EVALUATION OF SELECTED TARGETS INDICATORS AND REPORTING METHODOLOGIES FOR SDG 6

Report to the
Water Research Commission

by

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EXECUTIVE SUMMARY

South Africa is one of 193 countries that are signatories to the Sustainable Development Goal 2030 Agenda, which includes the commitment to achieve SDG 6: Clean Water and Sanitation. The Department of Water and Sanitation (DWS) is mandated to be responsible for the management of SDG 6 which aims to ensure clean water and sanitation for all by 2030. In adopting the goal, the DWS adopted existing indicators (UN Millennium Development Goals), domesticated new indicators, and defined additional indicators (where necessary).

BACKGROUND

Some of the SDG 6 targets and indicators are well established (those carried over from the UN Millennium Development Goals in 2000), while others are less established (those introduced with the adoption of the SDGs or in the years following adoption). At a global level, specialists in various international agencies developed methodologies for all the SDG targets and their indicators, first released in May 2017 and subsequently updated in 2018. At a national level, countries were encouraged to domesticate the methods and to set relevant targets to their context and resources, while maintaining consistency with the targets set out in the SDGs.

The project sought to improve our understanding of the context and status quo of SDG 6 in South Africa through the identification of areas for improvement in relation to measurement and monitoring of the SDG 6 indicators in South Africa. The project outcome is for meaningful and pragmatic tracking of South Africa's progress on SDG 6 indicators, to achieve positive progress towards sustainable water resource management in South Africa.

AIMS

The SDG 6 Working Group convened by DWS identified the need for further work on selected targets and indicators under SDG 6. The three SDG 6 sub-indicators: SDG Target 6.3, SDG Target 6.6 and SDG Target 6.B were the primary focus of this assessment with the purpose of evaluating targets, indicators, and methodologies for SDG Target 6.6, 6.3 and 6.b; and to propose improvements where shortfalls are identified. These gaps / shortfalls informed the development and definition of new additional indicators, where necessary.

The following were the aims of the project:

1. To review and further develop selected current South African targets, indicators and methodologies that have been developed for SDG 6.
2. To review the methodologies that have been developed for selected indicators for Targets 6.6 and 6.b.
3. To take stock of, and evaluate the management targets and indicators that have been set for water quality (point and non-point sources and instream/resources water quality) and water-related ecosystems (estuaries, groundwater, wetlands, rivers, artificial ecosystems and lakes) in South Africa.
4. To review the list of domesticated and proposed additional targets and indicators for SDG Target 6.6 and make recommendations for meaningful country-level targets and indicators.
5. To develop a methodology for measuring the additional indicators for Target 6.3.
6. To review the Indicator 6.b.1 and assess the DWS approach towards compliance with the method of computation and indicator requirements.
7. To develop a new Indicator 6.b.2 and accompanying method of computation, which will measure the performance of community involvement related to Indicator 6.b.1; which will culminate in a realistic target for 2030.

METHODOLOGY

SDG Target 6.3 focuses specifically on water quality and wastewater with the ultimate motive of improving the quality of the resource. The SDG Target 6.3 aims to “improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally, by 2023.”

SDG Target 6.6 aims to ensure that all water-related ecosystems are protected and restored to allow for the sustainability of the resource in the long-term. The SDG Target 6.6 is to "protect and restore water related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes, by 2020.". The UN SDG Target 6.6 only comprised of one indicator, which monitors changes in the extent of water-related ecosystems over time.

SDG Target 6.B works towards ensuring the needs of all people in terms of water and sanitation are being met through the participation of local communities in water and sanitation planning and management. The SDG Target 6.B is to "Support and strengthen the participation of local communities in improving water and sanitation management".

The management targets and indicators that have been set for SDG Target 6.3, 6.6 and 6.B in South Africa were evaluated, and integrated with similar indicators defined in ten relevant strategies, listed below. The intention being to identify other initiatives within the SDG Target 6.3, 6.6 and 6.B. space to prevent duplication, where targets and indicators have been developed and incorporation of recommended targets into the various sector strategies.

a. Agenda 2063
b. UNCCD: South Africa: Final country report of the LDN Target Setting Programme (October 2018)
c. National Development Plan (NDP)
d. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
e. National Water Resource Strategy 2 (NWRS)
f. National Water and Sanitation Master Plan (Volume 1-3) (NWSMP)
g. Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation in South Africa
h. National Protected Area Expansion Strategy (NPAES)
i. South Africa's National Biodiversity Strategy and Action Plan
j. National Biodiversity Assessment 2018
k. Peat Management Protocol (Draft)

GENERAL

On 22 November 2022, a conversation, hosted by Mark Bannister, of DWS, was held with the UN SDG 6 team. According to the UN, the UN SDG methodologies developed for the 11 SDG 6 global indicators are the key high level reporting criteria to which countries have reporting commitments. The SDG global indicators are intended to provide data that can be used to action responses to change at a global level.

While the SDG 6 targets are fixed by the UN, there is room to nationalise or "domesticate" the indicators for country-specific data management and tracking of indicators. The global reporting requirements of the domesticated indicators are not a UN requirement as they are unable to be compared internationally. The SDG domesticated indicators therefore provide a data set to track changes and action responses at a local level while maintaining the goal/focus of the global methodologies/indicators.

Water reporting interlinkage and cross-learning reporting requirements are recognised to be necessary by the UN, however currently discussions around interlinkages at a UN and global level are limited. According to the UN, SDG implementation is following a three-phased approach of structure, process followed by action. The structure and process phases are underway, while the action phase is still to be implemented to address risks identified in relation to the SDG tracking.

SDG TARGET 6.3 CONCLUSIONS

Wastewater discharge and ambient water quality are parameters that have been monitored by South African authorities in one form or another for many years prior to the definition and adoption of the specific indicators

SDG Indicator 6.3.1 and SDG Indicator 6.3.2 in 2015. The South African methodologies developed for SDG Indicators 6.3.1D and 6.3.2D are considered to be well developed, and thorough.

Significant overlap between the indicators in the SDG programme have been identified, with SDG Target 6.3 (DWS water sector lead) and SDG Target 11, 12 and 14 (DFFE waste sector lead). The SDG 6.3 Methodologies for SDG Indictors 6.3.1D and SDG 6.3.2D rely on Water Use Licence discharge compliance reporting. While the methodology is robust, improvements in the available data in terms of samples taken at point and non-point sources is necessary. The Green Drop Assessment (GDA) programme can further bolster the SDG Indicators 6.3.1D reporting, while alignment of the SDG Indicator 6.3.2D data with the resource quality objectives database will aid reporting of SDG Sub Indicator 6.3.2D. SDG Indicator 6.3.2D could be expanded to include additional waste parameters such as floating plastic debris, and the microplastic content of water (covered in SDG Indicator 14.1.1).

The following key findings and recommendations relate to SDG Target 6.3:

- The closing out of data gaps is necessary, retrospectively, due to a lack of discharge compliance reporting and WUL audits (2017 and 2018 period primarily) for SDG Indicators 6.3.1D and SDG 6.3.2D monitoring.
- SDG Indicators 6.3.1D and 6.3.3A data should be aligned with, and retrieved from the Green Drop programme.
- Engage with DFFE, national permitting processes (WUL) and municipal permitting processes to obtain data for mines, industries, and agriculture.
- SDG Indicator 6.3.2D indicator data should be aligned with and retrieved from the RQO database. SDG Indicator 14.1.1 should be converted to two additional parameters within SDG Indicator 6.3.2D: index of floating plastic debris, and microplastic content of water; which would be sampled along with the other parameters for SDG Indicator 6.3.2D.
- The duplicate indicators for SDG Indicators 6.3.4A and SDG 6.3.5A require alignment between DWS and DFFE, with data sharing required to enable effective reporting.

SDG TARGET 6.6 CONCLUSIONS

The global ambition of the Target 6.6 is to “protect and restore” ecosystems (without any numeric specification), with it being each country’s responsibility to set their own targets in this regard, i.e. to determine what is an acceptable change in ecosystem extent, quantity and health, and when and how management intervention should be introduced.

The SDG Target 6.6 – Water Related Ecosystems Methodology Report is a well compiled report, incorporating extensive material from both a global and national perspective. South Africa has extensive datasets developed over many years of work, in relation to water related ecosystems. The challenge faced in reporting against the UN SDG Target 6.6 methodologies is that the South African historical data sets were largely not compiled for the particular purpose prescribed by the UN. However, the UN SDG Target 6.6 global reporting provides a platform for the amalgamation of the locally generated data sets into a standardised reporting system. The combined data sets are therefore comparable in relation to other global data sets, which helps to benchmarking South Africa in the global context.

The South African methodologies generated in relation to SDG Target 6.6 water related ecosystems, have largely been created based on historical data sets to compile the baseline data, against which future monitoring updates are compared. These methodologies may require updating as further data are generated, and should be robust enough to accommodate technological advances, to improve on the reporting efficiencies to supplement historical date reporting systems.

Certain limitations need to be addressed in order to produce more representative datasets and ensure that the changes in the extent of water-related ecosystems are well monitored to sustain them in the long term, including:

- Amendments to the SDG Indicator 6.6.1 methodology are underway by the UN, which requires ongoing collaboration to aid the development of the new methodology to take cognisance of the South African context and challenges experienced.
- More continuous datasets rather than the provision of statistics at a point in time, to make more representative comparisons with the global datasets. The country can achieve this by collaborating with the UNEP to improve upon the datasets that are produced at a global scale.
- The use of satellite-based earth observations acquired from both Landsat and Sentinel imagery is highly recommended for monitoring changes in the number of lakes and dams affected by high trophic and turbidity states.
- The use of data platforms to process and acquire data at a more efficient rate is recommended.

SDG TARGET 6.B CONCLUSIONS

For the purpose of SDG Target 6.B tracking, DWS has considered Water Service Authorities as the local administrative units, required to have policies in place to unlock funding to implement their business, with South Africa scoring 100% in terms of the criteria provided by the UN.

There is little data available globally at a local administrative unit level that would allow for a direct computation of SDG Indicator 6.B.1. The current methodology is therefore too broad to be able to determine any material indication on the percentage of local administrative units within the country that have been established, and operational policies and procedures for participation of local communities in water and sanitation management. The following areas requiring improvement and gaps have been highlighted during the review of the current methodology:

- The current indicator for the target does not fully encompass the outcome for Target 6.B – support and strengthen the participation of local communities on improving water and sanitation management.
- The indicator is not a true representation of the level of support and participation in a country, and does not determine if the current support and participation of local communities is sufficient to improve management of water and sanitation in the country.
- The current indicator also does not incorporate the level of implementation of procedures in law or policies in a country.
- There is currently no way of measuring whether local communities are being included in targets or aspects in the country's procedures in law or policies.
- The impact of a local community's participation towards a particular project is also not measured.

RECOMMENDATIONS

The SDG Targets 6.3, 6.6 and 6.B indicators, methodologies, target setting and data collection are all key steps in the SDG reporting. The methodologies serve the purpose of providing robust data set that can then be used to identify areas at risk, which need to be addressed and mitigated, to prevent detrimental impacts to the environment. Further expansion to the reporting methodologies should be carefully considered, based on the relevance and applicability of the data.

The SDG Indicator 6.B.2, 6.3.3A, 6.3.4A and 6.3.5A Methodologies developed were all tested on example data sets to determine the usability as well as the data representation. Real data gathering needs to be undertaken over the course of the first year of implementation, whereafter the methodologies can be further tested and refined.

SDG TARGET 6.3 RECOMMENDATIONS

The proposed methodologies for the additional indicators SDG Indicators 6.3.3A, 6.3.4A and 6.3.5A require data to be obtained from the DWS and DFFE in relation to solid waste management. The proposed methodology for SDG Indicator 6.3.3A centres on the recycling and reuse of water containing waste. The proposed methodology for SDG Indicator 6.3.4A focuses on the proportion of waste lawfully disposed of, while SDG Indicator 6.3.5A concentrates on proportion of waste recycled, reused and recovered. The duplicate indicators for SDG Indicators 6.3.4A and SDG 6.4.5A require alignment between DWS and DFFE, with data sharing required to enable effective reporting. Increased recycling and reuse of waste and water containing waste, in appropriate situations, supports SDG Target 6.3, and, in the case of the recycling or reuse of water containing waste, reduces demand for raw water. Sub-indicator methodology calculations have been developed, with possible targets and indicators identified for consideration based on global and national targets. These targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

SDG Indicator 6.3.2D could be expanded to include additional waste parameters which are covered in SDG Indicator 14.1.1, including floating plastic debris, and the microplastic content of water which would be sampled along with the other parameters for SDG Indicator 6.3.2D. The extent of data availability for each proposed data source should be established, and a matrix compiled to determine the minimum data sources required to triangulate waste sources and receptors.

SDG TARGET 6.6 RECOMMENDATIONS

The setting of management targets or objectives for the extent of water-related ecosystems has become a global priority. While the SDG process sets out to monitor the percentage change in extent of water-related ecosystems over time, it will be incumbent on countries to actually set targets for this change, to determine what an acceptable change is and when and how management intervention should be introduced.

The sub-indicator targets for each of the UN SDG Indicators 6.6.1, reflecting possible global and national targets, are listed below. The targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

- 6.6.1
  Countries may set their own targets but ideally there should be no further degradation of water-related ecosystems from the 2017 baseline.
  Aichi Biodiversity Target 5, where countries have economic needs, then degradation rates should be at least halved.
- 6.6.1.A – Spatial Extent
  Many countries have set a no-net-loss policy as promoted by the Ramsar Convention on Wetlands. Countries may set an alternative target, but this must be justified, and as described by Aichi Biodiversity Target 5, the rate of loss should at least be halved but ideally approach zero.
  Aichi Biodiversity Target 15 aims to restore 15% of degraded ecosystems that store carbon (wetlands, peat).
- 6.6.1.B – Quantity of Water
  Targets for quantities of water ideally should be established for each river and tributary, for lakes and groundwater, based on priorities in the basin and sub-basin. These should aim to protect the integrity of water-related ecosystems based on their environmental flow requirements.
  Aichi Biodiversity Targets apply (5, 14).
- 6.6.1.C – Water Quality
  Apply existing standards and targets for water quality data.
  Where national standards are lacking, use existing data to set target values.
- 6.6.1.D – Ecosystem Health
  Targets for the health or state of ecosystems ideally should be established for key river, lakes and for priority wetlands based on priorities in the basin and sub-basin.
  Aichi Biodiversity Targets apply (5, 14).

SDG TARGET 6.B RECOMMENDATIONS

The global aim for Target 6.B relates to the participation of local communities in water and sanitation planning and management, which is essential for ensuring that the needs of all people are being met. Water resource management requires integrated approaches to sustainable development. The development of a new indicator (Indicator 6.B.2) and a method of computation was undertaken to assist in measuring performance linked to Indicator 6.B.1 This indicator aims to measuring community involvement as per the policy/guideline intentions and the impact of their participation is towards a particular project.

Tracking the participation of local communities in improving water and sanitation management is vital to ensure that the needs of everyone in the community are met, including the most vulnerable. It is also essential to ensure the long-term sustainability of water and sanitation solutions. The new SDG Indicator 6.B.2 will provide a more accurate representation of the participation of local communities in improving water and sanitation within South Africa and the status quo of the country in achieving SDG Target 6.B.

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ACRONYMS & ABBREVIATIONS

ACDEG	African Charter on Democracy, Elections and Governance
AFAFWA	Affirmative Finance Action for Women in Africa
AfCFTA	African Continental Free Trade Agreement
AfDB	African Development Bank
ATI	Access to Information
AU	African Union
BIOFIN	Biodiversity Finance Initiative
CBD	Convention on Biological Diversity
COGTA	Department of Co-operative Governance and Traditional Affairs
CSIR	Council for Scientific and Industrial Research
DFFE	Department of Forestry, Fisheries and Environment
DLRRD	Department of Agriculture, Land Reform and Rural Development
DWS	Department of Water and Sanitation
EbA	Ecosystem-based Adaptation
EBSA	Ecologically or Biologically Significant Marine Areas
EFZ	Estuarine Functional Zone
EI	Ecological Importance
EN	Endangered
EPWP	Expanded Public Works Programme
ES	Ecological Sensitivity
GCF	Green Climate Fund
GIS	Geographical Information System
GSPC	Global Strategy for Plant Conservation
IDP	Integrated Development Plans
IHI	Index of Habitat Integrity
IPBES	Intergovernmental science – policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union of Conservation of Nature
KBA	Key Biodiversity Area
KPI	Key Performance Indicator
LC	Least Concern
LDN	Land Degradation Neutrality
MDG	Millennium Development Goal
MiniMEC	Mini Member of the Executive Council
MP	Moderately Protected
MTSF	Medium-Term Strategic Framework
NAP	National Action Plan
NBA	National Biodiversity Assessment
NBF	National Biodiversity Framework
NBSAP	National Biodiversity Strategy and Action Plan

NCCR	National Climate Change Response
NDC	National Development Corporation
NDP	National Development Framework
NFP	National Focal Point
NGLMP	National Groundwater Level Monitoring Programme
NIWIS	National Integrated Water Information System
NP	Not Protected
NPAES	National Protected Area Expansion Strategy
NT	National Treasury
NWG	National Working Group
NWMP	National Wetland Monitoring Programme
NWRS	National Water Resource Strategy
NW&SMP	National Water and Sanitation Master Plan
OFO	Organising Framework for Occupations
OMPA	Offshore Marine Protected Area
PAES	Protected Area Expansion Strategies
PES	Present Ecological State
PGDS/P	Provincial Growth and Development Strategies / Plans
PP	Poorly Protected
RQO	Resource Quality Objective
RSDF	Regional Spatial Development Frameworks
SA	South Africa
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SDG	Sustainable Development Goal
SLM	Sustainable Land Management
SOC	Soil Organic Carbon
SRK	SRK Consulting South Africa (Pty) Ltd
UKZN	University of KwaZulu-Natal
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VU	Vulnerable
WARMS	Water use Authorization and Registration Management System
WCWDM	Water Conservation and Water Demand Management
WP	Well Protected
WRC	Water Research Commission
WSA	Water Service Authority
WUL	Water Use License

CHAPTER 1: BACKGROUND

1.1 INTRODUCTION AND APPROACH

South Africa is one of 193 countries that are signatories to the Sustainable Development Goal (SDG) 2030 Agenda, which includes the commitment to achieve SDG 6: Clean Water and Sanitation. The Department of Water and Sanitation (DWS) is mandated to be responsible for the management of SDG 6 policy, plans and implementation programs. In adopting the goal, the DWS adopted existing indicators (carried over from the UN Millennium Development Goals [MDGs]), domesticated new indicators, and defined additional indicators (where necessary).

South Africa has committed to the achievement of the 17 SDGs by 2030. SDG 6 aims to ensure clean water and sanitation for all by 2030. Some of the SDG 6 targets and indicators are well established (those carried over from the MDGs in 2000), while others are less established (those introduced with the adoption of the SDGs or in the years following adoption). At a global level, specialists in various international agencies developed methodologies for all the SDG targets and their indicators. In May 2017 the UN released the first round of the Step-by-step Methodology Reports for each of the indicators. Revisions of these methods have subsequently been published through updated methodology reports and captured in the 2018 Synthesis Reports for each indicator. At a national level, countries were encouraged to domesticate these methods and to set targets that are relevant to their context and resources, while maintaining consistency with the targets set out in the SDGs.

While South Africa has developed methodologies to domesticate its indicators, some of the indicators are still not being measured in a meaningful way that shows and drives progress against the targets. For some of these indicators, an assessment, and potentially, a revision of these methodologies is required. For others, new methodologies are required to be developed. In addition, several new indicators are required, and a solid founding methodology is required for the new indicators. Research by a multidisciplinary team with a deep understanding of water resources management in the SA context was required to achieve these research outputs.

1.2 SDG 6 ADOPTION IN SOUTH AFRICA

SDG 6 has been divided into 8 targets, which are then divided into indicators (**Figure 1.1**). The intent of setting the targets and defining the indicators is to monitor progress towards achieving the SDG 6 targets. The DWS, works closely with several other branches of government, as well as other organisations, to measure and report on the indicators. In addition to the UN reporting requirements, the objective of monitoring and reporting on the indicators is to effect real change in the water and sanitation landscape in South Africa, by informing policy formulation and implementation and aiding decision-making.

South Africa's monitoring of, and performance against, the SDG 6 indicators has shown slow uptake of policies and actions developed for water and sanitation. South Africa published a Community Survey in 2016 (StatsSA, 2016), an SDG Baseline Report in 2017 (StatsSA, 2017), an SDG Country Report in 2019 (StatsSA, 2019), and a General Household Survey in 2019 (StatsSA, 2019). In addition, South Africa has established a Goal Tracker website (StatsSA, 2021). These documents show that several indicators are not tracked, that data continuity is poor for some indicators, and that there is a lack of consistency in tracking some indicators.

The SDG 6 Working Group convened by DWS identified the need for further work on selected targets and indicators under SDG 6. Through its involvement in the Working Group's Research and Innovation Task Team, the Water Research Commission (WRC) appointed SRK Consulting South Africa (Pty) Ltd (SRK) to undertake a project to evaluate targets, indicators, and methodologies for SDG Target 6.6, 6.3 and 6.b; and to propose improvements where shortfalls are identified. These gaps / shortfalls(identified by DWS) informed the development and definition of new additional indicators, where necessary; using existing data (where available) and investigating new data sources (where data are not available).

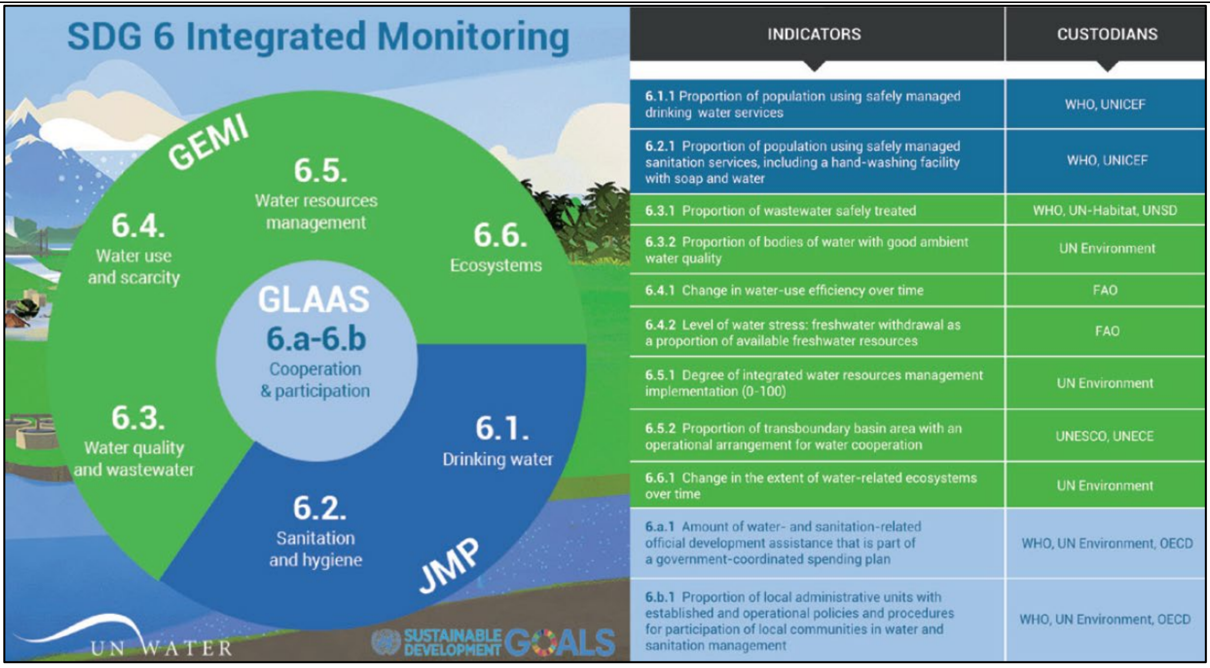


Figure 1.1. UN SDG6 Targets and Indicators (Ref: UN-Water, Integrated Monitoring Guide for Sustainable Development Goal 6 on Water and Sanitation, 2017).

1.3 SCOPE AND LIMITATIONS

In February 2022, SRK Consulting was appointed by the WRC to undertake the “Evaluation of selected South African targets, indicators and reporting methodologies for Sustainable Development Goal 6.”

The project is intended to improve our understanding of the context and status quo of SDG 6 in South Africa. The identification of areas for improvement in relation to measurement and monitoring of the indicators for SDG 6 is (by providing realistic indicators and benchmarks), will lead to achieving water sustainability in South Africa. Four new methodologies were to be developed for measuring three additional indicators for Target 6.3 and for one additional indicator for Target 6.B.

The project outcome (**Table 1.1**) is for meaningful and pragmatic tracking of South Africa's progress on SDG 6 indicators, with the resultant impact of positive progress towards sustainable water resource management in South Africa (i.e. progress towards the achievement of SDG 6).

Table 1.1. Aims of Evaluating Selected Targets, Indicators and SDG6 Reporting Methodologies

No	Aim
1	To review and further develop selected current South African targets, indicators and methodologies that have been developed for SDG6
2	To review the methodologies that have been developed for selected indicators for Targets 6.6 and 6.b
3	To take stock of, and evaluate the management targets and indicators that have been set for water quality (point and non-point sources and instream / resources water quality) and water-related ecosystems (estuaries, groundwater, wetlands, rivers, artificial ecosystems and lakes) in South Africa
4	To review the list of domesticated and proposed additional targets and indicators for SDG Target 6.6 and make recommendations for meaningful country-level targets and indicators
5	To develop a methodology for measuring the additional indicators for Target 6.3
6	To review the Indicator 6.b.1 and assess the DWS approach towards compliance with the method of computation and indicator requirements
7	To develop a new Indicator 6.b.2 and accompanying method of computation, which will measure the performance of community involvement related to Indicator 6.b.1; which will culminate in a realistic target for 2030.

To achieve this goal the project was split into six tasks as follows:

Research Task 1: Project Inception, initiated through a project inception meeting held on 2 February 2022, with key role players in the DWS, WRC, Statistics South Africa (StatsSA) and SRK Consulting. The objective of the meeting was for team members to be introduced, with an inception report produced providing a high-level summary of the SDG 6 project tasks.

Research Task 2: Peer review and assessment of the SDG Target 6.6 methodology, and development of additional indicators (Task Leader: Erin Haricombe. Team: Giulia Barr, Bjanka Korb, Lindsay Shand, Simon Lorentz, Kershani Chetty and UKZN Student):

1. Review of the existing methodology document for SDG Target 6.6 to determine the adequacy of the current SDG Target 6.6 indicators for influencing national decision-making and showing progress against SDG Target 6.6.
2. Assessment to determine whether the SDG Target 6.6 indicators pertaining to water quality and water-related ecosystems adequately represent changes in the extent of water-related ecosystems over time in South Africa. The content and frequency of reporting (i.e. in the next SDG Voluntary National Review) was considered based on the global-level reporting standard to show the sustainability status for water quality and water-related ecosystems in South Africa.
3. Evaluation of the statistical correctness and scientific validity of the methodology for SDG Target 6.6 by examining available data in relation to the methodology, and analysing the status quo reflected by the data.
4. Recommendations for amendments and improvements, and where appropriate, alternative methodologies.
5. Review the domesticated and proposed additional indicators for SDG Target 6.6 for the 2016 to 2020 period, and recommend meaningful (relevant, pragmatic, indicative of progress) country-level targets and indicators. Indicator development was based on availability of data, taking cognisance of varying local conditions, that can be aggregated into a single country-level indicator without losing impact or meaning.

6. Review of an additional indicator and methodology developed by the SDG Target 6.6 DWS team.
7. Data analysis and synthesis in collaboration with DWS taking cognisance of possible linkages with other SDGs relating to water-related ecosystems.
8. Setting management targets for SDG Target 6.6 and selecting and developing methods for additional country level indicators where gaps were identified.

Research Task 3: New measurement methodologies for SDG Indicators 6.3.3A, 6.3.4A and 6.3.5A (Task Leader: Bjanka Korb. Team: Giulia Barr, Erin Haricombe, Simon Lorentz, UKZN Student)

1. Assessment to determine whether the Target 6.3 indicators pertaining to wastewater and ambient water quality adequately represent changes in water quality in relation to wastewater discharge and the disposal of waste over time in South Africa. The content and frequency of reporting (i.e. in the next SDG Voluntary National Review) was considered based on global level reporting standard to show the sustainability status of ambient water quality, and treatment of wastewater in South Africa.
2. Development of methodologies for the proposed three additional indicators (proposed by DWS):
   - 6.3.3A. Proportion of water containing waste recycled or reused;
   - 6.3.4A. Proportion of waste lawfully disposed of; and
   - 6.3.5A. Proportion of waste recycled or reused.
3. Alignment of the methodology structure for the proposed additional indicators with the structure used for the SDG Indicators 6.3.1D and 6.3.2D methodology reports.
4. Testing of the methodologies for the proposed additional indicators, to see whether they produce the values they were designed to measure; at a small scale first before testing the national-level data.
5. Data analysis and syntheses collaboration with DWS and Stats SA, taking cognisance of the possible linkages with other SDGs relating to waste management and recycling to avoid any duplication of reporting by SA.
6. Selecting and developing methods for additional country level indicators where gaps have been identified.

Research Task 4, included a two-tiered approach, split into Task 4a: Situation assessment, reviewed methodology for SDG Target 6.B (Task Leader: Giulia Barr. Team: Bjanka Korb, Lindsay Shand and Simon Lorentz) and Research Task 4.b[1]: additional new indicators for SDG Target 6.B (Task Leader: Giulia Barr. Team: Bjanka Korb, Lindsay Shand and Simon Lorentz):

Research Task 4.a: Situation assessment included:

1. Review of the developed methodology to measure the current SDG Indicator 6.B.1, taking into consideration the methodology given by the UN and assessing if it is applied in the most pragmatic and rational way.
2. Assessment of current progress against the SDG Indicator 6.B.1.
3. Evaluation of the way in which the methodology and results influence national decision-making (if at all) to see if the indicator has inspired policy-level changes in the years since its adoption.
4. Assessment of the DWS approach towards compliance with the method of computation and indicator requirements for SDG Indicator 6.B.1.
5. Review of the statistical correctness and scientific validity of the method for SDG Indicator 6.B.1.
6. Compilation of recommendations for amendments and improvements, and where appropriate, alternative methodologies.

Research Task 4.b: additional new indicators for SDG Target 6.B included:

1. Development of a new SDG Indicator 6.B.2 and its method of computation, which will measure the level of community involvement related to SDG Indicator 6.B.1. Consideration was given to data that is currently accessible.

[1] Research Task 4b was undertaken as a separate task following Research Task 4a.

2. Compilation of recommendations for additional information in future management targets for SDG Indicator 6.B.2.
3. Data analysis and syntheses, taking cognisance of the possible linkages with other SDGs relating to community involvement in water management to avoid any duplication of reporting by SA.
4. Selecting and developing methods for additional country level indicators where gaps were identified.
5. Review of the following strategies to align any new indicators developed (for community involvement in water management) with related indicators in these strategies:
    a. Agenda 2063
    b. National Development Plan
    c. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
    d. National Water Resource Strategy 3
    e. National Water and Sanitation Master Plan (Volume 1-3)

Research Task 5: Situation assessment and integration of water quality and water-related ecosystem indicators for South Africa (Task Leader: Lindsay Shand. Team: Simon Lorentz, Bjanka Korb, Giulia Barr, Kivana Naidoo, Kershani Chetty).

The management targets and indicators that have been set for Target 6.3 water quality (point and non-point sources and instream / resources water quality) and SDG Target 6.6 water-related ecosystems (estuaries, groundwater, wetlands, rivers, artificial ecosystems, and lakes) in South Africa were identified and evaluated, and integrated with similar indicators defined in the following relevant strategies:

a. Agenda 2063
b. UNCCD: South Africa: Final country report of the Land Degradation Neutrality (LDN) Target Setting Programme (October 2018)
c. National Development Plan
d. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
e. National Water Resource Strategy 2
f. National Water and Sanitation Master Plan (Volume 1-3)
g. Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation in South Africa
h. National Protected Area Expansion Strategy (NPAES)
i. South Africa's National Biodiversity Strategy and Action Plan
j. National Biodiversity Assessment 2018
k. Peat Management Protocol (Draft)

1.4 SUMMARY OF WORK TO DATE

Table 1.2 and **Table 1.3** summarise the work to date, revised due dates and deliverables submitted.

Table 1.2. Work completed to date.

No.	Task	Summary of work to date
1	Project Inception	To review and further develop selected current South African targets, indicators and methodologies that have been developed for SDG6
2	SDG Target 6.6 methodology review	To review the methodologies that have been developed for selected indicators for Targets 6.6

3	New measurement methodologies for SDG Indicators 6.3.3A, 6.3.4A and 6.3.5A	To develop a methodology for measuring the additional indicators for Target 6.3
4a	SDG Target 6.B methodology review	To review the Indicator 6.B.1 and assess the DWS approach towards compliance with the method of computation and indicator requirements
4b	New indicators for SDG Target 6.B	To develop a new Indicator 6.B.2 and accompanying method of computation, which will measure the performance of community involvement related to Indicator 6.B.1; which will culminate in a realistic target for 2030.
5	Situation assessment and integration of water quality and water-related ecosystem indicators for South Africa	To take stock of, and evaluate the management targets and indicators that have been set for water quality (point and non-point sources and instream / resources water quality) and water-related ecosystems (estuaries, groundwater, wetlands, rivers, artificial ecosystems and lakes) in South Africa

Table 1.3. Deliverable due dates and deliverables submitted

No.	Deliverable	Status	Due date
1	Project Inception	Completed	Mar 2022
2	SDG Target 6.6 methodology review	Completed	Jul & Sept 2022
3	New measurement methodologies for SDG Indicators 6.3.3A, 6.3.4A and 6.3.5A	Completed	Nov 2022 & Mar 2023
4a	SDG Target 6.B methodology review	Completed	Nov 2022
4b	New indicators for SDG Target 6.B	Completed	Feb 2023
5	Situation assessment and integration of water quality and water-related ecosystem indicators for South Africa	Completed	Mar 2023

CHAPTER 2: UNITED NATIONS TARGET 6.3, 6.6 AND 6.B METHODOLOGIES

2.1 INTRODUCTION

The United Nations (UN) global methodologies for Target 6.3, 6.6 and 6.B have been reviewed as these form the basis for the SDG reporting against which South Africa is required to report and is assessed globally. The nationalization (referred to as domestication in South Africa) of indicators is encouraged by the UN to allow for country specific data management and tracking of indicators (**CHAPTER 3**:). A brief overview of the UN monitoring methodologies used for each indicator is summarized below.

2.2 UNITED NATIONS SDG TARGET 6.3

SDG Target 6.3

"By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally" [2]

SDG Target 6.3 focuses specifically on water quality and wastewater with the ultimate motive of improving the quality of the resource.

The presence of increased waste in our water bodies poses a serious health hazard both to humans and ecosystems, which makes it crucial to address this issue and minimize the associated impacts. Therefore, monitoring all water bodies and gathering data for all relevant aspects pertaining to this target is necessary to be able to keep track of the quality of freshwater, and based on the quality, to develop or undertake measures for improvement (UN Water, 2022). Currently, the discharge of waste from agricultural, industrial and urban areas has significantly contributed to the deterioration in the quality of surface water bodies. This is one of the key concerns that needs attention when addressing SDG Target 6.3.

On a global scale, there are two indicators for SDG Target 6.3: indicators 6.3.1 and 6.3.2:

- SDG Indicator 6.3.1 monitors the proportion of wastewater from residential, urban and industrial areas that is safely treated (UN Water, 2022). The World Health Organization (WHO) and United Nations Human Settlements Programme (UN-Habitat) are the responsible organisations for this indicator.
- SDG Indicator 6.3.2 focuses on monitoring the percentage of water bodies with good ambient water quality (UN Water, 2022). These bodies of water include rivers, lakes as well as groundwater. This indicator aims to ensure that the quality of water is good enough to maintain healthy ecosystems and not to pose any health hazards to human life. Water quality is monitored using an index, which comprises five parameters: oxygen, salinity, nitrogen, phosphorus and acidification (i.e. pH). These parameters are used as they are sensitive to changes in water quality (UN Water, 2022).

The UN-Water Integrated Monitoring Initiative 2020 Data Drive for SDG 6 involved countries collecting and reporting data, on various SDG 6 indicators to multiple UN agencies, coordinated by UN-Water, as well as to the UN (DWS, 2020). There is a discrepancy in alignment of the data requested by the UN and the South African SDG reporting; in that the indicators are not the same. The DWS informed the UN of this discrepancy

[2] 2030 Agenda for Sustainable Development

but was not successful in obtaining clarification. The DWS resolved to report on the data that they collect and have available.

2.2.1 SDG Target 6.3 Goal Tracker

The UN SDG Target 6.3 goal tracker reports on Indicator 6.3.1 “proportion of wastewater safely treated” and Indicator 6.3.2 “proportion of bodies of water with good ambient water quality”.

The goal of Indicator 6.3.1 is “Halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally” by 2030. **Figure 2.1** presents the World Health Organization goal tracker data (2020) for SDG Indictor 6.3.1.

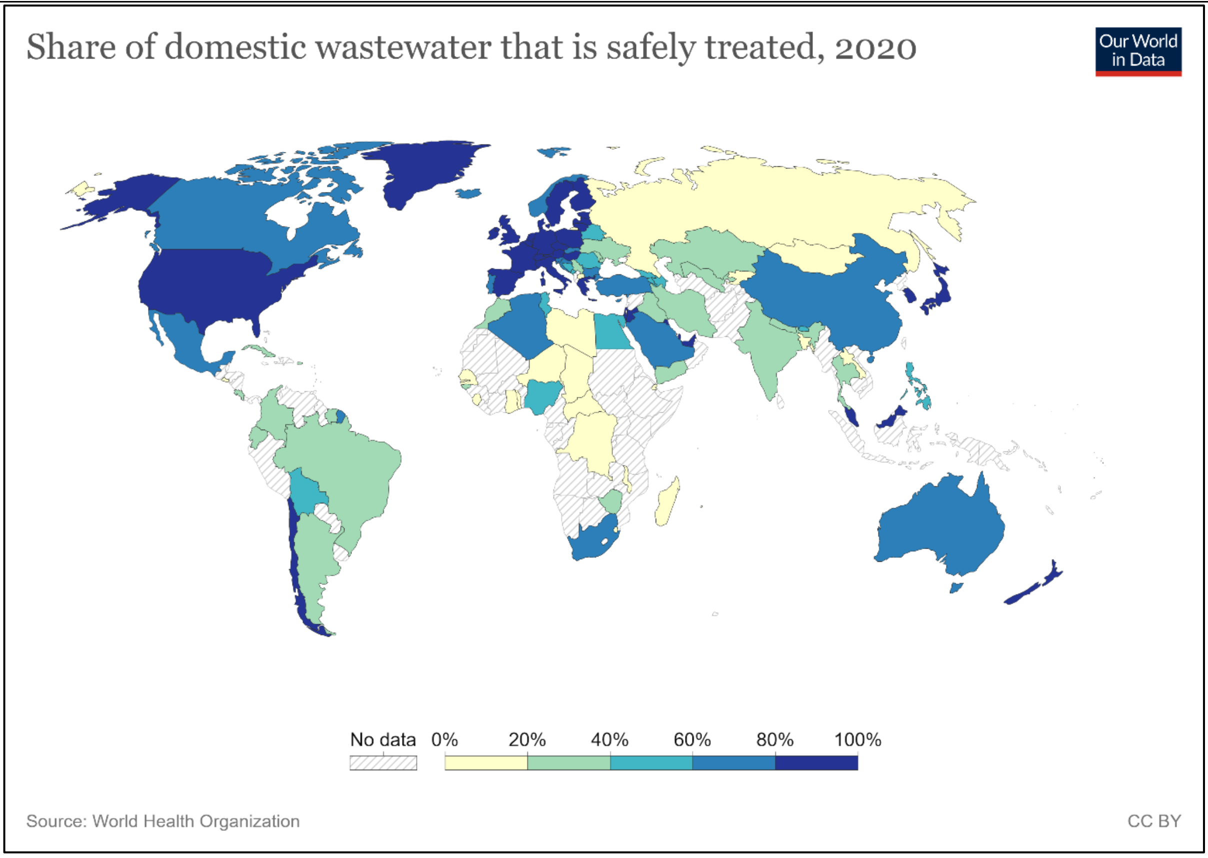


Figure 2.1. Share of Domestic Wastewater that is safely treated, 2020[3]

The goal of Indicator 6.3.2 is “Halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally” by 2030. **Figure 2.2** presents the UN Statistics Division goal tracker data (2017 and 2020) for SDG Indicator 6.3.2.

[3] https://sdg-tracker.org/water-and-sanitation

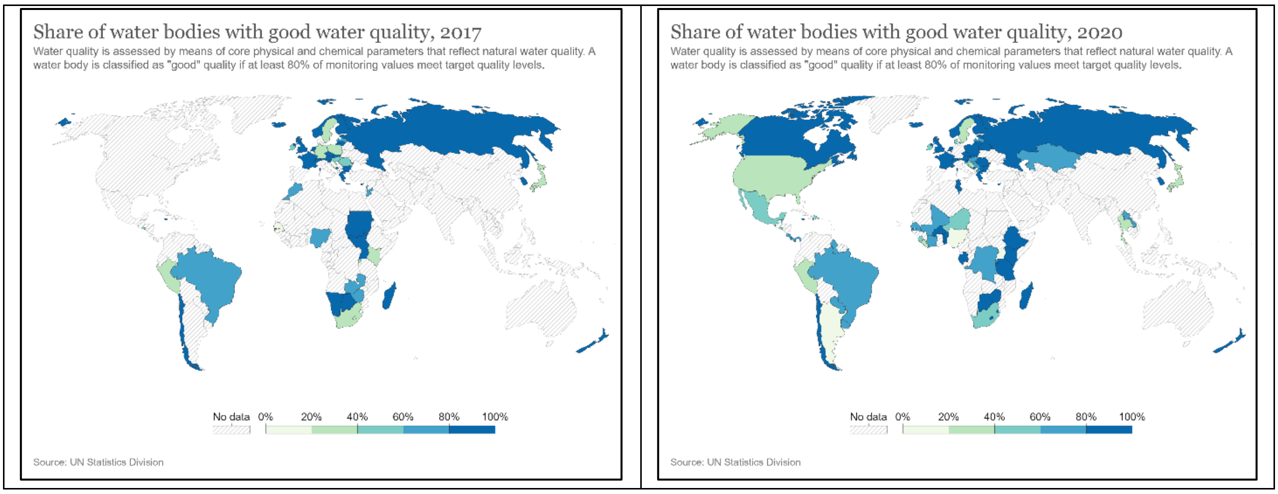


Figure 2.2. Share of Water Bodies with Good Water Quality, 2017 (left) and 2020 (right)[2]

2.3 UNITED NATIONS SDG TARGET 6.6

SDG Target 6.6

"By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes" [4]

SDG Target 6.6 aims to ensure that all water-related ecosystems are protected and restored to allow for the sustainability of the resource in the long-term. The UN SDG Target 6.6 only comprised one indicator, which monitors changes in the extent of water-related ecosystems over time. These water-related ecosystems include rivers, wetlands, lakes, aquifers, estuaries, artificial water bodies, mountains and forests.

The UNEP methodology applies a progressive monitoring approach whereby countries can utilize both globally- and nationally-derived data to report on the UN defined Indicator 6.6.1. According to the UNEP Monitoring Methodology for Indicator 6.6.1 "Countries should aim to report on all aspects of Indicator 6.6.1 should they have the data and capacity to do so. While it is beneficial to capture data on all aspects of the indicator, some countries may be able to achieve this, and others may not have all data available."

As a result, the monitoring approach uses two Levels and five Sub-Indicators. Level 1 utilizes data which is already globally available as a "foundation" which countries need to validate for correctness. This implies spatial selection of within-country information that intersects with the global dataset and ensuring that these are fully validated, as this is the dataset that will be carried forward into deriving global trends from year to year.

It includes two Sub-Indicators based on the globally available data from earth observations which is expected to be validated by countries against their own methodologies and datasets:

- Sub-Indicator 1 (also referred to as: 6.6.1.a) – spatial extent of water-related ecosystems (using the validated global dataset).
- Sub-Indicator 2 (also referred to as: 6.6.1.c) – water quality of lakes and artificial water bodies.

[4] 2030 Agenda for Sustainable Development

Level two data are additional data informing progress on Target 6.6 collected by countries. Countries are encouraged to consolidate this data to better understand the state of their freshwater ecosystems and prioritize actions, where necessary. Level 2 data includes the following three Sub-Indicators:

- Sub-Indicator 3 (also referred to as: 6.6.1.b) – quantity of water (discharge) in rivers and estuaries.
- Sub-Indicator 4 (also referred to as: 6.6.1.c) – water quality imported from SDG Indicator 6.3.2.
- Sub-Indicator 5 – quantity of groundwater within aquifers.

The global methodologies for SDG Indicator 6.6.1 have been reviewed by SRK and found to be applicable and relevant to the South African water context. The data utilized for the formulation of the global data sets is required to be reviewed at a local level to determine the validity of the global data sets presented by the UNEP. The challenge faced by South Africa in reporting against the UN SDG Target 6.6. methodologies are that the South African historical data sets have not been compiled for the particular purpose prescribed by the UN. However, the UN SDG Target 6.6. global reporting provides a platform for the amalgamation of the locally generated data sets into a standardised reporting system. The combined data set will then replace the stock global data originally made available to the country, and will be in a format that is comparable to other global data sets, which is a critical reporting requirement of the SDGs, allowing South Africa to be benchmarked in the global context.

2.3.1 SDG Target 6.6 Goal Tracker

The UN SDG Target 6.6 goal tracker reports on Indicator 6.6.1, "change in extent of water-related ecosystems", with the goal to "protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes." by 2023. **Figure 2.3** presents the UN Environmental Programme goal tracker data (2000 to 2021) for SDG Indicator 6.6.1 in relation to sub-indicators for Coverage of Wetlands, Change in Total Mangrove Area and Share of Land Covered by Lakes and Rivers. It does so by assigning an entire country into a class according to overall percent change recorded by that country per sub-indicator.

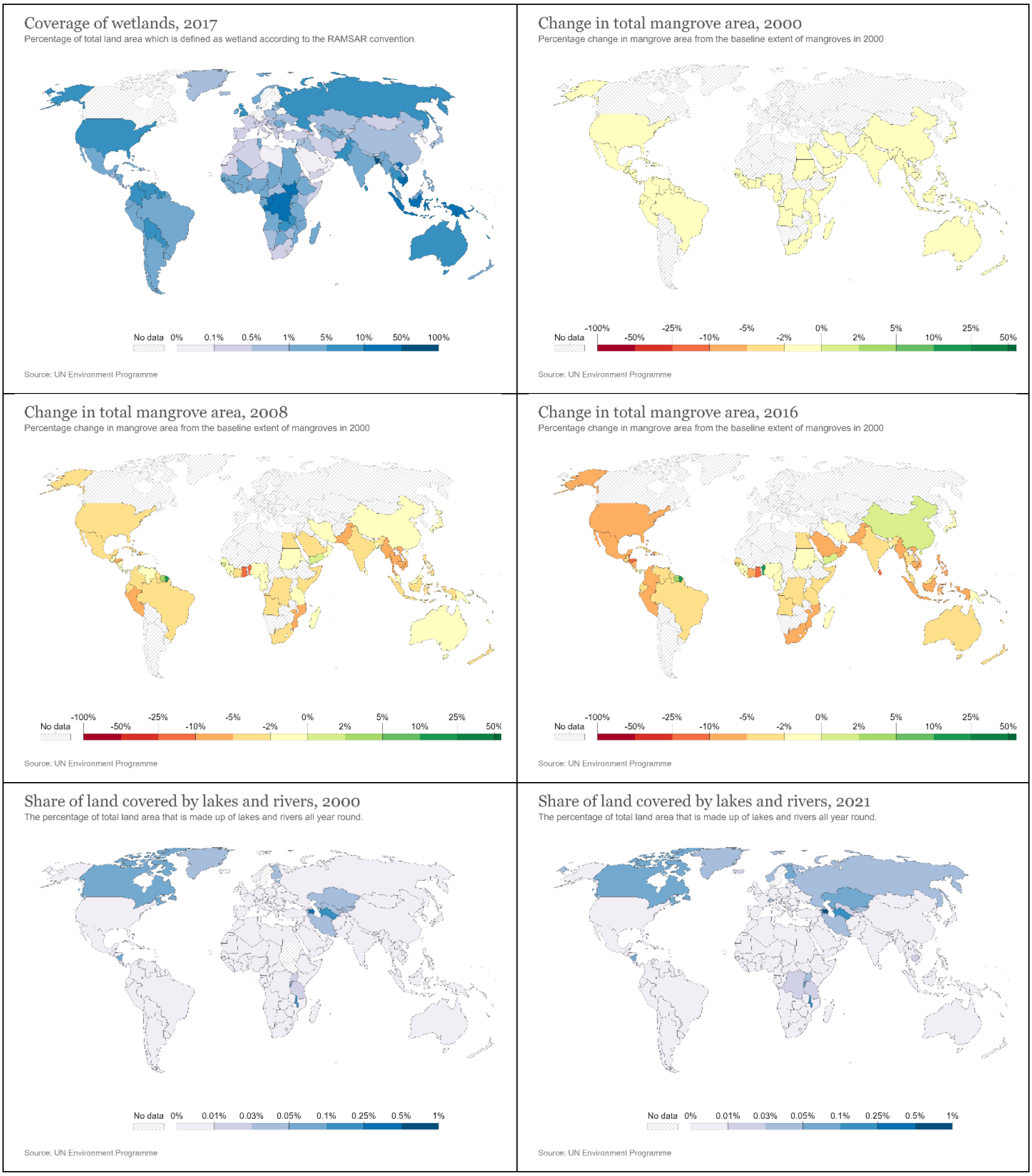


Figure 2.3. Share of Water Bodies with Good Water Quality, 2017 and 2020[2]

2.4 UNITED NATIONS SDG TARGET 6.B

SDG Target 6.B

"Support and strengthen the participation of local communities in improving water and sanitation management" [5]

SDG Target 6.B works towards ensuring the needs of all people, in terms of water and sanitation, are being met through the participation of local communities in water and sanitation planning and management.

The global SDG Target 6.B methodology report (WHO, March 2017) entitled "Methodological Note: Indicators and Proposed Monitoring Framework for Means of Implementation Targets for Sustainable Development Goal 6" (WHO, March 2017), allows for the incorporation of extensive material from both a global and national perspective.

South Africa currently does not have any existing domesticated methodologies for SDG Target 6.B and is therefore using the global methodology. South Africa has been submitting data on community participation in Integrated Development Plans to report on the country's progress. Based on this, South Africa has been reporting at 100% on the Global Goal Tracker.

2.4.1 SDG Target 6.B Goal Tracker

The UN SDG Target 6.B goal tracker reports on Indicator 6.B.1 "proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management".

The goal of Indicator 6.B.1 is to "support and strengthen the participation of local communities in improving water and sanitation management" by 2030. **Figure 2.4** presents the UN Water goal tracker data (2019) for SDG Indicator 6.B.1.

[1]

[5] 2030 Agenda for Sustainable Development

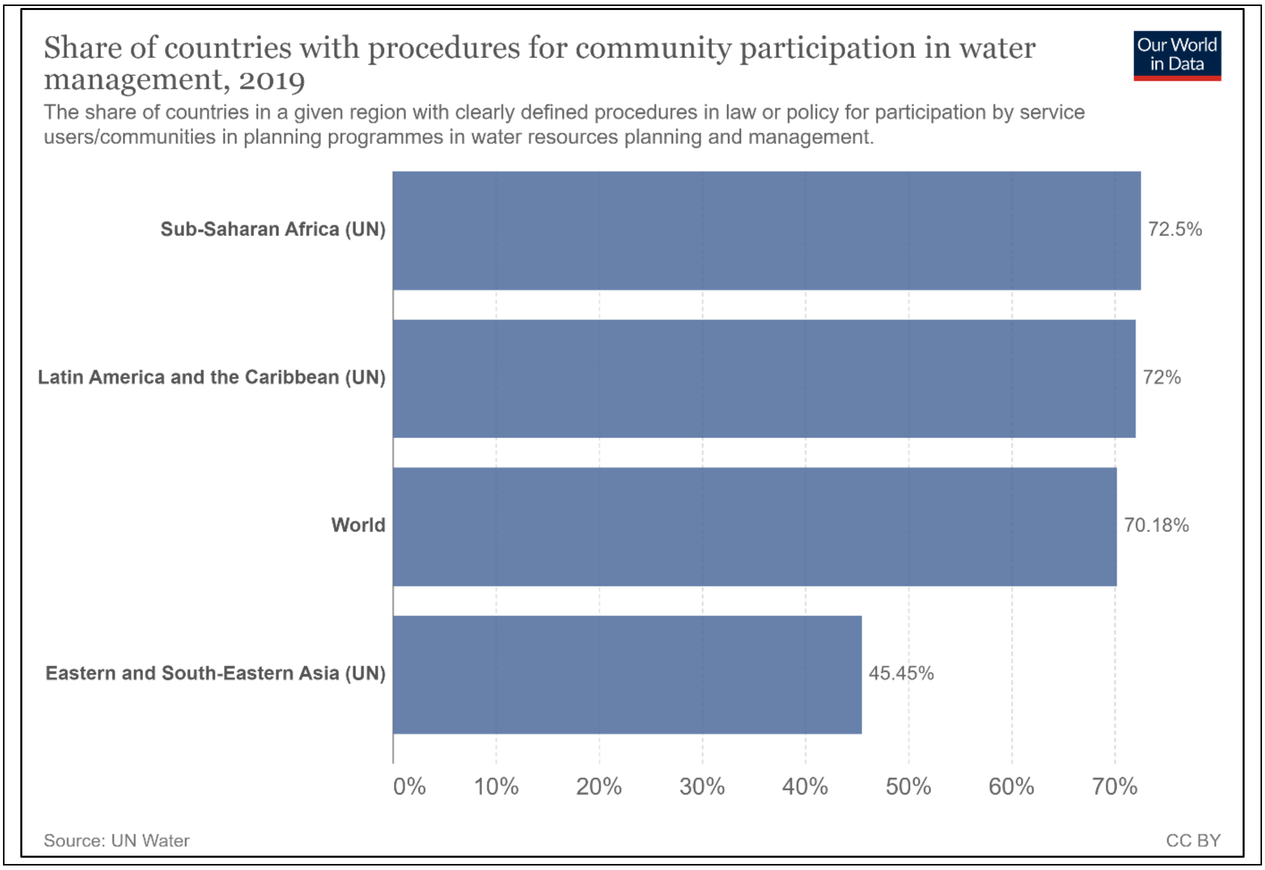


Figure 2.4. Share of Countries with Procedures for Community Participation in Water Management, 2019[2]

2.5 UN SDG 6 TEAM CONVERSATION

A conversation with the UN SDG 6 team was arranged on 22 November 2022, by Mark Bannister, of DWS, who hosted and chaired a meeting with William Reidhead, Global Monitoring Officer for UN Water, Kilian Christ of UNEP, responsible for the SDG Indicator 6.3.2 indicator and Stuart Crane of UNEP, responsible for SDG Targets 6.3, 6.6 and Indicator 6.5.1, while being the technical lead for SDG Indicator 6.6.1.

A summary of the relevant strategies associated with SDG 6 is summarised below, along with feedback from the conversation with the UN SDG team. The conversation aimed to gain further clarity regarding SDG6 Domestication. Five discussions points were prepared to guide the conversation:

1. Should countries be prioritising the UN SDG reporting to align to the UN Methodologies, from a globally consistent reporting approach?
2. If country specific data are lacking, is this calculated based on global data sets as an estimate or is it reported as being unreported.
3. Do the domesticated indicators developed at a country specific level have key standing in the UN reporting, or are these only useful at a country level?
4. What is the UN's perspective on country specific domesticated indicators, from a UN reporting perspective?
5. If a UN methodology calculation were found to produce a less than perfect output, how does one go about discussing adaptation of this methodology?

In response, the UN shared that all UN member states have signed up to meet the 261 UN SDG reporting requirements, including 11 SDG 6 indicators. The responses received have been split based on the numbering of the questions above.

1. & 2. According to the UN, the UN SDG methodologies developed for the 11 SDG 6 global indicators are the key high level reporting criteria to which countries have reporting commitments. These indicators are intended to provide a consistent global data set against which the world can be assessed for the different indicators. In some instances, data are tracked globally, for example SDG Indicator 6.6.1. Ultimately the SDG global indicators are intended to provide data that can be used to action responses to change at a global level.

While the SDG 6 targets are fixed by the UN, there is room to "domesticate" the indicators for the country circumstances. This should be done in a way that still enables the generation of information that is relevant for use in informing global reporting requirements. South Africa views domestication as a change in what is being measuring as well as in the way it is measured.

3. & 4. The nationalization (referred to as domestication in South Africa) of indicators is encouraged by the UN to allow for country specific data management and tracking of indicators. The global reporting requirements of the domesticated indicators are not a UN requirement as they are unable to be compared internationally. Ultimately the SDG domesticated indicators are intended to provide a data set to track changes and action a response at a local level.

The UN is aware that water reporting interlinkage and cross-learning reporting requirements are needed, however currently discussions around interlinkages at a UN and global level are limited. According to the UN, South Africa is currently the leading state in southern Africa and the African Region, as a whole, in relation to SDG 6 reporting. The UN suggested that South Africa could play a lead role for SDG development and implementation in Africa.

According to the UN, SDG implementation is following a three phased approach of structure, process followed by action. The structure and process phases are underway, with the action phase still to be implemented to address risks identified in relation to the SDG tracking.

5. Stuart Crane of the UNEP discussed the additional queries relating to calculations, with particular reference to the SDG Target 6.6 methodology. According to Stuart "the formula has been updated" during the last revision of the metadata published on 7 July 2022. "When Percentage change is negative this means that there is a gain in the wetland extent and when the Percentage change is positive this means a loss in the wetland extent"
(Ref: https://unstats.un.org/sdgs/metadata/files/Metadata-06-06-01a.pdf).

Based on this conversation the UN SDG Water Task Team showed an interest in maintaining and building a relationship with the South African team. The extensive work conducted by the South African SDG 6 task teams is to be commended and is well recognized by the UN SDG team.

CHAPTER 3: SOUTH AFRICAN SDG TARGET 6.3, 6.6 AND 6.B METHODOLOGIES

3.1 INTRODUCTION

The SDG methodology allows room to "domesticate" global SDG target indicators to cater for country specific circumstances (referred to as national indicators by the UN). In domesticating the indicators, the intension of the UN SDG Target is retained, while terminology has been adapted to cater for the South African situation and local water quality terminology.

StatsSA is responsible for country reporting on all SDGs. According to StatsSA in their presentation at the SDG6 midterm review the following terminology is applicable to the South African SDG indicator development:

- Domesticated (proxy) indicators: in line with the principle of domestication, ensuring indicators are adjusted to meet local peculiarities.
- Additional (supplementary) indicators: will be included where the SDG indicators are not sufficient or applicable to explain the situation in the country

3.2 SDG TARGET 6.3 BACKGROUND AND INDICATORS

Pollution of water resources can take place through point source and non-point source pollution. Point-source discharges include those from wastewater treatment works (WWTWs) of municipalities, commercial activities, and industrial activities. Non-point source pollution is generated over larger areas, including run-off from urban and agricultural land, mine residue deposits and waste disposal facilities.

Increased recycling and reuse of waste and water containing waste, in appropriate situations, supports SDG Target 6.3, and, in the case of the recycling or reuse of water containing waste, reduces demand for raw water. At the international level, SDG Target 6.3 comprises two indicators:

- 6.3.1: Proportion of water safely treated
- 6.3.2: Proportion of bodies of water with good ambient water quality

The UN SDG methodology framework allows for the domestication of the indicators, and the development of additional indicators, to make them meaningful to an individual country's context. The DWS domesticated versions of SDG Indicator 6.3.1 and 6.3.2 are:

- 6.3.1D: Proportion of water containing waste lawfully discharged; and
- 6.3.2D: Proportion of bodies of water that complies with water quality objectives.

In order to enhance water policy, reporting and decision-making related to SDG Target 6.3, three new indicators have been proposed, namely:

- 6.3.3A. Proportion of water containing waste recycled or reused;
- 6.3.4A. Proportion of waste lawfully disposed of; and
- 6.3.5A. Proportion of waste recycled or reused.

Collaboration and alignment with the DFFE is necessary, in the future, to ensure the correct data is sourced and reported, as well as alignment of the SDG 6.3 reporting criteria.

A summary of the SDG Target 6.3 Indicators in South Africa is shown in **Table 3.1** below:

Table 3.1. Current SDG Target 6.3 Indicators in South Africa

Target 6.3	Indicator		Extent	Status
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	6.3.1G	Proportion of domestic and industrial wastewater flows safely treated	Global (G)	Inactive
	6.3.2G	Proportion of bodies of water with good ambient water quality	Global (G)	Inactive
	6.3.1D	Proportion of water containing waste lawfully discharged	Domesticated (D)	Active – reported globally under 6.3.1G
	6.3.2D	Proportion of bodies of water that complies with water quality objectives	Domesticated (D)	Active – reported globally under 6.3.2G
	6.3.3A	Recycling of water containing waste	Additional (A)	Inactive
	6.3.4A	Disposal of waste	Additional (A)	Inactive
	6.3.5A	Recycling of waste	Additional (A)	Inactive

It is important to note the linkages that exist between the additional indicators for SDG Target 6.3 and SDG 11; i.e. SDG 11.6.1 (Urban Solid Waste), SDG 12.4.2 (Hazardous Waste) and SDG 12.5.1 (National Recycling Rate). The DWS is the water sector lead organisation, and the Department of Forestry, Fisheries and Environment (DFFE) is the waste sector lead.

3.2.1 SDG Target 6.3 Methodology Review

Wastewater regulation in the country is conducted by the DWS through the monitoring of effluent quality and Water Use Licence conditions. Since the inception of the Green Drop Certification process, attention has been given to the actual service of wastewater collection, treatment and discharge. However, the discharge of effluent (water containing waste) remains a Section 21 Water Use as legislated in the National Water Act.

The DFFE is the waste sector lead, and as such is responsible for the monitoring of all waste-related SDG indicators in South Africa (The disposal of waste also constitutes a water use, as per Section 21(g) of the National Water Act, with associated reporting conditions and management measures). The DFFE has historically reported against the following indicators:

- SDG Indicator 11.6.1: Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities;
- SDG Indicator 12.4.1: Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement;
- SDG Indicator 12.4.2: Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment;
- SDG Indicator 12.5.1: National recycling rate, tons of material recycled

The DFFE has domesticated SDG 11.6.1, SDG 12.4.1. An environmental sectoral working group (ESWG) has been established between the DWS and DFFE to collaborate on the monitoring of water and waste indicators. In 2022 the group signed off on indicators that they are reporting on (to StatsSA).

SDG 14.1.1 pertains to plastic in the marine environment. Although SDG Target 6.3 pertains to fresh water, there is increasing global concern relating to the presence of plastics and microplastics in water. The methodology for this indicator should be studied further and can be converted into one for fresh water; and include the microplastic element in addition to larger plastics.

The DFFE is the custodian of waste data collection, and waste indicator monitoring and reporting, while the DWS is responsible for the wastewater and water related to waste aspects of the SDG Target 6.3 reporting. It is therefore necessary to establish:

a. Whether these indicators are already being reported under other SDGs by the DFFE;
b. Whether duplication of these indicators is desirable;
c. Whether sufficient waste data are available.

A key consideration for the development of new dedicated methodologies under SDG Target 6.3 is to determine whether the DFFE reporting is aligned with the intentions of SDG Target 6.3, allowing for adoption/sharing of the existing methodologies. Based on feedback from the SDG Target 6.3 team, DWS specific, SDG Target 6.3 methodologies, need to be developed (or modified) for three additional indicators, which align with the ambition of SDG Target 6.3. If duplication of the indicators is not considered to be desirable then these indicators are recommended to be merged or discontinued, based on a unified approach between DWS and DFFE.

A collaborative effort between the DWS, DFFE, WRC and Professional Services Provider (PSP) will be required to identify and source the data. Existing platforms / sources such as the South African Waste Information System (SAWIS) should be studied to establish the availability, completeness and relevance of the data. This would be considered to be a positive SDG outcome, based on the improvements developed through collaborative work across departments and SDG reporting programmes.

Collaboration and alignment with the DFFE is necessary to ensure the correct data are sourced and reported. Similar collaboration and alignment is required for the SDG Target 6.3 reporting criteria.

3.2.2 SDG Target 6.3 Findings and Recommendations

Based on the SDG Target 6.3 review significant overlap between the indicators in the SDG programme have been identified; for example, the monitoring of water quality, and the monitoring of wastewater discharge from WWTWs and industry. The following key findings and recommendations relate to SDG Target 6.3:

- Improvements have been identified in relation to the South African domesticated SDG Indictors 6.3.1D and SDG 6.3.2D monitoring, including:
    - The closing out of data gaps is necessary, retrospectively, due to a lack of discharge compliance reporting and Water Use Licence (WUL) audits (2017 and 2018 period primarily).
    - An increase in the number of samples taken, and an increase in requirements for data reporting, relative to the 2017 number of samples.
    - Industrial and mining discharge point sources should be monitored (identified from the WUL database); and
    - Mining and agricultural non-point sources should be monitored (identified from the WUL database).

3.2.2.1 SDG Indicators 6.3.1D and SDG 6.3.3.A

- The SDG Indicators 6.3.1D and 6.3.3A data should be aligned with and retrieved from the Green Drop Assessment (GDA) programme.
- The data for SDG Indicator 6.3.1D needs to be expanded and deficits in the data need to be rectified before SDG Indicator 6.3.3A can produce meaningful numbers. Recommendations in relation to the closing out of data deficits include:
    - Assessment of the currently available data for usefulness and/or relevance.
    - Investigate the feasibility of common information management systems (for waste and water containing waste).
    - Improve data collection of wastewater recycling volumes (the amount prevented from being discharged) by engaging with DFFE, national permitting processes (WUL) and municipal permitting processes to obtain data for mines, industries, and agriculture.

3.2.2.2 SDG Indicator 6.3.2D

- The SDG Indicator 6.3.2D data should be aligned with and retrieved from the resource quality objectives (RQO) database. Noting that not all WMA's have RQO's. In the absence of RQO's the DWS State of the Rivers Report may provide suitable data until such time as RQO's are developed. (Ref: REMP (River Eco-status Monitoring Programme) State of Rivers reports - formerly RHP (River Health Programme), RQIS (Resource Quality Information Services) - Department of Water and Sanitation - South Africa - (dwa.gov.za))
- SDG Indicator 6.3.2D should be expanded to include additional waste parameters which are covered in SDG Indicator 14.1.1, including floating plastic debris, and the microplastic content of water; which would be sampled along with the other parameters for SDG Indicator 6.3.2D.
    - The extent of data availability for each proposed data source should be established, and a matrix compiled to determine the minimum data sources required to triangulate waste sources and receptors.

3.2.2.3 SDG Indicators 6.3.4A and SDG 6.3.5A

- The additional indicators SDG Indicators 6.3.4A and SDG 6.3.5A, require data to be obtained from the DFFE in relation to solid waste management.

Refer to **Appendix A**, for the detailed SDG Target 6.3. report and draft methodologies for SDG Indicators 6.3.3A, SDG 6.3.4A and SDG 6.3.5A.

3.2.3 SDG Target 6.3 Additional Indicator Methodologies

Pollution of water resources can take place through point source and non-point source pollution. Point-source discharges include those from wastewater treatment works (WWTWs) of municipalities, commercial activities, and industrial activities. Non-point source pollution is generated over larger areas, including run-off from urban and agricultural land, mine residue deposits (particularly relevant to old and abandoned deposits) and waste disposal facilities. Increased recycling and reuse of waste and water containing waste, in appropriate situations, supports SDG Target 6.3, and, in the case of the recycling or reuse of water containing waste, reduces demand for raw water.

The proposed methodologies for the additional indicators SDG Indicators 6.3.3A, SDG 6.3.4A and SDG 6.3.5A, require data to be obtained from the DFFE in relation to solid waste management. The proposed methodology for SDG Indicator 6.3.3A centres on the recycling and reuse of water containing waste. The proposed methodology for SDG Indicator 6.3.4A focuses on the proportion of waste lawfully disposed of, while SDG Indicator 6.3.5A concentrates on proportion of waste recycled, reused and recovered. **Table 3.2** summarizes the sub-indicator methodology calculations, with possible targets and indicators identified for consideration based on global and national targets. The methodologies include assessment of existing indicator data, or examples thereof. These targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

Table 3.2. SDG Indicators 6.3.3A, 6.3.4A and 6.3.5A Methodology and Target Recommendations

Sub-Indicator	Methodology	Global Target	National Target
6.3.3A Recycling and reuse of water containing waste	The proposed methodology includes measurement of recycled and reused water streams, for municipal, agricultural, industrial and mining applications. The proposed methodology consists of two calculations: • Recycled/reused water percentage from point sources of wastewater (households, commercial establishments and industries) • Recycled/reused water percentage from non-point sources of wastewater (run-off from urban and agricultural land). $V_t = \frac{V_a + V_c}{V_b + V_d} \times 100$	The global aspiration of Target 6.3 is that by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Countries may set their own targets but ideally there should be no further degradation of water-related ecosystems from the baseline. A Milestone Sub-Target proposed that 50% of designed streams of water containing waste are reused and / or recycled
6.3.4A Proportion of waste lawfully disposed of	The SDG 11.6.1 methodology aims to ensure that solid waste produced by cities is collected and managed to ultimately improve upon living conditions and promote environmental sustainability (Min, 2020). Data that is collected for this indicator, is collected on a regional basis and can be disaggregated at both city and town levels. $x = \frac{\left[\begin{matrix} Total\ mass\ of\ solid \\ waste\ collected \\ and\ managed\ in \\ controlled\ facilities \end{matrix}\right]}{\left[\begin{matrix} Total\ solid \\ waste\ generated \\ by\ South\ Africa \end{matrix}\right]} \times 100$ (Ghafari, 2022)		**Target 11.6**: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management **Indicator 11.6.1:** Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities
6.3.5A Proportion of waste recycled,	The National Recycling Rate refers to the amount of material that is recycled in a country, plus		**Target 12.5:** By 2030, substantially reduce waste generation through

Sub-Indicator	Methodology	Global Target	National Target
reused and recovered	quantities exported for recycling in relation to the total waste generated in the country, minus any material intended for recycling that is imported (Ghafari, 2022; SDG 12 Hub, 2022) $\boldsymbol{National\ recycling\ rate} = \frac{\left[\begin{matrix} total\ material\ recycled \\ +material\ exported \\ for\ recycling\ - \\ material\ imported \\ for\ recycling \end{matrix}\right]}{\left[\begin{matrix} total\ waste \\ generated\ in \\ South\ Africa \end{matrix}\right]} x100$ (Ghafari, 2022)		prevention, reduction, recycling and reuse. **Indicator 12.5.1**: national recycling rate, tons of material recycled.

3.3 SDG TARGET 6.6 BACKGROUND AND INDICATORS

SDG Target 6.6 is a global indicator, which monitors the extent and quality of the water-related ecosystems using global data tools and products. According to the UN Water Integrated Monitoring Guide for SDG 6 on Water and Sanitation Targets and Global Indicators, "Target 6.6 seeks to halt the degradation and destruction of water related ecosystems, and to assist the recovery of those already degraded. The target includes water-related ecosystems such as vegetated wetlands, rivers, lakes, reservoirs and groundwater as well as those occurring in mountains and forests, which play a special role in storing freshwater and maintaining water".

Table 3.3 summarises the South African SDG Target 6.6 Indicators and Sub-indicators.

Table 3.3. SDG Target 6.6 South African Indicator and Sub-indicators

Target 6.6	Indicator		Extent	Status
Ecosystems – protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1G	Change in the extent of water-related ecosystems over time	Global	Percentage change in the surface area of wetlands (vegetated and unvegetated/arid), estuaries, reservoirs and lakes over time from a predefined baseline, expressed as a % of the total land area
	6.6.1.1D	Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes and estuaries as a	Domesticated	Change in Spatial Extent of Rivers Change in Spatial Extent of Wetlands, including lakes, vegetated wetlands, and ephemeral wetlands

Target 6.6	Indicator		Extent	Status
		percentage of total land area		Change in Spatial Extent of Estuaries Change in the Extent of Estuarine Functional Zones (EFZ) Change in Spatial Extent of Artificial Systems (Reservoirs)
	6.6.1.2D	Number of lakes and dams affected by high trophic and turbidity states	Domesticated	Proportion of lakes and dams affected by High Trophic States Proportion of lakes and dams affected by High Turbidity States
	6.6.1.3D	Change in the national discharge of rivers and estuaries over time	Domesticated	Change in the Water Quantity in Rivers Change in the Water Quantity in Estuaries
	6.6.1.4D	Change in groundwater levels over time	Domesticated	Change in Groundwater Levels over time
	6.6.1.5D	Change in the ecological condition of rivers, estuaries, lakes and wetlands	Additional	Change in the Ecological Condition of Rivers Change in the Ecological Condition of Estuaries Change in the Ecological Condition of wetlands

Based on the UN SDG Goal Tracker for South Africa[6], data for Indicator 6.6.1 (2018) and 6.6.1.3 (2010 and 2017) is available at present.

3.3.1 SDG Target 6.6 Methodology Review

The SDG Target 6.6. – Water Related Ecosystems Methodology Report is a well compiled report, incorporating extensive material from both a global and national perspective.

South Africa has extensive datasets developed over many years of work, in relation to water related ecosystems. The challenge faced in reporting against the UN SDG Target 6.6 methodologies is that the South African historical data sets were largely not compiled for the particular purpose prescribed by the UN, i.e. relates to a dataset that is stable (not still mapping and adding in "new" wetlands, and accurate enough, the extent is regularly review, sufficient to pick up change in extent over time). However, the UN SDG Target 6.6. global reporting does provides a platform for the amalgamation of the locally generated data sets into a

[6] https://south-africa.goaltracker.org/platform/south-africa/data

standardised reporting system, which then allows the combined data sets to be comparable to other global data sets, and allows for benchmark South Africa in the global context.

The South African methodologies generated in relation to SDG Target 6.6. water related ecosystems, have largely been based on historical data sets (data sets collected for various monitoring purposes, prior to the development and implementation of the SDGs) to develop the baseline data set, against which future monitoring updates are compared. These methodologies may require updating as further data are compiled, and should be robust enough to accommodate technological advances, to improve on the reporting efficiencies to supplement historical data reporting systems.

3.3.1.1 SDG Target 6.6 Methodology Considerations

From the review of current methodologies that have been implemented for monitoring changes in the extent of water-related ecosystems, it is evident that there are certain limitations that need to be addressed in order to produce more representative datasets and ensure that these ecosystems are well monitored to sustain them in the long-term, including:

- SDG Indicator 6.6.1 sub-indicators need more continuous datasets (rather than the provision of statistics at a point in time), to be able to make more representative comparisons with the datasets globally. The country can achieve this by collaborating with the UNEP to improve upon the datasets that are produced at a global scale.
- Landsat imagery (at a 30 m spatial resolution) is currently being used to derive data for water-related ecosystems. These images can classify large areas of surface water, however, are too coarse to identify smaller water bodies. Developments are reportedly currently taking place to ensure the use of higher resolution Sentinel data together with Landsat imagery for future datasets to produce more accurate outcomes. This will result in more representative and continuous globally available datasets for South Africa's water-related ecosystems.
- The water quality of water-related ecosystems and methodologies for monitoring changes in the number of lakes and dams affected by high trophic and turbidity states, are still in progress.
    - The labour intensive secchi disc depth is being used to obtain measurements for monitoring turbidity of water bodies, limiting data to areas that have been sampled. Newer methods of turbidity measurement are available and a window period of using both methods would be required to ensure continuity of observations.
    - The trophic status, data are currently generated using the NEMP.
    - The use of satellite-based earth observations acquired from both Landsat and Sentinel imagery is highly recommended. This imagery can be used to derive chlorophyll α (Chl) and total suspended solids (TSS) data. Chl can provide an indication of the extent of eutrophication in water bodies, while TSS can be used to determine the extent of sedimentation.

3.3.1.2 SDG Target 6.6 Targets and Indicators

According to the UN Integrated Monitoring Guide for SDG 6, Step-by-step monitoring methodology for indicator 6.6.1 on water related ecosystems "The 2030 Agenda for Sustainable Development specifies that all SDG targets "are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances."

The global ambition of the Target 6.6 is to "protect and restore" ecosystems (without any numeric specification), and it is up to each country to set their own targets. The Aichi Biodiversity Targets of the Convention of Biological Diversity, sets out several objectives for ecosystem management. The Target for 2020 was to have Indicator 6.6.1 monitoring information, that could be used to guide countries in relation to the management, protection and restoration of these ecosystems. The three primary Aichi Biodiversity Targets that are of relevance to SDG Indicator 6.6.1 include Target 5, 14 and 15, which are further discussed below.

3.3.1.3 SDG Target 6.6 Possible Additional Sub-Indicator

The spatial extent of mangroves is currently incorporated into the SDG Indicator 6.6.1D(1b) methodology, however the available data and UN methodologies provide an opportunity to separate this indicator out from the group wetland indicator reporting. There is no particular need to create a separate mangrove methodology, unless this is considered necessary by the particular team involved in the data collection, collation, aggregation and reporting. The possible additional sub-indicator identified during this review, for consideration is the "Change in spatial extent of water related ecosystems – vegetated wetlands (mangroves)".

Refer to **Appendix B**, for the detailed review of the SDG Target 6.6. methodologies.

3.4 SDG TARGET 6.B BACKGROUND AND INDICATORS

According to the UN Water Integrated Monitoring Guide for SDG 6 on Water and Sanitation Targets and Global Indicators, "*Target 6.B aims for the participation of local communities in water and sanitation planning and management, which is essential for ensuring that the needs of all people are being met. The involvement of relevant stakeholders is further necessary to ensure: that the technical and administrative solutions decided upon are suitable for specific socioeconomic contexts, the full understanding of the impacts of a certain development decision and the encouragement of local ownership of the solutions when implemented (to ensure sustainability over time). Target 6.B supports the implementation of all SDG 6 targets (targets 6.1-6.6 and 6.a) by promoting the meaningful involvement of local communities, which is also a central component of IWRM.*"

At the international level, SDG Target 6.B comprises one indicator: "*Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management*."

Table 3.4 summarises the South African SDG Target 6.B Target and Indicators.

Table 3.4. Current SDG Target 6.B Targets and Indicators in South Africa

Target 6.B	Indicator		Extent	Status
Support and strengthen the participation of local communities in improving water and sanitation management	6.B.1G	Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management	Global	Active

The DWS has considered Water Service Authorities (WSAs) as the local administrative units, which are required to have such policies in place to unlock funding to implement their business. All WSAs include policies and procedures in terms of the inclusion of communities throughout the project cycle and therefore South Africa scores 100% in terms of the criteria provided by the UN.

The current indicator does not measure performance in terms of the application of such policies and guidelines. There is no way of measuring whether communities are being included as per the policy/guideline intentions nor what the impact of their participation is towards a particular project (e.g. measured in terms of cost/benefit, sustainability, numbers of community members employed, etc.) As a result, DWS requires a new indicator (Indicator 6.B.2) and a method of computation which will assist in measuring performance linked to Indicator 6.B.1.

1. Indicator 6.B.1: Review of "Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management". The scope is to review the current approach and confirm its suitability.
2. Indicator 6.B.2: New indicator and method of computation including a proposed Target for 2030.

3.4.1 SDG Target 6.B Methodology Review

The global SDG Target 6.B methodology report (WHO, March 2017) is a well compiled report, allowing for the incorporation of extensive material from both a global and national perspective. This report is however only in its draft form and should therefore be finalised before being used for domestic reporting.

There are no domesticated methodologies available for South Africa and the country is currently using the draft global methodology report. While the current methodology report for SDG Target 6.B is very comprehensive, a few limitations have been identified, especially in terms of the data requirements and suitability of the current indicator outcomes in meeting the target requirements.

To achieve sustainable development, consistency is required between the development of policies and the providers of development assistance (Fourie, 2018). The difficulty comes in achieving this consistency, which can be improved by using the following five guidelines, identified to be of relevance for South Africa, including:

i. Prioritising political buy-in.
ii. Safeguarding country ownership of development priorities.
iii. Using and improving existing institutional structures and processes.
iv. Stimulating cooperation across government departments by using an issue-based approach.
v. Including a long-term and transnational perspective when considering policy impacts.

Water resource management requires an integrated approach to sustainable development (Fourie, 2018). Trade-offs have also been identified resulting from water and sanitation management, therefore stressing the importance of improving water and sanitation management efforts. For example, improved water management will result in an increase in the access of clean water, improving the output of agricultural yields.

3.4.2 SDG Target 6.B Key Findings and Recommendations

Based on the review of the methodology developed to date for SDG Target 6.B, the lack of monitoring of community involvement in water and sanitation management is a key concern. A new draft methodology for SDG Indicator 6.B.2 to allow for the gauging of community involvement related to SDG Indicator 6.B.1, will provide and accurate representation of:

- Community participation in improving water and sanitation within South Africa
- The status quo of the country in achieving SDG Target 6.B.

1. The proposed methodology for SDG Indicator 6.B.2 includes measurements for stakeholder engagements and data collection at national, provincial and local scales.
2. The proposed South African methodology generated in relation to SDG Indicator 6.B.2 focuses on the level of community involvement in improving water and sanitation management within South Africa. This methodology should be robust enough to accommodate technological advances, to improve on the reporting efficiencies to supplement historical date reporting systems.

Refer to **Appendix C**, for the detailed review of the SDG Target 6.B. methodology and the draft additional methodology developed for SDG Indicator 6.B.2.

CHAPTER 4: SITUATION ASSESSMENT OF SDG TARGET 6.3, 6.6 AND 6.B INDICATORS FOR SOUTH AFRICA

4.1 INDICATOR SITUATION ASSESSMENT BACKGROUND

The management targets and indicators that have been set for SDG Target 6.3 water quality (point and non-point sources and instream / resources water quality) in South Africa are to be identified and evaluated, and integrated with similar indicators defined in the following relevant strategies:

a. Agenda 2063
b. United Nations Convention to Combat Desertification (UNCCD): South Africa: Final country report of the LDN Target Setting Programme (October 2018)
c. National Development Plan
d. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
e. National Water Resource Strategy 2
f. National Water and Sanitation Master Plan (Volume 1-3)

The management indicators that have been set for SDG Target 6.6 water-related ecosystems (estuaries, groundwater, wetlands, rivers, artificial ecosystems, and lakes) in South Africa are to be identified and evaluated, and integrated with similar indicators defined in the following relevant strategies:

a. Agenda 2063
b. UNCCD: South Africa: Final country report of the LDN Target Setting Programme (October 2018)
c. National Development Plan (NDP)
d. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
e. National Water Resource Strategy 2 (NWRS)
f. National Water and Sanitation Master Plan (Volume 1-3) (NWSMP)
g. Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation in South Africa
h. National Protected Area Expansion Strategy (NPAES)
i. South Africa's National Biodiversity Strategy and Action Plan
j. National Biodiversity Assessment 2018
k. Peat Management Protocol (Draft)

The intention is to identify other initiatives within the SDG Target 6.3 and SDG Target 6.6. space to prevent duplication, where targets and indicators have been developed and to assess relevance and applicability of existing targets and indicators. Where there are identified gaps (i.e. where new targets and indicators are required), potential priorities for method development and incorporation of recommended targets into the various sector strategies will be proposed by DWS. Based on the outcome of the review, potentially applicable targets and indicators are summarised for consideration by DWS in relation to the relevant SDG Targets.

4.1.1 Agenda 2063

Agenda 2063 is Africa's blueprint and master plan for transforming Africa into the global powerhouse of the future. It is the continent's strategic framework that aims to deliver on its goal for inclusive and sustainable development (**Table 4.1**). Agenda 2063 is the concrete manifestation of how the continent intends to achieve this vision within a 50-year period from 2013 to 2063.

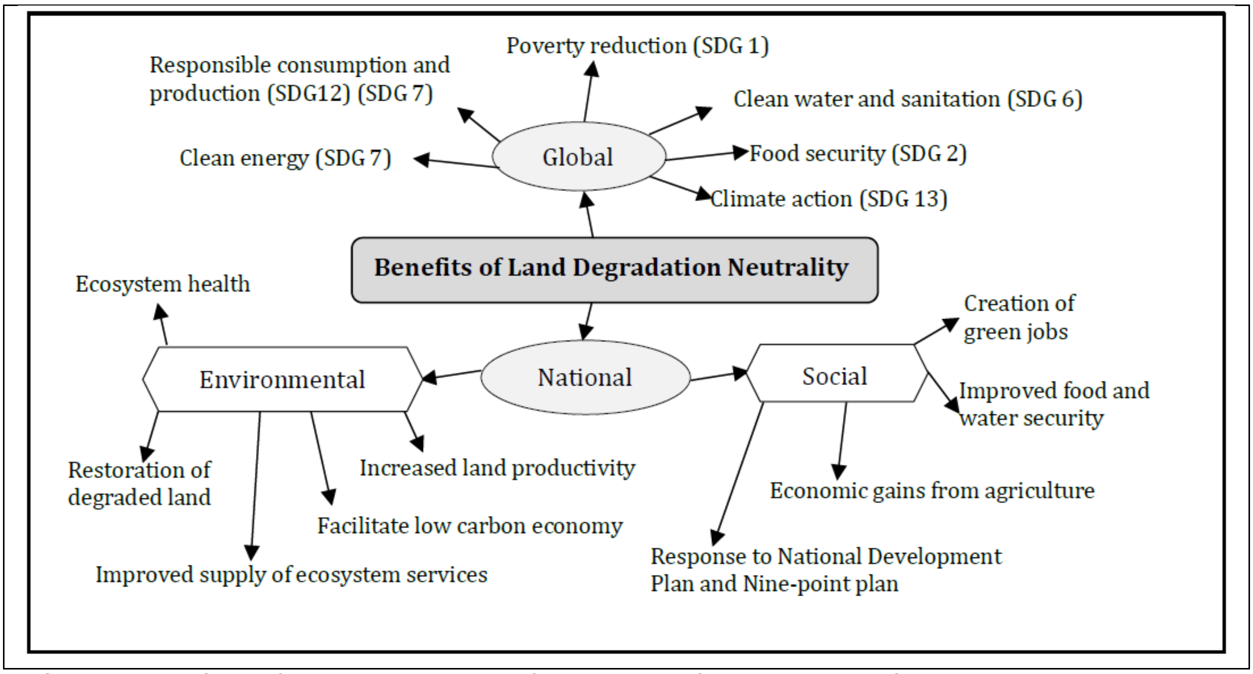
Table 4.1. **Agenda 2063 Goals relating to SDG 6**

Aspiration	Agenda 2063 Goal		Agenda 2063 Priority Areas
A Prosperous Africa, based on Inclusive Growth and Sustainable Development	6.	Blue/ocean economy for accelerated economic growth	Marine resources and energy Port operations and marine transport
	7	Environmentally sustainable and climate resilient economies and communities	Sustainable natural resource management and Biodiversity conservation Sustainable consumption and production patterns Water security Climate resilience and natural disasters preparedness and prevention Renewable energy

Note: Source – “https://au.int/agenda2063/goals”

4.1.2 UNCCD LDN Target Setting Programme (2018)

Land degradation, biodiversity loss and climate change are interlinked global environmental problems. At the national scale, South Africa aims to achieve Land Degradation Neutrality (LDN) by 2030. The implementation of the LDN targets will be achieved through South Africa’s UNCCD National Action Programme (NAP). The revised NAP (2017-2027) aims to achieve LDN by 2027. Achievement of LDN will result in benefits at multiple scales (**Figure 4.1**). At the global scale, achievement of LDN will have positive effects on other SDGs, including SDG 6.



Note: Source – DFFE, South Africa: Final country report of the LDN Target Setting Programme, October 2018

Figure 4.1. Benefits of Achieving Land Degradation Neutrality.

Key drivers of land degradation and targets to avoid or minimize degradation or restore degraded land in relation to SDG 6 in South Africa are summarised in **Table 4.2** and **Table 4.3**, respectively.

Table 4.2. SDG 6 Relevant LDN Proximate and Underlying Drivers of Land Degradation

Driver	Example of causality	Proximate or Underlying Drivers
Over-abstraction of water	Major challenge in dryland areas	Proximate (direct) drivers
Alien invasive species	Several invasive species in country adversely affecting biodiversity and supply of ecosystem services	
Topography (natural)	Steep slopes vulnerable to water induced erosion	
Climate (natural)	Dry hot areas prone to naturally occurring fires which, may lead to erosion	
Soil erodibility (natural)	Soils with high silt or sodium content naturally prone to erosion	
	Duplex soils prone to erosion	
Pollution of land and water sources	Heavy metals in effluent from mines	
High population density	May lead to increased pressure on land, a common problem in former homelands	Underlying (Indirect) drivers
Market access	Reduced livestock offtake may lead to overgrazing	
Land tenure	Insecure tenure may lead to adoption of unsustainable land management practices	
Poverty	Vicious cycle between poverty and land degradation: poverty may lead to land degradation while land degradation may lead to poverty	
Decentralization	Lack of decentralization could lead to poor enforcement of bylaws and other regulations resulting in poor governance	

Note: Source – Adapted from Nkonya *et al.* (2016) define proximate drivers as biophysical factors and unsustainable land management practices, and underlying drivers as social, economic and institutional factors that lead to unsustainable land management practices

Table 4.3. SDG 6 Relevant LDN Targets for South Africa

Negative trend	Corrective measures	LDN Target year
Shrubs, grassland and sparsely vegetated areas showing early signs of decline and having a declining productivity	SLM practices to avoid overgrazing SLM practices to avoid soil erosion Control of alien invasive species Control bush encroachment Rehabilitation of degraded areas (through economic incentives) Introduce stewardship programmes	2030
Wetlands showing early signs of decline and declining productivity	SLM practices to avoid overgrazing Rehabilitation	2030
Artificial areas	Waste management Storm water control Establishing vegetation strips and cover	2030

Negative trend	Corrective measures	LDN Target year
	Water quality improvement	
Alien invasive species (e.g. Prosopsis species)	Clearance of invasive species and promote establishment of local species Rehabilitation after clearing of alien vegetation to avoid soil erosion and re-colonization by alien species	2030

Note: Source – DFFE, South Africa: Final country report of the LDN Target Setting Programme, October 2018

4.1.3 National Development Plan

The National Development Plan (NDP), issued in 2012, aims to eliminate poverty and reduce inequality by 2030 and provides a broad strategic framework to guide key choices and actions. The 15 chapters of the NDP address the major thematic areas in detail, providing evidence, recommendations and clear implementation frameworks.

A summary of the NDP objectives and actions which relate to SDG 6 is summarised in **Table 4.4.**

Table 4.4. SDG 6 Relevant NDP Objectives and Actions for South Africa

Chapter		Action		
3	Economy and Employment	5	Increase the benefit to the country of our mineral resources by	Increasing rail, water and energy infrastructure
4	Economic Infrastructure	24	Water Resources	Comprehensive management strategy including an investment programme for water resource development, bulk water supply and wastewater management for major centres by 2012, with reviews every five years
		25	Water Resources	Complete phase 2 of the Lesotho Highlands water project by 2020
		26	Water Resources	Development of several new water schemes to supply urban and industrial centres, new irrigation systems in the Umzimvubu river basin and Makhathini Flats, and a national water conservation programme to improve water use and efficiency
		27	Water Resources	Create regional water and wastewater utilities, and expand mandates of the existing water boards (between 2012 and 2017)
7	South Africa in the Region and the World	41	Implement a focused regional integration strategy with emphasis on:	Strengthening regional cooperation in food and energy markets and water management

4.1.4 Medium Term Strategic Framework: Outcome 10 Phase 2

The Medium-Term Strategic Framework (MTSF) 2014-2019 outlined the plan and outcome-based monitoring framework for implementing the NDP, issued in 2012.

The MTSF reflects the NDP 5 Year Implementation Plan and Integrated Monitoring Framework at a national level. The Provincial Growth and Development Strategies / Plans (PGDS/P) for the nine provinces are intended to incorporate the Integrated Development Plans (IDPs) at Metropolitan and District Municipality level, to ensure effective service delivery. The PGDSs will form the mechanism through which the MTSF implementation takes place.

South Africa, as a member of the UN, has been actively involved in the process leading up to the adoption of the Agenda 2030 and the achievement of the SDGs. According to the MTSF the enhanced national implementation of the UN SDGs, in accordance with Agenda 2030 and Agenda 2063, is identified as one of the 6 key outcomes of the '2024 Impact I: A better South Africa'. The proposed interventions require improvement of the overall quality of infrastructure, to be measured as a percentage improvement.

The implementation of SDG 6 is identified under Priority 2 "Economic transformation and job creation" and Priority 5 "Spatial integration, human settlements and local government".

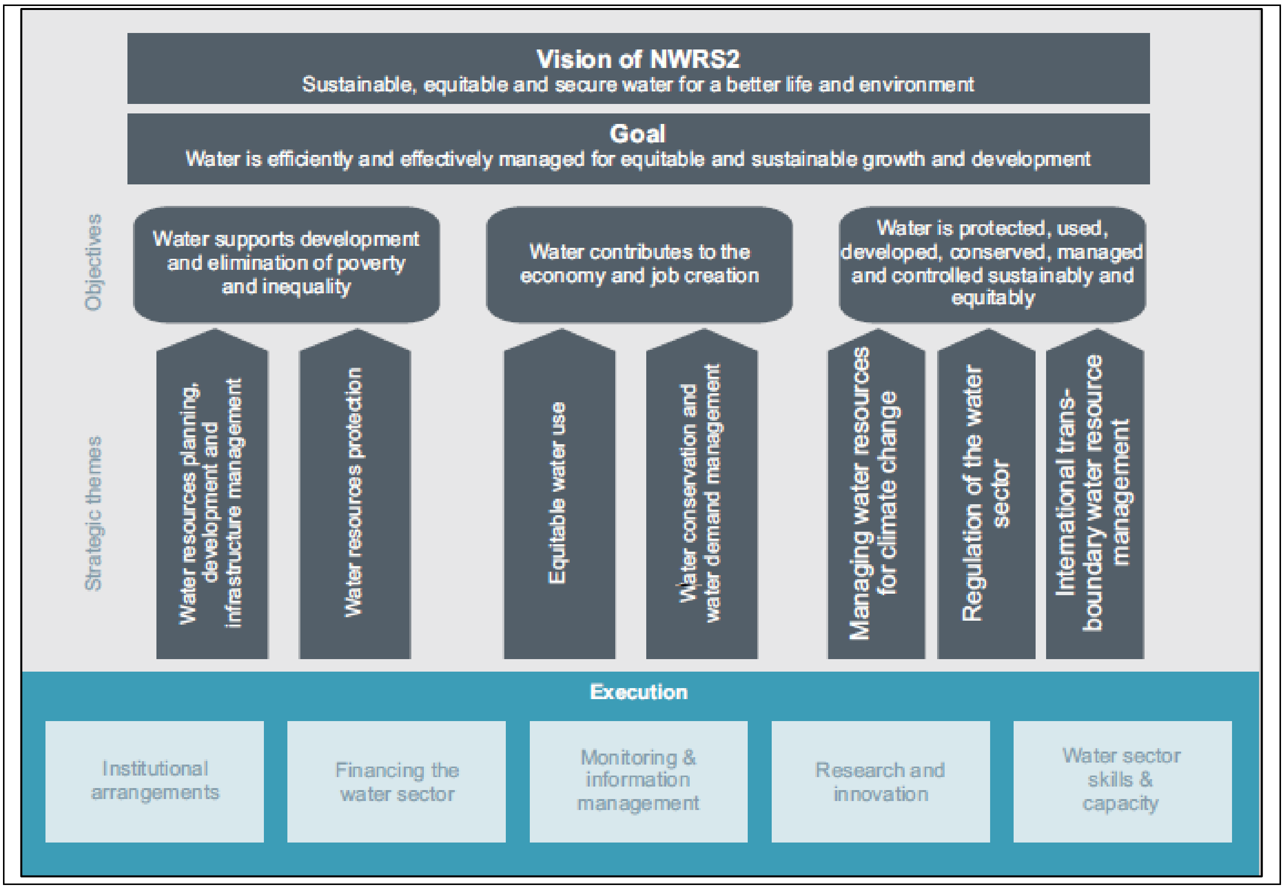
4.1.5 National Water Resource Strategy 2

The major focus of the National Water Resource Strategy 2 (NWRS2), issued by DWS in 2013, is equitable and sustainable access and use of water by all South Africans, while sustaining our water resources. The NWRS2 sets out how South Africa will achieve three core objectives:

- Water supports development and the elimination of poverty and inequality.
- Water contributes to the economy and job creation, and
- Water is protected, used, developed, conserved, managed, and controlled sustainably and equitably.

South Africa is considered to have well-developed water resources infrastructure, however the NWRS2 of 2013 states that "we are fast approaching full utilisation of available surface water yields and are running out of suitable sites for new dams". Further pressure in relation to climate change outcomes in terms of rainfall and temperature will have a negative impact on water storage. New ways of reducing water demand and increasing availability are required to ensure a sustainable water balance. A multitude of alternative strategies to "traditional engineering solutions" have been identified, including water conservation and water demand management (WCWDM), further utilisation of groundwater, desalination, water re-use, rainwater harvesting and treated acid mine drainage.

The NWRS2 analyses the role of water in the economy (in accordance with the NDP) and identifies the specific challenges, development opportunities and actions that inform the agreed framework for priority areas of focus for the country. The NWRS2 objectives, strategic themes and execution are summarised in **Figure 4.2**.



Note: Source – DWA, National Water Resource Strategy, Second Edition, June 2013

Figure 4.2. NWRS2 Strategy Overview from Vision to Execution

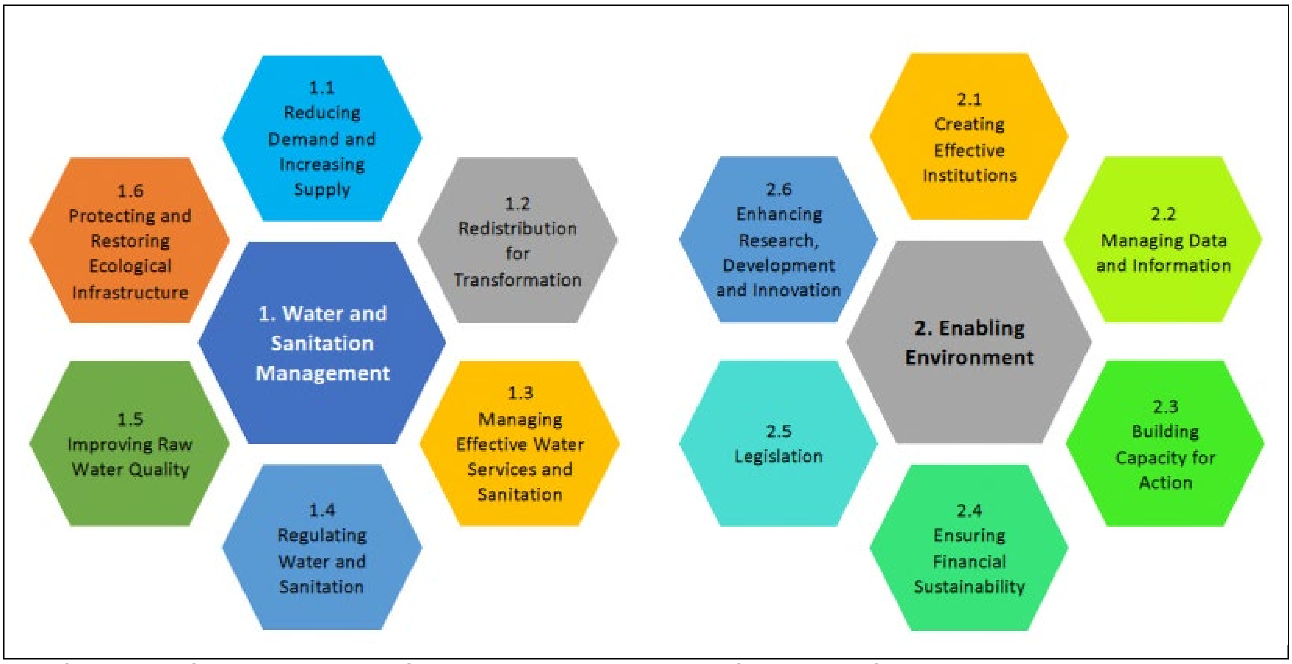
4.1.6 National Water and Sanitation Master Plan (Volume 1-3)

The aim of the National Water and Sanitation Master Plan (NW&SMP) is to achieve a water secure future including reliable and affordable access to adequate and safe water and sanitation to improve social and economic well-being with due regard to the environment. As introduced in Volume 1: Call to Action of the NW&SMP, the key objectives of the Master Plan that define a 'new normal' for water and sanitation management in South Africa speak to the main challenges within the water sector, including:

- Resilient and fit-for-use water supply.
- Universal water and sanitation provision.
- Equitable sharing and allocation of water resources.
- Effective infrastructure management, operation and maintenance; and
- Reduction in future water demand.

The NW&SMP identifies critical priorities for the water sector, in alignment with the SDGs, African Union Agenda 2063, the NDP and the MTSF. To facilitate and accelerate progress towards the attainment of a water secure future for South Africa, the NW&SMP focuses on twelve key elements which are grouped under two main themes (**Figure 4.3**)., namely:

- Water and sanitation management; and
- Enabling environment.



Note: Source – DWS, National Water and Sanitation Master Plan, Volume 1: Call to Action, October 2018

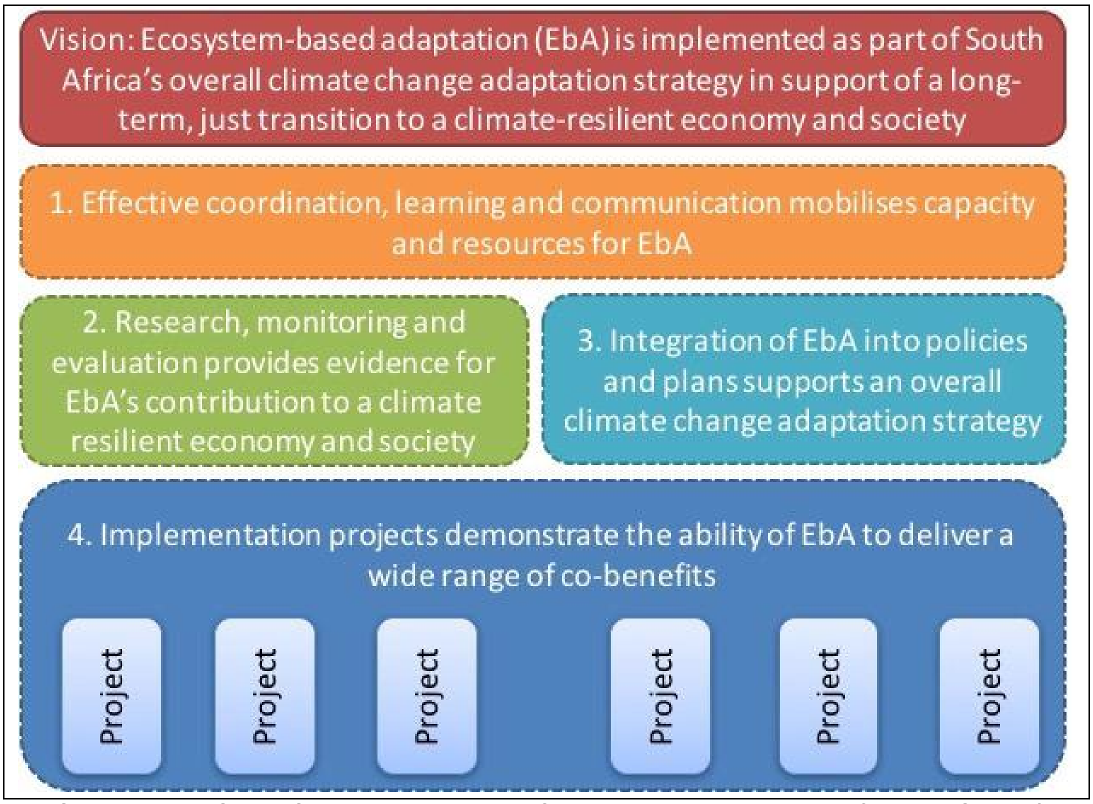
Figure 4.3. NW&SMP Service Strategy

4.1.7 Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation in South Africa

The Strategic Framework and Overarching Implementation Plan for Ecosystem-based Adaptation (EbA) aims to take forward EbA as a central component of South Africa's work programme on biodiversity and climate change. The EbA is aligned to the SDGs, and particularly with Goal 13 and its targets to "Take urgent action to combat climate change and its impacts".

The EbA Strategy sets out a vision for EbA and identifies four priorities / outcomes required to achieve that vision (**Figure 4.4**) that EbA be "*implemented as part of South Africa's overall climate change adaptation strategy in support of a long term, just transition to a climate-resilient economy and society*"

Outcome 2 (one of four outcomes relevant to SDG Target 6): Research, monitoring and evaluation provides evidence for EbA's contribution to a climate-resilient economy and society, to provide methodologies aligned to SDG 6. The research strategy aimed to identify priorities and institutional alignment to enable research in support of a body of evidence needed to inform EbA policy and practice. In conjunction with a monitoring and evaluation plan, EbA is anticipated to be better understood and evaluated to support effective implementation, replication, and upscaling.



Note: Source – DFFE, SANBI, Strategic Framework and Overarching Implementation Plan for EbA in South Africa, 2016-2021

Figure 4.4. South Africa's Strategic Framework for Ecosystem-based Adaptation

4.1.8 National Protected Area Expansion Strategy

The National Protected Area Expansion Strategy (NPAES), first published in 2008 (NPAES 2008), presents a 20-year strategy for the expansion of protected areas in South Africa. The NPAES 2016 includes:

- New biodiversity data and newly declared protected areas as well as updated provincial conservation plans and provincial Protected Area Expansion Strategies (PAES), to improve the setting of targets and the identification of priority areas for meeting these targets.
- A review of the performance of protected area institutions in protected area expansion for the first implementation phase of the NPAES (2008-2014).
- A description of the priority activities, with explicit performance targets, for the second implementation phase (2016-2020) of the NPAES

The goal of the NPAES is to achieve cost effective protected area expansion for improved ecosystem representation, ecological sustainability, and resilience to climate change. It sets protected area targets, maps priority areas for protected area expansion, and makes recommendations on mechanisms to achieve this.

The partialities of the current protected area network are being addressed to ensure more effective inclusion of under-represented terrestrial ecosystems, river ecosystems, wetlands, estuaries, and marine ecosystems in the national protected area estate. The revised NPAES 2016 includes targets for terrestrial vegetation types and broad marine systems, as well as comprehensive targets for wetlands, rivers, estuaries, specific marine ecosystems, as well as for the terrestrial and marine ecosystems of our Southern Oceans and Sub-Antarctic territories. These targets were set based on a new integrated ecosystem map, covering terrestrial, river, wetland, estuarine, coastal and marine ecosystems, and therefore aligned to the SDG Target 6.6 targets and indicators.

4.1.9 South Africa's National Biodiversity Strategy and Action Plan

The National Biodiversity Strategy and Action Plan (NBSAP) is a requirement of contracting parties to the Convention on Biological Diversity (CBD). NBSAPs set out a strategy and plan for contracting parties to fulfil the objectives of the CBD. With the adoption of the CBD's Strategic Plan for Biodiversity for 2011-2020, parties agreed to revise and align their NBSAPs to the CBD's Strategic Plan and the Aichi Targets. The NBSAP was revised for the period 2015-2025. It identifies the priorities for biodiversity management in South Africa for this period, aligning these with the priorities and targets in the global agenda, as well as national development imperatives.

The NBSAP's vision is to "conserve, manage and sustainably use biodiversity to ensure equitable benefits to the people of South Africa, now and in the future". The NBSAP has 6 strategic objectives, and those that relate to SDG 6 are summarised in **Table 4.5**.

1. Management of biodiversity assets and their contribution to the economy, rural development, job creation and social wellbeing is enhanced.
2. Investments in ecological infrastructure enhance resilience and ensure benefits to society.
3. Biodiversity considerations mainstreamed into policies, strategies and practices for a range of sectors.
4. People mobilized to adopt practices that sustain the long-term benefits of biodiversity.
5. Conservation and management of biodiversity is improved through the development of an equitable and suitably skilled workforce.
6. Effective knowledge foundations, including indigenous knowledge and citizen science, support the management, conservation, and sustainable use of biodiversity

Table 4.5. SDG 6 Relevant NBSAP Strategic Objectives and Outcomes for South Africa

NBSAP Strategic Objectives		NBSAP Outcomes	
2	Investments in ecological infrastructure enhance resilience and ensure benefits to society	2.1	Restore, maintain and secure important ecological infrastructure in a way that contributes to rural development, long-term job creation and livelihoods
3	Biodiversity considerations are mainstreamed into policies, strategies and practices of a range of sectors	3.3	Strengthen and streamline development authorisations and decision-making
		3.4	Compliance with authorisations and permits is monitored and enforced
5	Conservation and management of biodiversity is improved through the development of an equitable and suitably skilled workforce	5.1	Macro-level conditions enabled for skills planning, development and evaluation of the sector as a whole
		5.2	An improved skills development system incorporates the needs of the biodiversity sector
		5.3	Partnerships are developed and institutions are capacitated to deliver on their mandates towards improved service delivery
6	Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation and sustainable use of biodiversity	6.1	Relevant foundational data sets on species and ecosystems are in place and well-coordinated
		6.3	Geographic priority areas for the management, conservation and restoration of biodiversity assets and ecological infrastructure are identified based on best available science

4.1.10 National Biodiversity Assessment 2018

The National Biodiversity Assessment (NBA) is the primary tool for monitoring and reporting on the state of biodiversity in South Africa and informs policies, strategic objectives and activities for managing and conserving biodiversity more effectively. The NBA is especially important for informing the National Biodiversity Strategy and Action Plan (NBSAP), the National Biodiversity Framework (NBF) and the National Protected Area Expansion Strategy (NPAES).

Key advances made in the process of developing the NBA 2018 include the development of several new indicators that add value to the NBA and allow for more comprehensive reporting on the status of the country's biodiversity. The indicators are key elements of the emerging National Biodiversity Monitoring Framework and support South Africa's international reporting requirements linked to the United Nations' CBD and UNCCD, as well as for the SDGs. New indicators in the NBA 2018 include:

- The species protection level indicator, which gauges how well protected areas represent and conserve species. A world first, this indicator complements the existing NBA indicator for ecosystem protection level.
- The first application of the Red List Index for South African species, utilising national Red List assessments, allows us to track trends in extinction risk for certain taxonomic groups that have undergone repeat assessments.
- Indicators of rates of terrestrial habitat loss, possible for the first time due to land cover data from several time points, strengthening assessment of ecosystem threat status which can be used in biodiversity prioritisation efforts.
- Potential indicators to track and monitor the status of genetic diversity were tested in the NBA 2018 and can assist to identify areas essential for the maintenance of genetic diversity across the landscape.

Effective management of national biodiversity data facilitates data sharing across user groups and sectors. The importance of the preparation and release of biodiversity indicators, on a more regular basis than the current NBA intervals (5-7 years) was identified to improve current data management. Indicator dashboards were noted to be under development to provide users with up-to-date information for improved reporting (e.g. SDGs) and streamlined management and planning.

CHAPTER 5: REVIEW OF SDG TARGET 6.3, 6.6 AND 6.B INDICATORS AND TARGETS FOR SOUTH AFRICA

5.1 INTRODUCTION

Through the review of global management targets and indicators for water quality, the type of targets that South Africa should be reporting are to be reconsidered. The sufficiency of existing targets and indicators regarding SDG Target 6.3 water quality and SDG Target 6.6 water-related ecosystems are to be assessed within this global context including the frequency of reporting in order to represent the true "sustainability status".

The relevant strategies associated with SDG Target 6.3 and SDG Target 6.6 that are to be integrated into the existing indicators and targets have been split accordingly, as presented under **CHAPTER 4**:.

5.2 AGENDA 2063

Agenda 2063 has some alignment to the SDG reporting however it would seem that the indicators and targets set for Agenda 2063 have a different reporting purpose and therefore limit alignment with the SDG's. This is resulting in a capacity and reporting challenge for countries torn between different reporting platforms and systems.

The actual indicators and target setting methodologies and associated calculations were not readily available for review to determine potential for better alignment between the SDG and Agenda 2063 reporting platforms. Task teams involved in Goals 6 and 7 of Agenda 2063 should be approached to determine alignment to the SDG reporting criteria.

5.2.1 Background

To ensure social and economic growth and development in Africa, Agenda 2063 was initialized for a period of 50 years at continental, regional and national scales. This period was separated into five ten-year plans, which included certain goals and targets that had to be achieved. These goals and targets are mainly set out to work towards the development of seven aspirations that ultimately aim to ensure sustainable socio-economic growth. The seven aspirations include:

1. A prosperous Africa based on inclusive growth and sustainable development.
2. An integrated continent, politically united based on the ideals of Pan-Africanism and the vision of Africa's Renaissance.
3. An Africa of good governance, democracy, respect for human rights, justice and the rule of law.
4. A peaceful and secure Africa.
5. An Africa with a strong cultural identity, common heritage, values and ethics.
6. An Africa, whose development is people-driven, relying on the potential of African people, especially its women and youth, and caring for children.
7. Africa as a strong, united, resilient and influential global player and partner.

The First Ten-Year Implementation Plan has already been implemented, extending from 2014 up until 2023. The latest progress has been reported in the second biennial report, detailing each country's performance, which involves an assessment of the actual value derived for 2021 against the base value (2013) and the expected value (2021). The methodology pertaining to these three data points, includes various analyses for specified indicators and involves multi-stakeholder participation. Significant progress has been made towards achieving the targets of the First Ten-Year Implementation Plan of Agenda 2063. This is evident from the reports provided from 38 of the 55 African Union (AU) Member States.

Aspiration 1, based on the data analysis, it is evident that progress has been made regarding better access to electricity, internet and health status. Some aspects, such as an increase in job opportunities, provision of better salaries and reducing hunger and poverty, however, revealed a weaker performance, which could have been attributed to several socio-economic factors. One of the major difficulties experienced was the COVID-19 outbreak.

Aspiration 2, Africa had an overall score of 84% indicating that the continent is on track to reach the 2023 targets. A major aspect contributing to the advanced continental integration is the African Continental Free Trade Agreement (AfCFTA) being signed by 54 of the 55 AU Member States. However, trading under this agreement is yet to take place. The main purpose of this AfCFTA is to promote trading within Africa to ensure growth and sustainable development and strengthen Africa as a continent in global trade.

Aspiration 3, an overall score of 42% was achieved. Good governance, democracy, respect for human rights, justice and rule of law are all aspects that need to be achieved to ensure that all citizens of this continent are able to live in harmony and have the right to be involved in the development of Africa. The African Charter on Democracy, Elections and Governance (ACDEG) has been implemented for the purpose of these aspects and includes commitments set out for all AU Member States to ultimately work towards a stronger democratic governance system. Additionally, the implementation of the Access to Information (ATI) legislation in certain countries, including South Africa, has also contributed towards this aspiration.

Aspiration 4, committed to ensuring a peaceful and secure Africa, with an overall score of 63% in the 2021 report. This score is mainly attributed to the significant decrease in the total amount of conflict-related deaths and the presence of National Peace Councils in AU Member States. A total of 76% of AU Member States have established National Peace Councils.

Aspiration 5, achieved an overall score of 45%. The First Ten-Year Implementation Plan focussed on promoting the concept of Pan-Africanism to schools across the continent to bring out the importance of heritage, languages and values and ethics. This has been supported by several policies and interventions, including the Charter for the African Cultural Renaissance.

Aspiration 6, has resulted in an overall progress score of 67% for the 2021 report. The inclusion of all citizens participating in the development of Africa has become very important. This includes the empowerment of both women and children, thereby, eradicating discrimination and violence related to gender equity. Despite a score of 67%, women's ownership over agricultural land was still low against the expected 2021 target value, and increases in child labour, child marriage and child trafficking were evident. However, there are currently certain interventions that were established to promote the empowerment of women, such as the African Development Bank (AfDB), which is providing women with access to finance through the Affirmative Finance Action for Women in Africa (AFAFWA). For the empowerment of children, interventions such as the African Youth Charter, have been established.

Aspiration 7, achieved an overall score of 58%. This score is mainly attributed to the continent's efforts in strengthening policy and programmatic interventions for improved national systems to ultimately make Africa a strong and influential global player. In order to achieve the targets, set out for this aspiration, African countries have implemented their respective financing strategies.

The initial phase of the First Ten-Year Implementation Plan exhibited a steady performance, however, the COVID-19 pandemic resulted in drastic socio-economic impacts. However, despite this downfall, the continent still exhibited significant progress and performed better than in 2019. To achieve the future goals and targets of Agenda 2063, an increase in investments is required to ensure its success. Recommendations to be able to meet these requirements include:

- Increased political support and accountability,
- Involving multi-stakeholder participation, and
- Strengthened programming.

Due to the significant impact of the COVID-19 outbreak, building resilience on such incidents should be one of the targets in the Second Ten-Year Implementation Plan. Furthermore, other shortcomings experienced during the first decade of Agenda 2063, should also be addressed and used to guide the development of the Second Ten-Year Implementation Plan.

5.2.2 Link to SDG's

The alignment between Agenda 2063 and the SDG's, particularly SDG 6, is summarised as follows:

Aspiration 1 of Agenda 2063 is most relevant with regards to water resources management. Goal 1 and Goal 7 as shown in **Table 5.1**, focus particularly on protecting the environment and ecosystems to ensure the sustainability of all natural resources. These goals align with SDG indicators 6, 7, 11, 13 and 15.

Goal 7 of Agenda 2063 focuses on ensuring environmentally sustainable and climate resilient economies and communities. Building a community's resilience to unforeseen events is crucial for its well-being. From the Agenda 2063 report, it was evident that the COVID-19 outbreak drastically affected the implementation of several initiatives, emphasizing the need to build more resilient communities. Climate change has been more drastic in the recent years due to several factors with the most dominant being increased greenhouse gas emissions. This has resulted in higher temperatures and an increase in extreme weather events. Many communities have suffered from the associated impacts being unable to withstand such events. To build a climate resilient economy and society, financial sustainability, investment in green technologies and the creation of jobs are essential. Achieving this goal is necessary for sustainable water resources management.

Table 5.1. Agenda 2063 Goals relating to SDG 6

Aspiration	Agenda 2063 Goal	Agenda 2063 Priority Areas
A Prosperous Africa, based on Inclusive Growth and Sustainable Development	1 A high standard of living, quality of life and well-being for all	Incomes, jobs and decent work
		Poverty, inequality and hunger
		Social security and protection including persons with disabilities
		Modern and liveable habitats and basic quality services
	7 Environmentally sustainable and climate resilient economies and communities	Sustainable natural resource management and biodiversity conservation
		Sustainable consumption and production patterns
		Water security
		Climate resilience and natural disasters preparedness and prevention
		Renewable energy

Note: Source – https://au.int/agenda2063/goals

5.2.3 Agenda 2063 Indicators and Targets

Many African countries are making efforts to promote good governance, democratic values and practices as evidenced by the progress of the relevant performance indicators including oversight mechanisms, freedom of expression, free and fair elections, and the application of the African Charter on Democracy, Election and Governance. This entails translating the Charter into practical and tangible implementation steps, featuring the integration of democratic values and practices that are (re)produced and sustained as norms and subsequently incorporated in electoral processes.

Indicator performance is based on relative change in scores between base values in 2013 and actual values in 2021. While the base values and actual values, in absolute terms, of the indicators may be better in some countries than in others, the performance during the period may not reflect this. Agenda 2063 Goal indicator implementation tracking is presented in Annex 4 of the Agenda 2063 progress report. The aggregate performance scores at country, regional and continental level are based on indexed scores of aspirations, capped at 100% as highest value and 0% as the minimum value. Those Agenda 2063 Goals with relevance to SDG6 are summarised in **Table 5.2**:

Table 5.2. Agenda 2063 Goal Indicator Implementation Relevant to SDG6

Priority Area	A63 Indicators	Based Value (2013)	Target Value by 2023	Expected Value by 2012	Actual Value (2021)	Actual Value (2021)
Goal 1: A High Standard of Living, Quality of Life and Well Being for All						31%
3. Modern and Liveable Habitats and Basic Quality Services	% of population with access to safe drinking water	55%	98%	97%	64%	72%
	% of population using safely managed sanitation services	34%	97%	84%	44%	
Goal 7: Environmentally sustainable climate resilient economies and communities						64%
1. Biodiversity, conservation and sustainable natural resource management	% of agricultural land placed under sustainable land management practice	4.84%	30%	25%	8.25%	64%
	a) % of terrestrial and inland water areas preserved	13.84%	17%	16%	20.22%	
	b) % of coastal and marine areas preserved	2.26%	10%	8%	5.10%	

The overall performance of the continent on Goal 1 of Agenda 2063 was recorded at 31%, while South Africa achieved 14% in 2021. The relatively weak performance can be attributed, in part, to performance on specific parameters. The population with access to safe drinking water increased nominally from 55% to 64% (below the 2021 expected target value of 97%). The percentage of the population using safely managed sanitation services increased marginally from 34% in 2013 to 44% in 2021, falling far below the 2021 expected target of 84%.

The continent recorded varied performance among the three core indicators for Goal 7's environmentally sustainable and climate resilient economies and communities (South Africa achieved 100% in 2021). At a continental level, a commendable performance was recorded in the proportion of terrestrial and inland water areas preserved, which increased from 13.8% to 20.2%. However, the Continent did not meet the 2021 targets in the preservation of coastal and marine areas and in the proportion of agricultural land placed under sustainable land management practice due to the slow pace of implementing sustainable land management and climate adaptation policies and frameworks.

5.2.4 Lessons Learned and Gaps Associated with Agenda 2063

Performance scores are based on the availability of both the base value and current value of the indicators in Member States' data entry. Where data are unavailable, some of the resulting scores do not paint an accurate picture of progress made and the performance of countries, regions and the continent. While the base values and actual values of the indicators may be better in some countries than in others, the performance during the period may not reflect this, as performance is based on relative change in scores between base values in 2013 and actual values in 2021.

The maturation period for some of the core indicators is longer than the biennial reporting cycle. In some instances, some of the countries that submitted reports in 2021 used the same data submitted in 2019, or they used proxy data, administrative data or data harvested from other sources, creating uncertainty associated with the 2021 data set. The risks associated with using unofficial data and its impact on the quality of overall data will inform the construct of subsequent capacity strengthening efforts at national, regional and continental levels.

A few indicators do not apply to some countries. For example, the indicator on preservation of coastal areas may be unapplicable to land-locked countries. In country, regional or continental computations, considerations were made to exclude such exceptional cases.

The Agenda 2063 progress report of February 2022 notes that notable progress has been registered in domesticating Agenda 2063 at national and regional levels, however process has been affected by the following challenges:

- Low technical and financial support offered towards domesticating Agenda 2063 as compared to the SDGs. Resulting in notably limited appreciation and visibility of Agenda 2063 compared to SDGs at national level.
- High-policy level within the African Union (AU) and the UN, provides commitment to ensuring that the global and continental development agendas are domesticated in a coordinated manner that harnesses synergies and complementarities based on strong convergence. The practical processes during regional and national domestication often present the two agendas as parallel and competing frameworks, presenting a challenge for Regional Economic Communities (RECs) and AU Member States to domesticate the different agendas.
- Owing to limited human and financial resources, progress, and performance on implementation of Agenda 2063 at regional and country level has been negatively impacted.

5.3 UNCCD LDN TARGET SETTING PROGRAMME (2018)

The partnership between the public and private sectors through the National Working Group (NWG) and the UNCCD NAP will focus resources on key LDN issues to address national grand challenges that the NDP is targeting (i.e. reducing poverty, unemployment, and inequality).

Incorporation of LDN principles into the operational mandates of key government departments such as DFFE, Department of Agriculture, Land Reform and Rural Development (DALRRD) and South African National Parks (SANParks) will reduce the “silo” mode of operation of public departments, helping to utilize scarce national resources to address the national problem of land degradation. Furthermore, the integration of LDN targets programme into the UNCCD NAP will contribute to the achievement of LDN beyond 2030, improving the future sustainability of the LDN programme.

5.3.1 Background

The UNCCD has sought to enhance the adaptive capacities of dryland populations to highly variable environmental conditions. As vulnerability varies across sectors, regions and social groups, adaptation measures range from reducing vulnerability to enhancing the long-term sustainability of the poorest and most vulnerable populations in dryland areas.

The UNCCD LDN provides an integrated approach to addressing the physical, biological, and socio-economic aspects of the processes of desertification and drought. Parties are encouraged to coordinate activities carried out under the UNCCD and under other relevant international agreements, particularly the United Nations Framework Convention on Climate Change (UNFCCC) and the CBD, to derive maximum benefit while avoiding duplication of effort. Article 10 provides for the formulation of National Action Programmes, which address poverty reduction and vulnerability to climate change in affected areas. These action programmes seek to identify the factors contributing to desertification and practical measures necessary to combat desertification and mitigate the effects of drought, thereby contributing fully to sustainable land management and ecosystem-based adaptation efforts.

Climate change adaptation is also firmly integrated into the UNCCD 10-Year Strategic Plan and framework, which includes the following objectives:

- Strategic objective 1: To improve the living conditions of affected populations.
- Strategic objective 2: To improve the condition of affected ecosystems.
- Strategic objective 3: To generate global benefits through effective implementation of the UNCCD.

The proposed time horizon for the achievement of LDN targets is the year 2030 to align to the 2030 Agenda for Sustainable Development (SDG Target 15.3).

5.3.2 Link to SDG’s

Achievement of LDN can result in benefits at multiple scales. At the global scale, achievement of LDN will have positive effects on other SDGs besides SDG Target 15. It will contribute to poverty reduction (SDG Target 1), food security (SDG Target 2), clean water and sanitation (SDG 6), affordable and clean energy (SDG 7), responsible consumption and production (SDG Target 12) and climate action (SDG Target 13).

The implementation of the LDN targets will be achieved through South Africa’s UNCCD National Action Programme (NAP) by 2027. Implementation of LDN will contribute to the achievement of these national development priorities. An LDN leverage plan was proposed to be developed by the DFFE based on a workshop hosted in March 2017 to explain why LDN matters, what to leverage and who to engage to create leverage (Ref: South Africa: Final country report of the LDN Target Setting Programme, DFFE, October 2018). At the time of compiling this report no LDN leverage plan was found to be available online (Ref: https://www.biodiversityinvestment.co.za/biodiversity-economy/ecological-infrastructure-2/land-degradation-neutrality).

The achievement of LDN will also result in environmental and socio-economic benefits at both national and local scales. The key national development priorities are to: (a) reduce poverty, (b) ensure food security, (c) create jobs, and (d) reduce inequality.

Environmental benefits arising from the achievement of LDN include: (a) restoration of degraded lands, (b) improved grazing conditions, (c) ecosystem health and resilience, (d) improved supply of ecosystem services, (d) facilitation of a low carbon economy, and (e) increased land productivity.

Socio-economic benefits arising from the achievement of LDN include: (a) economic gains from agriculture, (b) social cohesion through job creation, (c) community ownership of sustainable land-based projects, (d) creation of green jobs, (e) food security and water security, (f) creation of synergies between different sectors and stakeholders, (g) response to government priorities as highlighted in the National Development Plan10 and Nine-point plan, (h) carbon credits, (i) improved income, (j) increased livestock productivity and (k) sustainable livelihoods.

5.3.3 UNCCD LDN Target Setting Programme Indicators and Targets

The three indicators that are used for assessing trends in land degradation are land cover change, land productivity (metric: net primary productivity) and carbon stocks above and below ground (metric: Soil Organic Carbon [SOC]). The indicators are complemented as needed by nationally relevant indicators (e.g. bush encroachment and alien invasive species) and other available information.

South Africa has set LDN targets at a national scale with an ambition to reach LDN for the entire country considering all LDN indicators.

The national targets are supplemented with sub-national and specific targets. Specific targets have been set for the grassland biome, thicket biome and renosterveld because they are under severe threat of land degradation. These vegetation types represent degradation “hotspots” and are a high-value priority in achieving LDN. Areas invaded by alien species and those that are under bush encroachment will also be targeted for clearing and rehabilitation.

At the national scale, South Africa aims to achieve LDN by 2030 as compared to 2015, and an additional 5% of the national territory has improved. At the sub-national scale South Africa aims to achieve LDN in the grassland biome, thicket biome and renosterveld.

Through the LDN targets, South Africa aims to achieve a balance between anticipated land degradation (losses) and planned positive actions (gains), in order to achieve, at least, a position of no net loss of healthy and productive land. Neutrality is the minimum objective.

The LDN targets are being integrated into existing environmental, agricultural, infrastructure and overall development policies and plans, including UNCCD NAP, National Development Corporation (NDC), SDGs and restoration targets. The targets will become an essential component of integrated land-use planning.

The measures to achieve LDN relevant to SDG 6 are summarised in **Table 5.3**.

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Table 5.3. SDG 6 Relevant LDN Targets for South Africa

Negative trend	Corrective measures	LDN Target year
Shrubs, grassland and sparsely vegetated areas showing early signs of decline and having a declining productivity	SLM practices to avoid overgrazing SLM practices to avoid soil erosion Control of alien invasive species Control bush encroachment Rehabilitation of degraded areas (through economic incentives) Introduce stewardship programmes	2030
Wetlands showing early signs of decline and declining productivity	SLM practices to avoid overgrazing Rehabilitation	2030
Artificial areas	Waste management Storm water control Establishing vegetation strips and cover Water quality improvement	2030
Alien invasive species (e.g. Prosopsis species)	Clearance of invasive species and promote establishment of local species Rehabilitation after clearing of alien vegetation to avoid soil erosion and re-colonization by alien species	2030

5.3.4 Lessons Learned and Gaps Associated with UNCCD LDN Target Setting Programme

The major lessons from the LDN Target Setting Programme included the following:

- Regular meetings kept the LDN target setting programme at the fore, enabling stakeholders' buy-in and alignment with different organizations, developmental agendas, and SDGs.
- Expansion of the NWG to include different key stakeholders, increased the legitimacy of the NWG.
- The National Focal Point (NFP) was vital in the development of the LDN targets programme.
- Collaboration among the public, private, international, and local non-governmental organizations was vital because land degradation requires inputs from different partners.
- The importance of housing the national focal points for the three Rio-conventions (UNCCD, UNFCCC and United Nations Convention on Biological Diversity [UNCBD]) in one government department, strengthens South Africa's efforts to address LDN coupled and interlinked global environmental problems.
- Dissemination and access to information on DLDD and LDN is vital, establish a website where all the key information and resources (documents) on LDN can be accessed by the public.
- Other key government departments (Statistics South Africa, (StatsSA)) and local municipalities need to play a more active role in the reporting and monitoring of LDN targets and implementation of LDN in IDPs.

(Ref: South Africa: Final country report of the LDN Target Setting Programme, DFFE, October 2018)

5.4 NATIONAL DEVELOPMENT PLAN

The NDP 2030 is a visionary document setting big picture goals and objectives for South Africa.
The development of indicators and targets to meet these goals and objectives is delegated to the national governmental departments responsible to achieve the sector specific objectives.

The climate change responses play a significant part in the water related risk and management presented in the NDP. Alignment of the SDG 6 reporting with the NDP driven climate change reporting would be pertinent, to align data sets and enable reporting efficiencies.

5.4.1 Background

This is government's long-term plan that determines what the country should look like by 2030. It highlights two strategic goals of eliminating poverty and sharply reducing inequality with associated objectives to ensure their achievement. As it identifies the various priority areas over the long-term period, it is the underlying document for all government plans.

The NDP 2030 sets out a thirty-year vision and road map to address South Africa's priorities. As a significant risk to South Africa's development future, climate change needs to be considered in planning South Africa's development future and critically, in deciding which investments in sectors such as agriculture, energy and others to prioritise. The NDP makes specific mention of the need to "actively support the development of plans that cross municipal, and even provincial boundaries that would promote collaborative action in fields such as biodiversity protection, climate-change adaptation, tourism and transportation." (Ref: Government of South Africa, 2012:286)

While South Africa has advanced post-apartheid by working towards an inclusive society, poverty and inequality remain a major concern in the country. Furthermore, the country's population is continuously increasing, which emphasizes the need for a faster-growing economy. As a result. The NDP aims on addressing the following:

- Economy and employment
- Economic infrastructure
- Environmental sustainability and resilience
- Inclusive rural economy
- South Africa in the region and the world
- Transforming human settlements
- Improving education, training and innovation
- Health care for all
- Social protection
- Building safer communities
- Building a capable and developmental state
- Fighting corruption
- Nation-building and social cohesion

To reach these goals, a multi-stakeholder approach is necessary, including participation from the government, social partners, relevant state agencies as well as society. Many of the goals are interlinked, while others are long-term and will take a significant amount of time to reflect improvements.

An increase in employment opportunities is mainly possible with a faster-growing economy. Critical strategies to create a better economy include increasing the country's exports requiring improvements in infrastructure and policy frameworks. Other strategies to improve economic growth include skills development, especially amongst young citizens, improved financial services, and better infrastructure. Infrastructure investments noted to be crucial in the NDP include upgrade of informal settlements, improved public transport infrastructure, better infrastructure in the mining industry, the development of several water schemes, new irrigation systems and a national water conservation programme to promote sustainable water use and efficiency.

In the process of ensuring a faster-growing economy to eradicate poverty and inequality, it is important to do so in an environmentally sustainable manner. While benefiting from the country's mineral wealth, the environment is generally disregarded. South Africa is provided with many services from its oceans, soil, water and biodiversity. Therefore, priority needs to be given towards the protection of the environment, which is equally important in creating a better standard of living.

5.4.2 Link to SDG's

The purpose of the NDP is to secure the future of all South Africans. The action plan aligns with the Constitution, which sets out the rights and duties of its citizens. Both the NDP and Constitution elaborate the right of citizens to have access to sufficient safe water. While the primary focus of the NDP is to promote economic growth to overcome poverty and inequality, water resources management is also prioritized as it is a critical component in ensuring economic growth. The water-related actions set out in the NDP are in **Table 4**.4.

The strategies outlined in **Table 4.4** focus on ensuring economic stability, which requires improved water-related infrastructure and sustainable management of the resource. A particular focus is placed on wastewater management and infrastructure, which strongly aligns with SDG Target 6.3 in ensuring good water quality for all citizens. Poor infrastructure leads to increased amounts of waste in our water bodies posing a serious health hazard to citizens and affecting the economy.

In addition to the need for better infrastructure, the development of new irrigation systems is prioritized. The agricultural sector uses a large proportion of water resources; therefore, efficient irrigation systems are necessary to prevent wastage of water.

The NDP also aims at ensuring environmental sustainability and resilience. While benefitting from the services provided by the environment, it is important to do so in a sustainable manner without degrading the health of our ecosystems. This aspect aligns with SDG Target 6.6 focusing on protecting and managing water-related ecosystems. Economic growth relies heavily on water-related ecosystems for freshwater resources. Climate change is currently a major concern and is being accelerated by increased greenhouse gas emissions. As a result, weather patterns are changing, which means that rainfall as a source of water is becoming more unreliable. In such instances, water-related ecosystems such as wetlands, rivers and lakes become more necessary, emphasizing the importance of maintaining such water bodies.

5.4.3 National Development Plan relating to Environmental Sustainability

The maintenance of ecosystem services such as those providing food and clean water, regulating climate and disease, supporting crop pollination and nutrient cycles, and delivering cultural benefits such as recreational opportunities, is fundamental to achieving South Africa's social and economic development objectives.

Proposed interventions and planning imperatives related to sustaining South Africa's ecosystems, relate to the following government lead departments and organizations (Ref: NPC, National Development Plan 2030, Our Future Make it Work, 2012):

- The DFFE and SANBI should implement the protected areas expansion strategy and promote the biodiversity stewardship programme to build conservation partnerships around privately-owned land.

National Treasury should introduce incentives to protect and rehabilitate ecosystems, such as rebates and tax reductions.

- The DFFE, together with related departments such as Agriculture, Land Reform and Rural Development, should investigate the socioeconomic implications and policy requirements of a system for requiring commensurate investment in community development and the protection of ecosystem services to mitigate the environmental and social impacts of new developments.
- The DWS should ensure that the implementation of national strategies for water conservation and demand management are properly resourced and enjoy appropriate policy prioritisation across the economy.
- The Department of Mineral Resources and Energy, DWS and DFFE should collaborate in developing planning instruments that ensure South Africa uses its endowment of renewable energy resources, combined with effective implementation of environmental regulations to mitigate the exploitation of strategic mineral resources.
- The National Treasury and the Department of Public Enterprises should ensure that decisions on the use of financial incentives and disincentives, will in future be made on the basis of evaluating both the effect on employment, and the environmental impact.

The NDP's Environmental Sustainability and Resilience proposed objectives and actions that have relevance to SDG 6 include the following:

- Objectives
  - A target for the amount of land and oceans under protection (presently about 7.9 million hectares of land, 848 km of coastline and 4 172 km2 of ocean are protected).
  - A set of indicators for natural resources, accompanied by publication of annual reports on the health of identified resources to inform policy.
  - Absolute reduction in the total volume of waste disposed to landfill each year.
  - Improved disaster preparedness for extreme climate events.
- Actions
  - Put in place a regulatory framework for land use to ensure the conservation and restoration of protected areas.
  - An environmental management framework. Developments that have serious environmental or social effects need to be offset by support for improvements in related areas.

5.4.4 Lessons Learned and Gaps Associated with National Development Plan

The National Planning Commission is an advisory body appointed in 2010 to specifically focus on developments toward the NDP. This commission highlighted several challenges, mainly pertaining to inequalities amongst citizens. Some of these challenges include:

- Few employed citizens
- Poor quality of education for black people
- Poor infrastructure developments
- An unstable economy
- Poor quality of public services
- A divided society
- High levels of corruption

Despite living twenty-eight years into democracy, these challenges still exist, which emphasizes the need to accelerate progress and create a more inclusive economy. Transforming the economy is necessary to ensure that opportunities provided to citizens are based on their education and ability and not on their race and gender.

5.5 MEDIUM-TERM STRATEGIC FRAMEWORK: OUTCOME 10 PHASE 2

It is evident that there is a need for enhanced management capacity to overcome the growing pressures placed on water resources. This includes the development of human resource capacity to allow individuals to gain the skills that are necessary for effectively managing water resources. Furthermore, to implement the strategies set out in the Medium-Term Strategic Framework (MTSF) such as the rehabilitation of ecological infrastructure with investments required to support such interventions. An effective water management system, the protection of the natural water environment and working together in a holistic manner are all crucial aspects in achieving water security and sustaining the resource in the long term.

The MTSF presents a set of targets and indicators relevant to SDG 6 at a governmental and strategic level. The targets and indicators may therefore be less appropriate as technical targets and indicators for SDG Target 6.3, 6.6 and 6.B. The relevance of the targets will need to be adapted and updated based on changes to the MTSF going forward.

5.5.1 Background

This is a government five-year strategic plan (i.e. within a given electoral term) that reflects commitments made in the governing party's election manifesto and commitments to implement the NDP. It is a building block towards achieving the country's long-term plan and contains priority actions from various government plans within a given electoral term. It provides a link between priorities in the governing party's election manifesto and the individual plans of government departments. As the performance agreements signed between the President and each Minister are based on relevant actions in the MTSF, it is crucial for each department to ensure that their respective strategic and annual performance plans are aligned with the MTSF targets. For the MTSF to be systematically implemented, its actions must be incorporated into other government plans. Efficient and effective monitoring of the implementation of the NDP requires that there is a high level of alignment of the measurable indicators and targets across all these plans.

Transitioning South Africa to the NDP vision is envisaged as a phased process over three MTSF periods. The current MTSF, for the 2014-2019 period, recognizes the vulnerability of the economy, water, food security, health and natural resources to climate change and addresses this further under Outcome 10 ("protect and enhance our environmental assets and natural resources").

South Africa has been involved in several initiatives, all leading to a common purpose, which is to improve the quality of life in a sustainable manner. These initiatives include Agenda 2030 and Agenda 2063 with the objective of achieving the SDG targets. The goals of the initiatives have formed the basis of the National Development Plan (NDP), which outlines the nation's long-term goals and provides methods that can be implemented by the country to ensure a faster and more equitable growing economy. South Africa has made significant progress toward achieving the targets of the NDP. The country has made a mark internationally through its participation in the UN, AU and several other representative bodies.

The NDP aligns with and is supported by the MTSF. The MTSF reviews the initiatives put forward by the NDP and sets out a realistic plan for achieving those targets. Whilst the 2014-2019 MTSF focussed on outlining a plan to implement the NDP, the 2019-2024 framework looks specifically into the government priorities set out by the president in 2019. The limitations and challenges experienced in the past were considered and used as a guide toward the initialization of the 2019-2024 MTSF. The government outlined a total of seven priorities, which cover all the aspects considered important for South Africa's development. A great amount of planning and initiative will be dedicated to achieving each of these seven priorities, which include:

1. A capable, ethical, and developmental state

   The focus of this priority will also be a key driver to success in achieving the other six priorities. This will require a stronger governmental system consisting of strong leadership, an integrated approach, and the inclusion of key stakeholders and society. Focus will be required to be placed on skills development, improved financing strategies, good governance, and better infrastructure.

2. Economic transformation and job creation

   Economic transformation and job creation form a crucial step toward minimizing poverty, inequality, and unemployment. A faster, equitable, and more efficient growing economy will allow for a broader scale of opportunities and ultimately lead to better standards of living. Industrialization also leads to job creation and skills development, being a focus of this priority. It will also promote economic growth due to the expansion of the business sector. Access to information will need to be increased to allow for citizens to participate in developing the country, hence, updated Information Communication Technologies (ICT) is necessary

3. Education, skills, and health

   This focuses on broadening education opportunities, skills development, and strengthening health programmes. The quality of education and the type of skills that one acquires will determine their capabilities. Increased human capability will promote economic growth and reduce poverty levels. Promoting the implementation of the National Health Insurance (NHI) Bill, which provides protection against any financial issues associated with access to health care services, will allow for the equitable provision of health care to all citizens.

4. Consolidating the social wage through reliable and quality basic services

   Social protection and social wage aid vulnerable groups by providing assistance to manage any crisis being experienced. Therefore, necessary investments such as better health care, improved infrastructure, and public transport have to be made, particularly in poor communities.

5. Spatial integration, human settlements, and local government

   According to the NDP, rural areas will be prioritized to ensure that citizens residing in these communities will have access to good quality basic services and will be able to participate in the development of the country. As a result, the initialization of the National Spatial Development Framework (NSDF) was proposed to transform human settlements across South Africa to ensure all citizens can reside in areas that are equitable and efficient. This aligns with the constitution of the country where all citizens have the right to the provision of quality basic services.

6. Social cohesion and safe communities

   A socially cohesive society involves building shared values among people and minimizing differences in wealth to make it known that all members are united and are facing a shared set of challenges. A cohesive society will result in equality and will ultimately lead to safer communities. This involves the provision of good quality basic services to all citizens, strengthening the criminal justice system, improving police services, and the inclusion of society in public policing. A united nation will allow for increased growth and development of the country. The NDP also proposed the implementation of a resilient anti-corruption system to ensure a corruption-free society.

7. A better Africa and world

   To ensure a better future for all, change will have to take place. Increasing opportunities to ensure economic growth is a crucial priority. This will involve many strategies including achieving equality among communities, a good governance system, increasing exports, growth in the tourism sector, increasing trade, and enhancing the implementation of the SDGs, Agenda 2030 and Agenda 2063.

Each of these priorities has specific outcomes, interventions, and indicators, which ultimately align with the overall aim of the priority. To achieve the goals set out in each of the priorities, a holistic approach will be necessary to reach the best possible outcome. This will include participation from the government, multiple stakeholders, and society. In the process of implementing the outlined plan, priority will be given to women, youth, and people with disabilities. The seven priorities are aligned with the three pillars of the NDP. These three pillars include:

- Achieving a more capable state
- Driving a strong and inclusive economy
- Building and strengthening the capabilities of South Africans

5.5.2 Link to SDG's

The MTSF ratifies the SDG's, which include provision for access to basic services including clean drinking water, sanitation, electricity, and associated services. The MTSF also targets the implementation of climate change responses in five critical sectors (namely, water, agriculture and commercial forestry, health, biodiversity and ecosystems and human settlements), providing a direct alignment with SDG 6.

5.5.3 MTSF Indicators and Targets

A focus of the MTSF includes the enhanced national implementation of the SDGs. With alignment to SDG 6, there are certain outcomes in the MTSF that prioritize water resources management. One of the outcomes under priority 2 aims at promoting water security by reducing delays in water use licensing. To prevent wastage of water resources, water users require authorization, which is undertaken through a water use license application. The MTSF aims to reduce the timeframe for processing these applications to achieve this goal.

With regards to priority 5 of the MTSF, there are a few outcomes relating to water resources. Priority 5 places focus on rural communities, which are exposed to high levels of poverty and inequality. These communities do not have access to good quality basic services including clean water. As a result, the MTSF has set out a target to improve ecological infrastructure, which is a key source of freshwater. Assessing water treatment works is also prioritized to ensure good water quality. While water treatment works are essential due to drinking water shortages, poor treatment can result in the contamination of water bodies, which poses a health hazard to both humans and ecosystems. Current water legislation will also be reviewed to evaluate current water ownership and governance to be able to make more equitable and sustainable decisions. This will aid in identifying illegal uses of water resources, which would prevent wastage as well as the degradation of the environment.

Table 5.4 provides a summary of the indicators and targets included in the MTSF relevant to SDG 6, grouped under the relevant MTSF priorities.

Table 5.4. MTSF Priority 2 and 5 Indicators and Targets Relevant to SDG6

Outcomes	Interventions	Indicators	Targets	Lead and Contributing Department
PRIORITY 2: ECONOMIC TRANSFORMATION AND JOB CREATION				
2024 Impact: Unemployment reduced to 20%-24% with 2 million new jobs especially for youth; economic growth of 2%-3% and growth in levels of investment				
Water Security Secured	Reduce delays in water use licenses.	Timeframe for processing Water use license Applications	Timeframe for water use license applications reduced by 50% by 2020	DWS
PRIORITY 5: SPATIAL INTEGRATION, HUMAN SETTLEMENTS AND LOCAL GOVERNMENT				
2024 Impact: Natural Resources are managed and sectors and municipalities are able to respond to the impact of climate change.				
State of ecological infrastructure improved	Rapidly and intensively rehabilitate and restore land.	Hectares of land under rehabilitation / restoration	8 000 000 ha	DFFE, DWS
	Water resource classes and RQOs by 2024.	Number of water resources classified	6	DFFE, DWS
2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security				

Outcomes	Interventions	Indicators	Targets	Lead and Contributing Department
Sustainable land reform	Water rights allocated to land reform projects (water use licences)	% of land reform projects with secure water rights	90%	DALRRD, DWS, DTIC, DFFE
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities.				
Improved capacity to deliver basic services, quality infrastructure and integrated public transport to increase household access to basic services.	Assess water treatment works for compliance with Blue Drop Regulatory requirements.	Number of water treatment works assessed.	1 010 every 2 years – alternating with Green Drop assessments	DWS
Improved capacity to deliver basic services, quality infrastructure and integrated public transport to increase household access to basic services.	Bulk water supply projects Implemented (completed).	No. of bulk water supply projects implemented (completed)	51 bulk water and wastewater supply project phases completed of which: 9 were sanitation services and 42 were for water supply	DWS
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities.				
Review Regulatory Framework on Water Ownership and Governance (Water Rights, Water Allocation and Water Use).	Review current Water Legislations	Amended Regulatory framework on Water Ownership and Governance.	Amended Regulatory framework on Water Ownership and Governance.by 2024	DWS, DoJ, & C, DALRRD, DFFE, DCOG, WRC, CSIR, and Water Boards and IGR Impact zones.
Effective water management system for the benefit of all	Feasibility studies for rehabilitation vs new dams)	No of dams rehabilitated projects and new dams constructed.	9 dams' rehabilitation projects. 9 Provincial plans development and implemented in the IGR impact zones. by 2024.	DCOG, DFFE, DALRRD, DWS, ARC, WRC
	Plans developed to support the implementation of the Integrated Water Resource Plan by provinces and districts (IGR Impact zones) to cater for water demand and capacity requirements.	9 provincial plans implemented in support of the Integrated Water Resource Plan implemented.	9 plans	DCOG, DFFE, DALRRD, DWS, ARC, WRC
	9 alternative water sources strategy established and implemented. 2 alternatives water sources implemented by 52 development spaces (IGR Impacts Zones).	No of new water sources expansion plan for each IGR impact zone developed by 2021 and implemented by 2024.	52 projects implemented by 2024	DCOG, DFFE, DALRRD, DWS, CSIR,
2024 Impact: Institutionalise spatial / territorial integration to fast track transformation and resilience of sub-national regions. **Shared national spatial vision and frames to support integration between sector departments, provinces and regions**				

Outcomes	Interventions	Indicators	Targets	Lead and Contributing Department
Functional Sub-National Regional Development in Urban and Rural Spaces	Establish regional institutional collaboration structures through joint implementation protocols or related mechanisms such as regional SDFs in stressed regions that are of huge national ecological importance and have lagging economies and/or highly socially vulnerable populations	Number of Regional Spatial Development Frameworks (RSDF) /Joint implementation protocols prepared in priority areas.	Two RSDFs prepared, adopted and in use by 2024. 4 additional Implementation protocols / Regional SDFs prepared in National Spatial Action areas by 2024.	DALRRD, DCOG, DPME, DFFE, DWS, (Provinces)

5.5.4 Lessons Learned and Gaps Associated with the MTSF

The lessons learnt from the 2014-2019 MTSF period are that the institutional arrangements for reporting were fragmented, that progress reporting on MTSF Outcomes was one of many items on the agenda of MinMECs, clusters and or Implementation Forums.

DPME plans to ensure implementation through the District Development Model and will monitor performance against milestones and targets, identifying performance gaps, intervening to address the root causes of underperformance and reporting to drive delivery forward.

5.6 NATIONAL WATER RESOURCE STRATEGY 2

The NWRS provides the strategy for how the water sector and its key institutions will achieve the strategic objectives through the development of detailed implementation plans. The implementation plans are to be developed for each strategic theme and for each institution. These implementation plans are not part of the NWRS however the key plans identified to be implemented, that have alignment with SDG6 are summarised in **Table 5.5**.

Table 5.5. NWRS2 Implementation Priority Themes aligned to SDG6

Theme	Strategic objective/outcome	KPI / target	Responsibility	Timeframe
Water resource protection	Manage for sustainability using resource directed measures	Management Class, and associated reserve and resource quality objectives set for 10 significant WR	DWS	2017
Compliance monitoring and enforcement	Enforce compliance to all legal provisions, quality and quantity	60% green drop compliance, 80% blue drop, 100%	DWS, CMA's, DFFE, DMR, Water Tribunal	2017

Theme	Strategic objective/outcome	KPI / target	Responsibility	Timeframe
	standards to ensure effluent WRM	compliance license conditions		

5.6.1 Background

The Second rendition of the NWRS, launched in 2013, builds on the first NWRS of 2004. The NWRS2 is aimed at achieving South Africa's development priorities in an equitable manner such that South Africa's national water resources are protected, developed, conserved, utilised, managed and controlled in an efficient and sustainable manner. This Strategy responds to and is aligned with priorities set by Government within the NDP and National Water Act imperatives which support sustainable development (DWS, 2013).

According to (DWS, 2013), the NWRS2 acknowledges that South Africa is a water-stressed country facing several water related challenges, which include security of supply, environmental degradation and resource pollution and the inefficient use of water. The NWRS2 strategy identifies three broad objectives: water supports development and the elimination of poverty and inequality; water contributes to the economy and job creation; and water is protected, used, developed, conserved, managed and controlled in an equitable and sustainable manner given the context that water is a scarce resource that requires adequate, effective and efficient management. **Figure 4.2** illustrates the vision, goal, objectives and strategic themes of the NWRS2.

The most important consideration in the NWRS2 is that water is scarce and requires careful management to enable provision of basic water services and equitable allocation, while meeting the needs of inclusive economic growth without threatening the integrity of aquatic ecosystems. According to the NWRS2, water resources planning, infrastructure and development theme indicates that surface water sources are limited in many catchments and that infrastructure, and the costs of construction and maintenance is prohibitive. South Africa must prioritise, the available options to supply the water demands for equitable allocation for development and economic growth. The country will thus consider other potential sources, which include water re-use, desalination, groundwater utilisation, water conservation and water demand management measures, rainwater harvesting, recovering water from acid mine drainage, and the import of water intensive goods. The NWRS2 continues to state that these measures will augment the available water resources to support the key developmental objectives of the country (DWS, 2013)

The water resource protection theme of the NWRS2 emphasises the need to protect our freshwater ecosystems, which are under threat because of pollution from many sources. The need for the determination and preservation of the ecological reserve and the classification of our river freshwater systems is also a priority. This will assist in determining the nature and the extent of pollution to provide appropriate rehabilitation solutions. The NWRS2 stresses the need for the value of water to be appreciated and for the attitudes and habits of all citizens to change towards water and to work towards its protection. It is reported that climate change will progressively alter the environment in future and present new challenges, which need to be taken into consideration in the strategy and associated future planning.

The NWRS2 proposes the development of adequate capacity within the sector and the country for monitoring and effective detection and adaptation to protect water and to ensure sustainable water supplies into the future. According to DWS (2013), "Reconciliation Strategies project depletion in the water supplies for some water supply systems in the country. Considering the urgency to protect our water resources and the adverse effects of climate change, the NWRS2 submits that water conservation and water demand management should be one of the top priorities, and measures to reconcile demand and supply in order provide for all our goals of a better life for all through job creation and economic growth".

According to DWS (2013) the NWRS2 is developed within a changing environment and acknowledges that monitoring and collecting relevant data will not only affect the accurate assessments of the status of water resources and the magnitude of water problems but will vastly improve planning and policy formulation processes. The NWRS2 also strongly promotes technology and innovation to contribute to effective and efficient water management solutions that respond to the needs for water security and sustainability for individuals, communities, productive and strategic water use as well as ecosystem services. The achievement of the country and sector goals must be sustained within an environment that protects the integrity of the National Water Act and all other legislation that has an impact on water resource management. According to DWS (2013), the NWRS2 emphasises that the achievement of the vision and objective will require support by strong institutions, competent and capacitated personnel with the requisite financial resources to implement interventions.

5.6.2 National Water Resource Strategy Indicators and Targets

The NWRS1 outlined some of the key priorities for the water sector, which include water conservation and water demand management, equitable allocation of water resources, appropriate institutional arrangements and strengthening regulation, but little progress was made in these areas. Therefore, the need to action implementation and ensure that priority programmes are given focus and attention. The NWRS2 Implementation Plan thus proposes that key programmes are prioritised, which include water resource protection, infrastructure planning, operation and maintenance, compliance monitoring and enforcement, and institutional arrangements. The NWRS requires that a collective detailed implementation plan be developed in consultation with sector partners to clearly identify roles and set measures to monitor progress (DWS, 2013). This implementation plan has long been in existence. At the 2022 mid-term review the SDG Target 6.4 team gave extensive report on work done to look at WDM, the NWRS, etc. (Personal coms: M. Mazibuko).

Six key principles have been identified in the NWRS to enable water resource protection is founded on ensuring that sufficient water is left in the rivers to sustain ecosystem functioning, that the quality of the resource is protected at the source and that the water environment has an intrinsic value for economic and social growth.

- Principle 1: Protection of the resource through classification of the resource with the Reserve as a priority right.
- Principle 2: Water resource protection should be based on a participatory approach, involving users, planners, and policy makers. (SDG Target 6.B)
- Principle 3: The value of water resources must be recognised from an economic point of view and the social and environmental benefits of the resource.
- Principle 4: Water resource protection must guide setting conditions for water use allocation. (SDG Target 6.3)
- Principle 5: Incentive based protection of the water resource.
- Principle 6: Integrated Protection of aquatic ecosystems. (SDG Target 6.6)

A series of objectives for water resource protection have been set to help to achieve the six principles, as follows:

- Ensure sustainable management of the water resources through resource directed measures and source directed controls.
- Protect and maintain existing freshwater ecosystem priority areas in good condition and well-functioning water resource ecosystems by managing riparian and wetland buffers and critical groundwater recharge areas (SDG Target 6.6).
- Carry out rehabilitation of strategic water ecosystems (SDG Target 6.6).
- Ensure prevention of water resources from point source and non-point source pollution by managing at source (SDG Target 6.3).

- Create awareness among communities, business, and decision makers about the value of water and ensure commitment to sustainable water use practices (SDG Target 6.B).
- Create an enabling environment for water resource protection through an incentive-based approach to water resource management.
- Monitor the ecological health of our resources through an integrated information management system (SDG Target 6.3 and 6.6).

Ten strategic actions are presented to achieve the water resource protection objectives. These actions bear a close relation to the SDG 6 indicators, as follows:

- Manage water resources sustainably using resource directed measures.
- Invest in strategic water source areas.
- Strategic investment in the maintenance and rehabilitation of water ecosystems (SDG Target 6.6).
- Maintain freshwater ecosystem priority areas in good condition (SDG Target 6.6).
- Protect riparian and wetland buffer and crucial groundwater recharge areas (SDG Target 6.6).
- Rehabilitate strategic water ecosystems to support water quality and water quantity (SDG Target 6.3).
- Monitor ecological health to inform management (SDG Target 6.3).
- Minimisation of pollution from wastewater treatment works (SDG Target 6.3).
- Establish commitment to sustainable water resource management.
- Target actions with immediate benefits.

The Regulatory Performance Management System, initiated in the 2007/08 financial year, monitors the performance of water services authorities against the key performance indicators provided in the Strategic Framework for Water Services.

The NWRS2 provides the strategy for how the water sector and its key institutions will achieve the strategic objectives through the development of detailed implementation plans. The implementation plans are to be developed for each strategic theme and for each institution. Each plan is required to include the following:

- Key milestones and performance indicators
- Strategic actions to achieve the milestones
- Activities to achieve the performance indicators
- Resources (budget and any other resources) required
- Person(s) responsible
- Time frame for implementation

5.6.3 Lessons Learned and Gaps Associated with the National Water Resource Strategy

Successful implementation of the broader scope of regulation under the NWA remains a challenge that must be addressed by the DWS and other water sector institutions.

5.6.3.1 Lack of awareness of the value of water resources

Many South Africans are not aware of the scarcity of water in the country and that if the water is not managed well, there will not be enough to meet all the demands. Some work has been done in linking the environmental benefits of water and its economic benefit, however, more must be done to understand the linkages. There is a need to improve on the current technologies by:

- developing a common framework for the economic analysis of ecological benefits, and
- discussing the economic benefit through the analysis of elements of ecological risk assessment.

The challenge is to work with businesses, organisations, communities, and individuals to ensure that they value water and the water environment. The aim is to change habits by providing better information so that they can make more informed choices and use water more efficiently

5.6.3.2 Lack of monitoring to inform management actions

To inform the management of water ecosystems, information about the ecological state of these systems as well as the trajectories and rates of change taking place in that state is needed. Such information is obtained through monitoring selected indicators, which can be defined as "measures, variables, or indices that represent or mimic either the structure or function of ecological processes and systems across a disturbance gradient" (Brooks et al. 1998).

The information from such monitoring is necessary for evaluating the effectiveness of past management decisions, demonstrating the outcome of service delivery and refining management approaches and policy options. Sound scientific monitoring and effective and transparent communication of monitoring results can also be a powerful catalyst for participatory water resource management.

5.6.3.3 Water and climate scenario key issues

The uncertainty in projected water-related climate change impacts is one of the biggest challenges facing water managers. Adaptive management is necessary, in which water resource systems are carefully monitored and management actions are tailored and revised in relation to the measured changes on the ground.

The NWRS identified several key issues that need to be addressed based on an assessment of the South African water and climate scenarios, as follows:

- Build capacity, response capability and commitment to timeous action of water sector institutions to function in a context of high levels of uncertainty.
- Improved collaboration between all agencies to address climate change, particularly those that are likely to have similar objectives.
- Adjust water resources planning and management processes in the country to build resilience and adaptive capacity in society and ecosystems, through improved water conservation and water demand management across the country.
- Strengthen the present rainfall, environmental, hydrological, and hydro-geological monitoring systems to support effective climate change detection and effective adaptation.
- Strengthen the available human capacity relating to climate change impact assessments and adaptation within the water sector.
- Address research gaps in current water sector climate change programmes and water and climate change knowledge.

5.7 NATIONAL WATER AND SANITATION MASTER PLAN (VOLUME 1-3)

The NW&SMP prioritizes all the key elements that need to be addressed to ensure the sustainability of water resources. It is evident that all these elements that form part of the NW&SMP either directly or indirectly relate to SDG Target 6.3 and 6.6, indicators. Therefore, this plan is crucial in achieving the goals and targets set out in SDG 6 to allow for the management of water resources more effectively. To carry forward this plan, participation from the government, multiple stakeholders from both the public and private sectors, and civil society are crucial. Owing to the many factors that negatively impact water resources, the NW&SMP acts as an urgent response to overcome these issues and sustain the resource in the long term.

The indicators and targets set in the NW&SMP are primarily at a high level, identifying reporting requirements rather than specifying the methodologies to be used to achieve these indicators. The targets however and the responsible parties allocated with the responsibility to achieve the indicators are useful to align to the SDG Target 6.3 and 6.6 methodologies. The goals set in the NW&SMP, in some instances, are high level but may provide an underlying guide for target setting for SDG 6.

5.7.1 Background

South Africa is a water-scarce country, experiencing approximately 30% of the global average annual rainfall. The country is currently undergoing a water crisis due to the low rainfall distribution, which is further exacerbated by several factors including climate change, population growth, poor infrastructure, deterioration in water quality, lack of human capacity, and numerous other factors. This has a detrimental impact on the sustainability of water resources in the long term, ultimately minimizing economic growth and affecting the lives of all citizens. Therefore, it is of utmost importance that the country overcomes this water crisis through the implementation of effective strategies to ensure a sufficient supply of good-quality freshwater resources in the future. Several initiatives have been implemented, which place a focus on monitoring water bodies and developing strategies to address the current crisis. These include the National Development Plan, Medium-Term Strategic Framework, National Water Resource Strategy, and Agenda 2063. Additionally, the Sustainable Development Goals (SDGs), particularly SDG 6, aim to ensure the provision and sustainable management of water resources for every citizen. Each of these initiatives has its respective targets in order to achieve its goals. The National Water and Sanitation Master Plan (NW&SMP) aligns with all the aforementioned initiatives and sets out a strategic framework to ensure the country achieves the water-related targets and goals that are put forward. The key objectives of this plan include:

- Resilient and fit-for-use water supply
- Universal water and sanitation provision
- Equitable sharing and allocation of water resources
- Effective infrastructure management, operation, and maintenance
- Reduction in future water demand

To carry forward this plan of ensuring the sustainability of water resources, the inclusion of multiple stakeholders all working together will be a crucial step. The time frame for the implementation of the different strategies set out in the NW&SMP is between the present until 2030. During this time frame, the plan will be evaluated and updated where necessary. This will be based on factors such as additional inputs from stakeholders, amendments to the targets that have been set out, and available budgets. The NW&SMP will be led by the Department of Water and Sanitation (DWS) and will also involve participation from other governmental institutions, the public sector, and society. There are two main categories, the first being water and sanitation management and the second being an enabling environment, which each consists of six priorities that must be addressed to ensure water security. These priorities are listed in **Table 5.6**.

Table 5.6. The twelve elements of the NW&SMP

Water and Sanitation Management	Enabling Environment
1. Reducing water demand and increasing supply	1. Creating effective water sector institutions
2. Redistributing water for transformation	2. Managing data and information
3. Managing effective water and sanitation services	3. Building capacity for action
4. Regulating the water and sanitation sector	4. 3.Ensuring financial stability
5. Improving raw water quality	5. Amending the legislation
6. Protecting and restoring ecological infrastructure	6. Enhancing research, development and innovation

The NW&SMP consists of three volumes, overall documenting the plan toward addressing these elements:

- Volume 1 particularly focused on an overview of the NW&SMP where challenges and existing gaps are identified. Based on the challenges, the necessary actions that have to be implemented to overcome these issues are all stated.
- Volume 2 outlines the same aspects addressed in volume 1, however, this is a more detailed review of the different challenges being faced and the key actions that have to be undertaken.
- Volume 3 is the most detailed and crucial part of the plan, consisting of the schedule of actions. This is where each action is positioned based on its element, categorized according to its importance, and assigned responsibilities, time frames, and costs.

Population growth accelerates the need to reduce the demand for water and increase its supply to ensure that all citizens have access to an adequate quantity of water. In addition to population growth, other factors such as climate change, improper planning, poor infrastructure, and water wastage negatively impact water supply. The agricultural sector utilizes most of the water supply (c.61%), however, there are several concerns regarding this usage. While this sector is a major contributor toward food supply, job creation, and the GDP of the country, there are concerns such as water wastage due to inefficient irrigation scheduling options, unlawful abstraction, and low tariffs. Furthermore, climate change impacts are expected to increase the water demand of the agricultural sector due to increased temperatures, which will make rainfed agriculture more unreliable. Therefore, it is important to eliminate any issues that currently exist to ultimately prevent water wastage. The average domestic consumption also needs to be reduced to ensure water efficiency and equity. There are currently several strategies that have been implemented to increase water supply and lower its demand. These include the Water Administration System (WAS) Release Module for more efficient irrigation scheduling and the National Strategy for Water Reuse (NSWR) to promote the reuse of water at all scales. Other solutions to increase the supply of quality freshwater resources include desalination and maintaining ecological infrastructure.

The second category of the NW&SMP focused on strengthening the capability of the country to ensure that it has the ability and resources necessary to overcome the water crisis and ensure water security. The first priority involves creating effective water-related institutions. The DWS is the lead institution regarding the distribution and management of water resources. There are several other institutions that also play a critical role in management including the Department of Co-operative Governance and Traditional Affairs (COGTA) and the National Treasury (NT). Amendments to water-related institutions are necessary to promote more efficient regulation of water and sanitation services. Furthermore, while the DWS leads the process, a more decentralized approach is needed in managing water resources.

5.7.2 Link to SDG's

While significant progress has been made in providing households with water supply and sanitation services, the reliability regarding access to these basic services remains an issue. Poorly maintained Water Treatment Works (WTW) and Wastewater Treatment Works (WWTW) are among the key concerns regarding public health. This strongly aligns with SDG Target 6.3, indicator focusing specifically on improving water quality and wastewater treatment to ensure a good health status for both humans and ecosystems. While several strategies have been initiated over the years, the supply of water and sanitation services remains a concern due to the lack of human and institutional capacity, financial restraints toward maintaining infrastructure, and poor management. To effectively manage the provision of water and sanitation services to all citizens, more appropriate interventions are required such as upskilling technical staff and finding better funding strategies to improve and maintain water-related infrastructure.

Regulation of water use is necessary to ensure the efficient use and sustainability of the resource. The DWS oversees regulating water resource use across South Africa. Despite efforts that have been put into place regarding this element, water wastage and illegal use are still a great concern. Therefore, the implementation of better strategies is needed. Some possible actions include identifying and prosecuting unauthorized abstractors, setting a cap on water use, and developing by-laws to ensure the protection of the natural water environment. Improving raw water quality also aligns with managing water resources effectively and relates directly to SDG Target 6.3. Water quality is affected by both point-source and non-point source discharges. Poor water quality has many detrimental impacts on the economy, society, and environment. Implementing solutions to ensure that all water users utilize and discharge water resources in a sustainable manner is crucial. Furthermore, the development of more reliable water-related infrastructure is required. Ensuring good water quality is of great importance, therefore, monitoring the quality of water on a frequent scale must be undertaken to avoid long-term consequences.

The protection and restoration of ecological infrastructure is also a key element in ensuring water and sanitation management. This element aligns with SDG Target 6.6 in ensuring that all water-related ecosystems are protected and restored to allow for the sustainability of the resource in the long term. South Africa's ecological infrastructure consists of a wide range of ecosystems that provide many services to both the economy and society. Many of these ecosystems, however, are being severely degraded due to poor practices, an increasing population, and the spread of alien invasive species. This has resulted in many consequences such as communities being more prone to flood disasters and increased costs to maintain infrastructure. Therefore, it is important to prioritize the protection of ecological infrastructure due to the number of benefits it provides. The DWS has been working with the South African Biodiversity Institute (SANBI) and the Council for Scientific and Industrial Research (CSIR) to be able to locate and ensure the protection of strategic water source areas.

Managing data and information is crucial to reach more decisive outcomes and ensure better planning for the sustainability of water resources. Gathering information regarding water use and the key activities affecting this resource, on a consistent basis will aid in better decision-making among stakeholders and create a more adaptive approach. This is particularly useful for SDG Target 6.3 and 6.6, indicators, which requires all water bodies to be monitored frequently to keep track of the water quality status and be able to develop measures for improvement where necessary. There are currently several information systems that exist such as HydroNET, the Water use Authorization and Registration Management System (WARMS), and the National Integrated Water Information System (NIWIS). However, to keep up with the changing circumstances, continuous improvements and the development of modernized information systems are needed to expand on knowledge to better monitor and manage water resources.

5.7.3 National Water and Sanitation Master Plan Indicators and Targets

The NW&SMP guides delivery in the water and sanitation sector, it is therefore necessary to understand the relationships between the various government planning tools and the planning, budgeting, monitoring, and evaluation cycle. The understanding of these processes provides the basis for aligning the ongoing monitoring and evaluation of progress in implementing the NW&SMP with that of other related government plans.

The NW&SMP recognises that monitoring progress at regular intervals provides the necessary performance information that enable adjustments to approach and, where needed, in intent. Whilst understand the broader monitoring and evaluation environment, it is equally important to enable the modalities for a more “live” approach.

The Schedule of Actions included in Volume 3 is presented in tabular format, with appropriate functionality allowing the user to conveniently navigate through the listed actions and drill down into the specific NW&SMP section, action level, province, catchment, etc. A summary of those relevant actions to SDG Target 6.3 and 6.6. have been selected and summarised in **Table 5.7**.

5.7.4 Lessons Learned and Gaps Associated with National Water and Sanitation Master Plan

To create more effective institutions, building human capacity is essential. Skills development allows for staff to have the necessary expertise to be able to have a good understanding pertaining to water resources and carry out the key functions to sustainably manage and operate the sector. Currently, there is a shortage of qualified individuals within water-related institutions. Additionally, graduates entering the working environment do not have the necessary practical skills. The lack of skilled professionals makes it difficult to undertake key functions in the water sector. Therefore, developing high-end skills, providing training for recent graduates, and expanding on knowledge are all crucial in building capacity to ensure a well-skilled workforce.

The availability of finances is one of the most important elements in the NW&SMP. This determines the ability of the country to successfully implement the necessary strategies to ensure water security. Currently, the water sector is financially unstable due to factors such as economic recession, reduced revenues, and increasing debt. To ensure financial stability, costs will need to decrease, and revenues will have to be increased. Furthermore, the implementation of strategic and innovative objectives will attract more funding opportunities to successfully carry out the key actions.

Water-related institutions abide by two acts, the National Water Act and the Water Services Act. The National Water Act aims to ensure that the country’s water resources are protected, used sustainably, conserved, managed, and controlled. The Water Services Act aims to provide all citizens with access to basic water supply and sanitation services to ensure good human health and well-being. Amending these legislations as well as other existing acts is necessary to align the with current circumstances in order to derive a more sustainable outcome. Current concerns that exist in these legislations revolve around the ownership of water-related and sanitation infrastructure and services, water use authorization, the protection of ecological infrastructure, and the regulation of water resources. These aspects need to be addressed and amended accordingly.

Enhancing research, development and innovation are also prioritized and align with each of the aspects accounted for in the NW&SMP. To ensure that all the targets of the NW&SMP are achieved, the expansion of knowledge through research is necessary for developing new and innovative solutions and technologies. Furthermore, continuous research and development will allow for better decision-making and increased capability, which is key to enabling South Africa to overcome the water crisis.

Table 5.7. NW&SMP Volume 3 Selected Schedule of Action Relevant to SDG Target 6.3 and SDG Target 6.6

Level 1: Key Actions	Level 2: Supporting Actions	Baseline / Status Quo	Major Measurable Deliverable	Target Date	Limitations	SDG Target
1.1 Reducing water demand and increasing supply						
Integrated Water Resources Planning and management	1.1.8 Develop a guideline for the protection, recharge, use and monitoring of groundwater	Groundwater Strategy completed	Groundwater Guidelines	2022	-	6.6
1.4 Regulating the water and sanitation sector						
Regulating the water and sanitation sector	1.4.1 Revitalise the Green, Blue and No Drop programmes and publish results and revise and establish norms and standards.	BDS last published in 2014; GDS last published in 2014; NDS Not received since 2013,	National • Obtain annual BD and GD Assessments reports • Obtain from 144 WSAs IWA Water Balance requirements (No Drop report) • Monitoring of Monthly No Drop reports and annual BD and GD reports • Capturing and publish of results on DWS web Provincial • Monthly submission of 19 IWA Water Balance requirements (No Drop report) to DWS • Annual submission of 19 BD and GD compliance assessments	Annual	Lack responsibility	6.3 and 6.6
	1.4.4 Identify and prosecute major non-compliant abstractors (water thieves) across the country, with a national communication campaign to accompany the action inclusive of reviving the Blue Scorpions	Non-Compliance to WUL, Directives, Notices, and prosecution	• 10 by 2020; additional 10 by 2023, • Non-Compliance and Compliance, • Compliance promotion, Audit/Inspections Do physical inspections supported by updated V&V and build prosecution case material together with dedicated NPA team.	2020	The value of the BS is underestimated	6.6
	1.4.7 Develop and implement municipal bylaws to protect water quality.	No prescribed bylaws	Publication of updated bylaws that includes Project of Raw Water Quality	2020	Leadership DWS	6.3 and 6.6

Level 1: Key Actions	Level 2: Supporting Actions	Baseline / Status Quo	Major Measurable Deliverable	Target Date	Limitations	SDG Target
	1.4.9 Establish a mechanism for applying administrative penalties	An Environmental Management Inspectorate Network does exist within the Department but needs to be strengthened.	Strengthening Compliance and Enforcement training modules to build the capacity of EMIs in-house Strengthen the CME, finalisation of the Strategy and Implemented Plan Appoint Environmental Management Inspectors (EMI) to conduct CME	2023	Skills, Resources, understanding of legislation needs to be strengthened within DWS	6.3
1.5 Improving raw water quality						
Integrated Water Quality Management	1.5.1 Determine in-stream Resource Water Quality Objectives (RWQOs), based on the SA Water Quality Guidelines (SA36), in support of RQO's Capacity, budgetary constraints	RWQO's	Publish the RWQOs for water quality RQOs adequately reflect IWQM requirements	2019 2020	Capacity, budgetary constraints	6.3
	1.5.2 Routinely monitor resource water quality (SA46, SA47 SA48)	Resolve supply chain management challenges to ensure the availability of back to back laboratory services to effectively address technical needs	Laboratory facilities not readily available in all WMAs hampering IWQM	*2020*	Poor monitoring network and system support	6.3
		Undertake routine national water quality monitoring, considering the recommendations of the Review of the South African Water Resource Monitoring	National monitoring network in place but coverage requires expansion	2030		6.3
		Realign/ establish regional water quality monitoring programmes in cooperation with all relevant role-players and undertake routine regional monitoring	Regional water quality programmes insufficient to manage pressure on water resources	2039		*6.3*
		Development and implement a programme to create and support citizen-based water quality monitoring programmes	Regional and local water quality programmes insufficient to manage pressure on water resources	2030 and beyond		*6.3*
	1.5.3 Establish and maintain appropriate and accessible information management	Improve the effectiveness and efficiency of the water quality data management system(s) through the implementation of the findings of the Data Acquisition	WMS system functional but not utilised nationally. Staff capacity to use system requires strengthening	2023/2024	Capacity, lack of alignment, complexities, capacity challenges,	6.3

Level 1: Key Actions	Level 2: Supporting Actions	Baseline / Status Quo	Major Measurable Deliverable	Target Date	Limitations	SDG Target
	system(s) for resource water quality (SA49, SA51 & SA60)	and Management (DAM) Strategy pertaining to water quality			complex system integration challenges	
		Harmonise the systems and approaches being used across sector Departments and catchments for resource water quality data and information	Limited exchange of data and information. No integrated systems supporting.	2029/2030		6.3
		Ensure that the link between WARMS, WMS and SAP is successful and live as part of the Waste Discharge Charge System (WDCS) implementation process	Connectivity between systems not as effective in order to support the implementation of the WDCS	2020/2021		6.3
	1.5.4 Assess resource water quality information (SA52 & SA59)	Compile annual national resource water quality status report(s)	Routine national assessments of water quality and input in support of the SDG process	2029/2030	Limited information	6.3
		Compile annual catchment resource water quality status report(s)	Routine catchment assessments of water quality and the identification of "hot spots" for potential water quality management intervention			6.3
	1.5.6 Develop and implement a strategic action plan for the rehabilitation and upgrade of prioritized WWTWs (SA17)	Turn around the functionality of five, currently dysfunctional large wastewater treatment works with an accompanying publicity campaign, followed by a programme to address the rest	Public campaign and five functional WWTWs with maintenance plans and turnaround strategy	2022/2023	Complex intergovernmental relations	6.3
		Turn around the functionality of the remaining dysfunctional wastewater treatment works	Programme to address the remaining WWTWs and functional WWTWs with maintenance plans	2029/2030		6.3
	1.5.9 Ensure IWQM is supported by effective departmental arrangements (SA8 & SA9)	Reconfigure the DWS water Quality management function and structures as needed to ensure efficiency and effectiveness	Existing DWS Structure	2019/2020	Uncertainty in WQM institutional arrangements	6.3
	1.5.10 Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61)	Establish an action plan to strengthen inter-governmental structures for water quality management at trans-boundary (international), national and provincial levels to ensure efficient coordination and joint action supported by regular reporting	Build from IGR framework and SADC protocols	2021/2022	Poor IGR, uncertainty wrt institutional frameworks	6.3

Level 1: Key Actions	**Level 2: Supporting Actions**	**Baseline / Status Quo**	**Major Measurable Deliverable**	**Target Date**	**Limitations**	**SDG Target**
1.6 Protecting and restoring ecological infrastructure						
Protecting and restoring ecological infrastructure	1.6.1 Declare strategic water source areas and critical groundwater recharge areas and aquatic ecosystems recognised as threatened or sensitive as protected areas	The continuous over utilisation and inadequate protection of our ecological systems and infrastructure has led to changed characteristics rivers and other water resources beyond the point where they can be restored to their original ecological condition	Identify and declare protected / sensitive areas per CMA 1) Strategic Water Source Areas 2) GW Recharge Areas 3) Aquatic Ecosystems Develop rehabilitation systems to	2021	Technical understanding leadership	6.6
	1.6.2 Review and promulgate aggressive restrictions within the legislation to restore and protect ecological infrastructure	Current restrictions not forceful enough	Develop enforceable restrictions to be implemented by DFFE	2020	-	6.6
	1.6.3 Implementation of the Reserve (The classification, RQO's and the Reserve collectively known as Resource Directed Measures (RDM)) for main stem rivers starting with the Berg, Breede and Gouritz, Middle and upper Vaal WMA's)	Water resource protection limits	Gazetted RQOs, Classes and Reserve	2022	-	6.6
	1.6.4 Secure funds for restoration and ongoing maintenance of ecological infrastructure through operationalising the water pricing strategy	Funds to ensure the protection of the ecological reserve limited	Develop funding programmes specially earmarked for the projects to endure the restorations and protection of the ecological reserve Include projects into annual budget plan	2020 Annually	-	6.6

5.8 STRATEGIC FRAMEWORK AND OVERARCHING IMPLEMENTATION PLAN FOR ECOSYSTEM-BASED ADAPTATION IN SOUTH AFRICA

The Strategic Framework and Overarching Implementation Plan for Ecosystem-based Adaptation provides the framework for the implementation of EbA in South Africa. This strategic plan cites various local and international documents and presents the overarching aims and visons for EbA in South Africa.

Following the initial 5-year implementation timeframe (2016 to 2021) a revised Strategy is anticipated to be developed, but has been waylaid by funding limitations during the COVID-19 pandemic (Ref: The Adaptation Network, AGM Minutes, Jan 2022). This strategy is expected to contain more tangible and relevant indictors and targets relating to EbA in South Africa.

5.8.1 Background

According to the Strategic Framework and Overarching Implementation Plan for Ecosystem-based Adaptation, EbA aims to maintain and increase resilience and reduce the vulnerability of ecosystems and people to the adverse effects of climate change. The EbA is integrated into broader adaptation and development strategies (CBD, 2009).

EbA draws on the linkages between ecosystem services, climate change and biodiversity, recognising the potential to support poor and rural communities, more directly dependent on natural resources and ecosystem services in adapting to climate change. The EbA interventions are noted to have the potential to be relatively cost-effective and adaptable long-term solutions, compared to other adaptation solutions that rely on engineering and hard infrastructure. The EbA has the added benefit of contributing towards a broader set of socio-economic and development goals, including job creation, poverty reduction and rural/peri-urban development.

DFFE is South Africa's primary environmental custodian, mandated to protect the environment and conserve natural resources while balancing this with sustainable development and the equitable distribution of natural resource benefits. DFFE fulfils its mandate through formulating, coordinating and monitoring the implementation of national environmental policies, programmes and legislation, and through undertaking appropriate research. The research includes ecosystem-based approaches to increase the resilience of ecosystems and support sustainable livelihoods in the face of climate change.

There are a number of national level programmes that contribute to EbA. These include DFFE's Environmental Programmes, including Working for Water, Working for Wetlands, Working for Energy and others, that implement restoration activities in support of the Expanded Public Works Programme (EPWP). SANBI's Climate Change Programme Strategy also (2011/12-2015/16) seeks to research ecosystem-based solutions. Since 2018, SANBI has been working with stakeholders to develop a national pipeline of project proposals for submission to the Green Climate Fund (GCF). The GCF is a tiered accreditation system which classifies applicant entities based on the nature of their organizations and the intended scale, nature and risks of their proposed climate finance activities (Ref: https://www.sanbi.org/biodiversity/science-into-policy-action/nie-adaptation-fund/green-climate-fund/). In addition, SANBI's programmes of work in Ecological Infrastructure, Municipal Support, Biodiversity Mainstreaming, and others, similarly contribute to EbA. The WRC also supports sustainable development through research funding, knowledge creation and dissemination, e.g. ecological infrastructure-related work.

Drawing on South Africa's Climate Change and Biodiversity Policy, in particular the National Climate Change Response (NCCR) White Paper, the vision for South Africa's EbA Strategy is that EbA is implemented as part of South Africa's overall climate change adaptation strategy in support of a long-term transition to a climate-resilient economy and society. The Strategy identifies four areas of work that will contribute towards achieving the vision, including:

1. Effective coordination, learning and communication mobilises capacity and resources for EbA.
2. Research, monitoring and evaluation provide evidence for Ebba's contribution to a climate resilient economy and society.
3. Integration of EbA into policies, plans and decision-making supports an overall climate change adaptation strategy.
4. Implementation projects demonstrate the ability of EbA to deliver a wide range of co-benefits.

The EbA Strategic Framework and Overarching Implementation Plan provide a roadmap to take forward South Africa's EbA programme of work.

5.8.2 Link to SDGs

The 2030 Agenda for Sustainable Development along with a set of new Sustainable Development Goals (SDGs) focuses on the linkage between sustainable management of natural resources and social and economic development as well as on strengthening "co-operation on desertification, dust storms, land degradation and drought and promote resilience and disaster risk reduction".

The EbA contributes to the SDGs, as an approach that is able to contribute across the SDGs, with a specific alignment to Goal 13 (Climate Action) and its targets.

5.8.3 Ecosystem Based Adaptation Indicators

The Convention on Biodiversity's (CBD) 2009 Report of the Ad Hoc Technical Expert Group on Biodiversity and Climate Change explores the interactions between biodiversity and climate change adaptation and mitigation; and highlights several important points in relation to EbA, which may relate to indicators for SDG Target 6.6. summarised as follows:

- Like all adaptation activities, EbA is not without complexity, uncertainty, and risk.
- Legislative
  - EbA can be applied at regional, national and local levels (project and programmatic levels), and over short or long-time scales.
  - Co-benefits of EbA (multiple social, economic, cultural, and biodiversity benefits) should be specifically considered in the planning, design, implementation, monitoring and evaluation of these activities.
- Biodiversity (SDG Target 6.6)
  - Intact, well-functioning ecosystems, with natural levels of biodiversity, are usually more able to continue to provide ecosystem services and resist and recover more readily from extreme weather events than degraded, impoverished ecosystems.
  - EbA, if designed and implemented appropriately, contributes to biodiversity conservation and sustainable use of such biodiversity and natural resources.
  - Ecosystems play an important role in protecting infrastructure and enhancing human security.
  - Restoration of ecosystems can still be part of a cost-effective adaptation strategy, despite the relatively high costs compared to conservation of existing intact ecosystems.
- Social Change (SDG Target 6.B)
  - EbA options are often more accessible to the rural poor than infrastructure and engineering adaptation solutions.
  - The use of EbA can generate multiple social, economic, and environmental co-benefits for local communities.

  - Systems to monitor and evaluate co-benefits from EbA measures should be established to ensure the equitable distribution of benefits among stakeholders.
- Climate Change (SDG 13)
  - EbA uses biodiversity and ecosystem services as part of an overall adaptation strategy to provide a range of opportunities for the sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate change.
  - EbA can contribute to climate-change mitigation, by conserving carbon stocks, reducing emissions from ecosystem degradation and loss, and enhancing carbon sequestration.
  - The value of ecosystems has been demonstrated by their ability to ameliorate the negative impacts of extreme events.

5.8.4 Ecosystem Based Adaptation Targets

The Convention on Biological Diversity (CBD's) Strategic Plan for Biodiversity (2011-2020) and the Aichi Targets offer further support for EbA under Strategic Goal D and Target 15 (**Table 5.8**). The CBD provides clear policy direction that parties need to take into national implementation, and for which South Africa can demonstrate solid progress. South Africa's second NBSAP (2015-2025) is aligned with the priorities and targets in the global agenda (Aichi Targets), as well as national development imperatives, having set six strategic objectives, associated to outcomes and activities, see Section 5.10.

Table 5.8. EbA alignment with CBD's Strategic Plan for Biodiversity

Strategic Goal D	**Enhance the benefits to all from biodiversity and ecosystem services**
Target 15	By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including **restoration of at least 15 per cent of degraded ecosystems**, thereby contributing to climate change mitigation and adaptation and to combating desertification

5.8.5 Lessons Learned and Gaps from Ecosystem Based Adaptation Implementation

According to the Strategic Framework and Overarching Implementation Plan for Ecosystem-based Adaptation "it has become clear that there are limits to what EbA should be expected to achieve. Whilst EbA is a powerful mechanism to address a number of climate change, biodiversity and socio-economic issues, it needs to be integrated with other approaches to address the complexities of natural and human systems."

Of particular importance is the fact that, there are crucial thresholds to ecosystem resilience that need to be considered, beyond which adaptation is unlikely to be successful (CBD, 2009; Roberts et al., 2012). Ecosystems can only provide a certain suite of ecosystem services and their ability to do so is diminished as they become degraded and fragmented.

Research has highlighted knowledge gaps that need to be addressed to improve the success of implementation of EbA projects.

- Lack of effective monitoring mechanisms to assess the effectiveness and cost-efficiency of EbA projects, compared to other adaptation approaches (Doswald et al., 2014; Roberts et al., 2012).

- Better understanding of how EbA projects can contribute to sustainable development under a range of different social, political and financial contexts (Ziervogel et al, 2014). In South Africa, additional vulnerability assessments are needed to identify areas that are most at risk (Midgley et al., 2012).
- Improved communication to encourage peer learning, capacity building and improved policy relevance.

By acknowledging the lessons learnt, and making provision to fill the identified knowledge gaps, there are likely to be a number of opportunities to contribute towards the broader outcomes of EbA.

5.9 NATIONAL PROTECTED AREA EXPANSION STRATEGY

The revised NPAES 2016 includes targets for terrestrial vegetation types and broad marine systems, as well as comprehensive targets for wetlands, rivers, estuaries, specific marine ecosystems, as well as for the terrestrial and marine ecosystems of our Southern Oceans and Sub-Antarctic territories. These targets were set based on a new integrated ecosystem map and align to the SDG 6 targets and indictors under consideration by the DWS.

5.9.1 Background

The goal of the NPAES is to achieve cost effective protected area expansion for improved ecosystem representation, ecological sustainability and resilience to climate change. It sets protected area targets, maps priority areas for protected area expansion, and makes recommendations on mechanisms to achieve this.

Protected areas are the most secure and effective mechanism for conserving a representative sample of all biodiversity including all ecosystems and species. This is especially important in South Africa because of our globally exceptional levels of biodiversity. Conserving a viable representative sample of biodiversity contributes to ecological resilience and is one of the cornerstones of ecological sustainability.

For protected areas to achieve their full potential contribution to ecological sustainability, they need to include a representative sample of all ecosystems as well as key ecological processes, in both aquatic and terrestrial environments. Ideally, seamless integration is required between terrestrial, freshwater, estuarine, inshore and offshore marine protected areas, to maximise the ecological sustainability benefits of protected areas. Estuaries can provide a focal point for integrating the design of terrestrial, freshwater and marine protected areas.

Healthy natural ecosystems can increase resilience to the impacts of climate change, by allowing ecosystems and species to adapt as naturally as possible to the changes and by buffering human settlements and activities from the impacts of extreme climate events. South Africa has an opportunity to take a global lead in giving protected areas a central role in our climate change response strategy.

Protected areas can be a cornerstone for local economic development, providing immediate socio-economic benefits to surrounding communities. Scope exists for protected area expansion to work in partnership with land reform for mutual benefit, actively supporting the land reform agenda and the diversification of rural livelihoods.

5.9.2 Link to SDG's

The NPAES has not specifically been aligned to the UN SDG's, but is aligned to the Biodiversity Finance Initiative (BIOFIN), managed by the United Nations Development Programme (UNDP), in partnership with the

European Commission and the Governments of Germany and Switzerland, being piloted in South Africa (amongst 29 other countries) under the auspices of the DFFE.

BIOFIN is intended to provide a comprehensive analysis of the funding gap for the local implementation of the CBD's Aichi biodiversity targets, also aiming to develop a comprehensive national resource mobilisation strategy, while improving cost effectiveness through the mainstreaming of biodiversity into national development and sector planning.

5.9.3 National Protected Areas Indicators

Measurable progress across a range of indicators was made in implementing the first phase of the NPAES, for the protected areas in both the marine and terrestrial environments. The following key aspects underpin the NPAES.

A key activity for the NPAES was the preparation of a fully integrated ecosystem map covering terrestrial, river, wetland, estuarine, coastal and marine ecosystems, including the following:

- Terrestrial Ecosystems: The revised 2012 National vegetation map, including 450 ecosystem types in 12 bioregional zones. The bioregional zones and corresponding terrestrial biome are very similar in terms of mapping. Some portions of the terrestrial ecosystem unit will be mapped as wetlands or rivers, thereby reducing the terrestrial ecosystem area mapped.
- Wetlands: Natural wetlands included in the revised national wetland map (2018) have 135 distinct ecosystem types. The ecosystem types were developed according to bioregional zones of South Africa, as a reliable field-collected data or ongoing monitoring basis on which to divide these systems is currently not available.
- Coastal and marine types: The integrated coastal and benthic ecosystem maps prepared for the National Biodiversity Assessment 2011 was used. An additional ecosystem was defined for all marine areas in the Southern Oceans, previously not included in the national map. There are 109 benthic and coastal ecosystem types, 16 pelagic types and 1 Southern Ocean type distributed across 9 biozones.
- Estuaries: Estuary types were mapped based on the outlines in the National Estuary map 2012 and the classification in Whitfield (1992). There are 46 estuary ecosystem types in 3 biozones.
- Rivers: River Ecosystems were based on the NFEPA classification and dataset (Nel et al., 2011), with 126 distinct ecosystem types. The map treats rivers as lines with no area, river areas are estimated by buffering rivers based on stream order (smallest rivers having a 30m buffer and largest ones 210m).

A single map, integrating the individual components, created at a 30m resolution, uses a simple rule-based approach as follows:

- wetlands and estuaries overrode all other layers;
- rivers overrode terrestrial ecosystems; and
- terrestrial ecosystems overrode marine and coastal systems.

An integrated ecosystem map was a core product of the National Biodiversity Assessment of 2018. The product of this is a 2022 DFFE hosted interactive protected areas map (Ref: Protected Areas Register | Environmental Geographical Information Systems (E-GIS), March 2023). The map includes mountain catchment areas, but does not include rivers and wetlands.

5.9.4 National Protected Areas Targets

Protected area targets are action targets that indicate how much of each ecosystem should be included in protected areas. These targets help to focus protected area expansion based on the ecosystem protection distribution. The NPAES uses the established biodiversity targets for each ecosystem from the National

Biodiversity Assessment (NBA) as the long-term protected area targets, ensuring scientifically robust targets based on ecological condition, ensuring alignment of the NPAES with the NBA.

The 20-year targets are designed to achieve overall Convention on Biological Diversity (CBD) Aichi biodiversity targets, while optimally shifting the emphasis onto high biodiversity value ecosystems. Clear principles and a repeatable method are established for target setting, which will enable easy updates and allow provinces and agencies to calculate compatible targets.

The NPAES cites the CBD to which South Africa is a signatory, and as a result commits government to a range of targets (Aichi biodiversity targets). Target 11 states that:

"by 2020, at least 17% of terrestrial and inland water areas, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape".

5.9.4.1 NPAES Target Setting

South Africa has established systematic biodiversity planning which uses biodiversity targets[7] to determine which areas of the landscape (seascape) are most important for conserving as a representative sample of biodiversity pattern (ecosystems and species) and for keeping key ecological processes intact. These targets are used as the basis for national monitoring of Protection Level in the NBA. The NPAES 2016 core principles established for the NPAES 2008, include:

- Align long-term protected area targets with established biodiversity targets, allowing for consistent reporting by the NBA and NPAES.
- Targets should be specifically set for each ecosystem, although they can be reported for broader units, however the target is set at ecosystem level.
- South Africa should aim to achieve its commitments under the CBD, over a 20-year period.
- The target allocation is optimised across ecosystems to reflect differing biodiversity levels, so that overall South Africa will achieve its CBD commitment.

These thresholds are widely used in national systematic biodiversity planning processes such as the National Freshwater Ecosystem Priority Areas Assessment (NFEPA), for marine protected areas in Offshore Marine Protected Area (OMPA) Project (2011), and the National Estuary Biodiversity Plan for South Africa (2012). The same ecosystem targets are used in provincial conservation plans.

5.9.4.2 NPAES Targets

Biodiversity targets for terrestrial ecosystems in South Africa range from 16% to 36% of the original extent of each ecosystem, with higher thresholds for more variable and species-rich ecosystems. In the absence of better data, a 20% biodiversity threshold is used for marine, river, wetland and estuarine systems. The following principles have been set in relation to target setting:

- Targets should also be set for marine, wetland, river, and estuarine features at the ecosystem level.
- Targets can be met only by intact habitat. This principle was established in the NPAES 2008 but only artificial waterbodies were excluded at that time.
- Targets can be met in protected areas and other areas with effective area-based conservation measures. Currently, we only evaluate protected areas, as these are the only areas where biodiversity is currently legally secured.

[7] *Biodiversity targets are sometimes called biodiversity thresholds. See Driver et al., 2012 for details on how biodiversity targets are determined and used in the evaluations of ecosystem protection level*

- In the future, once other area-based conservation mechanisms have been secured effectively, it is anticipated that the intact and secure areas zoned for conservation under these other measures will also contribute to meeting targets.
- Targets for features should not be artificially inflated by having falsely overlapping habitat maps.
- The approach should set out clear principles for target setting, so that when habitat maps inevitably improve, biodiversity targets are refined, or political commitments change, only minor administrative and GIS amendment are required to recalculate the area.
- The area is a function of the percentage of the habitat and the original mapped extent, not the target area measurement (a secondary calculation).

The NPAES has established a set of robust targets, which can be quickly and easily updated when changes in any of the input elements occur. The target calculation for each ecosystem uses the following steps:

- Identify the appropriate biodiversity target percentage to use for the ecosystem in question. These currently range from 16 to 36% for terrestrial ecosystems, with a 20% target used for other ecosystems. The appropriate biodiversity threshold for each ecosystem is published in the latest NBA (should the biodiversity thresholds change; this change should also be applied to the NPAES). This percentage value should be used as the long-term protected area target. Aligning the values also allows for robust and consistent assessment, and full alignment between the NPAES and the NBA.
- Calculate the required area to secure the long-term protected area target, is achieved by calculating the area of the ecosystem on an appropriate map and multiplying this by the long-term protected area target percentage.
- Establish the relationship between the total area required to meet long term protected area target for all ecosystems and the total area committed to politically or administratively.
- To do this add up all the areas required to meet long-term protected area targets and divided it by the total area committed to under the CBD (i.e. 17% of inland and 10% for marine ecosystems).
- Combining the long-term protected area target with the appropriate proportion from bullet 3, above, to calculate the 20-year protected area target.
- Shorter term protected area targets (e.g. a 5-year target) are calculated as a portion of the 20-year target.

5.9.5 Lessons Learned and Gaps Associated with Protected Areas

Ecological processes often occur across very large areas and over long periods of time, so they can be difficult to capture in the protected area network. Nevertheless, it is possible to take some ecological processes into account in the design of the protected area network. There are several issues relevant to protected area targets that have emerged since the publishing of the NPAES 2008:

- The international CBD targets have increased to 17% of terrestrial and inland water, and 10% of coastal and marine areas, and the timelines have been adjusted. The network needs to be ecologically representative, and the targets need to be met by intact habitat that is ecologically functional and is conserved in protected areas as well as other effective area-based conservation measures.
- The coast length target proved to be very difficult to monitor, from a detail scalability perspective. In this regard, natural ecosystems do not consist of a line, but rather consist of areas.
- In addition to the maps of terrestrial ecosystem types, there are good maps of rivers, wetlands, estuaries and marine ecosystems. Targets therefore need to be set for these features.
- The rivers, wetlands, estuaries and marine ecosystems maps were separately created, and therefore different habitat types can overlap, creating an issue related to the current fragmented approach to ecosystem mapping.
- If the individual thresholds were added up for these features that they will artificially inflate the required target.

- Updating of the terrestrial ecosystem, wetland and marine ecosystem maps having the consequence that areas of specific habitat types have changed.

According to the NPAES outstanding information gaps that need to be addressed include:

- Continual updating and improving spatial information on the distribution of protected areas in the Protected Area Register, including verifying protected area boundaries, their proclamation status and management effectiveness.
- The potential inclusion of areas protected by ‘other effective area-based measures’ should be evaluated and potentially included in the assessment of target achievement. Robust criteria need to be set up to ensure that only intact, well-managed areas with long-term security of biodiversity are included.
- New biodiversity data are routinely being collected but in not always available for the planning data sets. More streamlined mechanisms to include new biodiversity distribution data into the planning data sets is required.
- Mapping and classification of specific marine ecosystems at a finer scale is necessary, especially for vulnerable marine habitats, e.g. reefs, sponge beds and kelp forests.
- Mapping marine ecological processes, e.g. spawning and nursery grounds and foraging areas for marine species.
- The identification of remaining focus areas required to meet marine targets is a priority (after implementation of Phase 1 of Operation Phakisa).
- The specific biodiversity offset receiving areas (which will contribute to protected area expansion) need to be identified and agreed on.

5.10 SOUTH AFRICA’S NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

The National Biodiversity Strategy and Action Plan of 2015-2025 (NBSAP) provides both indicators and targets for six key aspects, including the management of biodiversity assets, investments into ecological infrastructure, biodiversity considerations into policies, strategies and practices, mobilization of people and improved biodiversity management and conversation.

The alignment of the NBSAP indicators and targets, while having relevance to SDG 6 may not be particularly aligned to the current SDG Target 6.3 and SDG Target 6.6 indicators and targets, however this presents an opportunity for the identification and implementation of possible supplementary indicators and targets to consider going forward.

5.10.1 Background

The preparation, coordination and monitoring of the NBSAP is led by the DFFE, with implementation coordinated and monitored through the existing intergovernmental and sectoral coordination structures.

Indicators and targets have been identified at the outcome level from existing national or organizational strategic plans in South Africa, as far as possible. This serves to track progress towards implementing the NBSAP and enables alignment between the NBSAP and South Africa’s development requirements. This has ensured that the NBSAP is firmly integrated and aligned with the strategic priorities and plans of major role players in South Africa and therefore represents a common vision and plan for biodiversity management.

5.10.2 Link to SDG's

Alignment of the NBSAP to the Aichi Targets and other global conventions is useful for country reporting against the conventions or agreements and supports an understanding of the many linkages between strategies, see **Table 5.9**. Those NBSAP objectives identified to have a link to SDG 6 are shaded green.

Table 5.9. Mapping the NBSAP to Relevant Conventions and Agreements

NBSAP Strategic Objectives and Outcomes	Aichi Targets [8]	SDG Targets [9]	NPCS Targets [10]	Cartagena [11]	IPBES [12]
SO 1. Management of biodiversity assets and their contribution to the economy, rural development, job creation and social well-being is enhanced					
1.1. The network of protected areas and conservation areas includes a representative sample of ecosystems and species and is coherent and effectively managed.	11, 12	1.4, 14.2, 14.5, 15.1, 15.6	4.1, 5.3, 7.2, 9.2		
1.2. Species of special concern are sustainably managed	6, 12, 13	2.5, 12.2, 14.2, 14.4, 15.7, 16.4	8.1-2, 9.1-2, 11.1-4, 12.2-4	1.7	
1.3. The biodiversity economy is expanded, strengthened, and transformed to be more inclusive of the rural poor.	6	1.2, 1.4, 8.1-8.3, 8.9, 12.2, 14.2, 15.6			
1.4. Biodiversity conservation supports the land reform agenda and socio-economic opportunities for communal land holders	14, 15, 16	1.4, 12.2			
SO 2. Investments in ecological infrastructure enhance resilience and ensure benefits to society					
2.1. Restore, maintain, and secure important ecological infrastructure in a way that contributes to rural development, long-term job creation and livelihoods	9, 11, 14	1.3, 1.5, 6.4-6.6, 8.3, 9.1, 9.5, 14.2, 15.2-4			2a, 2b
2.2. EbA is shown to achieve multiple benefits in the context of sustainable development	15	1.3, 1.5, 8.3, 13.1-3, 14.2, 15.6			

[8] https://www.cbd.int/sp/targets/
[9] https://sustainabledevelopment.un.org/focussdgs.html
[10] National Strategy for Plant Conservation, that aligns with the Global Strategy for Plant Conservation (GSPC), which is accessible from D.Raimondo@sanbi.org.za
[11] https://bch.cbd.int/protocol/issues/cpb_stplan_txt.shtml#elements
The Cartagena Protocol on Biosafety was adopted in January 2000 and entered into force on 11 September 2003. The Cartagena Protocol on Biosafety, provides a medium-term programme of work for the period covering the second to the fifth meeting of the Conference of the Parties serving as the meeting of the Parties to the Protocol.
[12] https://www.dffe.gov.za/projectsprogrammes/ipbes
The goal of IPBES is to provide overall strategic scientific intelligence and leadership in the DFFE: Science Policy Interface – through the coordination of specialist scientific advisory services and research for effective Biodiversity and Conservation decision making.

NBSAP Strategic Objectives and Outcomes	Aichi Targets[8]	SDG Targets[9]	NPCS Targets[10]	Cartagena[11]	IPBES[12]
SO 3. Biodiversity considerations are mainstreamed into policies, strategies and practices of a range of sectors					
3.1. Effective science-based biodiversity tools inform planning and decision-making	3	9.1, 11.7, 13.2		1.3	
3.2. Embed biodiversity considerations into national, provincial, and municipal development planning and monitoring	2, 4	2.4, 7.2, 11.6, 11.7, 13.2, 15.5, 15.8	6.1	1.8	
3.3. Strengthen and streamline development authorisations and decision-making	7	6.3, 12.6			
3.4. Compliance with authorisations and permits is monitored and enforced	8, 9	6.3, 11.7, 12.4, 14.1, 15.7, 15.8	4.2	1.8, 3.1	
3.5. Appropriate allocation of resources in key sectors and spheres of government facilitates effective management of biodiversity, especially in biodiversity priority areas	3, 20	10.5, 15.5, 15.9, 17.1, 17.3			
3.6. Biodiversity considerations are integrated into the development and implementation of policy, legislative and other tools	2-16	8.3, 8.9, 13.2, 14.4, 14.6, 15.9, 16.8	5.3, 6.1, 10.1	1.4, 1.5, 1.6, 3.2, 5.1	3d
SO 4. People are mobilised to adopt practices that sustain the long-term benefits of biodiversity					
4.1. People's awareness of the value of biodiversity is enhanced through more effective coordination and messaging	1	12.8, 13.3 & other SDGs	14.1-3	2.5, 2.6, 5.3	4d
4.2. People are mobilised to conserve and sustainably use biodiversity	1, 4	4.7, 14.2, 16.10		5.3	
SO 5. Conservation and management of biodiversity is improved through the development of an equitable and suitably skilled workforce					
5.1. Macro-level conditions enabled for skills planning, development and evaluation of the sector as a whole	Supports all Aichi targets	Supports NBSAP aligned SDGs, but specifically SDG 4.7		2.7	
5.2. An improved skills development system incorporates the needs of the biodiversity sector	Supports all		15.1-3	2.2-2.4	1b

NBSAP Strategic Objectives and Outcomes	Aichi Targets[8]	SDG Targets[9]	NPCS Targets[10]	Cartagena[11]	IPBES[12]
5.3. Partnerships are developed and institutions are capacitated to deliver on their mandates towards improved service delivery	Supports all		6.2, 16.1-2	2.2-2.4, 2.7, 5.2	1a, 1b
SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation and sustainable use of biodiversity					
6.1. Relevant foundational data sets on species and ecosystems are in place and well-coordinated	9, 18, 19, underpins rest of Aichi	Supports NBSAP aligned SDGs.	1.1-2., 3.1, 3.3, 13.1, 13.3	4.1	1c
6.2. The status of species and ecosystems is regularly monitored and assessed.	19, underpins rest of Aichi		2.1-2, 3.2	3.2, 4.1	3a, 3b
6.3. Geographic priority areas for the management, conservation and restoration of biodiversity assets and ecological infrastructure are identified based on best available science	11, 12, 19, underpins rest of Aichi		5.1-2, 7.1, 12.1		
6.4. Management-relevant and policy-relevant research and analysis is undertaken through collaboration between scientists and practitioners	19, underpins rest of Aichi		3.4, 13.2	1.3, 1.4, 4.3	1a-d, 4e
6.5. Knowledge base is accessible and presented in a way that informs decision-making	19, underpins rest of Aichi			4.1, 4.2	3c, 4b, 4c

5.10.3 South Africa's NBSAP Indicators and Targets

The NBSAP has drawn on existing indicators and targets, as far as possible, such as those in the MTSF, Outcome 10 or departmental long range strategic plans. This has been done to ensure that the NBSAP is integrated, aligned with, and contributing towards the achievement of existing priorities. Implementing and reporting on the NBSAP is therefore part of government's delivery programme.

There are however certain instances where indicators and targets do not exist. These have been identified in the action plan (**Table 5.10**). In some cases indicators have been proposed, however the adoption of and development of targets for these indicators will need to be taken forward by DFFE in its coordination and monitoring role for the NBSAP, which will also require review to align these indicators with the existing set of indicators.

South Africa's biodiversity is assessed across terrestrial, river, wetland, estuarine, coastal and marine ecosystems, using two national ecosystem indicators, namely:

- ecosystem threat status and
- ecosystem protection level.

Both of these indicators have direct links to policy, e.g. the listing of threatened ecosystems in terms of the Biodiversity Act, and the identification of ecosystems in need of protection, which informs the expansion of South Africa's protected area network and priority areas for conservation action. The biodiversity stewardship approach (an increasingly favoured mechanism) being used for the expansion of the protected area network and the conservation estate.

The indicators and targets highlighted to have relevance to SDG 6 are summarised in **Table 5.10**.

5.10.4 Lessons Learned and Gaps Associated with South Africa's NBSAP

Regular monitoring and evaluation of biodiversity status and trends is essential to informed decision making in environmental planning and management. Together with research it is essential to addressing gaps in our knowledge, evaluating the effectiveness of interventions, and the generation of new knowledge and information. It is the mandate of the South African National Biodiversity Institute, in terms of the Biodiversity Act to monitor and report regularly on the state of biodiversity. A national system for monitoring the status and trends of target species and for monitoring ecosystem health is being designed and it is critical that it be implemented effectively.

The gaps that remain, following the NBSAP revision and associated gap analysis (Gaylard et al. 2014), include:

- Knowledge gaps with respect to the conservation status of species in South Africa for marine and invertebrate species
- Gaps in foundational data that need to be filled in order to inform research, policy, management and conservation of ecosystems and species. Examples of priority gaps include, but are not limited to, gaps related to medicinal plants, undertaking surveys in under-sampled areas, and inventory lists of invasive alien species in World Heritage Sites, protected areas or Ramsar sites.

Table 5.10. Summary of NBSAP Strategic Objectives, Indicators and Targets

Outcome		Indictors	Targets	Source
SO 2. Investments in ecological infrastructure enhance resilience and ensure benefits to society				
2.1	Restore, maintain, and secure important ecological infrastructure in a way that contributes to rural development, long-term job creation and livelihoods	Number of significant, integrated water-related ecological infrastructure maintenance or improvement interventions	By 2019, 20 integrated interventions in each of 5 key rural Strategic Water Source Areas.	MTSF
		Hectares of land under restoration / restoration	By 2019, total of 1 370 600 ha restored (1 218 106 ha (DFFE) and 152 500 ha (DAFF)), with 3 230 271 ha of follow up treatment by DFFE.	MTSF
		Number of wetlands rehabilitated	By 2019, 695.	MTSF
		Number of emerging invasive species targeted for early detection	By 2019, 300.	MTSF
		Number of ha of firebreaks and prescribed burning prepared to prevent ecologically damaging fires	By 2019, 398 886 ha.	MTSF
SO 3. Biodiversity considerations are mainstreamed into policies, strategies, and practices of a range of sectors				
3.3	Strengthen and streamline development authorisations and decision-making	Pre-centage of environmental impact assessment applications processed within timeframes, reported quarterly from the National Environmental Assessment System	By 2019, 98%.	MTSF
		Number of environmentally significant areas identified and published for restriction for mining activities	By 2016, 1 environmentally significant area identified, negotiated, and published through NEMA.	MTSF
		Number of regulatory interventions developed and implemented to streamline the environmental authorisation process for SIP projects	By 2019, 8 regulatory interventions.	MTSF
3.4	Compliance with authorisations and permits is monitored and enforced	Number of compliance inspections conducted	By 2019, 14 500 compliance inspections conducted.	MTSF
		Number of enforcement actions undertaken for non-compliance with environmental legislation	By 2019, 1 500 completed criminal investigations handed to the NPA for prosecution (for EMI	MTSF

Outcome		Indictors	Targets	Source
			Institutions) and 3 100 administrative enforcement notices issued for non-compliance with environmental legislation.	
SO 5. Conservation and management of biodiversity is improved through the development of an equitable and suitably skilled workforce				
5.1	Macro-level conditions enabled for skills planning, development, and evaluation of the sector as a whole	An effective national mechanism is in place and capacitated to coordinate national HCD strategies and priorities	By 2016, cross-partner mechanism in place.	
		A monitoring and evaluation programme is in place	By 2017, M&E framework and evaluation initiated.	
		The BHCDS programme of implementation is funded	By 2020, funding support to increase from an average of 2% per annum to at least 30%.	
5.2	An improved skills development system incorporates the needs of the biodiversity sector	Representation and framing of biodiversity occupations has taken place with DHET	By 2020, 23 priority occupations identified in the BHCDS included in the Organising Framework for Occupations (OFO).	
		Increased percentage transformation in the biodiversity sector	By 2020, 74% of specialists, monitors, technicians including Government supply chain and partner organisations are from previously disadvantaged groups.	
		Multi and trans-disciplinary curricula in place within higher education institutions	By 2025, at least 40% of universities and universities of technology incorporate biodiversity, natural resource/social science multi and trans-disciplinary curricula into academic programmes.	
		A national biodiversity career guidance initiative is in place to attract black youth into relevant study and career paths	By 2020, all SA HEIs have incorporated biodiversity career guidance into student support.	
5.3	Partnerships are developed and institutions are capacitated to deliver on their mandates towards improved service delivery	Decreased vacancies in provincial and local government institutions	Reduction in vacancies in prioritised specialist professional occupations.	
		Decreased turnover of key positions in provincial and local government institutions	Decrease in turnover.	

Outcome		Indictors	Targets	Source
		Key positions in DFFE and key departments (national, provincial, local) are identified and capacitated to give effect to biodiversity mandates	Mentoring, career pathing and succession planning in place for leadership positions that are critical to the corporate vision and strategy.	
SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, and sustainable use of biodiversity				
6.1	Relevant foundational data sets on species and ecosystems are in place and well-coordinated	Foundational data co-ordination / management system developed, implemented, and maintained	Co-ordinating system established for foundational data sets.	
		Report on priority gaps in foundational data sets for species	By 2017, gaps identified.	
		Number of quality-controlled records added to spatial data for species – newly collected data, and existing records captured and added to data set and that address priority gaps	200,000 records added to spatial data sets (newly collected); 1 million existing records added to data set.	SANBI CSP
		Number of species for which information has been compiled, including indigenous knowledge where relevant (medicinal and used plants)	By 2025, information for a total of 40 000 species is compiled.	SANBI CSP
		Number of environments for which ecosystem classification systems finalised	By 2017, classifications for four environments completed.	SANBI CSP
		Number of national maps showing distribution of ecosystems	By 2020, four national maps.	SANBI CSP
		Number of institutions contributing data (data / information sharing agreements)	By 2025, 70% of major data holders sharing data.	
		Long term data sets identified, maintained, and continued	By 2020, long term data sets available, and programme for ongoing data collection implemented.	
		Number of provinces with functional National Recordable System in place	By 2016, a functional NRS is in place in 7 provinces.	DST Strategic Plan

Outcome		Indictors	Targets	Source
6.2	The status of species and ecosystems is regularly monitored and assessed.	National Biodiversity Assessment updated	Updated every seven years.	
6.3	Geographic priority areas for the management, conservation and restoration of biodiversity assets and ecological infrastructure are identified based on best available science	Spatial biodiversity plans (provincial, biodiversity sector plans, bioregional plans) are updated at least every five to ten years	By 2025, updates take place at least every five to ten years.	
6.4	Management-relevant and policy-relevant research and analysis is undertaken through collaboration between scientists and practitioners	Number of interventions aimed at advancing the biodiversity science policy interface.	By 2019, 8 Interventions (6 research programmes developed, Biodiversity Research strategy implemented and monitored and national IPBES hub established and functional.	
		An updated implementation plan for the National Biodiversity Research Strategy developed and funded	By 2017, the implementation plan has been completed.	
		Number of amendments to lists / legislation / management practice made through research outcomes.	By 2016, a tracking system for research impact has been established.	
6.5	Knowledge base is accessible and presented in a way that informs decision-making	Single portal exists through which all biodiversity information can be accessed	By 2016, the single portal is established, and it is being populated	

5.11 NATIONAL BIODIVERSITY ASSESSMENT 2018

The NBA provides a series of indicators and targets particularly relating to biodiversity at ecosystem scale. The relevance of these indicators and targets to SDG Target 6.6 is limited, due to their focus on the biodiversity status, and not on the extent of water bodies or water quality aspects that may be influencing the biodiversity status. However, SDG Target 6.3 and SDG Target 6.B may well benefit from aligning some of the NBA indicators and targets to their reporting systems. The 2018 NBA provides some reference to the method of computation which would be valuable to reassess the alignment to the SDG 6 calculations and targets, which may be able to be aligned, in some instances.

Gaps relating to data reporting frequencies have been highlighted as gaps, and therefore alignment with the NBA and associated research and reporting systems may be valuable for SDG 6 reporting.

5.11.1 Background

The NBA provides the broad framework for reporting on species and ecosystems monitored and assessed and includes amongst others, key indicators of species and ecosystem status (threatened and protected). South Africa already reports on the state of biodiversity, in the National Biodiversity Assessment (NBA), and this must be revised and updated at least every seven years.

The first national assessment of biodiversity in South African was completed in 2004 and called the National Spatial Biodiversity Assessment (NSBA 2004). It dealt only with spatial aspects of biodiversity. The NBA 2011 added non-spatial thematic elements such as the state of species of special concern and invasive alien species. The NBA 2011 also presents new work on geographic areas that contribute to climate change resilience and provides a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial, and local scales. Systematic biodiversity planning and assessments of climate change resilience at a landscape scale both consider features or areas important to maintaining connectivity in landscapes.

The NBA and its underlying information is used to streamline environmental decision-making, strengthen land-use planning, strengthen strategic planning about optimal development futures for South Africa, and identify priorities for management and restoration of ecosystems with related opportunities for ecosystem-based job creation.

The NBA provides headline indicators for monitoring and reporting and summarises spatial biodiversity priorities. The NBA informs the revision and updating of key national biodiversity policies and strategies, including the NBSAP, the National Biodiversity Framework (NBF) and the National Protected Area Expansion Strategy.

5.11.2 Link to SDG's

The NBA provides a range of national and international level monitoring, reporting and assessment processes such as state of environment reporting and reporting on commitments to international conventions (e.g. linked to the United Nations Convention on Biological Diversity [CBD], including the SDGs and the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services [IPBES]).

One such index, developed by the International Union of Conservation of Nature (IUCN), is the Red List Index for species that tracks changes in extinction risk across entire species groups between Red List assessments. It is used to track progress against the Aichi Targets and SDGs. A similar Red List Index for ecosystems is being developed. As these indicators mature in terms of input data and computation, the ability to undertake trend analysis will improve.

5.11.3 National Biodiversity Assessment Indicators

The indicators of the NBA should form the basis for indices that track change over time. Indicators that track the condition of ecosystems and the various pressures that act on biodiversity are emerging. The NBA includes two headline indicators that are assessed across all environments (terrestrial, inland aquatic, estuarine and marine) and in two cross-realm areas (the coast and South Africa’s sub-Antarctic territory).

- ecosystem threat status; and
- ecosystem protection level.

Indicators of rates of terrestrial habitat loss use land cover data from several time points and can be used in biodiversity prioritisation efforts (developed for the NBA 2018). The land cover change data was used to calculate the rate of loss of natural habitat to anthropogenic activities between 1990 and 2014 (expressed as percentage of the 1990 remaining extent lost per year). A comprehensive assessment of all terrestrial ecosystem threat status was performed focussing on IUCN Red List of Ecosystems Criteria (criteria linked to spatial configuration and remaining extent of ecosystems). Indicators for biological invasions, and international literature is expanding for indicators that track ecosystem extent and health.

Ecosystem protection level is an indicator that tracks how well represented an ecosystem type is in the protected area network. It has been used as a headline indicator in national reporting in South Africa since 2005. It is computed by intersecting maps of ecosystem types and ecological condition with the map of protected areas. Ecosystem types are then categorised based on the proportion of the biodiversity target for each ecosystem type that is included in one or more protected areas.

Indicators for assessing genetic diversity at a national scale are also being explored. Additional data will need to be collected to meaningfully compute some of these new indicators. Future assessments may also include Key Biodiversity Areas (KBAs) and Ecologically or Biologically Significant Marine Areas (EBSAs), which allow for improved alignment with emerging global biodiversity indicators linked to the SDGs and future iterations of CBD targets in the post-2020 agenda for biodiversity.

5.11.4 National Biodiversity Assessment Targets

For terrestrial ecosystems, biodiversity targets were set for each ecosystem type using established species area accumulation curves (ranging between 16 and 34%). For the other realms, species accumulation curves have not yet been estimated and a protection target of 20% was applied. The categories for protection level are Well Protected (WP) where the extent protected exceeds the biodiversity target; Moderately Protected (MP) where the extent protected is between 50 and 99% of the target; Poorly Protected (PP) where the extent protected is between 5 and 49% of the target; and Not Protected (NP) where the extent protected is less than 5% of the target.

The species protection level indicator measures progress towards protecting a population persistence target for each species. As species persistence is dependent on the degree to which protected areas can mitigate threats that cause population decline, a protected area effectiveness factor was included in the calculation of species protection level. The categories for protection level are:

- Well Protected where the species persistence target is met or exceeded by the protected area network;
- Moderately Protected where between 50 and 99% of the species persistence target is met;
- Poorly Protected where between 5 and 49% of the species persistence target is met; and
- Not Protected where less than 5% of the species persistence target is met.

Protection level was calculated for freshwater fishes and terrestrial birds, mammals, reptiles, amphibians and butterflies. Plants were assessed using a representative sample of 900 taxa, while peripheral taxa, which have less than 5% of their distribution range occurring in South Africa, were excluded.

To determine the threat status of inland aquatic ecosystems, the proportion of each ecosystem type in a natural/near-natural condition was assessed against a series of thresholds. Owing to insufficient data in determining ecologically differentiated targets, an agreed biodiversity target of 20% for inland aquatic ecosystems was agreed, meaning that at least 20% of each ecosystem type should remain in a natural or near-natural ecological condition, defined as the A or B ecological category (referred at as Present Ecological State [PES]). Rivers and inland wetlands were evaluated against this 20% biodiversity target and a set of additional thresholds (**Table 5.11**). Consequently, ecosystems with <20% of their spatial extent in a natural/near-natural ecological condition, were considered Critically Endangered. Thresholds of 35% and 60% were used for Endangered (EN) and Vulnerable (VU) categories, whereas ecosystems with >60% in a natural or near-natural ecological condition were considered of Least Concern (LC).

For the protection level assessment, which involved intersecting ecosystem maps with the protected areas layer, only inland wetland and river features in a natural or near-natural condition were considered to be contributing to the 20% target assigned to each ecosystem type. For the inland wetlands an additional step involved assessing the contribution of South Africa’s 23 Ramsar sites to ecosystem protection. The extent of inland wetlands in a natural/near-natural ecological condition that are within Ramsar sites not falling within the existing protected area boundaries are reported on separately. Rivers and inland wetlands within protected areas may however still be exposed to a number of pressures imposed from beyond the protected area, such as water abstraction or detrimental land uses in their catchments, which may result in fragmentation and water pollution. As a result of the high level of longitudinal and latitudinal connectivity between inland aquatic ecosystems, as well as dependency on baseflow, this indicator may tend to overestimate protection of aquatic systems.

The protection level assessment for marine ecosystems used the standard approach with an additional rule applied: for a marine ecosystem type to qualify in the Well Protected category, at least 20% of the ecosystem type (i.e. the ecosystem target) needed to be in a natural/near-natural ecological condition, within the protected area. If this rule was not met, the ecosystem was categorised as Moderately Protected.

Table 5.11. Thresholds used in determining the ecosystem threat status of rivers and inland wetlands. PES refers to ecological condition

	CR	EN	VU
Thresholds applied to river ecosystems	Where the length of river ecosystem type in a natural or near-natural ecological condition (PES = A or B) is ≤20% of the total length for that ecosystem type.	Where the length of river ecosystem type in a natural or near-natural ecological condition (PES = A or B) is ≤35% of the total length for that ecosystem type	Where the length of river ecosystem type in a natural or near-natural ecological condition (PES = A or B) is ≤60% of the total length for that ecosystem type.
Thresholds applied to inland wetland ecosystems	Where the extent (area) of each inland wetland modelled in a natural or near-natural ecological condition is ≤20% of the total extent for that ecosystem type.	Where the extent (area) of each inland wetland modelled in a natural or near-natural ecological condition is ≤35% of the total extent for that ecosystem type.	Where the extent (area) of each inland wetland modelled in a natural or near-natural ecological condition is ≤60% of the total extent for that ecosystem type.

5.11.5 Lessons Learned and Gaps Associated with the National Biodiversity Assessment

The NBA 2011 identified five main knowledge gaps and research priority areas that would strengthen future NBAs: improving taxonomy capacity for species, developing a National Ecosystem Classification System, measuring and mapping ecological condition, further researching the links between biodiversity and human wellbeing, and improving biodiversity-related monitoring work. These knowledge gaps have been a key focus since 2011, with may being addressed in the NBA 2018.

The knowledge gaps and research priorities identified in NBA 2018 are summarised below and a full description of each knowledge gap and its potential solutions or avenues for improvement are included in **Table 5.12**, those gaps identified to be most relevant to SDG6 have been highlighted in green. In addition, the following goals for improved data management and sharing emerged from the NBA 2018:

- A mechanism to feed information from site-based assessments (such as EIAs) back into national datasets to add to foundational biodiversity information.
- Biodiversity indicators are prepared and released on a more regular basis than the current NBA intervals (5-7 years). Indicator dashboards are being developed to provide up-to-date information for improved reporting (e.g. SDGs) and streamlined management and planning.
- New indicators are emerging internationally, and need to be incorporated into NBA data management and sharing processes (e.g. indicators that track the condition of ecosystems, KBAs, linked to the status of ecological infrastructure, genetic diversity, effectiveness of interventions).

Table 5.12. Summary analysis of overall knowledge gaps causing limitations to the NBA and priority actions for solutions

Knowledge gap causing limitation to the NBA	Priority actions for solutions
Since anthropogenic climate change is escalating at unprecedented speed, understanding, predicting and minimising its impacts in South Africa are major knowledge gaps. The reliability of models for predicting climate change impacts is improving, but these rely on input data of a high quality and confidence. Poor data quality and data gaps lead to low confidence of predictive models, resulting challenges for decision making.	A cohesive framework and indicators to track biodiversity and ecosystem service impacts because of climate change, identify critical thresholds or points of non-return and assess the effectiveness of interventions to minimise these impacts, is essential. Ecosystem change data and dedicated species population monitoring over long timeframes are needed to detect change and inform predictive models. Ensuring that reliable weather station data are available across South Africa remains a priority.
There are major gaps in data required to properly measure the indicators developed for the national status report on biological invasions. The NBA's terrestrial ecological condition indicators do not yet incorporate biological invasion data.	Spatial data on the abundance and distribution of alien invasive species should be included in ecological condition assessments. More data on the impacts of biological invasions on biodiversity, and the value of management efforts for conservation goals, is needed.
Spatial data on the benefits of biodiversity to people is currently limited, and there is limited data available on the economic value of biodiversity's benefits to people.	More quantitative and updated data on the benefits of biodiversity will be valuable for prioritisation and decision-making processes beyond the NBA, and communicating the relevance of biodiversity.
There is insufficient knowledge of the impacts of flow reductions on rivers, wetlands, estuaries and coastal and marine environments.	An improved understanding of flow requirements for each ecosystem is needed – from rivers and wetlands to estuaries and coastal and offshore

Knowledge gap causing limitation to the NBA	Priority actions for solutions
	marine environments (such as fluvial fans and mud habitats). A clearer understanding of the downstream and 'knock-on' effects of flow reductions on these ecosystems is required.
Currently the NBA does not take several emerging pressures into account, as data are not available.	Data on emerging pressures is needed: the impact of herbicides, pesticides and pharmaceuticals in water and soil; impacts of noise and light pollution on species; and impact of micro-plastics on biodiversity.
Species assessments (realm-specific species needs are covered in the realm sections below)	
Gaps in taxonomic knowledge are substantial, particularly for invertebrates, many estuarine and marine groups, and for alien invasive species. Taxonomic uncertainties are a major constraint to species assessments and the ability to conduct comprehensive status assessments of groups in all realms.	A systematic process of detailed taxonomic studies on priority groups, including field collections and DNA barcoding, is necessary for the enhancement of national species datasets. Building and maintaining South African taxonomic knowledge and expertise, especially for understudied taxonomic groups is considered necessary.
Lack of monitoring data to detect changes in species abundance and distribution in response to pressures such as climate change, invasive aliens, biological resource use, etc. limits the ability to determine trends in species status via the Red List Index. Structured monitoring programmes are only in place for birds, butterflies and plants with citizen scientists playing a role in the data collection.	Monitoring programmes that cover a range of taxa from different realms, that include plants, vertebrates and invertebrates need to be developed and implemented using online citizen science platforms (e.g. iNaturalist).

Further gaps are identified in the NBA relating to species assessment and genetic assessments, considered to be unrelated to SDG6, can be accessed in Table 17 in the NBA.

The systematic approach of the NBA allows for the identification of important national knowledge gaps and research priorities linked to biodiversity.

- First investigation of indicators of genetic diversity:
  Currently, the experimental genetic indicators have only been applied to two taxonomic groups (reptiles and amphibians). New indicators to track and monitor the status of genetic diversity are being developed and can assist in identifying areas essential to the maintenance of genetic diversity over the landscape for target species.
- A new indicator of the rate of habitat loss:
  Land cover change data (1990-2014) has made it possible to compute the rate of habitat loss for each terrestrial ecosystem type, leading to improved ecosystem assessments.
- New trend analysis for protection level:
  Protected level time-series analyses have been made possible by development of the South African Protected Areas Database that tracks new declarations.

5.12 SOUTH AFRICAN PEATLANDS: ECOHYDROLOGICAL CHARACTERISTICS AND SOCIO-ECONOMIC VALUE

The South African Peatlands study provides insight into the use of various tools to develop indicators for the monitoring and mapping of the spatial extent of peatlands across South Africa despite the challenges faced in relation to the arid nature of the country.

This study highlights a potential additional indicator to be added to the SDG Target 6.6 suite, while also presenting further data collection methodologies as well as showing adaptation of the methodology with time, and the advancement of available technologies.

5.12.1 Background

Wetlands in South Africa are defined by the National Water Act, Act 36 of 1998, as a key component of the water resources of South Africa. Wetlands have been shown to contribute to the livelihood of rural communities by providing valuable grazing land, cultivation areas, building materials and medicinal goods. In addition to these services, wetlands provide a host of other services, which are often indirectly used by society and are therefore undervalued in economic markets (flood attenuation, water purification and the provision of fresh water).

Different wetland types provide ecosystem services based on their hydrogeomorphic characteristics. Peatlands are one such wetland ecosystem. Research findings confirmed that peatlands in South Africa are mostly groundwater-dependent ecosystems that occur in the wetter eastern and southern parts of South Africa. The ecosystem services identified as the most important peatland services were carbon sequestration, water purification, knowledge and education, peat as a commodity, hydrological regulation, tourism, recreation, and spirituality.

The study supports the current wetland inventory of the South African National Biodiversity Institute (SANBI), the DFFE’s obligations towards the Ramsar Convention and the wetland rehabilitation initiatives of Working for Wetlands. The aim of this study was to evaluate the characteristics of peatlands and related processes and their contribution to South African wetland ecosystem services.

5.12.2 Peatland Indicators and Targets

The existing peatland ecoregion model was improved by using expert knowledge in the modelling process such as providing the boundary conditions (upper and lower limits) for each parameter, resulting in a series of key indicator layers. These parameters were combined in a model that identified areas where all criteria were met. Several variations on the key indicators of the selected parameters were processed while trying to identify the best-fit model. The output of the model was a geographical information system (GIS) coverage depicting potential peatland ecoregion distributions for South Africa, depicting areas where peatlands might possibly occur considering several spatial parameters.

The upgrade of the existing peatland database was designed to be compatible with the SANBI National Wetland Inventory. The updated database contains 635 peat points: 164 (25.83%) occurring in Ramsar sites; 222 (34.96%) in formally protected areas; 2 (0.31%) in informally protected areas; and the rest on private and communal land. The database, which is compatible with the SANBI Wetland Database, is hosted and maintained at the Agricultural Research Council – Institute for Soil, Climate and Water.

The key indicators or conditions ideal for peatland occurrence are presented in **Table 5.13**.

5.12.3 Lessons Learned and Gaps

Where there were data gaps, peatland experts were consulted, and ranges were determined. In this way, data required was inferred across regions to ultimately demonstrate the value of peatlands across South Africa. Knowledge gaps identified during this study included:

- The microbiology (for example, bacterial and fungal guilds) of peatlands.
- The identification, description, and barcoding of phyla (nematodes, spiders, mites and insects) in peatlands.

Table 5.13. Peatland ecoregion defining parameters, key indicators and special data sources

Name of Layer	Source	Scale and Key Indicator	Reference
Precipitation: spatial rainfall data grid at 1 km resolution per month, average monthly (mm)	ARC-ISCW	≥500 mm	Malherbe, 2014
Geology (dolomite)	Council for Geoscience	Dolomite, conglomerate, arenite, quartzite, dolerites, mudstone, other sedimentary lithologies	CGS, 2014
Slope	SRTM digital elevation model	≤12%	Weepener et al., 2011
Mean annual groundwater recharge	Recharge mean	≥5 mm	Vegter, 1995
Groundwater component of river base flow	Base flow	≥10 mm	Vegter, 1995
Depth to groundwater level and springs	Depth to groundwater level; springs	Water level ≤20 m combined with polygons that overlap or intersect with either thermal or cold springs	Vegter, 1995; DWA, 2014

CHAPTER 6: SUMMARY OF SDG 6 RELEVANT INDICATORS AND TARGETS IDENTIFIED

Many of the documents reviewed provide a high-level set of goals and objectives following a particular overarching principle or agenda. These agendas are incorporated into the operational mandates of particular government departments, based on their applicable mandate. Some of these reporting platforms have promoted and created task teams to allow for consolidated reporting under the different agendas, while others report into a centralised report generating group.

The number of reporting platforms present locally and globally creates an administrative burden on the government departments being tasked with this reporting. The government departmental reporting may in some instances be aligning their reporting systems but may also lack alignment and land up duplicating work already performed by other departments or groups. The consolidation of the reporting systems using a particular platform, such as the UN SDG's, is a positive approach to consolidating the reporting requirements and aligning the reporting systems, where possible.

The global reporting requirements of which the UN SDG's are one, include Agenda 2063 and the UNCCD NAP which incorporates LDN principles into the operational mandates of key government departments.
South Africa has developed a series of reporting platforms which range from high-level reporting plans through to more practical frameworks. This top-down system allows for alignment between government initiatives, overarching goals, and principles down to the more practical implementation of these principles to achieve the goals using measurable targets.

In South Africa the NDP 2030 is a visionary document setting big picture goals and objectives for South Africa. The MTSF presents a set of targets and indicators, typically at a governmental strategic level. The NWRS provides the strategy for how the water sector and its key institutions will achieve the strategic objectives through the development of detailed implementation plans, while the NW&SMP prioritizes all the key elements that need to be addressed to ensure the sustainability of water resources. All of these documents set indicators and targets at an advanced level identifying reporting requirements rather than specifying the methodologies to be used to achieve these indicators.

A number of specific frameworks, strategies and assessments provide task specific indicators and targets, which have more direct alignment with the SDG indicators and targets set in South Africa. These indicators and targets are developed to achieve the overarching principles of the global and national agendas and plans. The reports provide practical data collection methodologies and data sets, which mature with changes in available data and collection mechanisms. Therefore, aligning the SDG reporting to these reporting frameworks is necessary to remain current, but may mean change to the reporting methodologies where necessary.

Based on a review of the indicators and targets set across the different documents reviewed there are selected indicators and targets that may be relevant to the SDG Target 6.3, SDG Target 6.6 and SDG Target 6.B reporting requirement, summarised in **Table 6.1**, **Table 6.2** and **Table 6.3**, respectively.

6.1 SDG TARGET 6.3 INDICATORS AND TARGETS

Wastewater discharge and ambient water quality are parameters that have been monitored by South African authorities in one form or another for many years prior to the definition and adoption of the specific indicators SDG Indicator 6.3.1 and SDG Indicator 6.3.2 in 2015.

The Voluntary National Review published in 2019 (South African Government, 2019) and the SDG Country Report of 2019 reported on the status of wastewater discharge (SDG Indicator 6.3.1) and ambient water quality (SDG Indicator 6.3.2). Review of further documentation presents the following potential links between global and national indicators and target for SDG Target 6.3 – (**Table 6.1**).

Table 6.1. Current SDG Target 6.3 Indicators in South Africa Link to Global and National Indicators and Targets

Target 6.3	Indicator		Extent	Status	Indicator	Target
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	6.3.1G	Proportion of domestic and industrial wastewater flows safely treated	Global (G)	Substituted with Indicator 6.3.1D	**MTSF PRIORITY 5: SPATIAL INTEGRATION, HUMAN SETTLEMENTS AND LOCAL GOVERNMENT**	
					2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities.	
					Number of water treatment works assessed.	1 010 every 2 years – alternating with Green Drop assessments
	6.3.2G	Proportion of bodies of water with good ambient water quality	Global (G)	Substituted with Indicator 6.3.2D		
	6.3.1D	Discharge of water containing waste	Domesticated (D)	Active	**NW&SMP 1.4 Regulating the water and sanitation sector**	
					1.4.1 Revitalise the Green, Blue and No Drop programmes and publish results and revise and establish norms and standards.	National Obtain annual BD and GD Assessments reports Capturing and publish of results on DWS web Provincial Annual submission of 19 BD and GD compliance assessments
	6.3.2D	Raw water quality	Domesticated (D)	Inactive	**NW&SMP 1.5 Improving raw water quality**	
					1.5.1 Determine in-stream Resource Water Quality Objectives (RWQOs), based on the SA Water Quality Guidelines (SA36), in support of RQO's Capacity, budgetary constraints	Publish the RWQOs for water quality RQOs adequately reflect IWQM requirements
					1.5.2 Routinely monitor resource water quality (SA46, SA47 SA48)	Laboratory facilities not readily available in all WMAs hampering IWQM
						National monitoring network in place but coverage requires expansion

Target 6.3	**Indicator**		**Extent**	**Status**	**Indicator**	**Target**
						Regional water quality programmes insufficient to manage pressure on water resources
						Regional and local water quality programmes insufficient to manage pressure on water resources
					1.5.4 Assess resource water quality information (SA52 & SA59)	Routine national assessments of water quality and input in support of the SDG process
						Routine catchment assessments of water quality and the identification of "hot spots" for potential water quality management intervention
	6.3.3A	Recycling of water containing waste	Additional (A)	Inactive		
	6.3.4A	Disposal of waste	Additional (A)	Inactive		
	6.3.5A	Recycling of waste	Additional (A)	Inactive		

6.2 SDG TARGET 6.6 INDICATORS AND TARGETS

According to the UN Integrated Monitoring Guide for SDG 6, “The 2030 Agenda for Sustainable Development specifies that all SDG targets “are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances.”

The global ambition of the Target 6.6 is to “protect and restore” ecosystems (without any numeric specification), and it is up to each country to set their own targets in this regard, i.e. to determine what is an acceptable change in ecosystem extent, quantity and health, and when and how management intervention should be introduced. Review of further documentation presents the following potential links between global and national indicators and targets for SDG Target 6.6 (**Table 6.2**).

Table 6.2. SDG Target 6.6 South African Indicator and Sub-indicators Link to Global and National Indicators and Targets

Target 6.6	Indicator			Sub-Indictors	Indicator	Target
Ecosystems – protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1	Change in the extent of water-related ecosystems over time	Global (G)	Percentage change in the surface area of wetlands (vegetated and unvegetated/arid), estuaries, reservoirs and lakes over time from a predefined baseline, expressed as a % of the total land area	**Agenda 2063**	
					Goal 7: Environmentally sustainable climate resilient economies and communities	
					1. Biodiversity, conservation, and sustainable natural resource management	
					a) % of terrestrial and inland water areas preserved	17%
					b) % of coastal and marine areas preserved	10%
					NBSAP SO 2. Investments in ecological infrastructure enhance resilience and ensure benefits to society	
					Number of significant, integrated water-related ecological infrastructure maintenance or improvement interventions	By 2019, 20 integrated interventions in each of 5 key rural Strategic Water Source Areas.
					Hectares of land under restoration / restoration	By 2019, total of 1 370 600 ha restored (1 218 106 ha (DFFE) and 152 500 ha (DAFF)), with 3 230 271 ha of follow up treatment by DFFE.
	6.6.1.1	Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes and estuaries as a percentage of total land area	Domesticated (D)	Change in Spatial Extent of Rivers	**Thresholds used in determining the ecosystem threat status of rivers and inland wetlands. PES refers to ecological condition**	
					Thresholds applied to river ecosystems	Where the length of river ecosystem type in a natural or near-natural ecological condition (PES = A or B) is CR: ≤20% of the total length for that ecosystem type.

Target 6.6	Indicator			Sub-Indictors	Indicator	Target
						EN: ≤35% of the total length for that ecosystem type VU: ≤60% of the total length for that ecosystem type.
				Change in Spatial Extent of Wetlands, including lakes, vegetated wetlands, and ephemeral wetlands	**NBSAP SO 2. Investments in ecological infrastructure enhance resilience and ensure benefits to society**	
					Number of wetlands rehabilitated	By 2019, 695.
					Thresholds used in determining the ecosystem threat status of rivers and inland wetlands. PES refers to ecological condition	
					Thresholds applied to inland wetland ecosystems	Where the extent (area) of each inland wetland modelled in a natural or near-natural ecological condition is CR: ≤20% of the total extent for that ecosystem type. EN: ≤35% of the total extent for that ecosystem type. VU: ≤60% of the total extent for that ecosystem type.
				Change in Spatial Extent of Estuaries		
				Change in the Extent of Estuarine Functional Zones (EFZ)		
				Change in Spatial Extent of Artificial Systems (Reservoirs)	**UNCCD LDN for South Africa**	
					Waste management Storm water control	Water quality improvement 2030

Target 6.6	Indicator			Sub-Indictors	Indicator	Target
					Establishing vegetation strips and cover	
	6.6.1.2	Number of lakes and dams affected by high trophic and turbidity states	Domesticated (D)	Proportion of lakes and dams affected by High Trophic States		
				Proportion of lakes and dams affected by High Turbidity States		
	6.6.1.3	Change in the national discharge of rivers and estuaries over time	Domesticated (D)	Change in the Water Quantity in Rivers		
				Change in the Water Quantity in Estuaries		
	6.6.1.4	Change in groundwater levels over time	Domesticated (D)	Change in Groundwater Levels over time		
	6.6.1.5	Change in the ecological condition of rivers, estuaries, lakes and wetlands	Additional (A)	Change in the Ecological Condition of Rivers	**MTSF PRIORITY 5: SPATIAL INTEGRATION, HUMAN SETTLEMENTS AND LOCAL GOVERNMENT**	
					2024 Impact: Natural Resources are managed, and sectors and municipalities are able to respond to the impact of climate change.	
					Hectares of land under rehabilitation / restoration	8 000 000 ha
					Number of water resources classified	6
				Change in the Ecological Condition of Estuaries		
				Change in the Ecological Condition of Wetlands	**UNCCD LDN for South Africa**	
					SLM practices to avoid overgrazing Rehabilitation	2030
					EbA alignment with CBD's Strategic Plan for Biodiversity	
					Enhance the benefits to all from biodiversity and ecosystem services	By 2020, ecosystem resilience and the contribution of biodiversity

Target 6.6	Indicator			Sub-Indictors	Indicator	Target
						to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification
					NBSAP SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, and sustainable use of biodiversity	
					Report on priority gaps in foundational data sets for species	By 2017, gaps identified.
					Number of quality-controlled records added to spatial data for species – newly collected data, and existing records captured and added to data set and that address priority gaps	200,000 records added to spatial data sets (newly collected); 1 million existing records added to data set.
					Number of environments for which ecosystem classification systems finalised	By 2017, classifications for four environments completed.
					Number of national maps showing distribution of ecosystems	By 2020, four national maps.
					Long term data sets identified, maintained, and continued	By 2020, long term data sets available, and programme for ongoing data collection implemented.

6.3 SDG TARGET 6.B INDICATORS AND TARGETS

In order to achieve sustainable development, consistency is required between the development of policies and the providers of development assistance (Fourie, 2018). The difficulty comes in achieving this consistency. Analyses and peer review research have been undertaken on policy documents and on the Policy Coherence for Development movement. Five guidelines have been identified to be of relevance for South Africa, which include:

i. Prioritising political buy-in
ii. Safeguarding country ownership of development priorities
iii. Using and improving existing institutional structures and processes
iv. Stimulating cooperation across government departments by using an issue-based approach
v. Including a long-term and transnational perspective when considering policy impacts

Water resource management requires integrated approaches to sustainable development (Fourie, 2018). Trade-offs have also been identified resulting from water and sanitation management, therefore stressing the importance of improving water and sanitation management efforts. Review of further documentation presents the following potential links between global and national indicators and targets for SDG Target 6.B (**Table 6.3**).

Table 6.3. Current SDG Target 6.B Indicators in South Africa Link to Global and National Indicators and Targets

Target 6.B	Indicator		Extent	Status	Indicator	Target
Support and strengthen the participation of local communities in improving water and sanitation management	6.B.1G	Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management	Global (G)	Active	**MTSF PRIORITY 2: ECONOMIC TRANSFORMATION AND JOB CREATION**	
					2024 Impact: Unemployment reduced to 20%-24% with 2 million new jobs especially for youth; economic growth of 2%-3% and growth in levels of investment	
					Timeframe for processing WUL Applications	50% reduction in WUL timeframe by 2020
					MTSF Priority 5: Spatial Integration, Human Settlements and Local Government	
					2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities.	
					No. of bulk water supply projects implemented (completed)	51 bulk water and wastewater supply project phases completed of which: 9 were sanitation services and 42 were for water supply
					2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security	
					% of land reform projects with secure water rights	90%
					NW&SMP 1.4 Regulating the water and sanitation sector	
					1.4.7 Develop and implement municipal bylaws to protect water quality.	Publication of updated bylaws that includes Project of Raw Water Quality
					1.4.9 Establish a mechanism for applying administrative penalties	Strengthening Compliance and Enforcement training modules to build the capacity of EMIs in-house Strengthen the CME, finalisation of the Strategy and Implemented Plan Appoint Environmental Management Inspectors (EMI) to conduct CME
					NW&SMP 1.5 Improving raw water quality	

Target 6.B	Indicator		Extent	Status	Indicator	Target
					1.5.10 Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61)	Build from IGR framework and SADC protocols
					NBSAP SO 3. Biodiversity considerations are mainstreamed into policies, strategies, and practices of a range of sectors	
					Number of compliance inspections conducted	By 2019, 14 500 compliance inspections conducted.
					Number of enforcement actions undertaken for non-compliance with environmental legislation	By 2019, 1 500 completed criminal investigations handed to the NPA for prosecution (for EMI Institutions) and 3 100 administrative enforcement notices issued for non-compliance with environmental legislation.
					NBSAP SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, **and sustainable use of biodiversity**	
					Single portal exists through which all biodiversity information can be accessed	By 2016, the single portal is established, and it is being populated

CHAPTER 7: CONCLUSIONS & RECOMMENDATIONS

7.1 CONCLUSIONS

The project aimed to improve our understanding of the context and status quo of SDG 6 in South Africa. The identification of areas for improvement in relation to measurement and monitoring of the SDG 6 indicators will lead to achieving water sustainability in South Africa.

The project outcome is for meaningful and pragmatic tracking of South Africa's progress on SDG 6 indicators, to achieve positive progress towards sustainable water resource management in South Africa (i.e. progress towards the achievement of SDG 6).

The three SDG 6 sub-indicators SDG Target 6.3, SDG Target 6.6 and SDG Target 6.B were the primary focus of this assessment with the following key findings and recommendations.

7.2 SDG TARGET 6.3 KEY FINDINGS AND RECOMMENDATIONS

Wastewater discharge and ambient water quality are parameters that have been monitored by South African authorities in one form or another for many years prior to the definition and adoption of the specific indicators SDG Indicator 6.3.1 and SDG Indicator 6.3.2 in 2015. The South African methodologies developed for SDG Indicators 6.3.1D and 6.3.2D are considered to be well developed, and through.

Based on the SDG Target 6.3 review significant overlap between the indicators in the SDG programme have been identified; for example, the monitoring of water quality, and the monitoring of wastewater discharge from WWTWs and industry. The following key findings and recommendations relate to SDG Target 6.3:

- The closing out of data gaps is necessary, retrospectively, due to a lack of discharge compliance reporting and WUL audits (2017 and 2018 period primarily) for SDG Indicators 6.3.1D and SDG 6.3.2D monitoring.
- SDG Indicators 6.3.1D and 6.3.3A data should be aligned with and retrieved from the Green Drop programme.
- Engage with DFFE, national permitting processes (WUL) and municipal permitting processes to obtain data for mines, industries, and agriculture.
- SDG Indicator 6.3.2D indicator data should be aligned with and retrieved from the RQO database. SDG Indicator 14.1.1 should be converted to two additional parameters within SDG Indicator 6.3.2D: index of floating plastic debris, and microplastic content of water; which would be sampled along with the other parameters for SDG Indicator 6.3.2D.
- The duplicate indicators for SDG Indicators 6.3.4A and SDG 6.3.5A require alignment between DWS and DFFE, with data sharing required to enable effective reporting.

7.2.1 SDG Target 6.3. Recommendations

Pollution of water resources can take place through point source and non-point source pollution. Point-source discharges include those from wastewater treatment works (WWTWs) of municipalities, commercial activities, and industrial activities. Non-point source pollution is generated over larger areas, including run-off from urban and agricultural land, mine residue deposits and waste disposal facilities. Increased recycling and reuse of waste and water containing waste, in appropriate situations, supports SDG Target 6.3, and, in the case of the recycling or reuse of water containing waste, reduces demand for raw water.

The proposed methodologies for the additional indicators SDG Indicators 6.3.3A, SDG 6.3.4A and SDG 6.3.5A, require data to be obtained from the DFFE in relation to solid waste management. The proposed methodology for SDG Indicator 6.3.3A centres on the recycling and reuse of water containing waste. The proposed methodology for SDG Indicator 6.3.4A focuses on the proportion of waste lawfully disposed of, while SDG Indicator 6.3.5A concentrates on proportion of waste recycled, reused and recovered. The duplicate indicators for SDG Indicators 6.3.4A and SDG 6.4.5A require alignment between DWS and DFFE, with data sharing required to enable effective reporting. **Table 7.1** summarizes the sub-indicator methodology calculations, with possible targets and indicators identified for consideration based on global and national targets. These targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

SDG Indicator 6.3.2D could be expanded to include additional waste parameters which are covered in SDG Indicator 14.1.1, including floating plastic debris, and the microplastic content of water; which would be sampled along with the other parameters for SDG Indicator 6.3.2D. The extent of data availability for each proposed data source should be established, and a matrix compiled to determine the minimum data sources required to triangulate waste sources and receptors.

The SDG Indicator 6.3.3A, 6.3.4A and 6.3.5A Methodologies developed were all tested on example data sets, to determine the usability as well as the data representation. Real data gathering needs to be undertaken over the course of the first year of implementation, whereafter the methodologies are recommended to be further tested and refined.

Table 7.1. SDG Indicator 6.3.3A, SDG 6.3.4A and SDG 6.3.5A Methodology and Target Recommendations

Sub-Indicator	Methodology	Global Target	National Target
6.3.3A Recycling and reuse of water containing waste	The proposed methodology includes measurement of recycled and reused water streams, for municipal, agricultural, industrial and mining applications. The proposed methodology consists of two calculations: • Recycled/reused water percentage from point sources of wastewater (households, commercial establishments and industries) • Recycled/reused water percentage from non-point	The global aspiration of Target 6.3 is that by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Countries may set their own targets but ideally there should be no further degradation of water-related ecosystems from the baseline. A Milestone Sub-Target proposed that 50% of designed streams of water containing waste are reused and / or recycled

Sub-Indicator	Methodology	Global Target	National Target
	sources of wastewater (run-off from urban and agricultural land). $$\boldsymbol{V_t = \frac{V_a + V_c}{V_b + V_d} \times 100}$$		
6.3.4A Proportion of waste lawfully disposed of	The SDG 11.6.1 methodology aims to ensure that solid waste produced by cities is collected and managed to ultimately improve upon living conditions and promote environmental sustainability (Min, 2020). Data that is collected for this indicator, is collected on a regional basis and can be disaggregated at both city and town levels. $$x = \frac{\begin{bmatrix} Total\ mass\ of\ solid \\ waste\ collected \\ and\ managed\ in \\ controlled\ facilities \end{bmatrix}}{\begin{bmatrix} Total\ solid \\ waste\ generated \\ by\ South\ Africa \end{bmatrix}} \times 100$$ (Ghafari, 2022)		Target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management Indicator 11.6.1: Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities
6.3.5A Proportion of waste recycled, reused and recovered	The National Recycling Rate refers to the amount of material that is recycled in a country, plus quantities exported for recycling in relation to the total waste generated in the country, minus any material intended for recycling that is imported (Ghafari, 2022; SDG 12 Hub, 2022) $$\boldsymbol{National\ recycling\ rate} = \frac{\begin{bmatrix} total\ material\ recycled \\ +material\ exported \\ for\ recycling - \\ material\ imported \\ for\ recycling \end{bmatrix}}{\begin{bmatrix} total\ waste \\ generated\ in \\ South\ Africa \end{bmatrix}} \text{x}100$$ (Ghafari, 2022)		Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse. Indicator 12.5.1: national recycling rate, tons of material recycled.

7.3 SDG TARGET 6.6 KEY FINDINGS AND RECOMMENDATIONS

The global ambition of the Target 6.6 is to “protect and restore” ecosystems (without any numeric specification), with it being each country’s responsibility to set their own targets in this regard, i.e. to determine what is an acceptable change in ecosystem extent, quantity and health, and when and how management intervention should be introduced.

The SDG Target 6.6 – Water Related Ecosystems Methodology Report is a well compiled report, incorporating extensive material from both a global and national perspective.

South Africa has extensive datasets developed over many years of work, in relation to water related ecosystems. The challenge faced in reporting against the UN SDG Target 6.6. methodologies is that the historical data sets were largely not compiled for the particular purpose prescribed by the UN. However, the UN SDG Target 6.6. global reporting provides a platform for the amalgamation of the locally generated data sets into a standardised reporting system. The combined data sets are therefore comparable in relation to other global data sets, which helps to benchmarking South Africa in the global context.
The South African methodologies generated in relation to SDG Target 6.6. water related ecosystems, have largely been created based on historical data sets to compile the baseline data, against which future monitoring updates are compared. These methodologies may require updating as further data are generated, and should be robust enough to accommodate technological advances, to improve on the reporting efficiencies to supplement historical date reporting systems.

7.3.1 SDG Target 6.6 Methodology Considerations

From the review of current methodologies that have been implemented for monitoring changes in the extent of water-related ecosystems, it is evident that there are certain limitations that need to be addressed in order to produce more representative datasets and ensure that these ecosystems are well monitored to sustain them in the long-term, including:

- SDG Indicator 6.6.1 sub-indicators need more continuous datasets, to be able to make more representative comparisons with the datasets globally. The country can achieve this by collaborating with the UNEP to improve upon the datasets that are produced at a global scale.
- Landsat imagery currently being used to derive data for water-related ecosystems, can classify large areas of surface water, while being too coarse to identify smaller water bodies. The use of higher resolution Sentinel data together with Landsat imagery for future datasets is anticipated to produce more accurate outcomes.
- The water quality of water-related ecosystems, methodologies for monitoring changes in the number of lakes and dams affected by high trophic and turbidity states are still in progress. The use of both secchi disc and satellite-based earth observations, acquired from both Landsat and Sentinel imagery, is highly recommended.

7.3.2 SDG Target 6.6 Targets and Indicators

According to the UN Integrated Monitoring Guide for SDG 6, Step-by-step monitoring methodology for indicator 6.6.1 on water related ecosystems “The 2030 Agenda for Sustainable Development specifies that all SDG targets “are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances.”

The global ambition of the Target 6.6 is to “protect and restore” ecosystems (without any numeric specification), and it is up to each country to set their own targets. The Aichi Biodiversity Targets of the Convention of Biological Diversity, which set out several objectives for ecosystem management The Target for 2020 was to have information from monitoring the indicators for Indicator 6.6.1 that could guide countries to manage, protect and restore these ecosystems, in keeping with. The three primary Aichi Biodiversity Targets that are of relevance to SDG Indicator 6.6.1 include Target 5, 14 and 15.

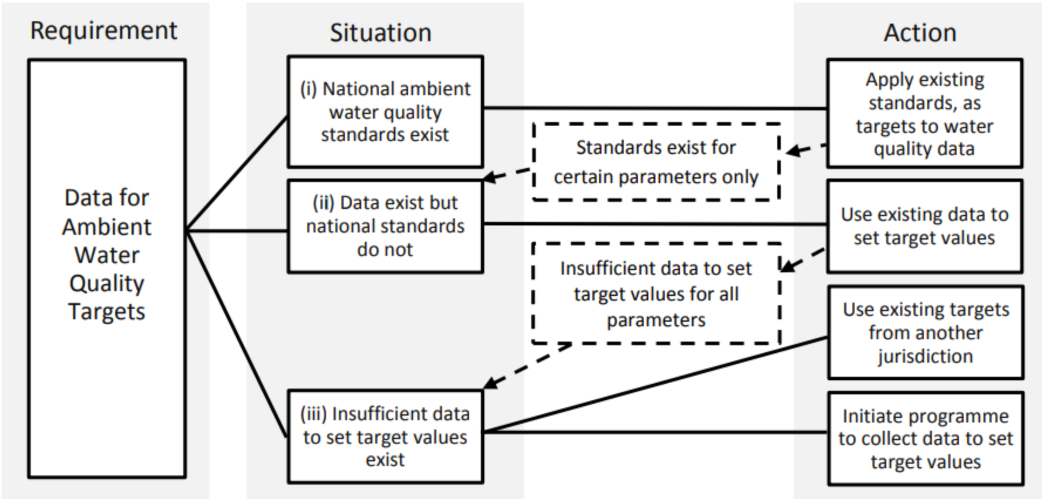
7.3.3 SDG Target 6.6. Recommendations

The setting of management targets or objectives for the extent of water-related ecosystems has become a global priority. While the SDG process sets out to monitor the percentage change in extent of water-related ecosystems over time, it will be incumbent on countries to actually set targets for this change, to determine what an acceptable change is and when and how management intervention should be introduced.

Table 7.2 summarizes the sub-indicator targets for each of the UN SDG Indicators 6.6.1 reflecting possible global and national targets. These targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

Table 7.2. Target recommendations for each SDG Indicator 6.6.1 Sub-indicator (UN Step by step monitoring methodology for SDG Indicator 6.6.1, 2017)

UN Indicator	Global Target	National Target
6.6.1	The global aspiration of Target 6.6 is to protect and restore ecosystems (in agreement with Aichi Biodiversity Targets 5,14,15), i.e. there should be no further degradation of water-related ecosystems from the 2017 baseline.	Countries may set their own targets but ideally there should be no further degradation of water-related ecosystems from the 2017 baseline. As in the Aichi Biodiversity Target 5, where countries have economic needs then degradation rates should be at least halved.
6.6.1.A – Spatial Extent	No-net-loss as promoted by the Ramsar Convention. Aichi Biodiversity Target 5 aims to reduce rate of loss almost to zero.	Many countries have set a no-net-loss policy as promoted by the Ramsar Convention on Wetlands. Countries may set an alternative target, but this must be justified, and as described by Aichi Biodiversity Target 5, the rate of loss should at least be halved but ideally approach zero. Aichi Biodiversity Target 15 aims to restore 15% of degraded ecosystems that store carbon (wetlands, peat).
6.6.1.B – Quantity of Water	The global ambition is to protect and restore ecosystems, i.e. water withdrawals should not damage the integrity of ecosystems. Aichi Biodiversity Target 5 promotes that habitat loss is reduced to zero (or at least to half), and Target 14 requires that essential ecosystems are restored and safeguarded.	Targets for quantities of water ideally should be established for each river and tributary, for lakes and groundwater, based on priorities in the basin and sub-basin. These should aim to protect the integrity of water-related ecosystems based on their environmental flow requirements. Aichi Biodiversity Targets also apply (5, 14)

UN Indicator	Global Target	National Target
6.6.1.C – Water Quality		
6.6.1.D – Ecosystem Health	The global ambition is to protect and restore ecosystems. Thus there should be no reduction of the 2017 baseline. Aichi Biodiversity Target 5 promotes that habitat loss is reduced to almost zero, and Target 14 requires that essential ecosystems are restored and safeguarded.	Targets for the health or state of ecosystems ideally should be established for key river, lakes and for priority wetlands based on priorities in the basin and sub-basin. The guideline presented in Section 5.2 may be used. Aichi Biodiversity Targets also apply (5, 14).

Certain limitations need to be addressed in order to produce more representative datasets and ensure that the changes in the extent of water-related ecosystems are well monitored to sustain them in the long term, including:

- Amendments to the SDG Indicator 6.6.1. methodology are underway by the UN, which requires ongoing collaboration to aid the development of the new methodology to take cognisance of the South African context and challenges experienced.
- More continuous datasets rather than the provision of statistics at a point in time, to make more representative comparisons with the global datasets. The country can achieve this by collaborating with the UNEP to improve upon the datasets that are produced at a global scale.
- The use of satellite-based earth observations acquired from both Landsat and Sentinel imagery is highly recommended for monitoring changes in the number of lakes and dams affected by high trophic and turbidity states.
- The use of data platforms to process and acquire data at a more efficient rate is recommended.

7.4 SDG TARGET 6.B KEY FINDINGS AND RECOMMENDATIONS

The global aim for Target 6.B relates to the participation of local communities in water and sanitation planning and management, which is essential for ensuring that the needs of all people are being met. Water resource management requires integrated approaches to sustainable development (Fourie, 2018).

There is little data available globally at a local administrative unit level that would allow for a direct computation of SDG Indicator 6.B.1. The current methodology is therefore too broad to be able to determine any material indication on the percentage of local administrative units within the country that have been established, and operational policies and procedures for participation of local communities in water and sanitation management. The following areas requiring improvement and gaps have been highlighted during the review of the current methodology:

- The current indicator for the target does not fully encompass the outcome for Target 6.B – support and strengthen the participation of local communities on improving water and sanitation management.
- The indicator is not a true representation of the level of support and participation in a country, and does not determine if the current support and participation of local communities is sufficient to improve management of water and sanitation in the country.
- The current indicator also does not incorporate the level of implementation of procedures in law or policies in a country.
- There is currently no way of measuring whether local communities are being included in targets or aspects in the country's procedures in law or policies.
- The impact of a local community's participation towards a particular project is also not measured

Based on the review of the methodology developed to date for SDG Target 6.B, the lack of monitoring of community involvement in water and sanitation management is a key concern. A new draft methodology for SDG Indicator 6.B.2 allows for the gauging of community involvement related to SDG Indicator 6.B.1, by providing an accurate representation of community participation in improving water and sanitation within South Africa as well as providing a tool to assess the status quo, of the country, in achieving SDG Target 6.B.

7.4.1 SDG Target 6.B. Recommendations

The proposed methodology for Indicator 6.B.2: Performance of Community Involvement in Improving Water and Sanitation Management in terms of the application of policies and guidelines. The stakeholder participation refers to a process or procedure in which individuals and communities can significantly contribute to management decisions and directions. The indicator also incorporates information regarding the existence of procedures in law or policies relating to the participation of service users and communities, the level of participation, separated according to sectors (e.g. drinking water, sanitation, hygiene promotion and water resources planning and management).

Tracking the participation of local communities in improving water and sanitation management is vital to ensuring that the needs of everyone in the community are met, including the most vulnerable. It is also essential to ensuring the long-term sustainability of water and sanitation solutions. This indicator, informs the sustainability of water and sanitation management in a country and at local levels.

Table 7.3 summarizes the sub-indicator methodology calculations, with possible targets and indicators identified for consideration based on global and national targets. These targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

The SDG Indicator 6.B.2 Methodology developed was tested on an example data set, to determine the usability as well as the data representation. Real data gathering needs to be undertaken over the course of the first year of implementation, whereafter the methodology can be further tested and refined.

Table 7.3. SDG Indicator 6.B.2 Methodology and Target Recommendations

Sub-Indicator	Methodology	Global Target	National Target
6.B.2	The proposed methodology includes measurement of stakeholder engagement and data collection at both national and provincial scales. The proposed methodology consists of a two-fold calculation: • Percentage change in the number or quantity for water and sanitation management projects that involve community participation. $\frac{a}{b}$ X 100 • Percentage of communities that are involved in water and sanitation management projects. $\frac{c}{d}$ X 100	In terms of progressive monitoring, countries can start with a qualitative estimation and gradually move towards more accurate quantitative estimations and assessments of the degree of stakeholder participation at the subnational level. In addition, starting in 2018.	No particular target aligns to this SDG 6.B.2. A progressive monitoring and improvement in community participation and involvement is necessary, with an ideal of having 100% community involvement in the long term future,

The new SDG Indicator 6.B.2 will provide a more accurate representation of the participation of local communities in improving water and sanitation within South Africa and the status quo of the country in achieving SDG Target 6.B.

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APPENDIX A: SDG TARGET 6.3 ASSESSMENT AND DRAFT SDG INDICATORS 6.3.3A, 6.3.4A AND 6.3.5A METHODOLOGIES

Existing Indicator Assessment and Additional Indicator Development for SDG 6.3

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List of Abbreviations

CSIR	Council for Scientific and Industrial Research
DFFE	Department of Forestry Fisheries and the Environment
DWS	Department of Water and Sanitation
GEMS	Global Environmental Monitoring System
IRIS	Integrated Regulatory Information System
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreement
PSP	Professional Services Provider
RQO	Resource Quality Objectives
SANBI	South African National Biodiversity Institute
SDG	Sustainable Development Goal
SRK	SRK Consulting South Africa (Pty) Ltd
StatsSA	Statistics South Africa
UN	United Nations
VNR	Voluntary National Review
WRC	Water Research Commission
WSA	Water Service Authority
WWTW	Wastewater Treatment Works

1 Introduction and Background

1.1 The UN Sustainable Development Goals

South Africa is one of 193 countries committed to achieving the Sustainable Development Goals (SDGs). SDG 6: Clean Water and Sanitation, is one of these goals. The lead entity responsible for the policy, plans and implementation programmes affecting the ambitions of SDG 6, is the Department of Water and Sanitation (DWS). In adopting the goal, the DWS adopted existing indicators (carried over from the United Nations [UN] Millennium Development Goals [MDGs]), domesticated some indicators, and defined additional indicators.

In May 2017 the UN released the first round of the Step-by-step Methodology Reports for each of the indicators. Revisions of these methods have subsequently been published through updated methodology reports and captured in the 2018 Synthesis Reports for each indicator. At a national level, countries were encouraged to domesticate these methods and to set targets that are relevant to their context and resources, while maintaining consistency with the targets set out in the SDGs.

While South Africa has developed methodologies to domesticate our indicators, some of the indicators are still not being measured in a meaningful way that shows and drives progress against the targets. For some of these indicators, an assessment, and potentially, a revision of these methodologies is required. For others, new methodologies are required to be developed. In addition, several new indicators are required, and a solid founding methodology is required for the new indicators.

1.2 SDG 6 Adoption in South Africa

SDG 6 has been divided into 8 targets, which are then divided into indicators. The intent of setting targets and defining indicators is to allow for monitoring of progress in achieving SDG 6. The DWS works closely with several other branches of government (e.g. the Department of Forestry, Fisheries and the Environment [DFFE]), as well as other organisations (e.g. the Water Research Commission, Council for Scientific and Industrial Research, etc.), to measure and report on the indicators. The objective of monitoring and reporting on the indicators is to effect real change in the water and sanitation landscape in South Africa, by informing policy and strategy formulation and aiding decision-making when planning and implementing interventions.

South Africa has reported on SDG 6 progress in several reports to date; including the 2016 Community Survey, SDG Baseline Report in 2017, SDG Country Report in 2019, and 2019 General Household Survey. In addition, Statistics South Africa (StatsSA) has partnered with Data Act Lab (a collaboration with SIDA [Swedish International Development Cooperation Agency]) to develop a Goal Tracker portal (Data Act Lab, 2021). The reports and portal show that several indicators are not tracked, that data continuity is poor for some indicators, and that there is a lack of consistency in tracking some indicators.

The DWS and Water Research Commission (WRC) have identified indicators within SDG 6 that present challenges with data availability, data collection, calculation, or reporting. The two organisations appointed a working group, to evaluate targets, indicators, and methodologies for SDG 6.6, 6.3 and 6.b; and to propose improvements where shortfalls are identified. This report deals with the indicators for SDG 6.3.

2 SDG 6.3 Background

SDG 6 aims to monitor all aspects relating to freshwater to ensure the availability and sustainable management of the resource (South African Government, 2019). SDG target 6.3 focuses specifically on water quality and wastewater with the ultimate motive of improving the quality of the resource.

The presence of increased waste in our water bodies poses a serious health hazard both to humans and ecosystems, which makes it crucial to address this issue and minimize the associated impacts. Therefore, monitoring all water bodies and gathering data for all relevant aspects pertaining to this target is necessary to be able to keep track of the quality of freshwater, and based on the quality, to develop or undertake measures for improvement (UN Water, 2022). Currently, the discharge of waste from agricultural, industrial and urban areas has significantly contributed to the deterioration in the quality of surface water bodies. This is one of the key concerns that needs attention when addressing SDG Target 6.3.

On a global scale, there are two indicators for SDG Target 6.3: indicators 6.3.1 and 6.3.2:

- SDG Indicator 6.3.1 monitors the proportion of wastewater from residential, urban and industrial areas that is safely treated (UN Water, 2022). The World Health Organization (WHO) and United Nations Human Settlements Programme (UN-Habitat) are the responsible organisations for this aforementioned indicator.
- SDG Indicator 6.3.2 focuses on monitoring the percentage of water bodies with good ambient water quality (UN Water, 2022). These bodies of water include rivers, lakes as well as groundwater. This indicator aims to ensure that the quality of water is good enough to maintain healthy ecosystems and not to pose any health hazards to human life. Water quality is monitored using an index, which comprises five parameters: oxygen, salinity, nitrogen, phosphorus and acidification (i.e. pH). These parameters are used as they are sensitive to changes in water quality (UN Water, 2022).

On a national scale, both of these indicators have been domesticated for adaptation to the current situation in South Africa:

- 6.3.1D: Discharge of Water Containing Waste; and
- 6.3.2D: Raw Water Quality.

Furthermore, three additional indicators were developed with a focus on recycling of water containing waste, disposal of waste and recycling of waste:

- 6.3.3A. Proportion of water containing waste recycled or reused;
- 6.3.4A. Proportion of waste lawfully disposed of; and
- 6.3.5A. Proportion of waste recycled or reused.

These additional indicators have not been formally adopted yet, and do not have methodologies developed for their monitoring and reporting. They focus specifically on minimizing the amount of waste reaching the water bodies, which would ultimately result in good quality of freshwater resources (DWS, 2021). This focus is aligned with the ambitions of SDG Target 6.3:

> *By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.*

SDG Indicator 6.3.4A and SDG Indicator 6.3.5A both pertain to solid waste, and duplicate existing indicators in other SDGs. This is explored further in Section 4.1.

2.1 Overview of SDG Target 6.3 progress

The DWS has monitored progress against the SDG Target 6.3 indicators since their adoption in 2015. The decision was taken to domesticate the indicators in 2018. The monitoring serves to track progress internally (within South Africa), and to gather data and report progress to the UN.

The following statements on progress against SDG Indicator 6.3.1D and 6.3.2D are paraphrased from the Voluntary National Review of 2019 (South African Government, 2019):

- South Africa has seen improvements relating to safe water and basic services over the years. However, rural areas are still facing challenges due to rural municipalities lacking the capacity and skills that are needed for the provision of water services. This has resulted in the poor operation and maintenance of water related infrastructure.
- In 2016, approximately 40% of water bodies in South Africa had poor water quality resulting from pollution and the destruction of river catchments. The pollution includes point-source and non-point sources of waste discharge.
- In 2017, 52% of wastewater going through wastewater treatment works (WWTWs) was safely treated and lawfully discharged into the water resource. Other sectors that discharge wastewater, such as mines, are not included in this number.

The detailed information on how the indicators track performance against SDG Target 6.3 over time is shown and discussed in Section 4.1.

The challenges in collecting data for SDG Indicators 6.3.3A, 6.3.4A and 6.3.5A include:

- Data are not gathered in a coordinated fashion;
- No information management system is currently available for SDG Indicators 6.3.3A;
- Some municipalities are not submitting data.

3 Problem definition

The ultimate ambition of SDG Target 6.3 is improved ambient water quality. This is outlined in the UN definition of the target:

> *By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.*

Increased recycling and reuse of waste and water containing waste supports this ambition; and, in the case of the recycling or reuse of water containing waste, reduces demand for raw water.

Methodologies have been developed for SDG Indicators 6.3.1D and 6.3.2D; while methodologies for the additional three indicators have not been developed yet. A summary of the status of the SDG 6.3 indicators is shown in Table 3-1 below:

Table 3-1: Current SDG 6.3 indicators in South Africa

Indicator		**Extent**	**Status**
6.3.1D	Discharge of water containing waste	Domesticated	Active
6.3.2D	Raw water quality	Domesticated	Active
6.3.3A	Recycling of water containing waste	Additional	Inactive
6.3.4A	Disposal of waste	Additional	Inactive
6.3.5A	Recycling of waste	Additional	Inactive

This research problem is split into three:

- Problem: lack of understanding of the relationship between SDG Indicator 6.3.1D, SDG Indicator 6.3.2D, and ambient water quality, over time;
    - Research objective:
        - assess existing data to attempt to determine this relationship / correlation;
        - compare the Resource Quality Objectives (RQOs) compliance data to the Global Environmental Monitoring System (GEMS) data, and assess RQO readiness to replace GEMS data
- Problem: absence of methodology for collecting data, calculating and reporting on SDG Indicator 6.3.3A;
    - Research objective: develop a methodology for collecting data, calculating and reporting on this indicator (Recycling of water containing waste);
- Problem: absence of methodology for collecting data, calculating and reporting on SDG Indicators 6.3.4A and 6.3.5A; noting that there are indicators in other SDGs that report on solid waste disposal and recycling;
    - Research objective: develop methodologies for collecting data, calculating and reporting these two indicators, if the decision is taken to duplicate the reporting of indicators by two departments (collaboration between the departments can be implemented).

4 Research Sub-tasks

4.1 Assessment of relationship between SDG 6.3.1D and SDG 6.3.2D over time

4.1.1 Voluntary National Review and SDG Country Report of 2019

Wastewater discharge and ambient water quality are parameters that have been monitored by South African authorities in one form or another for many years prior to the definition and adoption of the specific indicators SDG Indicator 6.3.1 and SDG Indicator 6.3.2 in 2015. The Voluntary National Review published in 2019 (South African Government, 2019) stated the following in relation to these two indicators:

- Wastewater discharged (SDG 6.3.1): 52% of wastewater going through WWTWs was safely treated and lawfully discharged into the water resource;
- Ambient water quality (SDG 6.3.2): 40% of water bodies had poor water quality."

These statistics were duplicated for the SDG Country Report of 2019, with the following additional commentary:

- SDG 6.3.1D: Municipalities are guilty of non-submission of water-quality data to the Integrated Regulatory Information System (IRIS)
- SDG 6.3.2D: South Africa's reporting ability on this indicator has been reduced by the lack of data, limited monitoring due to lack of funding and resource mobilisation, and to a certain degree the inability to coordinate monitoring across various sectors, government departments and public sector institutions. Data on instream and in-aquifer water-quality monitoring across South Africa has been steadily declining since 2015. This is largely as a result of the financial

constraints that have affected both the collection of water-quality samples as well as the analysis of the samples by the DWS laboratories.

4.1.2 UN Data Drive of 2020

In 2020, the UN-Water Integrated Monitoring Initiative had a Data Drive for SDG 6; in line with their ambition to “Ensure availability and sustainable management of water and sanitation for all”. The Data Drive involved countries collecting and reporting data on various SDG 6 indicators to multiple UN agencies, coordinated by UN-Water, as well as to the UN (DWS, 2020). There is a discrepancy in alignment of the data requested by the UN and the SDG reporting – in that the indicators are not the same. The DWS informed the UN of this discrepancy but was not successful in obtaining clarification. The DWS resolved to report on the data that they collect and have available.

4.1.3 Methodology Document of 2021

In order to address some of the above issues and to formalise monitoring and reporting on SDG Target 6.3; a methodology document for SDG Target 6.3 was published in January 2021 (DWS, 2021). The methodologies for SDG Indicator 6.3.1D and 6.3.2D are well developed and summarised below:

- The lead organisations are clearly defined;
- The indicator data for SDG 6.3.2D is divided into quaternary catchments, which are well-defined and delineated for South Africa.
- Management targets are defined
- Cost estimates to achieve the monitoring requirements are available
- The indicator data is available.

It should be noted that collect data from the GEMS site. However, we are working towards reporting on compliance to RQOs

4.1.4 Indicator movement over time for SDG 6.3.1D and 6.3.2D

The progression over time of SDG 6.3.1D is shown in the below graph supplied by the DWS (DWS, 2022), followed by commentary by the DWS:

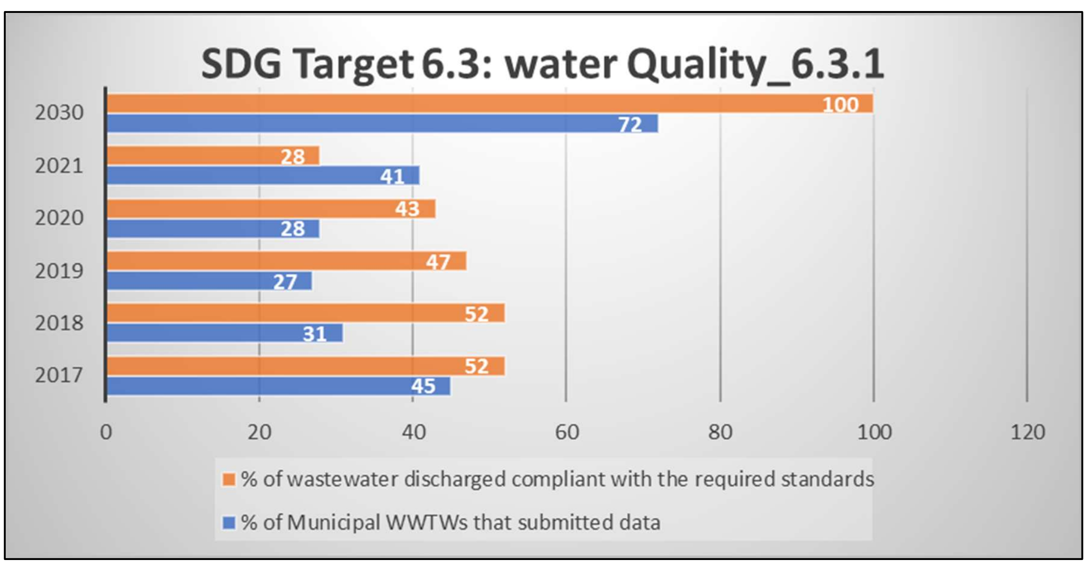

Figure 4-1: Wastewater quality compliance target

The SDG 6.3.1D 2030 target is to: "*Halve the proportion of wastewater that is not lawfully discharged by 2030*" (i.e. using 2017 as the baseline, this means 76% of Municipal discharges must be lawful). There is evidence of a drop or reduction in effluent quality compliance due to lack of submission of effluent quality results onto IRIS and/or monitoring. The percentage of WWTWs that have Water Use Authorisations, and discharge into a water resource, and submitted data onto IRIS; reduced between 2018 and 2020, but increased again in 2021. Therefore, South Africa is not on-track to achieving the set target. A great improvement in data is needed to understand the extent and location of the problem.

Wastewater regulation in the country is conducted by the DWS through the monitoring of effluent quality and Water Use Licence conditions. Since the inception of the Green Drop Certification process, attention has been given to the actual service of wastewater collection, treatment and discharge. However, the discharge of effluent (water containing waste) remains a Section 21 Water Use as legislated in the National Water Act. Data provided above in Figure 4-1 is based on results from municipal WWTWs as captured in IRIS by municipalities. Data provided above excludes wastewater treatment works that discharge into sea outfall, non-discharge treatment technologies such as Oxidation Ponds and those treatment works that use effluent for irrigation.

The progression over time of SDG 6.3.2D is shown in the below graph supplied by the DWS (DWS, 2022), followed by commentary by the DWS:

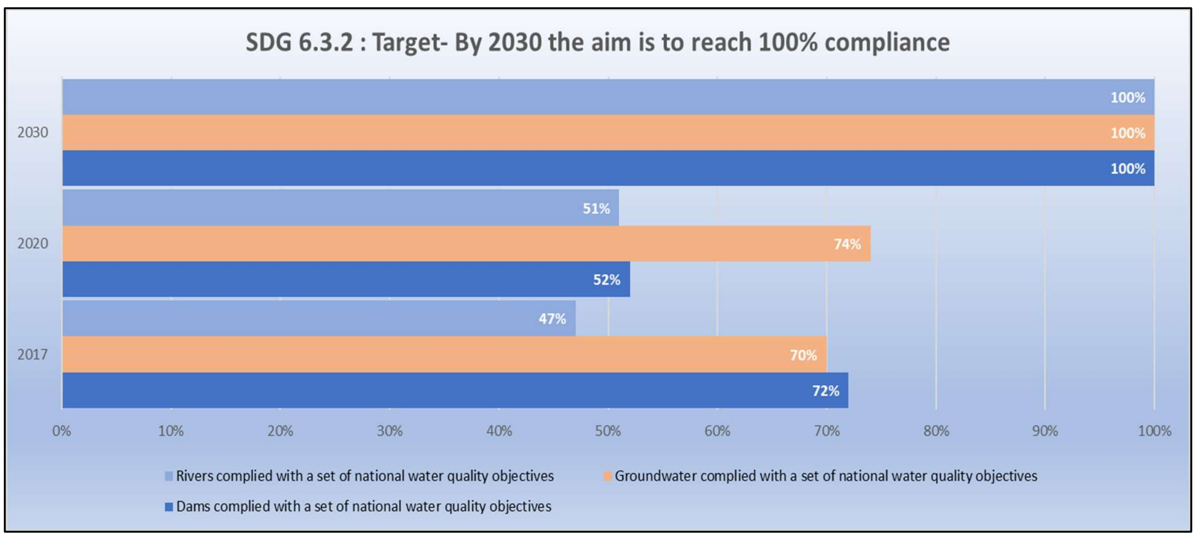

Figure 4-2: Proportion of water bodies that comply with the water quality objectives

The SDG 6.3.2D 2030 target is that: "*100% of bodies of water comply with the water quality objectives*".

Figure 4-2 reveals that 2017 data showed that 72% of dams and 70% of groundwater complied with a set of national water quality objectives, however only 47% of the water quality in rivers complied (baseline data). In comparison during the 2020 Data Drive, 52% of dams and 74% of groundwater complied with a set of national water quality objectives; and 51% of the water quality in rivers complied. For the dam results, the reason for the drop in water quality is a mixture between worsening water quality and the fact that:

- Between 2014-2016, the results were based on 76 586 samples;
- Between 2017-2019, the results were based on far fewer samples (27 784);
- There was a data gap for 2018-2019, as no monitoring was conducted due to financial constraints;

For the groundwater results, the accuracy has been questioned by some stakeholders, as it is known that there are areas with poor groundwater quality. The groundwater networks or data would have to be improved to pick these problem areas up.

An attempt is made to show the relationship between SDG 6.3.1A and SDG 6.3.2A over time in Figure 4-3 below.

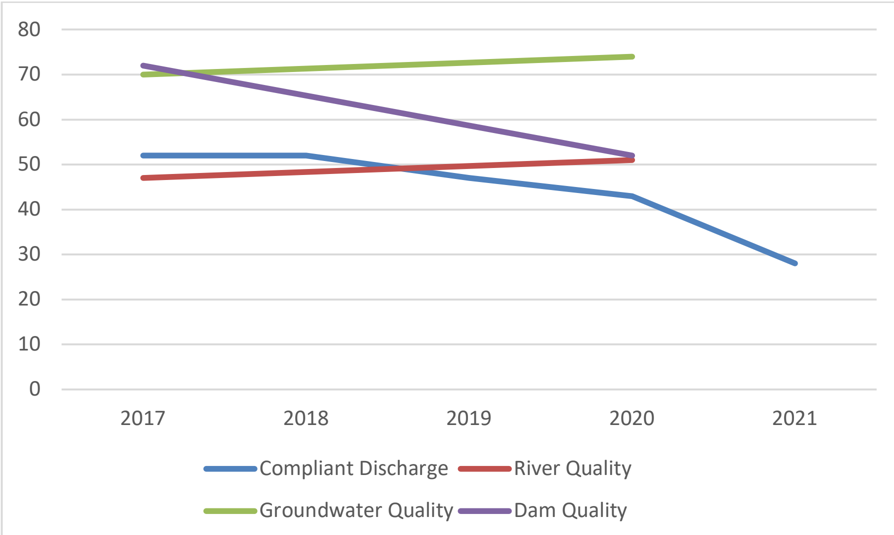

Figure 4-3: Relationship between compliant discharge and quality

It can be concluded that an accurate relationship cannot be calculated due to too few data points for water quality, as well as a significant gap in data collection. Recommendations to remedy this are outlined in Section 5, and are a combination of recommendations identified by the DWS and by SRK.

4.1.5 The introduction of SDG 6.3.3A

SDG 6.3.3A pertains to the recycling of wastewater. According to the DWS, SDG 6.3.3A data is currently only available at municipal level, in the form of the Green Drop system, rather than at quaternary catchment level like SDG Indicator 6.3.1D and SDG Indicator 6.3.2D. This presents a challenge, which could be overcome in a number of ways, as detailed in the SDG Target 6.3 Methodology report, Appendix A, Section A3. Other ways include spatial mapping of overlaps between municipal boundaries and quaternary catchment boundaries. The solutions will largely be dependent on the data available; see Section 5.2 for more detail.

4.2 Identifying duplication in the reporting of waste-related indicators

The new indicators SDG Indicators 6.3.4A and 6.3.5A pertain to solid waste, which falls under the ambit of the DFFE. Table 4-1 lists the SDG indicators that are related to solid waste. More detail and calculations for the indicators listed, follow below the table.

Table 4-1: SDGs containing waste-related indicators

SDG	Target	Indicator
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	**Target 11.6**: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	**Indicator 11.6.1**: Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities

SDG	Target	Indicator
Goal 12: Ensure sustainable consumption and production patterns	**Target 12.4**: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	**Indicator 12.4.1**: Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement
		Indicator 12.4.2: Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
	Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	**Indicator 12.5.1**: National recycling rate, tons of material recycled
Goal 14: Conserve and sustainably use the oceans, seas and marine resources	**Target 14.1**: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	**Indicator 14.1.1**: Index of coastal eutrophication and floating plastic debris density

4.2.1 SDG Goal 11

Goal 11 aims to ensure that cities are safe and sustainable. Therefore, essential improvements regarding urban settlements are necessary especially when it concerns informal areas (VNR Report, 2019). The amount of people situated in informal settlements has been increasing over the years (VNR Report, 2019). These settlements have inadequate access to services such as water, sewer and electrical connections, which makes it crucial to focus on social and economic development in order to ensure safe more resilient cities (VNR Report, 2019). Target 11.6 specifically focuses on reducing the environmental impacts of cities, which includes indicator 11.6.1, pertaining to solid waste management (Min, 2020). Solid waste refers to any waste produced by households and through commercial and industrial activities (Min, 2020). This indicator aims to ensure that solid waste produced by cities is collected and managed to ultimately improve upon living conditions and promote environmental sustainability (Min, 2020).

SDG indicator 11.6.1 is derived using the following calculation (Ghafari, 2022):

$$x = \frac{\mathit{Municipal\ solid\ waste\ collected\ and\ managed\ in\ a\ controlled\ facility}}{\mathit{Total\ municipal\ waste\ generated\ by\ the\ city}} \times 100$$

Data that is collected for this indicator, however, is undertaken on a regional basis and can be disaggregated at both city and town levels (SDG tracker, 2018a). The correlation of this indicator, in relation to the impact of solid waste management on water resources remains to be created. The water resource monitoring requirements prescribed for the operation of solid waste management facilities, provide a data set that could be utilized for an indicator for SDG 6.3.4A.

4.2.2 SDG Goal 12

SDG 12 aims to ensure sustainable consumption and production patterns. South Africa has focused on improving sustainability through the development of innovative programs that involve recycling

(VNR Report, 2019). However, while several of these programs have been put into place, there is a need for an overall vision that brings all these strategies from different sectors together in order to achieve SDG 12 (VNR Report, 2019). Furthermore, one of the major challenges pertaining to this indicator is the lack of data. On a national level, only SDG indicators 12.2.2 and 12.4.1 are being reported, whilst some indicators currently have no methodologies developed (Min, 2018).

Target 12.4 focuses on the environmental management of chemicals and all wastes throughout their life cycle in order to minimize their impact on both humans and/or the environment (Min, 2018). This target includes indicator 12.4.1, which refers to and assesses several parties that are involved in Multilateral Environmental Agreements (MEAs) and based on each of these agreements, are required to produce and submit any necessary information (Min, 2018). There are five MEAs, as follows (SDG Tracker, 2018b):

- Montreal Protocol
- Rotterdam Convention
- Basel Convention
- Stockholm Convention
- Minamata Convention

Each of these agreements look into different aspects relating to indicator 12.4.1. This indicator is expressed in relation to the degree of compliance of the different parties in reporting necessary information to each of the five MEAs as follows (Ghafari, 2022):

$$Transmission\ Rate = \frac{a_{cs} + b_{cs} + c_{cs} + d_{cs} + e_{cs}}{No. of\ conventions} \times 100$$

where: cs = country score
a, b, c, d, e = Multilateral Environmental Agreements

The calculations pertaining to this indicator are undertaken over a five-year period due to the fact that each of the MEAs are associated with different reporting times (Min, 2018).

Indicator 12.4.2, which also falls under target 12.4, involves an investigation into hazardous waste generation and the proportion of this waste that is treated (SDG Tracker, 2018b). Hazardous waste refers to any waste from households and commercial and industrial activities, that could potentially have a harmful effect on human health and the environment (SDG Tracker, 2018b; Ghafari, 2022). While there are many benefits of using chemicals across different sectors, it becomes equally important to manage hazardous waste associated with such chemicals in order to limit any adverse effects that they may cause. In addition to hazardous waste generated by industries, there are also non-industrial sectors that produce wastes such as sludge, waste oils and batteries (World Bank Group, 2022). Certain issues in monitoring this indicator include limited data due to constraints that may exist within different countries such as insufficient resources and a lack of policies and regulations (World Bank Group, 2022).

The calculations pertaining to this indicator are divided, with the determination of the amount of hazardous waste generated being derived first, which is then followed by the determination of the proportion of hazardous waste treated. These calculations are as follows (Ghafari, 2022):

$$\begin{aligned} &Hazardous\ waste \\ &\quad = hazardous\ waste\ collected\ through\ munipcal\ services\ or\ private\ companies \\ &\quad + hazardous\ waste\ given\ by\ generator\ to\ treatment\ or\ disposal\ facilities \\ &\quad + estimation\ of\ hazardous\ waste\ unaccounted\ for \end{aligned}$$

$$\begin{aligned} &Proportion\ of\ hazardous\ waste\ treated \\ &\quad = \frac{quantity\ of\ hazardous\ waste\ treated\ during\ the\ reporting\ year}{total\ quantity\ of\ hazardous\ waste\ generated\ during\ the\ reporting\ year} \times 100 \end{aligned}$$

The correlation of indicator SDG 12.4.1, in relation to the impact of solid waste management on water resources, remains to be created. The water resource monitoring requirements prescribed for the operation of hazardous waste management, provides a data set that could be utilized as an indicator for SDG 6.3.4A.

Target 12.5 under SDG 12 aims to reduce waste generation through prevention, reduction, recycling and reuse (SDG 12 Hub, 2022). This target consists only of indicator 12.5.1, focussing on the National Recycling Rate (SDG Tracker, 2018b). To ensure the sustainability of the environment in the long-term, it is crucial to reduce waste production and encourage recycling of waste. However, the current situation indicates that recycling rates are significantly low, which makes it extremely important to monitor such indicators relating to waste management and guide countries towards the development and initiation of methods that could reduce the adverse impacts of waste (SDG 12 Hub, 2022). The National Recycling Rate refers to the amount of material that is recycled in a country, plus quantities exported for recycling in relation to the total waste generated in the country, minus any material intended for recycling that is imported (Ghafari, 2022; SDG 12 Hub, 2022). This can be expressed as follows (Ghafari, 2022):

$$\begin{aligned} &National\ recycling\ rate \\ &= \frac{material\ recycled + material\ exported\ for\ recycling - material\ imported\ for\ recycling}{total\ waste\ generated} x100 \end{aligned}$$

Due to recycling not being practiced on a large scale, limited data is currently available for recycling rates (SDG Tracker, 2018b).

Indicator SDG 6.3.5A aligns with the proposed reporting of Indicator SDG 12.5.1. The relationship of the country's recycling initiatives needs to be aligned to the benefit this is anticipated to provide in relation to water resource quality. Perhaps utilizing the spatial extent of recycling initiatives in relation to total waste generated or population distribution per area/town or province could provide an indicator to represent the water resource protection due to recycling initiatives. Alternatively, as suggested for indicator SDG 6.3.4A the water resource monitoring requirements prescribed for the operation of solid waste management facilities, where recycling initiatives are in operation, could provide a data set that could be utilized for an indicator for SDG 6.3.5A.

4.2.3 SDG Goal 14

Waste generation is also associated with marine water bodies. Therefore, it is equally important to ensure that these water bodies are clean and safe as they provide many services to both humans and the environment. Target 14.1 focuses on reducing marine pollution particularly from land-based activities such as marine debris and nutrient pollution (SDG Tracker, 2018c). The only two indicators for achieving this target are 14.1.1 (a) and 14.1.1 (b), which aim to minimize marine pollution of all kinds by 2025 (SDG Tracker, 2018c). This indicator monitors the extent of eutrophication and plastic debris density (UN environment programme, 2022). Eutrophication is caused mainly by the presence of excess nutrients due to factors such as agricultural runoff and wastewater discharge. High levels of eutrophication can result in detrimental impacts such as the disruption of marine ecosystems as well as the loss aquatic life (UN environment programme, 2022). Data collection pertaining to these indicators are undertaken on a global and national level. Global data is collected through earth observations and modelling, whilst national data is acquired by countries that have their respective methodologies (UN environment programme, 2022).

4.3 Monitoring of waste-related indicators in South Africa

The DFFE is the waste sector lead, and as such is responsible for the monitoring of all waste-related indicators in South Africa. The DFFE has historically reported the following indicators:

- SDG Indicator 11.6.1: Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities;
- SDG Indicator 12.4.1: Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement;
- SDG Indicator 12.4.2: Hazardous waste generated *per capita* and proportion of hazardous waste treated, by type of treatment;
- SDG Indicator 12.5.1: National recycling rate, tons of material recycled

The DFFE has domesticated SDG 11.6.1, SDG 12.4.1. An environmental sectoral working group (ESWG) has been established between the DWS and DFFE to collaborate on the monitoring of water and waste indicators. The group has committed to signing off on indicators that they will be reporting on (to Stats SA), in September 2022. The sign-off for these indicators needs to be confirmed.

SDG 14.1.1 pertains to plastic in the marine environment. Although SDG 6.3 pertains to fresh water, there is increasing global concern relating to the presence of plastics and microplastics in water. The methodology for this indicator should be studied further and can be converted into one for fresh water; and include the microplastic element in addition to larger plastics.

4.4 Desirability of duplicate methodologies for SDG 6.3.4A and 6.3.5A

Numerous discussions have been held with the DWS and the DFFE. The DWS is of the view that there is a correlation between solid waste disposal and water quality. The question of the magnitude of the impact and the spatial scale remains unanswered.

The DFFE is the custodian of waste data collection, and waste indicator monitoring and reporting. It and it is necessary to establish:

a) Whether these indicators are already being reported under other SDGs by the DFFE;

b) Whether duplication of these indicators is desirable;

c) Whether sufficient waste data is available.

If the answer to a), b) and c) is yes, then the following needs to be ascertained:

d) Whether this reporting is aligned with the ambitions of SDG Target 6.3. If yes, then the existing methodologies can be adopted. If no, then methodologies need to be developed (or existing methodologies modified) for these indicators, which align with the ambition of SDG Target 6.3. In both of these scenarios, collaboration and alignment with the DFFE is necessary to ensure that the correct data is sourced and reported.

If the answer to b) is no; then these indicators should be discontinued.

If the answer to a) and b) is yes, but the answer to c) is no; then the research effort should be directed at sourcing this data. A collaborative effort between the DWS, DFFE, WRC and Professional Services Provider (PSP) will be required to identify and source the data. Existing platforms / sources such as the South African Waste Information System (SAWIS) should be studied to establish the availability, completeness and relevance of the data.

As part of methodology development, customisation, or adoption; management sub-targets should also be defined.

If the methodologies for the proposed additional indicators are developed / customised / adopted, they should be tested using available data (if not already tested by the DFFE), to establish whether they produce the values they were designed to measure. Baselines would need to be developed using existing data. The indicators would need to be tested at a small scale first before testing data sets at the national level, keeping in mind the differences in implementation and reporting across provinces, nationally.

5 Preliminary recommendations

The research thus far has focused mainly on discovering the status quo of the monitoring and reporting of the SDG Target 6.3 indicators, as well as progress from 2015 to 2022. This has raised gaps and further research questions, as detailed below. SRK will attempt to close these gaps, with the DWS and DFFE, before the conclusion of the research project in 2023.

5.1 Improvement of SDG Indicator 6.3.1D and SDG Indicator 6.3.2D monitoring

The following should be instituted in order to close the gaps in monitoring and reporting:

- The municipalities that did not submit data for discharge compliance, should do so retrospectively, using effluent sample quality analyses that were done as part of permit monitoring.
- An attempt to close gaps in quality data for 2017 and 2018 can be made by retrospectively analysing data from Water Use Licence audit submissions, as a proxy for samples not taken in this period.
- Going forward, the number of samples should increase to that of the 2017 number.
- Industrial and mining discharge point sources should be monitored (these can be identified from the Water Use Authorisation database).
- Mining and agricultural non-point sources should be monitored (these can be identified from the Water Use Authorisation database).

5.2 Implementation of SDG Indicator 6.3.3A monitoring

The approach that is proposed (in the current methodology document) to deal with the challenges related to SDG 6.3.3A, is to:

- Assess the available data for usefulness and/or relevance;
- Conduct an investigation into the feasibility of a common information management system (for waste and water containing waste);

The wastewater recycling volumes should be obtained from various sources, including:

The DFFE:

- Volumes recycled according to Water Use Authorisation conditions
- Volumes recycled by municipalities. A data drive may be required for this.

- Industries: volumes of wastewater recycling (the amount prevented from being discharged)
- Mining: volumes of wastewater recycling (the amount prevented from being discharged)
- Agriculture: the source and quantity of wastewater used for irrigation.

The data for SDG 6.3.1 needs to be expanded and deficits in the data need to be rectified before SDG Target 6.3.3A can produce meaningful numbers.

5.3 Solutions to link SDG Indicator 6.3.2D with the rest of the SDG Target 6.3 indicators

Suggested solutions are listed in the SDG Target 6.3 methodology document, in Appendix A, Section A3. The extent of data availability for each proposed data source should be established, and a matrix compiled to determine the minimum data sources required to triangulate waste sources and receptors.

5.4 Decision on duplication of indicators

Two meetings should be held to make a decision on the inclusion of these indicators into SDG Target 6.3:

- Meeting with the DFFE Environmental Reporting Unit to establish the extent and completeness of data for solid waste disposal, as well as solid waste recycling.
- Meeting with the SDG Target 6.3 reference group to decide whether to adopt the indicators, and to decide on whether to use existing methodologies or to develop new ones.

If the decision is to proceed with the duplicate indicators; obtain SDG 6.3.4A and SDG 6.4.5A data from the DFFE.

In addition, SDG Indicator 14.1.1 should be converted to two additional parameters within SDG Indicator 6.3.2D: index of floating plastic debris, and microplastic content of water; which would be sampled along with the other parameters for SDG Indicator 6.3.2D.

5.5 Integration of the SDG programme with operational practices

There is significant overlap between the indicators in the SDG programme; for example, the monitoring of water quality, and the monitoring of wastewater discharge from WWTWs and industry. The SDG Indicator 6.3.2D data should be aligned with and retrieved from the resource quality objectives (RQO) database. The SDG Indicator 6.3.1D and 6.3.3A data should be aligned with and retrieved from the Green Drop programme.

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Methodology:
Indicator SDG 6.3.3A – Proportion of water containing waste recycled or reused

Version 1, February 2023

Goal 6:	Ensure availability and sustainable management of water and sanitation for all
Target 6.3:	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
Indicator 6.3.3A:	Proportion of water containing waste recycled or reused

C1 THE INDICATOR

C1.1 Organisation(s)

Department of Water and Sanitation (DWS)

Department of Forestry, Fisheries and Environment (DFFE)

C1.2 Definition

Target 6.3 sets out to improve ambient water quality, which is essential to protect both ecosystem health (Target 6.6 and SDGs 14 and 15) and human health (Target 6.1; recreational waters and drinking water sources), by eliminating, minimizing and significantly reducing different streams of pollution into water bodies. The main sources of pollution include wastewater from households, commercial establishments and industries (point sources), as well as run-off from urban and agricultural land (non-point sources). (Ref: UN Water, Integrated Monitoring Guide for Sustainable Development Goal 6 on Water and Sanitation. Targets and Global Indicators, July 2017)

The proposed methodology for Indicator 6.3.3.A: *Proportion of Water Containing Waste Recycled or Reused* implies the volume of wastewater collectively being recycled and reused, in comparative relation to the total volume of wastewater being produced (which could be recycled or reused without adversely affecting the relevant water budget). Table C.1 defines the terms used in terms of the application of policies and guidelines.

Table C.1: Phrase by phrase interpretation of Indicator 6.3.3.A

Indicator 6.3.3A	Normative interpretation
"Proportion of water containing waste recycled or reused."	*"Proportion of"* Percentage of total
	"Water containing waste" Water containing any solid material or material that is suspended, dissolved or transported in water. Water generated as a waste product by the following activities: • Domestic activities (households) • Commercial activities (businesses) • Food production • Energy production • Industrial production
	*"…recycled" ** The utilization of treated or untreated wastewater for the same process that generated it.
	*"…or reused" **

Indicator 6.3.3A	Normative interpretation
	The utilization of treated or untreated wastewater for a process other than the one that generated it.
	Water deemed to contain waste, as defined by the National Water Act, defines waste as: *"any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted"*

**There are currently no consistent definitions for "water reuse" and "water recycling" provided by the UN. The terms "reused" and "recycled" are used interchangeably.*

C1.3 Rationale

Wastewater generated by economic activities such as manufacturing industries may contain a variety of pollutants, including hazardous substances. Eliminating inadequate disposal of waste (dumping) and minimizing the generation, use and discharge of hazardous substances are goals consistent with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants.

Since South Africa is a water scarce country, wastewater reduction, reuse and recycling are imperative to conserve our limited freshwater resources. Furthermore, the reuse and recycling of wastewater benefits the environment and associated ecosystems by providing a use for the wastewater rather than discharging the treated wastewater. In addition, the reuse and recycling of wastewater provides and indirect energy saving, by reducing the wastewater treatment needs.

C1.4 Concepts and Terms

The concepts and definitions used in the methodology have been based on existing international frameworks and glossaries unless indicated otherwise below.

Cumulative: Increase in quantity by successive additions.

Change: a shift from one condition to another; in this case it refers to a change in cumulative volume over time, in relation to a point of reference, within a water-related ecosystem.

Disaggregation: Breaking down of data into constituent data sub-sets. Data can be disaggregated by subnational regions as well as by urban/rural regions, providing information on equity.

Non-point source discharge: Diffuse water or air that does not originate from a single discrete source, e.g. agricultural runoff.

Point source discharge: Discharge of water from a discrete source, e.g. a factory discharge pipeline.

Water balance: A mathematical model of a water system, compiled by defining inputs, outputs and accumulation of water in the system. The input, output and accumulation values can be probabilistic (e.g. rainfall), deterministic (e.g. a flow rate measured by a measuring device), or estimates (e.g. infiltration rate for surface water).

C1.6 Relationship between SDG Indicator 6.3.3A and Target 6.3 and 6.4

SDG Indicator 6.3.3A relates to the impact of wastewater on the quality of ambient water, and is thus linked to the other indicators in Target 6.3 (i.e. SDG Indicators 6.3.1D and 6.3.2D) to enhance understanding of what impacts water quality in South Africa.

SDG Indicator 6.3.3A is also related to the recycling/reuse of water, and is thus linked to Target 6.4 which deals with water efficiency, because the more recycling/reuse that takes place, the more water efficient that public and private entities are.

C2 COMMENTS AND LIMITATIONS

Some data is available for the volumes of water containing waste, because this is a requirement when applying for a water use licence or an environmental authorisation, much less data is available on the volumes recycled or reused. The recycling and reuse streams are seldom metered or reported.

C3 METHODOLOGY

C3.1 Computation Method

The proposed methodology includes measurement of recycled and reused water streams, for municipal, agricultural, industrial and mining applications.

The proposed methodology consists of two calculations:

- Recycled/reused water percentage from point sources of wastewater (households, commercial establishments and industries)
- Recycled/reused water percentage from non-point sources of wastewater (run-off from urban and agricultural land).

C3.1.1 Formula

To calculate the percentage of water containing waste that is recycled/reused, Equation 1 below is used:

Equation 1:

$$\boldsymbol{V_t = \frac{V_a + V_c}{V_b + V_d} \times 100}$$

Where:

V_t = percentage of wastewater that is recycled/reused

V_a = Volume of wastewater recycled/reused from point source discharges (as measured by flow measuring devices*)

V_b = Volume of wastewater discharged from point sources (as measured by flow measuring devices)

V_c = Volume of wastewater recycled/reused from non-point source discharges (as measured by flow measuring devices or modelled by water balance)

V_d = Volume of wastewater estimated to be discharged from non-point sources (as modelled by water balance)

*flow measuring devices include flow meters, weirs, etc

The recommended monitoring unit is megalitres per annum, however alternative units can be used, provided they are all assessed for the same time-period using a unit of measurement.

The volumes per source or per area (non-point source) can be aggregated into municipality, province, watershed, or for the country as a whole. This will assist in providing data at a range of scales, while also providing comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where the main wastewater discharge challenges lie. The percentages calculated can be presented graphically by being graphed, and on maps to assist with reporting and interpretation of the data.

In terms of progressive monitoring, owners of wastewater sources (e.g. factory owners and farm owners) can start with an estimation of volume, and gradually move towards more accurate quantitative estimations. Table C.2 provides an example of progressive monitoring.

Table C.2: Progressive Monitoring of Indicator 6.3.3A

Indicator 6.3.3A	Progressive Monitoring
"Proportion of water containing waste recycled or reused."	*First step* Estimation of total volumes of water containing waste recycled or reused, for point sources (municipal wastewater treatment plants and licensed wastewater generators) Where available; actual volumes should be used. Where actual volume data is not available, it should be estimated using the site/facility's water balance, or the pump and pipe size. For non-point sources (agricultural and urban areas): Volumes should be modelled based on the water balance of the non-point sources.
	Second step Refined estimation of total volumes of water containing waste recycled or reused, for point sources (municipal wastewater treatment plants and licensed wastewater generators) Inclusion of volume data from unlicensed point sources, where available (or nearest estimate). Refinement of volumes from non-point sources, using updated water balance input data (rainfall, evaporation, etc.)
	Third step Estimation of total volumes of water containing waste recycled or reused, focusing on all water return-flows Calculation of volume percentage, using measured volume data for all point sources in South Africa. Utilize accurate modelled data for all non-point sources in South Africa.

To align to the UN global reporting standard for SDG 6.3.3A, the proposed frequency of national data collection and reporting should be annually.

C3.2 Treatment of incorrect and missing data

Missing data on recycled/reused water will be treated as absent data, i.e. where there is no data for a given point or non-point wastewater source, it will be assumed that there is no wastewater recycling/reuse.

C3.3 Sources of discrepancies

For point sources: discrepancies may occur where there are multiple flow measuring devices on a single point source discharge line/weir. There may be two flow meters on a given line; for example, a municipal check meter may be installed in the same line as the meter that a company is using to report their discharge.

For non-point sources: where wastewater discharge is being calculated by municipalities, discrepancies may occur if different rainfall, evaporation and infiltration data is used in the water balance.

Various issues surrounding poor data capturing and uploading can exist namely:

- Insufficient funding for data collection and capture (human resources)
- Insufficient funding for data management systems (database maintenance, servers, backups, reporting software, etc.)
- Lack of training of human resources

C4 DISAGGREGATION OF DATA FOR MANAGEMENT PURPOSES

The listed additional and supporting data will make it possible to disaggregate national information to depict performance .

- At different scale per draining region / catchment;
- Per Water Management Area (WMA);
- Per province;
- Per municipality;
- Per waste generation sector;
- Per individual WWTWs;
- Per treatment technology category;
- Per entitlement (authorization type/approval);
- Per discharge endpoint (i.e. a municipal sewage network system or a water resource).

C5 DATA SOURCES

The data sources or monitoring mechanisms of information of management targets for 6.3.3A may include the following:

- Flow meter or weir data from municipal wastewater treatment works
- Flow meter or weir data from owners of mining, industrial or commercial entities
- Water balance data from owners of agricultural establishments
- Water balance data from municipalities, for urban runoff.

In addition to the core data sets, i.e. covering the essential water discharge volumes, reuse and recycling; additional supporting data is required to generate sufficient and appropriate intelligence to improve local water management efforts. Such additional and supporting data include the recording of-

- whether the activity falls within the municipal or non-municipal category;
- whether the discharge occurs to a municipal sewer network system or to a water resource;
- in the case of discharges to municipal sewer network systems, whether the wastewater is treated prior to it being discharged to the municipal sewer network system (Y/N);
- in the case of discharges to water resources, whether the wastewater is treated prior to it being discharged to the water resource (Y/N);
- if discharging to a water resource – providing the water resource name(s);
- the quaternary drainage region name(s) and/ or number(s);
- the name of the municipality and/or the water user;
- the name and coordinates of the WWTW(s);
- the type of waste generating activity (see APPENDIX C1);
- whether the water use is permissible or not (Y/N);
- the entitlement (i.e. authorisation type/ municipal approval) received or required;
- whether discharge volumes are recorded by the regulator, the municipality and/ or water user (Y/N).

C5.1 Collection process

Data collection could follow the following processes:

- Scanning and download of data in the DWS water use licence (WUL) database;
- Formal directed request for information for businesses operating in industrial parks in municipalities countrywide; and
- Scanning and download of publicly disclosed discharge and recycling data by major corporate entities (e.g. GRI and CDP Water disclosures).

The total volume of water containing waste that is discharged by WWTWs of non-municipal activities to water resources is to be derived from:

- The actual discharge volumes, as measured and reported to the DWS by the non-municipal activities; or
- In the absence of actual discharge volumes, the authorised discharge volumes can be used to substitute; or
- In the absence of actual and authorised discharge volumes, the volumes registered on the Water Authorisation and Registration Management System (WARMS) can be used.
- Note: The WARMS volumes would have to be presumed lawful until verified, especially in the case of Existing Lawful water Use (ELU); or
- In the absence of actual and WARMS volumes, the design capacity of the WWTWs can be used.

For non-municipal activities with more than one WWTW, the volume of the individual WWTWs are to added together to determine:

- a total volume of water containing waste lawfully discharged to water resources by a particular non-municipal activity; and
- a total volume of water containing waste produced and discharged to water resources by that non-municipal activity.

The discharged water containing waste is deemed to be lawful if the water use is permissible in terms of the NWA 36:1998 and if in compliance with the relevant Water Discharge Standards (WDSs). The frequency of sampling is as per the relevant approval or authorisation. A minimum discharge monitoring frequency of monthly discharge is recommended for SDG reporting purposes, unless otherwise specified in the relevant approval or authorisation.

The initial data gathering is a once-off exercise to generate an initial database. Thereafter, data would be updated on an annual basis.

C6 DATA AVAILABILITY

C6.1 Availability

Data is currently only available at municipal level, and even at municipal level, it is not a complete dataset.

Water use licence data is incomplete and not all WULs are audited regularly to capture volume data time series.

C6.2 Frequency

Data may not be captured in sufficient time intervals due to the above constraints.

The proposed frequency of national data collection and reporting should be annually.

C7 DATA PROVIDERS

Government data providers include:

- The Department of Water and Sanitation (DWS) WUL,
- Local and district municipalities: wastewater treatment departments, urban water management departments,
- Department of Forestry, Fisheries and Environment (DFFE) wastewater authorisation departments,

Private company data providers:

- Farm owners,
- Industrial company owners,
- Mine owners.

C8 DATA COMPILERS

The DWS will be the primary data compiler, with support from the DFFE and district municipalities. DWS will provide this data to StatsSA, who is responsible for country-level reporting on the SDGs. The roles of the various players is outlined below:

Table C.3: SDG 6.3.3A Summary of Data and Information Compilers

Data Provider	SDG 6.3.3A
DWS	X
StatsSA	x
DFFE	x
District Municipalities	x
Private companies	x

X = Lead role player

x = supporting role player

\- = No role

C9 MANAGEMENT TARGETS

SDG Indicator 6.3.3A is a new additional indicator under SDG 6.3. The purpose of SDG 6.3.3A sub-target is to provide a practical, step-by-step incremental and attainable integrated water quality management target that can be utilised for benchmarking purposes during SDG Target 6.3 implementation and reporting. Table C.4 includes the *Management* and supporting *Milestone Sub-targets* for SDG 6.3.3A.

Knowledge on the current baseline is necessary for the finalisation of the Milestone Sub-targets

Table C.4: Milestones and Management Targets to Benchmark Performance during SDG 6.3.3.A Implementation (Ref: DWS, SDG6.3 Methodology Report, Jan 2021)

Target Type	Year	Target Description
Milestone Sub-target	Baseline data	(baseline) *% water containing waste recycled / reused*
	2022	Baseline + 1/10 or 10% of Baseline
	2023	Baseline + 2/10 or 20% of Baseline
	2024	Baseline + 2/10 or 20% of Baseline
	2025	Baseline + 3/10 or 30% of Baseline
	2026	Baseline + 3/10 or 30% of Baseline
	2027	Baseline + 4/10 or 40% of Baseline
	2028	Baseline + 4/10 or 40% of Baseline
	2029	Baseline + 5/10 or 50% of Baseline
	2030	Baseline + 5/10 or 50% of Baseline
Milestone Sub-Target (MST)	2030	50% of designed streams of water containing waste are reused and / or recycled
SDG Target 6.3		By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Table C.5 summarises potential links between global and national indicators and targets for SDG 6.3.3A.

Table C.5: SDG 6.3.3A Indicator and Targets from Global and South African Literature

Global and National Indicators for 6.3.3A	Targets
Medium-Term Strategic Framework (MTSF)	
PRIORITY 2: Spatial Integration, Human Settlements and Local Government	
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities	
No. of bulk water supply projects implemented (completed)	51 bulk water and wastewater supply project phases completed of which: 9 were sanitation services and 42 were for water supply
2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security	
% of land reform projects with secure water rights	90%
National Water and Sanitation Master Plan (NW&SMP)	
1.4 Regulating the water and sanitation sector	
1.4.7 Develop and implement municipal bylaws to protect water quality.	Publication of updated bylaws that includes Project of Raw Water Quality
1.4.9 Establish a mechanism for applying administrative penalties	Strengthening Compliance and Enforcement training modules to build the capacity of EMIs in-house Strengthen the CME, finalisation of the Strategy and Implemented Plan Appoint Environmental Management Inspectors (EMI) to conduct CME
1.5 Improving raw water quality	
1.5.6 Develop and implement a strategic action plan for the rehabilitation and upgrade of prioritized WWTWs (SA17)	Public campaign and five functional WWTWs with maintenance plans and turnaround strategy
	Programme to address the remaining WWTWs and functional WWTWs with maintenance plans
1.5.10 Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61)	Build from IGR framework and SADC protocols
National Biodiversity Strategy and Action Plan (NBSAP)	
SO 3. Biodiversity considerations are mainstreamed into policies, strategies, and practices of a range of sectors	
Number of compliance inspections conducted	By 2019, 14 500 compliance inspections conducted.
Number of enforcement actions undertaken for non-compliance with environmental legislation	By 2019, 1 500 completed criminal investigations handed to the NPA for prosecution (for EMI Institutions) and 3 100 administrative enforcement notices issued for non-compliance with environmental legislation.
SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, and sustainable use of biodiversity	
Single portal exists through which all biodiversity information can be accessed	By 2016, the single portal is established, and it is being populated
Global and National Indicators for 6.3.3A	**Targets**
Medium-Term Strategic Framework (MTSF)	
PRIORITY 5: Spatial Integration, Human Settlements and Local Government	

Global and National Indicators for 6.3.3A	Targets
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities	
No. of water treatment works assessed	1 010 every 2 years – alternating with Green Drop assessments
2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security	
% of land reform projects with secure water rights	90%
National Water and Sanitation Master Plan (NW&SMP)	
1.4 Regulating the water and sanitation sector	
1.4.1 Revitalise the Green, Blue and No Drop programmes and publish results and revise and establish norms and standards.	National Obtain annual BD and GD Assessments reports Obtain from 144 WSAs IWA Water Balance requirements (No Drop report) Monitoring of Monthly No Drop reports and annual BD and GD reports Capturing and publish of results on DWS web Provincial Monthly submission of 19 IWA Water Balance requirements (No Drop report) to DWS Annual submission of 19 BD and GD compliance assessments
1.5 Improving raw water quality	
1.5.1 Determine in-stream Resource Water Quality Objectives (RWQOs), based on the SA Water Quality Guidelines (SA36), in support of RQO's Capacity, budgetary constraints	Publish the RWQOs for water quality RQOs adequately reflect IWQM requirements
1.5.2 Routinely monitor resource water quality (SA46, SA47 SA48)	Laboratory facilities not readily available in all WMAs hampering IWQM
	National monitoring network in place but coverage requires expansion
	Regional water quality programmes insufficient to manage pressure on water resources
	Regional and local water quality programmes insufficient to manage pressure on water resources
1.5.4 Assess resource water quality information (SA52 & SA59)	Routine national assessments of water quality and input in support of the SDG process
	Routine catchment assessments of water quality and the identification of "hot spots" for potential water quality management intervention

C10 DISPLAY OF RESULTS

The percentages calculated of wastewater reused or recycled as a percentage of the total wastewater generated, can be presented graphically by being graphed, and on maps to assist with reporting and interpretation of the data. The volumes per source or per area (non-point source) can be aggregated into municipality, province, watershed, or for the country as a whole. This will assist in providing data at a range of scales, while also providing comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where the main wastewater discharge challenges lie.

Table C10.1 provides an example of the format in which the SDG 6.3.3A results and be formatted. Figures C10.1 and C10.2 provide a graphical representation of how the data sets can be presented and assessed for comparative purposes.

Figure C.2: Example of wastewater recycling / reuse municipal vs by district municipality

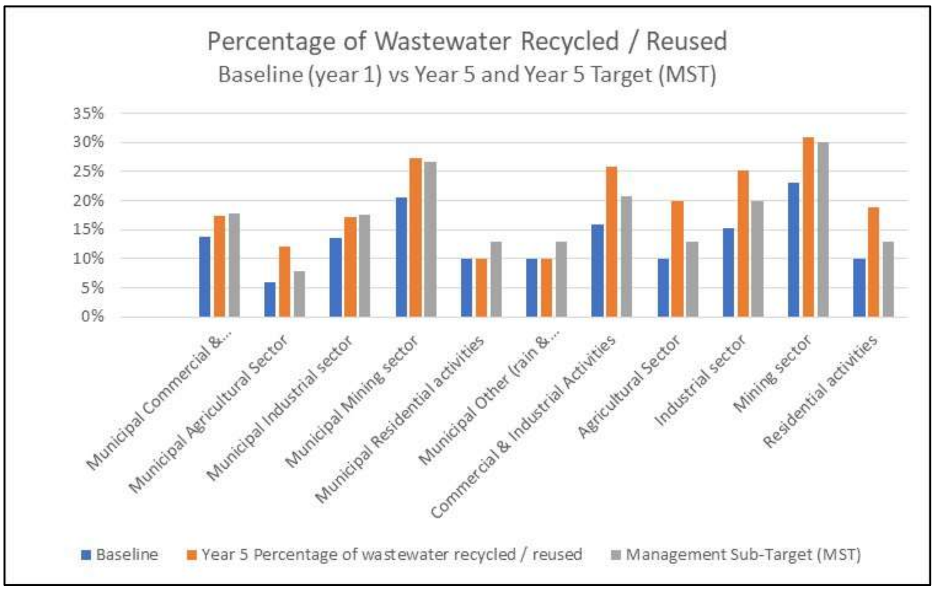

Figure C.3: Example of volume of wastewater discharged vs recycled / reused per sector

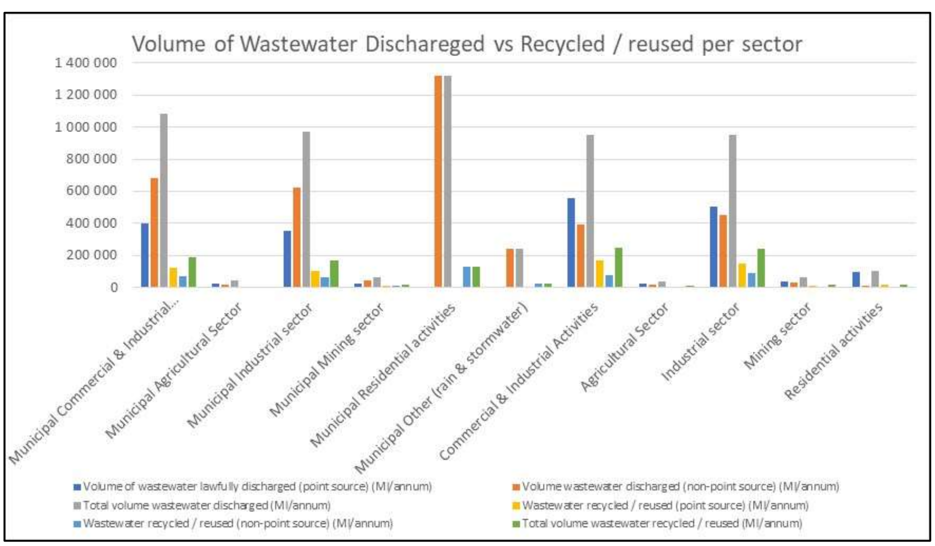

Table C10.1: SDG 6.3.3A Fictitious Wastewater Reuse and Recycling for South Africa

Category / Sector Wastewater Discharge		YEAR 1	YEAR 5							
		Baseline	**Volume of wastewater lawfully discharged (point source)**	**Volume wastewater discharged (non-point source)**	**Total volume wastewater discharged**	**Wastewater recycled / reused (point source)**	**Wastewater recycled / reused (non-point source)**	**Total volume wastewater recycled / reused**	**Year 5 Percentage of wastewater recycled / reused** **red < MST** **green ≥ MST**	**Management Sub-Target (MST)**
			(Ml/annum)	(Ml/annum)	(Ml/annum)	(Ml/annum)	(Ml/annum)	(Ml/annum)	$V_t = \frac{V_a + V_c}{V_b + V_d} \times 100$	
Municipal Category	Commercial & Industrial Activities	14%	399 667	680 513	1 080 180	119 900	68 051	187 951	17%	18%
	Agricultural Sector	6%	26 010	17 197	43 207	5 202	0	5 202	12%	8%
	Industrial sector	14%	350 000	622 162	972 162	105 000	62 216	167 216	17%	18%
	Mining sector	20%	23 657	41 154	64 811	9 463	8 231	17 694	27%	27%
	Residential activities	10%	0	1 320 220	1 320 220	0	132 022	132 022	10%	13%
	Other (rain & stormwater)	10%	0	240 040	240 040	0	24 004	24 004	10%	13%
Non-Municipal Category	Commercial & Industrial Activities	16%	560 000	390 558	950 558	168 000	78 112	246 112	26%	21%
	Agricultural Sector	10%	23 600	14 422	38 022	4 720	2 884	7 604	20%	13%
	Industrial sector	15%	502 000	448 558	950 558	150 600	89 712	240 312	25%	20%
	Mining sector	23%	34 400	28 971	63 371	13 760	5 794	19 554	31%	30%
	Residential activities	10%	94 000	11 618	105 618	18 800	1 162	19 962	19%	13%

V_t = percentage of wastewater that is recycled/reused

V_a = Volume of wastewater recycled/reused from point sources (as measured by flow measuring devices*)

V_b = Volume of wastewater discharged from point sources (as measured by flow measuring devices*)

V_c = Volume of wastewater recycled/reused from non-point sources (as measured by flow measuring devices* or modelled by water balance)

V_d = Volume of wastewater estimated to be discharged from non-point sources (as modelled by water balance)

C11 COMMENTS AND LIMITATIONS

Data collection in relation to water recycling/reuse has only been informally tracked prior to 2023, and has not had a formal methodology for such tracking. The data is largely incomplete, and requires a concerted effort to be collected, captured, and organised.

It is important that the same methods are used by all reporting agencies from which data is obtained for DWS's use when compiling data according to this new methodology. The methods, approaches, and interpretations should be consistently applied by owners of all wastewater sources.

This methodology document should be a living document, and should be updated as more information of constraints and details of recycling/reuse, become available.

C12 IMPLEMENTATION CALENDAR

Table C.5 describes how reporting on this indicator will be improved over time:

Table C.5: Improvement in the Availability of Data and Information for Indicator 6.3.3A

Indicator	Tier 1 First step of progressive monitoring and information handling	Tier 2 Second step of progressive monitoring and information handling	Tier 3 Third step of progressive monitoring and information handling
SDG 6.3.3A *"Proportion of water containing waste recycled or reused."*	For point sources (municipal wastewater treatment plants and licensed wastewater generators): - Where available, actual volumes should be used. Where actual volume data is not available, it should be estimated using the site/facility's water balance, or the pump and pipe size. For non-point sources (farms and urban areas): - Volumes should be modelled based on the water balance of the non-point sources.	Inclusion of volume data from unlicensed point sources, where available (or nearest estimate). Refinement of volumes from non-point sources, using updated water balance input data (rainfall, evaporation, etc.)	Calculation of volume percentage, using: measured volume data for all point sources in South Africa, in addition to accurate modelled data for all non-point sources in South Africa.
	End 2023	End 2024	Data collection to be reported on annually basis

Table C.6 contains a summary of due dates and responsibilities for key implementation activities that apply to the roll-out of the Indicator methodology.

Table C.6: Key Implementation Activities and Due Dates to be Completed for Indicator 6.3.3A

Implementation Activities		Due Date	Responsibility
1	Methodology Finalised	June 2023	DWS
2	National database of available data and estimated data	December 2023	DWS, DFFE
3	National database with all data captured	December 2024	DWS, DFFE
4	Data analysis and national reporting	2024, 2026, 2028, 2030	DWS, DFFE

C13 ADDITIONAL INFORMATION

The data generated through the application of this methodology will be used to assist in validating the effectiveness of SDG 6.B.1 submitted by the UN, as part of the SDG process.

C14 METHODOLOGY REPORT COMPILERS

The draft methodology was compiled by:

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Lindsay Shand (SRK)

Department of Water and Sanitation

C15 REFERENCES

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APPENDIX C1 – WASTE GENERATING SECTOR CLASSIFICATION

Table C10.1: SDG 6.3.3A Fictitious Wastewater Reuse and Recycling for South Africa

Activity	South African classification of economic sectors used in SDG Indicator 6.3.3A reporting		International Standard Industrial Classification (ISIC) of economic sectors identified for global SDG Indicator 6.3.1 reporting.
	Parent waste generating sector	Waste generating sector	
Commercial / Industrial	1. Agriculture	Aquaculture	Agriculture, forestry and fishing ISIC (01 to 03)
		Intensive animal husbandry	
		Irrigation	
		Other	Construction (ISIC 41-43)
	2. Industry	Power generation	Electric power generation, transmission and distribution (ISIC 351)
		Agro processing	Manufacturing (ISIC 10 to 33)
		Fertilizers	
		Metal processing and finishing	
		Textiles	
		Meat processing	
		Manufacturing	
		Paper and pulp	
		Wineries	
		Petro-chemical	
		Other	Construction (ISIC 41-43)
			Electricity, gas, steam and air conditioning supply (ISIC 35) *
	3. Mining	Coal	Mining and quarrying (ISIC 05 to 09)
		Gold	
		Iron	
		Uranium	
		Copper	
		Chromium	
		Diamond	
		Peat mining	
		Platinum	
		Quarrying	
		Sand winning	

Activity	South African classification of economic sectors used in SDG Indicator 6.3.3A reporting		International Standard Industrial Classification (ISIC) of economic sectors identified for global SDG Indicator 6.3.1 reporting.
	Parent waste generating sector	Waste generating sector	
		Other	Construction (ISIC 41-43)
Residential	4. Urban / Domestic	Water treatment works (Water purification works)	-
		Sewage treatment works (Wastewater treatment works)	Wastewater treated in urban wastewater treatment plants (ISIC 37)
		Waste disposal	Sewage sludge production (dry matter)
		Other	Construction (ISIC 41-43)
			Households*
			Wastewater treated in independent treatment facilities (i.e. Septic Tanks) *

Ref: .

Methodology:
Indicator SDG 6.3.4A – Proportion of waste lawfully disposed of

Version 1, March 2023

Goal 6:	Ensure availability and sustainable management of water and sanitation for all
Target 6.3:	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
Indicator 6.3.4A:	Proportion of waste lawfully disposed of

D1 THE INDICATOR

D1.1 Organisation(s)

Department of Water and Sanitation (DWS)

Department of Forestry, Fisheries and Environment (DFFE)

Statistics South Africa (StatsSA)

D1.2 Definition

Target 6.3 sets out to improve ambient water quality, which is essential to protecting both ecosystem health (Target 6.6 and SDGs 14 and 15) and human health (Target 6.1; recreational waters and drinking water sources), by eliminating, minimizing and significantly reducing different streams of pollution into water bodies. The main sources of pollution from solid waste include landfills, informal waste dumps, and unlawful disposal of solid waste by industry into facilities that have not been designed to receive that waste.

It must be noted that solid waste and the recycling of waste is also covered under SDG Indicators 11.6.1 (Urban Solid Waste), 12.4.2 (Hazardous Waste) and 12.5.1 (National Recycling Rate).

The proposed methodology for Indicator 6.3.4.A: *Proportion of Waste Lawfully Disposed Of* implies the mass of solid waste being disposed of lawfully, in comparative relation to the total mass of solid waste being disposed of. Table D.1 defines the terms used in terms of the application of policies and guidelines.

Table D.1: Phrase by phrase interpretation of Indicator 6.3.4.A

Indicator 6.3.4A	Normative interpretation
"Proportion of waste lawfully disposed of."	*"Proportion of"* Percentage of total
	"Waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered— (a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; (b) which the generator has no further use of for the purposes of production; (c) that must be treated or disposed of; or (d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but— (i) a by-product is not considered waste; and (ii) any portion of waste, once re-used, recycled and recovered, ceases to be Waste. (Definition from the National Environmental Management: Waste Act)

Indicator 6.3.4A	Normative interpretation
	"lawfully" In a way that conforms to or is permitted or recognized by the law.
	"disposed of" Burial, deposited, discharged, abandoned, dumped, placed or released into, or onto, any land. (Definition from the National Environmental Management: Waste Act).

D1.3 Rationale

Eliminating disposal of waste and minimizing the generation, use and discharge of hazardous substances will assist South Africa in achieving its raw water quality goals, as measured by SDG Indicator 6.3.2D.

The elimination of disposal of waste and minimizing the generation, use and discharge of hazardous substances, is also consistent with goals of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants.

South Africa is a water scarce country, and therefore pollution reduction is imperative to conserve our limited freshwater resources.

D1.4 Concepts and Terms

The concepts and definitions used in the methodology have been based on existing international frameworks and glossaries unless indicated otherwise below.

Cumulative: Increase in quantity by successive additions.

Change: a shift from one condition to another; in this case it refers to a change in cumulative volume over time, in relation to a point of reference, within a water-related ecosystem.

Disaggregation: Breaking down of data into constituent data sub-sets. Data can be disaggregated by subnational regions as well as by urban/rural regions, providing information on equity.

Municipal Solid Waste: waste generated by households, and waste of a similar nature generated by commercial and business establishments, industrial and agricultural premises, institutions such as schools and hospitals, public spaces such as parks and streets and construction sites. (UN Habitat, 2016)

Other Solid Waste: waste that require special treatment such as hazardous waste from industrial processes, agricultural activities and mining wastes, hospital waste, end of life vehicles, construction and demolition waste and WEEE (Waste Electrical and Electronic Equipment). (UN Habitat, 2016).

Non-point source pollution: Diffuse pollutants that do not originate from a single discrete source, e.g. a pollution plume originating at a landfill site.

D1.5 Relationship between SDG Indicator 6.3.4A and Target 6.3.2D

SDG Indicator 6.3.4A measures the lawful disposal of waste. SDG Indicator 6.3.2D measures the quality of water resources around South Africa. The impact of unlawful waste disposal on the quality of ambient water can thus be established using this additional indicator.

D2 COMMENTS AND LIMITATIONS

Some data is available for the mass of waste lawfully disposed of, because this is a requirement when applying for a waste management licence. However, almost no data is available on the mass of solid waste disposed of unlawfully (illegal disposal is seldom monitored or reported).

D3 METHODOLOGY

D3.1 Computation Method

The proposed methodology includes estimation of the proportion of waste disposed of lawfully. The proportion of waste lawfully disposed of is: the mass of solid waste lawfully disposed of expressed as a percentage of the total mass of solid waste generated.

The proposed computation method consists of three calculations:

- Total mass of solid waste generated;
- Mass of solid waste lawfully disposed of; and
- Proportion of solid waste lawfully disposed of (calculated using the numbers in the points above)

D3.1.1 Formula

The total mass of solid waste generated in the country is currently not measured. However, it can be estimated for each sector using a combination of measurements and estimates, and added together to provide an overall total for the country. Equation 1 shows how the total can be estimated. The recommended monitoring unit is tonnes per annum.

Equation 1:

$$\boldsymbol{m_t = m_g + m_i + m_s}$$

Where:

m_t = total mass of solid waste generated in South Africa

m_g = total mass of general municipal solid waste generated (by households and commercial activities)

m_i = total mass of solid waste generated by the agricultural, power generation, and mining industries

m_s = total mass of solid waste generated by the manufacturing industries (chemicals, FMCG, fertiliser, tyres, etc)

Note: mass is measured by scales, weighbridges, etc. where mass data is available, and estimated per capita where mass data is not available.

The total mass of solid waste disposed of lawfully in the country is partially measured for some sectors, and estimated in others. The combination of these estimates and measurements can be used to provide an overall total for the country. Equation 2 shows how the total can be estimated. The recommended monitoring unit is tonnes per annum.

Equation 2:

$$\boldsymbol{m_{t,l} = m_{g,l} + m_{i,l} + m_{s,l}}$$

Where:

$m_{t,l}$ = total mass of solid waste lawfully disposed of in South Africa

$m_{g,l}$ = total mass of general municipal solid waste (generated by households and commercial activities) lawfully disposed of

$m_{i,l}$ = total mass of solid waste generated by the agricultural, power generation, and mining industries, that is lawfully disposed of

$m_{s,l}$ = total mass of solid waste generated by the manufacturing industries (chemicals, FMCG, fertiliser, tyres, etc), that is lawfully disposed of

Note: mass is measured by scales, weighbridges, etc. where mass data is available, and estimated per capita where mass data is not available.

The calculation for the proportion of waste lawfully disposed is in Equation 3 below.

Equation 3:

$$\boldsymbol{p_l = \frac{m_{t,l}}{m_t} \times 100}$$

Where:

p_l = proportion of solid waste lawfully disposed of in South Africa

$m_{t,l}$ = total mass of solid waste lawfully disposed of in South Africa

m_t = total mass of solid waste generated in South Africa

Lawful disposal in this context of this indicator means that the waste disposal was permissible in terms of the National Environmental Management: Waste Act, i.e. the waste was disposed of at a dedicated waste disposal facility, that was designed to receive the specific type of waste (e.g. general waste facility or hazardous waste facility). For households and businesses, lawful disposal means putting the waste in a designated container that is removed by the municipality or a waste management company.

The solid waste masses can be aggregated into municipality, province, watershed, or for the country as a whole. This will assist in providing data at a range of scales, while also providing comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where the main solid waste disposal challenges lie.

The percentages calculated can be presented graphically, and on maps using spatial techniques to assist with reporting and interpretation of the data.

In terms of progressive monitoring, municipalities can start with an estimation of volume, and gradually move towards more accurate quantitative estimations. Table D.2 provides an example of progressive monitoring.

Table D.2: Progressive Monitoring of Indicator 6.3.4A

Indicator 6.3.4A	Progressive Monitoring
"Proportion of waste lawfully disposed of"	*First step* Estimation of total masses of waste generated by households, using per capita estimates based on averages by location. These estimates should be aggregated into local municipalities, and then aggregated into district municipalities and provinces. Estimation of total masses of waste generated by commercial activities (businesses, malls, hospitals, etc.), based on municipal permits, and waste manifests of waste management companies. Estimation of total masses of industrial waste from waste management licences (that were granted but are not being declared or audited). Where available; actual masses should be used, as recorded on: • waste manifests from receiving landfills, • waste manifests from receiving waste management companies, • SAWIS. Where appropriate, masses should be inferred/extrapolated for similar activities (e.g. similar-sized businesses in the same local municipality).
	Second step Refined estimation of total masses of waste, including improved measurement of waste received at waste depots and landfilling facilities. Inclusion of total masses of waste disposed of unlawfully (e.g. informal community dump sites), using survey/spatial data to calculate mass based on volume of waste on land.
	Third step Further refined estimation of total masses of waste generated, using more measured data on lawful and unlawful disposal.

To align to the UN global reporting standard for SDG 6.3.4A, the proposed frequency of national data collection and reporting should be annually.

D3.2 Treatment of incorrect and missing data

In the first step of progressive monitoring, missing data on waste generation and disposal will be estimated, i.e. where there is no data for a given mass of waste generated, it will be calculated using per capita data, spatial data, or inferred data.

D3.3 Sources of discrepancies

There is a dearth of data on waste disposal, and as such, it is unlikely that duplicate data would exist for a given waste generator. However, if this does occur, the measured data, as declared on a waste manifest, will be used.

Various issues surrounding poor data capturing and uploading can exist namely:

- Insufficient funding for data collection and capture (human resources)

- Insufficient funding for data management systems (database maintenance, servers, backups, reporting software, etc.)
- Lack of training of human resources

D4 DISAGGREGATION OF DATA FOR MANAGEMENT PURPOSES

The measured and estimated data will make it possible to disaggregate national information to depict performance .

- Per receiving water resource
- Per draining region / catchment;
- Per Water Management Area (WMA);
- Per province;
- Per municipality;
- Per waste generation sector;
- Per waste type (e.g. general, hazardous);
- Per entitlement (authorization type/approval).

D5 DATA SOURCES

The data sources or monitoring mechanisms of information of management targets for Indicator 6.3.4A may include the following:

- Waste disposal data stored in the South African Waste Information System (SAWIS), established in terms of Section 60 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).
- Waste manifest from waste management companies;
- Waste manifests in informal waste sites (if available);
- Spatial data of for illegal dumping sites (that are not serviced by municipal waste removal services).

In addition to SAWIS data; additional supporting data is required to generate sufficient and appropriate intelligence to improve local water management efforts. Such additional and supporting data include the recording of-

- whether the activity falls within the municipal or non-municipal category;
- whether the disposal occurs to a municipal-controlled or privately controlled facility, or to an informal or illegal dump site;
- the quaternary drainage region name(s) and/ or number(s);
- the name of the municipality and/or the waste generator;
- the name and coordinates of the waste disposal sites;
- the type of waste generating activity;
- whether the waste disposal is permissible or not (Y/N);
- the entitlement (i.e. authorisation type/ municipal approval) received or required;
- whether waste masses are recorded by the regulator, the municipality and/ or waste generator (Y/N).

D5.1 Collection process

Data collection could follow the following processes:

- Scanning and download of data in the SAWIS database;
- Collection of all other waste management licence data not in the SAWIS database
- Formal directed request for information for businesses operating in industrial areas in municipalities countrywide;
- Spatial survey of informal and illegal dump sites;
- Scanning and download of publicly disclosed waste disposal data by major corporate entities (e.g. GRI and CDP Water disclosures);
- Direct request for per capita data for waste generation from StatsSA. If this data has not yet been calculated, then a workshop should be held with the StatsSA domestic survey team to calculate this data per municipality.

The initial data gathering is a once-off exercise to generate an initial database. Thereafter, data would be updated on an annual basis.

D6 DATA AVAILABILITY

D6.1 Availability

Only limited data is currently available (from a combination of sources such as SAWIS and waste management companies).

Water management licence data is incomplete and not all waste management licences are audited regularly to capture waste disposal data time series.

D6.2 Frequency

Data may not be captured in sufficient time intervals due to the above constraints.

The proposed frequency of national data collection and reporting should be annually.

D7 DATA PROVIDERS

Government data providers include:

- Local and district municipalities: waste management departments, human settlements departments,
- Department of Forestry, Fisheries and Environment (DFFE) waste authorisation and management departments,
- StatsSA: community survey and general household survey department

Private company data providers:

- Farm owners,
- Industrial company owners,
- Mine owners,
- Private waste management company owners.

D8 DATA COMPILERS

The DWS will be the primary data compiler, with support from the DFFE and district municipalities. DWS will provide this data to StatsSA, who is responsible for country-level reporting on the SDGs. The roles of the various players is outlined below:

Table D.3: SDG 6.3.4A Summary of Data and Information Compilers

Data Provider	SDG 6.3.3A
DWS	X
StatsSA	x
DFFE	X
District Municipalities	X
Private companies	x

X = Lead role player

x = supporting role player

\- = No role

D9 MANAGEMENT TARGETS

SDG Indicator 6.3.4A is a new additional indicator under SDG 6.3. The purpose of SDG 6.3.4A sub-target is to provide a practical, step-by-step incremental and attainable integrated water quality management target that can be utilised for benchmarking purposes during SDG Target 6.3 implementation and reporting. Table D.4 includes the *Management* and supporting *Milestone Sub-targets* for SDG 6.3.4A.

Knowledge on the current baseline is necessary for the finalisation of the Milestone Sub-targets

Table D.4: Milestones and Management Targets to Benchmark Performance during SDG 6.3.4.A Implementation (Ref: DWS, SDG6.3 Methodology Report, Jan 2021)

<table>
<tr><th>Target Type</th><th>Year</th><th>Target Description</th></tr>
<tr><td rowspan="10">Milestone Sub-target</td><td>Baseline data</td><td>(baseline) % waste lawfully dispose of</td></tr>
<tr><td>2022</td><td>Baseline + 1/10 or 10% of Baseline</td></tr>
<tr><td>2023</td><td>Baseline + 2/10 or 20% of Baseline</td></tr>
<tr><td>2024</td><td>Baseline + 2/10 or 20% of Baseline</td></tr>
<tr><td>2025</td><td>Baseline + 3/10 or 30% of Baseline</td></tr>
<tr><td>2026</td><td>Baseline + 3/10 or 30% of Baseline</td></tr>
<tr><td>2027</td><td>Baseline + 4/10 or 40% of Baseline</td></tr>
<tr><td>2028</td><td>Baseline + 4/10 or 40% of Baseline</td></tr>
<tr><td>2029</td><td>Baseline + 5/10 or 50% of Baseline</td></tr>
<tr><td>2030</td><td>Baseline + 5/10 or 50% of Baseline</td></tr>
<tr><td>Milestone Sub-Target (MST)</td><td rowspan="2">2030</td><td>100% of waste is lawfully disposed of</td></tr>
<tr><td>SDG Target 6.3</td><td>By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.</td></tr>
</table>

Table D.5 summarises potential links between global and national indicators and targets for SDG 6.3.4A.

Table D5: SDG 6.3.4A Indicator and Targets from Global and South African Literature

Global and National Indicators for 6.3.4A	Targets
Medium-Term Strategic Framework (MTSF)	
PRIORITY 2: Spatial Integration, Human Settlements and Local Government	
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities	
2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security	
National Water and Sanitation Master Plan (NW&SMP)	
1.5 Improving raw water quality	
1.5.1 Determine in-stream Resource Water Quality Objectives (RWQOs), based on the SA Water Quality Guidelines (SA36), in support of RQO's Capacity, budgetary constraints	Publish the RWQOs for water quality
1.5.2 Routinely monitor resource water quality (SA46, SA47 SA48)	Laboratory facilities not readily available in all WMAs hampering IWQM
	National monitoring network in place but coverage requires expansion
	Regional water quality programmes insufficient to manage pressure on water resources
	Regional and local water quality programmes insufficient to manage pressure on water resources
1.5.4 Assess resource water quality information (SA52 & SA59)	Routine national assessments of water quality and input in support of the SDG process
1.5.10 Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61)	Build from IGR framework and SADC protocols
	Routine catchment assessments of water quality and the identification of "hot spots" for potential water quality management intervention
National Biodiversity Strategy and Action Plan (NBSAP)	
SO 3. Biodiversity considerations are mainstreamed into policies, strategies, and practices of a range of sectors	
Number of compliance inspections conducted	By 2019, 14 500 compliance inspections conducted.
Number of enforcement actions undertaken for non-compliance with environmental legislation	By 2019, 1 500 completed criminal investigations handed to the NPA for prosecution (for EMI Institutions) and 3 100 administrative enforcement notices issued for non-compliance with environmental legislation.
SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, and sustainable use of biodiversity	
Single portal exists through which all biodiversity information can be accessed	By 2016, the single portal is established, and it is being populated
National Waste Management Strategy, 2020	
Pillar 2: Effective and Sustainable Waste Services	1. Integrated Waste Management Planning

Global and National Indicators for 6.3.4A	Targets
	2. Producers with the concurrence of Municipalities to provide recycling drop-off/buyback/storage centres 3. Waste Collection including separation at source 4. Safe Management of hazardous household wastes and absorbent hygiene products waste
Pillar 3: Compliance, Enforcement and Awareness	1. Compliance promotion and awareness 2. Waste Services Infrastructure Provision 3. Enforcement 4. Awareness and Community Participation 5. Reduce littering and illegal dumping 6. Ensure municipal landfill sites and waste management facilities comply with licensing requirements

D10 DISPLAY OF RESULTS

The percentages calculated of proportion of waste lawfully disposed of, can be presented graphically, and on maps to assist with reporting and interpretation of the data. The mass of waste disposed of can be aggregated into municipality, province, watershed, or for the country as a whole. This will assist in providing data at a range of scales, while also providing comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where the main waste disposal challenges lie.

Table D6 provides an example of the format in which the SDG 6.3.4A results and be formatted. Figure D1 provides a graphical representation of how the data sets can be presented and assessed for comparative purposes.

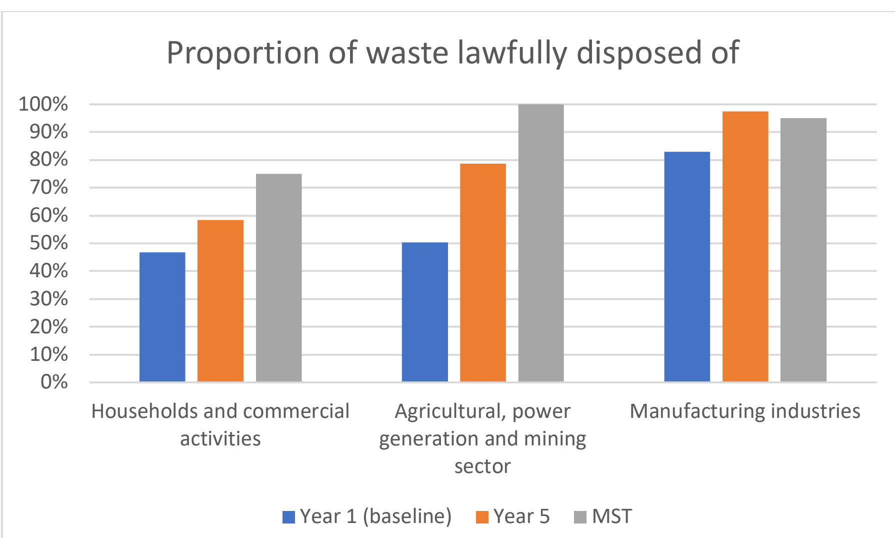

Figure D1: Example graph of proportion of lawful waste disposal by sector

Table D6: SDG 6.3.4A Fictitious Waste Disposal Data for South Africa

Category / Sector: Waste disposal	**YEAR 1 (BASELINE)**			**YEAR 5**			
	Total mass of waste generated [Equation 1]	**Total mass of waste lawfully disposed of [Equation 2]**	**Proportion of waste lawfully disposed of [Equation 3]**	**Total mass of waste generated**	**Total mass of waste lawfully disposed of**	**Proportion of waste lawfully disposed of red < MST green ≥ MST**	**Management Sub-Target (MST)**
	(tonnes/annum)	(tonnes/annum)	Percentage	(tonnes/annum)	(tonnes/annum)	Percentage	
Households and commercial activities	599 667	280 513	47%	629 900	68 051	58%	75%
Agricultural, power generation and mining sector	1 426 010	717 197	50%	1 205 202	948 650	79%	100%
Manufacturing industries	750 890	622 162	83%	605 900	590 216	97%	95%

D11 COMMENTS AND LIMITATIONS

Data collection in relation to lawful waste disposal has only tracked to a limited extent, and has not had a formal methodology for such tracking. The data is largely incomplete, and requires a concerted effort to be collected, captured, and organised.

It is important that the same methods are used by all reporting agencies from which data is obtained for DWS's use when compiling data according to this new methodology. The methods, approaches, and interpretations should be consistently applied by owners of all wastewater sources.

This methodology document should be a living document, and should be updated as more information of constraints and details of recycling/reuse, become available.

D12 IMPLEMENTATION CALENDAR

Table D7 describes how reporting on this indicator will be improved over time:

Table D7: Improvement in the Availability of Data and Information for Indicator 6.3.4A

Indicator	**Tier 1** **First step of progressive monitoring and information handling**	**Tier 2** **Second step of progressive monitoring and information handling**	**Tier 3** **Third step of progressive monitoring and information handling**
SDG 6.3.3A *"Proportion of waste lawfully disposed of."*	Estimation of total masses of waste generated by households, using per capita estimates based on averages by location. Estimates are aggregated into local municipalities, and then aggregated into district municipalities and provinces. Estimation of total masses of waste generated by commercial activities (businesses, malls, hospitals, etc.), based on municipal permits, and waste manifests of waste management companies. Estimation of total masses of industrial waste from waste management licences (that were granted but are not being declared or audited).	Refined estimation of total masses of waste, including improved measurement of waste received at waste depots and landfilling facilities. Inclusion of total masses of waste disposed of unlawfully (e.g. informal community dump sites), using survey/spatial data to calculate mass based on volume of waste on land	Further refined estimation of total masses of waste generated, using more measured data on lawful and unlawful disposal

Indicator	Tier 1 First step of progressive monitoring and information handling	Tier 2 Second step of progressive monitoring and information handling	Tier 3 Third step of progressive monitoring and information handling
	Where available; actual masses are used. Where appropriate, masses are inferred/extrapolated for similar activities.		
	Mid 2024	End 2025	Data collection on an annual basis to be reported on annually

Table D8 contains a summary of due dates and responsibilities for key implementation activities that apply to the roll-out of the Indicator methodology.

Table D8: Key Implementation Activities and Due Dates to be Completed for Indicator 6.3.4A

Implementation Activities		Due Date	Responsibility
1	Methodology Finalised	June 2023	DWS,DFFE, StatsSA
2	National database of available data and estimated data (baseline)	June 2024	DWS,DFFE, StatsSA
3	National database with all data captured	December 2025	DWS,DFFE, StatsSA
4	Data analysis and national reporting	2024, 2026, 2028, 2030	DWS,DFFE, StatsSA

D14 METHODOLOGY REPORT COMPILERS

The draft methodology was compiled by:

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Department of Water and Sanitation

D15 REFERENCES

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Methodology: Indicator SDG 6.3.5A – Proportion of waste recycled or reused

Version 1, March 2023

Goal 6:	Ensure availability and sustainable management of water and sanitation for all
Target 6.3:	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
Indicator 6.3.5A:	Proportion of waste recycled or reused

E1 THE INDICATOR

E1.1 Organisation(s)

Department of Water and Sanitation (DWS)

Department of Forestry, Fisheries and Environment (DFFE)

Statistics South Africa (StatsSA)

E1.2 Definition

Target 6.3 sets out to improve ambient water quality, which is essential to protecting both ecosystem health (Target 6.6 and SDGs 14 and 15) and human health (Target 6.1; recreational waters and drinking water sources), by eliminating, minimizing and significantly reducing different streams of pollution into water bodies. The main sources of pollution from solid waste include landfills, informal waste dumps, and unlawful disposal of solid waste by industry into facilities that have not been designed to receive that waste.

The 2020 National Waste Management Strategy has the concept of the "circular economy" at its centre. The circular economy is an approach to minimising the environmental impact of economic activity by reusing and recycling processed materials to minimise: (a) the need to extract raw materials from the environment; and (b) the need to dispose of waste. In the waste management hierarchy, reuse takes precedence over recycling, because reuse can take place without additional treatment or processing. Both reuse and recycling divert waste from the need for disposal, thereby freeing up available landfill space.

It must be noted that solid waste and the recycling of waste is also covered under SDG Indicators 11.6.1 (Urban Solid Waste), 12.4.2 (Hazardous Waste) and 12.5.1 (National Recycling Rate).

The proposed methodology for Indicator 6.3.5.A: *Proportion of Waste Recycled or Reused* implies the mass of solid waste being recycled or reused, in comparative relation to the total mass of solid waste being generated. Table E.1 defines the terms used in terms of the application of policies and guidelines.

Table E.1: Phrase by phrase interpretation of Indicator 6.3.5.A

Indicator 6.3.5A	Normative interpretation
"Proportion of waste Recycled or Reused."	*"Proportion of"* Percentage of total
	"Waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered— (a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;

Indicator 6.3.5A	Normative interpretation
	(b) which the generator has no further use of for the purposes of production; (c) that must be treated or disposed of; or (d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but— (i) a by-product is not considered waste; and (ii) any portion of waste, once re-used, recycled and recovered, ceases to be Waste. (Definition from the National Environmental Management: Waste Act)
	"Recycled" The recovery of materials from products (post-consumer) or manufacturing processes (pre-consumer) and returning them to the feedstock for some other process. (Definition from: A Circular Economy Guideline for the Waste Sector, DEFF, 2020)
	"or Reused" To re-use whole products after their current users no longer have use for them. This may include testing or minor repairs to ensure that products will perform reliably in the next life cycle. Multiple re-use cycles may be possible for a given product, especially if durability and reuse have been considered during its design. (Definition from: A Circular Economy Guideline for the Waste Sector, DEFF, 2020)

E1.3 Rationale

Reducing the amount of waste disposed of by diverting waste to landfill by increasing recycling and reuse, will assist South Africa in achieving its raw water quality goals, as measured by SDG Indicator 6.3.2D.

The elimination of minimizing the generation, use and discharge of hazardous substances, is also consistent with goals of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants.

South Africa is a water scarce country, and therefore pollution reduction is imperative to conserve our limited freshwater resources.

E1.4 Concepts and Terms

The concepts and definitions used in the methodology have been based on existing international frameworks and glossaries unless indicated otherwise below.

Change: a shift from one condition to another; in this case it refers to a change in cumulative volume over time, in relation to a point of reference, within a water-related ecosystem.

Disaggregation: Breaking down of data into constituent data sub-sets. Data can be disaggregated by subnational regions as well as by urban/rural regions, providing information on equity.

Municipal Solid Waste: waste generated by households, and waste of a similar nature generated by commercial and business establishments, industrial and agricultural premises, institutions such as schools and hospitals, public spaces such as parks and streets and construction sites. (UN Habitat, 2016)

Other Solid Waste: waste that require special treatment such as hazardous waste from industrial processes, agricultural activities and mining wastes, hospital waste, end of life vehicles, construction and demolition waste and WEEE (Waste Electrical and Electronic Equipment). (UN Habitat, 2016).

Non-point source pollution: Diffuse pollutants that do not originate from a single discrete source, e.g. a pollution plume originating at a landfill site.

E1.5 Relationship between SDG Indicator 6.3.5A and Target 6.3.2D

SDG Indicator 6.3.5A measures the recycling and reuse of waste (which is linked to a decrease in waste disposal). SDG Indicator 6.3.2D measures the quality of water resources around South Africa. The impact of reduced waste disposal on the quality of ambient water can thus be established using this additional indicator.

E2 COMMENTS AND LIMITATIONS

Some data is available for the mass of waste generated, because there are many waste management entities operating in South Africa, as well as household surveys by StatsSA. However, the total data set for waste generation is incomplete.

E3 METHODOLOGY

E3.1 Computation Method

The proposed methodology includes estimation of the proportion of recycled and reused. This indicator relies on the total mass of waste generated, which is computed as part of SDG Indicator SDG 6.3.4A. As such, that indicator will need to be used as source data for Indicator 6.3.5A. Please reference the SDG Indicator 6.3.4A methodology document for reference.

The proposed computation method consists of three calculations:

- Total mass of solid waste generated (using the number generated in SDG Indicator 6.3.4A);
- Mass of solid waste recycled and reused; and
- Proportion of solid waste recycled and reused of (calculated using the numbers in the points above)

E3.1.1 Formula

The total mass of solid waste generated in the is calculated in the methodology for SDG 6.3.4A (Equation 1), which produces the variable “m_t”, the total mass of solid waste generated in South Africa. The recommended monitoring unit is tonnes per annum. Equation 1 is shown below for clarity and information.

Equation 1:

$$\boldsymbol{m_t = m_g + m_i + m_s}$$

Where:

m_t = total mass of solid waste generated in South Africa

m_g = total mass of general municipal solid waste generated (by households and commercial activities)

m_i = total mass of solid waste generated by the agricultural, power generation, and mining industries

m_s = total mass of solid waste generated by the manufacturing industries (chemicals, FMCG, fertiliser, tyres, etc)

Note: mass is measured by scales, weighbridges, etc. where mass data is available, and estimated per capita where mass data is not available.

The total mass of solid waste recycled and reused in the country is partially measured for some sectors, and estimated in others. The combination of these estimates and measurements can be used to provide an overall total for the country. Equation 2 shows how the total can be estimated. The recommended monitoring unit is tonnes per annum.

Equation 2:

$$\boldsymbol{m_{t,r} = m_{r1} + m_{r2}}$$

Where:

$m_{t,r}$ = total mass of solid recycled and reused of in South Africa

m_{r1} = total mass of solid waste recycled

m_{r2} = total mass of solid waste reused

Note: mass is measured by scales, weighbridges, etc. where mass data is available, and estimated by the waste recycler/reuser using proxy data such as pump rates, processing rates, etc. where mass data is not available.

The calculation for the proportion of waste recycled and reused is shown in Equation 3 below.

Equation 3:

$$p_r = \frac{m_{t,r}}{m_t} \times 100$$

Where:

p_r = proportion of solid waste recycled and reused in South Africa

$m_{t,r}$ = total mass of solid waste recycled and reused in South Africa

m_t = total mass of solid waste generated in South Africa

The masses of solid waste recycled and reused can be aggregated into municipality, province, watershed, or for the country as a whole. This will assist in providing data at a range of scales, while also providing comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where the main solid waste recycling and reuse lie.

The percentages calculated can be presented graphically, and on maps using spatial techniques to assist with reporting and interpretation of the data.

In terms of progressive monitoring, municipalities can start with an estimation of mass, and gradually move towards more accurate quantitative estimations. Table E.2 provides an example of progressive monitoring.

Table E.2: Progressive Monitoring of Indicator 6.3.5A

Indicator 6.3.5A	Progressive Monitoring
"Proportion of waste recycled and reused"	*First step* Calculation of total masses of waste recycled and reused, using existing data from municipalities and private waste recyclers and reusers by location. These estimates should be aggregated into local municipalities, and then aggregated into district municipalities and provinces. Estimation of total masses of waste recycled and reused by the informal sector, using surveys from informal waste workers (waste pickers). Where available; actual masses should be used, as recorded on: • waste manifests of receiving processing facilities, • waste manifests of reuse applications, • SAWIS • Sales records in the informal sector. Where appropriate, masses should be inferred/extrapolated for similar activities (e.g. similar-sized businesses in the same local municipality).
	Second step Refined estimation of total masses of waste recycled and reused, including improved measurement of waste received at waste depots, recycling facilities, and reuse end users. Inclusion of total masses more waste streams, using survey/spatial data to calculate mass based on volume of waste on land.
	Third step Further refined estimation of total masses of waste recycled and reused, using more measured data on recycling and reuse streams.

To align to the UN global reporting standard for SDG 6.3.5A, the proposed frequency of national data collection and reporting should be annually.

E3.2 Treatment of incorrect and missing data

In the first step of progressive monitoring, missing data on waste generation and recycling and reuse will be estimated, i.e. where there is no data for a given mass of waste generated, it will be calculated using per capita data, spatial data, or inferred data.

E3.3 Sources of discrepancies

There is a dearth of data on waste recycling reuse, and as such, it is unlikely that duplicate data would exist for a given waste generator. However, if this does occur, the measured data, as declared on a waste manifest, or point of use scale/weighbridge, will be used.

Various issues surrounding poor data capturing and uploading can exist namely:

- Insufficient funding for data collection and capture (human resources)
- Insufficient funding for data management systems (database maintenance, servers, backups, reporting software, etc.)
- Lack of training of human resources

E4 DISAGGREGATION OF DATA FOR MANAGEMENT PURPOSES

The measured and estimated data will make it possible to disaggregate national information to depict performance .

- Per receiving water resource
- Per draining region / catchment;
- Per Water Management Area (WMA);
- Per province;
- Per municipality;
- Per waste generation sector;
- Per waste type (e.g. general, hazardous);
- Per entitlement (authorization type/approval).

E5 DATA SOURCES

The data sources or monitoring mechanisms of information of management targets for Indicator 6.3.5A may include the following:

- Scale, weighbridge and/or conveyor data from waste recycling companies or reuse end users;
- Waste disposal data stored in the South African Waste Information System (SAWIS), established in terms of Section 60 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).
- Waste manifests from waste management companies;
- Waste manifests in informal waste sites (if available);
- Spatial data of for informal waste management sites (e.g. waste picker central operations).

In addition to the above data; additional supporting data is required to generate sufficient and appropriate intelligence to improve recycling and reuse efforts. Such additional and supporting data include the recording of-

- whether the activity falls within the municipal or non-municipal category;
- whether the recycling/reuse occurs at a municipal-controlled or privately controlled facility, or at an informal site;
- the quaternary drainage region name(s) and/ or number(s);
- the name of the municipality and/or the waste recycler/reuser;
- the name and coordinates of the recycling/reuse sites;
- the type of waste;
- whether the waste recycling/reuse is permissible or not (Y/N);
- the entitlement (i.e. authorisation type/ municipal approval) received or required;
- whether waste recycling/reuse masses are recorded by the regulator, the municipality and/ or waste recycler/reuser (Y/N).

E5.1 Collection process

Data collection could follow the following processes:

- Scanning and download of data in the SAWIS database;
- Collection of all waste management licence data not in the SAWIS database (from private companies that recycle/reuse waste)

- Formal directed request for information from recycling businesses and reuse end users operating countrywide;
- Spatial survey of informal and illegal dump waste recycling/reuse sites;
- Scanning and download of publicly disclosed waste recycling and reuse data by major corporate entities (e.g. GRI and CDP Water disclosures);

The initial data gathering is a once-off exercise to generate an initial database. Thereafter, data would be updated on an annual basis.

E6 DATA AVAILABILITY

E6.1 Availability

Only limited data is currently available (from a combination of sources such as SAWIS, waste management companies, and recycling/reuse companies).

Waste management licence data is incomplete and not all waste management licences are audited regularly to capture waste recycling/reuse data time series.

E6.2 Frequency

Data may not be captured in sufficient time intervals due to the above constraints.

The proposed frequency of national data collection and reporting should be annually.

E7 DATA PROVIDERS

Government data providers include:

- Local and district municipalities: waste management departments, human settlements departments,
- Department of Forestry, Fisheries and Environment (DFFE) waste authorisation and management departments,

Private company data providers:

- Recycling/reuse company owners,
- Mine owners,
- Farm owners,
- Private waste management company owners.

E8 DATA COMPILERS

The DWS will be the primary data compiler, with support from the DFFE and district municipalities. DWS will provide this data to StatsSA, who is responsible for country-level reporting on the SDGs. The roles of the various players is outlined below:

Table E.3: SDG 6.3.5A Summary of Data and Information Compilers

Data Provider	**SDG 6.3.3A**
DWS	X
StatsSA	X
DFFE	X
District Municipalities	X
Private companies	X

X = Lead role player

x = supporting role player

\- = No role

E9 MANAGEMENT TARGETS

SDG Indicator 6.3.5A is a new additional indicator under SDG 6.3. The purpose of SDG 6.3.5A sub-target is to provide a practical, step-by-step incremental and attainable integrated water quality management target that can be utilised for benchmarking purposes during SDG Target 6.3 implementation and reporting. Table E.4 includes the *Management* and supporting *Milestone Sub-targets* for SDG 6.3.5A.

Knowledge on the current baseline is necessary for the finalisation of the Milestone Sub-targets

Table E.4: Milestones and Management Targets to Benchmark Performance during SDG 6.3.5.A Implementation (Ref: DWS, SDG6.3 Methodology Report, Jan 2021)

Target Type	**Year**	**Target Description**
Milestone Sub-target	Baseline data	(baseline) *% waste lawfully dispose of*
	2022	Baseline + 1/10 or 10% of Baseline
	2023	Baseline + 2/10 or 20% of Baseline
	2024	Baseline + 2/10 or 20% of Baseline
	2025	Baseline + 3/10 or 30% of Baseline
	2026	Baseline + 3/10 or 30% of Baseline
	2027	Baseline + 4/10 or 40% of Baseline
	2028	Baseline + 4/10 or 40% of Baseline
	2029	Baseline + 5/10 or 50% of Baseline
	2030	Baseline + 5/10 or 50% of Baseline
Milestone Sub-Target (MST)	2030	50% of waste is lawfully disposed of* (based on US target for 2030, SA target is 25% for 2023)
SDG Target 6.3		By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Table E.5 summarises potential links between global and national indicators and targets for SDG 6.3.5A.

Table E5: SDG 6.3.5A Indicator and Targets from Global and South African Literature

Global and National Indicators for 6.3.5A	Targets
Medium-Term Strategic Framework (MTSF)	
PRIORITY 2: Spatial Integration, Human Settlements and Local Government	
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities	
2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security	
National Water and Sanitation Master Plan (NW&SMP)	
1.5 Improving raw water quality	
1.5.1 Determine in-stream Resource Water Quality Objectives (RWQOs), based on the SA Water Quality Guidelines (SA36), in support of RQO's Capacity, budgetary constraints	Publish the RWQOs for water quality
1.5.2 Routinely monitor resource water quality (SA46, SA47 SA48)	Laboratory facilities not readily available in all WMAs hampering IWQM
	National monitoring network in place but coverage requires expansion
	Regional water quality programmes insufficient to manage pressure on water resources
	Regional and local water quality programmes insufficient to manage pressure on water resources
1.5.4 Assess resource water quality information (SA52 & SA59)	Routine national assessments of water quality and input in support of the SDG process
1.5.10 Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61)	Build from IGR framework and SADC protocols
	Routine catchment assessments of water quality and the identification of "hot spots" for potential water quality management intervention
National Biodiversity Strategy and Action Plan (NBSAP)	
SO 3. Biodiversity considerations are mainstreamed into policies, strategies, and practices of a range of sectors	
Number of compliance inspections conducted	By 2019, 14 500 compliance inspections conducted.
Number of enforcement actions undertaken for non-compliance with environmental legislation	By 2019, 1 500 completed criminal investigations handed to the NPA for prosecution (for EMI Institutions) and 3 100 administrative enforcement notices issued for non-compliance with environmental legislation.
SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, and sustainable use of biodiversity	
Single portal exists through which all biodiversity information can be accessed	By 2016, the single portal is established, and it is being populated
National Waste Management Strategy, 2020	
Pillar 2: Effective and Sustainable Waste Services	1. Integrated Waste Management Planning 2. Producers with the concurrence of Municipalities to provide recycling drop-off/buyback/storage centres 3. Waste Collection including separation at source

Global and National Indicators for 6.3.5A	Targets
	4. Safe Management of hazardous household wastes and absorbent hygiene products waste
Pillar 3: Compliance, Enforcement and Awareness	1. Compliance promotion and awareness 2. Waste Services Infrastructure Provision 3. Enforcement 4. Awareness and Community Participation 5. Reduce littering and illegal dumping 6. Ensure municipal landfill sites and waste management facilities comply with licensing requirements
Key Principles Underpinning the NWMS 2020	1. Waste as a Resource: beneficiating waste through re-use, recycling, treatment and recovery to reduce the amount and the toxicity of waste disposed of. Targets for 2025: - 70% of paper recycled, - 60% of plastic recycled, - 90% of glass recycled, - 90% of metals recycled and - 40% of fly-ash recycled

E10 DISPLAY OF RESULTS

The percentages calculated of proportion of waste recycled/reused, can be presented graphically, and on maps to assist with reporting and interpretation of the data. The mass of waste recycled/reused can be aggregated into municipality, province, watershed, or for the country as a whole. This will assist in providing data at a range of scales, while also providing comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where the main waste recycling/reuse challenges lie.

Table E6 provides an example of the format in which the SDG 6.3.5A results and be formatted. Figure E1 provides a graphical representation of how the data sets can be presented and assessed for comparative purposes.

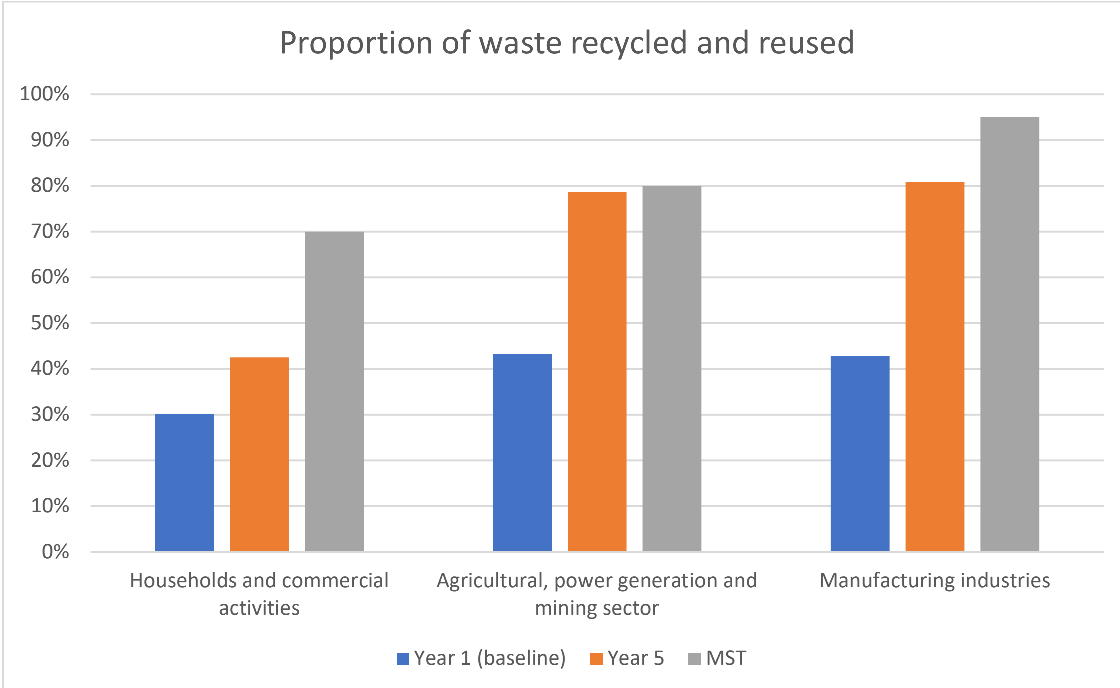

Figure E1: Example graph of proportion of waste recycled/reused by sector

Table E6: SDG 6.3.5A Fictitious Waste Recycling/Reuse Data for South Africa

Category / Sector: Waste recycling/reuse	**YEAR 1 (BASELINE)**			**YEAR 5**			
	Total mass of waste generated [Equation 1]	**Total mass of waste recycled and reused [Equation 2]**	**Proportion of waste recycled and reused [Equation 3]**	**Total mass of waste generated**	**Total mass of waste recycled and reused**	**Proportion of waste recycled and reused red < MST green ≥ MST**	**Management Sub-Target (MST)**
	(tonnes/annum)	(tonnes/annum)	Percentage	(tonnes/annum)	(tonnes/annum)	Percentage	
Households and commercial activities	599 667	180 513	47%	629 900	268 051	43%	70%
Agricultural, power generation and mining sector	1 426 010	617 197	50%	1 205 202	948 650	79%	80%
Manufacturing industries	750 890	322 162	83%	605 900	490 216	81%	80%

E11 COMMENTS AND LIMITATIONS

Data collection in relation to waste recycling and reuse is only tracked to a limited extent, and has not had a formal methodology for such tracking. The data is largely incomplete, and requires a concerted effort to be collected, captured, and organised.

It is important that the same methods are used by all reporting agencies from which data is obtained for DWS's use when compiling data according to this new methodology. The methods, approaches, and interpretations should be consistently applied by owners of all waste sources.

This methodology document should be a living document, and should be updated as more information of constraints and details of recycling/reuse, become available.

E12 IMPLEMENTATION CALENDAR

Table E7 describes how reporting on this indicator will be improved over time:

Table E7: Improvement in the Availability of Data and Information for Indicator 6.3.5A

Indicator	**Tier 1** **First step of progressive monitoring and information handling**	**Tier 2** **Second step of progressive monitoring and information handling**	**Tier 3** **Third step of progressive monitoring and information handling**
SDG 6.3.5A *"Proportion of waste recycled and reused."*	Calculation of total masses of waste recycled and reused, using existing data from municipalities and private waste recyclers and reusers by location. These estimates should be aggregated into local municipalities, and then aggregated into district municipalities and provinces. Estimation of total masses of waste recycled and reused by the informal sector, using surveys from informal waste workers (waste pickers). Where available; actual masses should be used, as recorded on: • waste manifests of receiving processing facilities, • waste manifests of reuse applications,	Refined estimation of total masses of waste recycled and reused, including improved measurement of waste received at waste depots, recycling facilities, and reuse end users. Inclusion of total masses more waste streams, using survey/spatial data to calculate mass based on volume of waste on land.	Further refined estimation of total masses of waste recycled and reused, using more measured data on recycling and reuse streams

	• SAWIS • Sales records in the informal sector. Where appropriate, masses should be inferred/extrapolated for similar activities (e.g. similar-sized businesses in the same local municipality).		
	Mid 2024	End 2025	Data collection on an annual basis to be reported on annually

Table E8 contains a summary of due dates and responsibilities for key implementation activities that apply to the roll-out of the Indicator methodology.

Table E8: Key Implementation Activities and Due Dates to be Completed for Indicator 6.3.5A

Implementation Activities		Due Date	Responsibility
1	Methodology Finalised	June 2023	DWS, DFFE
2	National database of available data and estimated data (baseline)	June 2024	DWS, DFFE
3	National database with all data captured	December 2025	DWS,DFFE
4	Data analysis and national reporting	2024, 2026, 2028, 2030	DWS,DFFE, StatsSA

D14 METHODOLOGY REPORT COMPILERS

The draft methodology was compiled by:

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Department of Water and Sanitation

D15 REFERENCES

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APPENDIX B: SDG TARGET 6.6 ASSESSMENT

Reviewed Methodology Report for SDG 6.6

Report Prepared for

Water Research Commission

Report Number 582205/02

Report Prepared by

srk consulting

November 2022

Reviewed Methodology Report SDG 6.6

Water Research Commission

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Disclaimer

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List of Abbreviations

Abbreviation	Definition
CBD	Convention on Biological Diversity
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation
EI	Ecological Importance
EFZ	Estuarine Functional Zone
ES	Ecological Sensitivity
IHI	Index of Habitat Integrity
LDN	Land Degradation Neutrality
MDG	Millennium Development Goal
NAP	National Action Plan
NBA	National Biodiversity Assessment
NBSAP	National Biodiversity Strategy and Action Plan
NGLMP	National Groundwater Level Monitoring Programme
NPAES	National Protected Area Expansion Strategy
NWM5	National Wetland Map Version 5
NWMP	National Wetland Monitoring Programme
NWRP	National Water Resource Strategy
NW&SMP	National Water and Sanitation Master Plan
PES	Present Ecological State
SA	South Africa
SANBI	South African National Biodiversity Institute
SDG	Sustainable Development Goal
SRK	SRK Consulting South Africa (Pty) Ltd
UNEP	United Nations Environment Programme
UKZN	University of KwaZulu Natal
UN	United Nations
WCWDM	water conservation and water demand management
WRC	Water Research Commission
WSA	Water Service Authority

1 Introduction and Approach

South Africa is one of 193 countries who is a signatory to the Sustainable Development Goal (SDG) 2030 Agenda, which included the commitment to achieve SDG 6: Clean Water and Sanitation. The Department of Water and Sanitation (DWS) is mandated to be responsible for the management of SDG 6 policy, plans and implementation programs. In adopting the goal, the DWS adopted existing indicators (carried over from the United Nations [UN] Millennium Development Goals [MDGs]), domesticated new indicators, and defined additional indicators (where necessary).

South Africa has committed to the achievement of the 17 SDGs by 2030. SDG 6 aims to ensure clean water and sanitation for all by 2030. Some of the SDG 6 targets and indicators are well established (those carried over from the MDGs in 2000), while others are less established (those introduced with the adoption of the SDGs or in the years following adoption). At a global level, specialists in various international agencies developed methodologies for all the SDG targets and their indicators. In May 2017 the UN released the first round of the Step-by-step Methodology Reports for each of the indicators. Revisions of these methods have subsequently been published through updated methodology reports and captured in the 2018 Synthesis Reports for each indicator. At a national level, countries were encouraged to domesticate these methods and to set targets that are relevant to their context and resources, while maintaining consistency with the targets set out in the SDGs.

While South Africa has developed methodologies to domesticate its indicators, some of the indicators are still not being measured in a meaningful way that shows and drives progress against the targets. For some of these indicators, an assessment, and potentially, a revision of these methodologies is required. For others, new methodologies are required to be developed. In addition, several new indicators are required, and a solid founding methodology is required for the new indicators. Research by a multidisciplinary team with a deep understanding of water resources management in the SA context is required to achieve these research outputs.

1.1 SDG 6 Adoption in South Africa

SDG 6 has been divided into 8 targets, which are then divided into indicators. The intent of setting the targets and defining the indicators is to monitor progress towards achieving SDG 6. The DWS, works closely with several other branches of government, as well as other organisations, to measure and report on the indicators. The objective of monitoring and reporting on the indicators is to effect real change in the water and sanitation landscape in South Africa, by informing policy formulation and aiding decision-making.

South Africa's monitoring of, and performance against, the SDG 6 indicators has shown slow uptake of policies and actions developed for water and sanitation. South Africa published a Community Survey in 2016 (StatsSA, 2016), an SDG Baseline Report in 2017 (StatsSA, 2017), an SDG Country Report in 2019 (StatsSA, 2019), and a General Household Survey in 2019 (StatsSA, 2019). In addition, South Africa has established a Goal Tracker website (StatsSA, 2021). These documents show that several indicators are not tracked, that data continuity is poor for some indicators, and that there is a lack of consistency in tracking some indicators.

The Water Research Commission (WRC) has identified complex indicators within SDG 6, resulting in the appointment of an SDG 6 working group, with SRK Consulting South Africa’s (Pty) Ltd (SRK’s) acting as a professional service provider, to evaluate targets, indicators, and methodologies for SDG 6.6, 6.3 and 6.b; and to propose improvements where shortfalls are identified. These gaps / shortfalls will inform the development and definition of new additional indicators, where necessary; using existing data (where available) and investigating new data sources (where data is not available).

2 Scope of Work

Research Task 1: Peer review and assessment of the SDG 6.6 methodology, and development of additional indicators (Task Leader: Erin Haricombe. Team: Giulia Barr, Bjanka Korb, Lindsay Shand, Simon Lorentz, Kershani Chetty and UKZN Student:

1. Review the existing methodology document for SDG 6.6 to determine the adequacy of the current SDG 6.6. indicators for influencing national decision-making and showing progress against SDG 6.6 to ensure restoration and protection of water related ecosystems.
2. An assessment will be carried out to determine whether the SDG 6.6 indicators pertaining to water quality of the water-related ecosystems adequately represent changes in the extent of water-related ecosystems over time in South Africa (Section 5). The content and frequency of reporting (i.e. in the next SDG Voluntary National Review) is to be considered based on the global-level reporting standard to show the sustainability status for water quality and water-related ecosystems in South Africa.
3. The statistical correctness and scientific validity of the methodology for SDG 6.6 will be evaluated by examining available data in relation to the methodology, and analysing the status quo reflected by the data.
4. Recommendations for amendments and improvements will be made, and where appropriate, alternative methodologies will be proposed.
5. The domesticated and proposed additional indicators for SDG 6.6 will be reviewed for the period from 2016 to 2020, and recommendations for meaningful (relevant, pragmatic, indicative of progress) country-level targets and indicators will be made. These indicators will be developed based on availability of data. Also, cognisance will be given to varying local conditions, that can be aggregated into a single country-level indicator without losing impact or meaning.
6. A methodology for at least one of the additional indicators identified for SDG 6.6 will be developed. This methodology will be tested using available data.
7. Data analysis and synthesis will be conducted in collaboration with DWS and StatsSA, taking cognisance of possible linkages with other SDGs relating to water-related ecosystems (e.g. SDG 14) to avoid any duplication of reporting by RSA. Regular virtual meetings will take place with key DWS representatives to facilitate this collaboration.
8. DWS will be assisted with setting management targets for SDG 6.6 and with selecting and developing methods for additional country level indicators where gaps were identified.

3 SDG 6.6 Methodology Background

SDG target 6.6 is a global indicator, which monitors the extent and quality of the water-related ecosystems using global data tools and products. According to the WRC, "the existing methodology for Target 6.6 requires review" where necessary and determination of targets. There is a need to consider developing a methodology for one of the additional indicators identified for SDG 6.6. Where data exist, testing will be crucial.

Due to the data gaps associated with national datasets, long-term monitoring of these ecosystems becomes a difficult task, therefore, the use of global data products has made it possible to bridge these gaps associated with the acquisition of data. Furthermore, this is also beneficial on a national level as countries can incorporate both globally available data and national data to monitor water-related ecosystems.

Part of the review is to determine the value of the current SDG 6.6. indicators for influencing national decision making i.e. will the method proposed be both useful for global reporting and at the same time have a real influence nationally? Where appropriate, the statistical correctness and scientific validity of the methods are to be evaluated. Recommendations for amendments and improvements will be made, and where appropriate, alternative methodologies may be recommended.

In addition to the need for peer review and finalization of the methodology report for SDG 6.6, the DWS need to:

1. Set management targets for SDG 6.6; and
2. Select and develop methods for additional, country level indicators for SDG 6.6.

3.1 SDG 6.6 Methodology and Development of Additional Indicators

According to the UN Water Integrated Monitoring Guide for SDG 6 on Water and Sanitation Targets and Global Indicators, "*Target 6.6 seeks to halt the degradation and destruction of water related ecosystems, and to assist the recovery of those already degraded. The target includes water-related ecosystems such as vegetated wetlands, rivers, lakes, reservoirs and groundwater as well as those occurring in mountains and forests, which play a special role in storing freshwater and maintaining water*".

Table 3-1 summarises the South African SDG 6.6 Target and Indicators and Sub-indicators.

SDG Target 6.6

"By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes" [1]

Table 3-1: SDG 6.6 South African Target, Indicator and Sub-indicators

Target 6.6	Indicator			Sub-Indicators
Ecosystems – protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes	6.6.1	Change in the extent of water-related ecosystems over time	Global	Percentage change in the surface area of wetlands (vegetated and unvegetated/arid), estuaries, reservoirs, and lakes over time from a predefined baseline, expressed as a % of the total land area
	6.6.1D(1)	Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes, and estuaries as a percentage of total land area	Domesticated	Change in Spatial Extent of Rivers
				Change in Spatial Extent of Wetlands, including lakes, vegetated wetlands, and ephemeral wetlands
				Change in Spatial Extent of Estuaries
				Change in the Extent of Estuarine Functional Zones (EFZ)

[1] 2030 Agenda for Sustainable Development

Target 6.6	Indicator			Sub-Indicators
				Change in Spatial Extent of Artificial Systems (Reservoirs)
	6.6.1D(2)	Number of lakes and dams affected by high trophic and turbidity states	Domesticated	Proportion of lakes and dams affected by High Trophic States
				Proportion of lakes and dams affected by High Turbidity States
	6.6.1D(3)	Change in the national discharge of rivers and estuaries over time	Domesticated	Change in the Water Quantity in Rivers
				Change in the Water Quantity in Estuaries
	6.6.1D(4)	Change in groundwater levels over time	Domesticated	Change in Groundwater Levels over time
	6.6.1A(5)	Change in the ecological condition of rivers, estuaries, lakes, and wetlands	Additional	Change in the Ecological Condition of Rivers
				Change in the Ecological Condition of Estuaries
				Change in the Ecological Condition of wetlands

Based on the UN SDG Goal Tracker for South Africa[2] data for Indicator 6.6.1 (2018) and 6.6.1.3 (2010 and 2017) is available at present.

4 SDG 6.6 UN Methodology Review

SDG target 6.6 aims to ensure that all water-related ecosystems are protected and restored to ensure sustainable water availability in the long-term. It is only comprised of one indicator, which monitors quantity and quality changes in the extent of water-related ecosystems over time. These water-related ecosystems include rivers, wetlands, lakes, estuaries, reservoirs, and mangroves. Data acquired for monitoring these ecosystems are based on and related to their spatial extent and water quality and quantity.

The UN methodology documents reviewed in relation to SDG 6.6 include the following documents:

- Step-by-step Monitoring Methodology for SDG Indicator 6.6.1, UN, Version 20, January 2017;
- Monitoring Methodology for SDG Indicator 6.6.1, UNEP, March 2018; and
- Sustainable Development Goal 6 2020 Data Drive: SDG Target 6.6 – Indicator 6.6.1 Change in Extent of Water-Related Ecosystems Over Time, UN, June 2020.

The global methodologies for SDG 6.6.1 have been reviewed as these forms the basis for the SDG reporting against which South Africa is required to report and is assessed globally. A brief overview of the UN monitoring methodologies used for each indicator is summarized below.

Figure 4-1 presents the current UN SDG 6.6 report on spatial extent of water-related ecosystems from earth observation data in South Africa, progress over time. Changes include both increases and decreases in the area covered by surface water, corresponding to flooding and droughts and often associated with climate change. Spatial extent of lakes, rivers, estuaries, and artificial water bodies.

[2] https://south-africa.goaltracker.org/platform/south-africa/data

- Baseline (2001-2005): 3,180 km^2
- Latest five-year period (2011-2015): 3,415 km^2
- Change in extent compared to baseline: gain of 26 %

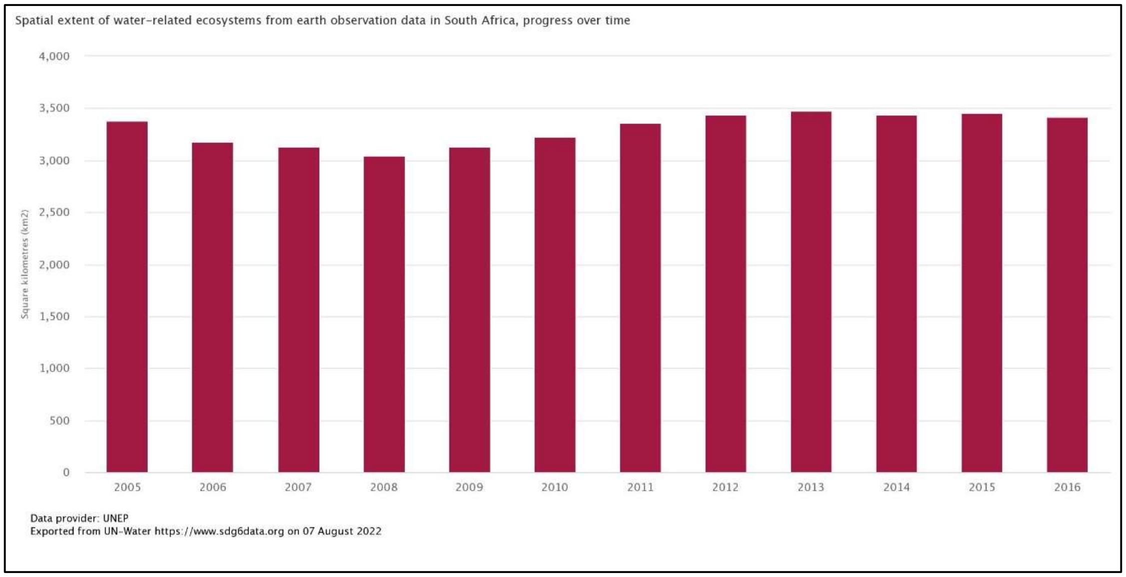


Figure 4-1 Spatial extent of water-related ecosystems from earth observation data in South Africa, progress over time (UNEP, August 2022)[3]

4.1 UNEP SDG 6.6.1. Measuring Change in the Extent of Water-related Ecosystems Over Time, SDG Monitoring Methodology Indicator 6.6.1

The UNEP methodology applies a progressive monitoring approach whereby countries can utilize both globally- and nationally- derived data to report on Indicator 6.6.1. According to the UNEP Monitoring Methodology for Indicator 6.6.1 "Countries should aim to report on all aspects of Indicator 6.6.1 should they have the data and capacity to do so. While it is beneficial to capture data on all aspects of the Indicator, some countries may be able to achieve this, and others may not have all data available."

As a result, a progressive monitoring approach uses 2 Levels and 5 Sub-Indicators. Level 1 data utilizes data which is already globally available as a "foundation" which provides scope to be strengthened by countries as they develop capacity and ability to report on Level 2 data.

Level 1 includes 2 Sub-Indicators based on globally available data from earth observations which is expected to be validated by countries against their own methodologies and datasets:

- Sub-Indicator 1 (also referred to as: 6.6.1D(1)) – spatial extent of water-related ecosystems.
- Sub-Indicator 2 (also referred to as: 6.6.1D(2)) – water quality of lakes and artificial water bodies.

Level 2 data is additional data informing progress on target 6.6 collected by countries. Countries are encouraged to consolidate this data to better understand the state of their freshwater ecosystems and prioritize actions, where necessary. Level 2 data includes the following 3 Sub-Indicators:

- Sub-Indicator 3 (also referred to as: 6.6.1D(3)) – quantity of water (discharge) in rivers and estuaries.
- Sub-Indicator 4 – water quality imported from SDG Indicator 6.3.2.
- Sub-Indicator 5 (also referred to as: 6.6.1D(4))– quantity of groundwater within aquifers.

[3] https://www.sdg6data.org/country-or-area/South%20Africa#anchor_6.6.1

The National Sub-indicator 6.6.1A(1) State of Ecosystem Health does not form part of the aggregated 6.6.1 index but is kept separate for National level reporting and to assist with restoration activities.

4.2 Sub-Indicator 1 (6.6.1D(1)): Spatial Extent of Water-Related Ecosystems

4.2.1 Measuring Change in Surface Water Area of Lakes and Rivers

To calculate percentage change in river area using a 2000-2019 dataset, a baseline period is first defined against which to measure change. This methodology uses 2000-2004 as the 5-year baseline period. Averaging all earth observations annually and over a five-year period the baseline is then compared a subsequent 5-year target period. From the baseline and target period, the percentage change of spatial extent is calculated using the following formula:

$$\textbf{Percentage Change in Spatial Extent} = (\beta - \gamma)/\beta \times 100$$

Where β = the average national spatial extent from 2000-2004

Where γ = the average national spatial extent of any other subsequent 5-year period

The nature of this formula yields percentage change values as either positive or negative, which helps to indicate how spatial area is changing. On the UN SDG 6.6.1 data portal, statistics are displayed using both positive and negative symbols. For the purpose of interpretation, if the value is positive, the statistics represent an area gain in surface area; while if the value is negative, it represents a loss in surface area.

“The use of ‘positive’ and ‘negative’ terminology does not imply a positive or negative state of the water related ecosystem being monitored. Gain or loss in surface water area can be beneficial or detrimental. The resulting impact of a gain or loss in surface area must be locally contextualized. The percentage change statistic produced represents how the total area of rivers within a given boundary (e.g. nationally) is changing over time. Percentage change statistics aggregated at a national scale should be interpreted with some degree of caution because these statistics reflect the areas of all the lakes and rivers within a country boundary. For this reason, sub-national statistics are also made available including at basin and sub-basin scales. The statistics produced at these smaller scales reflects area changes to a smaller number of lakes and rivers within a basin or sub-section of a basin, allowing for localized, water body specific, decision making to occur.”

4.2.2 Measuring the Change in Reservoir Surface Area

Data on reservoir area dynamics are available for a 36-year period, from 1984-2019. To calculate percentage change in reservoir area using a 2000-2019 dataset, a baseline period is first defined against which to measure change.

“This methodology uses 2000-2004 as the 5-year baseline period. Averaging all earth observations annually and over a five-year period the baseline is then compared a subsequent 5-year target period 2015-2019. From the baseline and target period, percentage change of spatial extent is calculated using the following formula”:

$$\textbf{Percentage Change in Spatial Extent} = (\beta - \gamma)/\beta \times 100$$

Where β = the average national spatial extent from 2000-2004

Where γ = the average national spatial extent of any other subsequent 5-year period

4.2.3 Measuring Wetland Area

This methodology uses a 2017 baseline (based on input imagery data from 2016 to 2018 to even out potential annual biases). Wetland area dataset updates will allow for the calculation of the change of wetland area from the baseline reference period. Percentage change of spatial extent is calculated using the following formula:

Percentage change in wetland extent (β-γ)/β×100

Where β = the spatial wetland extent for the baseline reference period.

Where γ = the spatial extent for the reporting period.

4.2.4 Measuring Change in Mangrove Area

Data on mangroves area is available (for 1996, 2007, 2008, 2009, 2010, 2015 and 2016), with new annual data for the 2017 and 2018 period produced during 2020. For the purpose of producing national statistics, the year 2000 has been used as a proxy based on the 1996 annual dataset to align this baseline with the surface water dataset. National mangrove extent for the year 2000 will be used as the baseline reference period, against which annual mangrove extent is compared. It should be noted that the data provided by the UN over estimated the extent of mangroves in South Africa.

Percentage change of spatial extent is calculated using the following formula:

Percentage Change in Spatial Extent=(β-γ)/β×100

Where β = the national spatial extent from year 2000

Where γ = the national spatial extent of any other subsequent annual period

4.3 Sub-Indicator 1 and 2 (6.6.1D(2)): Quality of Water in Ecosystems

4.3.1 Measuring Lake Turbidity and Trophic State

A baseline reference period has been produced utilizing monthly averages across 5 years of observations (2006-2010). From these five years of data, 12 monthly averages (one for each month of the year) for both trophic state and turbidity, were derived. A further set of observations are then used to calculate change against the baseline data. These monthly data sets comprise years 2017,2018 and 2019. The 12 monthly averages (monthly deviation of the multiannual baseline) for these three years have been calculated using the following equation:

((Month_average - Month_baseline) / Month_baseline) x 100

For each pixel, and for each month, the number of valid observations is counted and the number of months where there are monthly deviations, falling in one of the following range of values: 0-25%, 25-50% (medium), 50-75%, 75-100% (high). An annual deviation synthesis is also produced.

4.4 Sub-Indicator 2 (6.6.1D(3)): Quantity of Water in Ecosystems

4.4.1 Measuring or Modelling River Flow (discharge)

River and estuary discharge, or the volume of water moving downstream per unit of time, is an essential metric for understanding water quantity within an ecosystem and availability for human use. Key considerations for monitoring discharge and provides criteria for discharge data generated to support Indicator 6.6.1 include the following:

- Common in-situ monitoring methods: There are a variety of methods for monitoring discharge in situ and selection should be based on the size and type of the waterbody, terrain and velocity of water flow, the desired accuracy of measurement, as well as finances available. The most common and accessible approaches are gauging stations and current meters. Propeller, pygmy or electromagnetic current meters are often used to measure velocity and can be used in conjunction with cross-sectional area methods to obtain flow rates.

- Location of Monitoring: The chosen monitoring method may dictate where along a river or estuary the discharge is captured. The minimum monitoring effort is to locate one flow measuring site within proximity to each basin's exit (into another basin). Where there is a local impact on discharge due to human influence, then it is recommended to monitor flow upstream and downstream of these areas so that the overall situation can be managed.
- Frequency of Monitoring: The quantity of water in a river or estuary can change rapidly in response to rainfall and weather patterns. Data on discharge should ideally be collected at a given location once a month at minimum (ideally at a daily frequency) and this data can then be used to determine annual and long-term trends. The quantity of water in estuaries may be significantly influenced by tidal inflows, thus this indicator is limited to the freshwater inflows to the estuary from the upstream river.
- Modelling Discharge: In addition to in situ monitoring which always is impacted by all forms of flow moderation, storage or abstractions upstream, discharge may also be modelled from one of the many available models which use climatic and land-use data, amongst other data, to estimate both natural and present-day flows. It is recommended that modelled discharge data is complimented by measured in situ data wherever possible to ensure accuracy.

4.5 Additional National Indicator 6.6.1D(4)

4.5.1 Measuring Quantity of Groundwater within Aquifers

The changes to the quantity of groundwater within aquifers is important information for many countries that rely heavily on groundwater availability. For the purposes of Indicator 6.6.1 monitoring the changes to groundwater levels gives a good indication of changes to the water stored in an aquifer. Furthermore, only significant ground water aquifers, that can be seen as individual freshwater ecosystems will be included in the reporting.

Groundwater level data statistics generate a proxy to the quantity of groundwater in an aquifer over time. To examine this change over time, percentage change in groundwater level will be generated and validated between the custodian agency(s) and the country. Calculating percentage change at a national level requires the establishment of a common reference period for all basins, which can either be based on historical groundwater level data (preferred) or modelled data if available. In cases where these are unavailable, a more recent period can be adopted to represent the 'baseline' or reference period.

5 SDG 6.6 South African Methodology Review

The methodology documents reviewed for South Africa's SDG 6.6 reporting include the following documents:

- Methodology Report: SDG Target 6.6 - Water Related Ecosystems. Edition 01 (Version 08). DWS, 2021; and
- Indicator 6.6.1D(1) Spatial Extent of Water-Related Ecosystems Baseline Data - definition and method of computation, DWS, March 2022.
- Methodology for Measuring Lake Turbidity and Trophic State, DWS, July 2022.

The global methodologies for SDG 6.6.1 have been reviewed and are applicable and relevant to the South African water context. The data utilized for the formulation of the global data sets is required to be reviewed at a local level to determine the validity of the global data sets presented by the UNEP.

The existing domesticated methodologies for SDG 6.6 have also been reviewed and assessed to determine the adequacy of the current SDG 6.6. indicators to influence national decision-making and show progress against SDG 6.6. A brief overview of the methodologies used for each indicator is summarized with a more critical review of the methods, included below.

5.1 SDG6.6 General Methodology Review Feedback

The methodologies are numbered according to the South African reporting nomenclature system, some discrepancies seem to be present when comparing the South African numbering system to the UNEP numbering. Where possible alignment to the UN numbering system should be used to aid cross referencing and verification of data sets.

The methodologies have all been based on the UN SDG 6.6 indicator methodologies, which provides a good baseline off which to work. The domesticated and additional methodologies are recognised to have been developed by different teams with integral knowledge of the subject matter. Despite the variety of authors, it is recommended that the different methodologies be presented in a standardised format, for ease of reference and to ensure that the key content is communicated for future reporting requirements. The primary components identified and recommended to be included in all methodologies include the following:

- Title: Indicator
- Institutional Information
- Concepts and Definitions
  - Definitions
  - Rational
  - Concepts
- Methodology
  - Computation Method
- Data Sources
- Data Availability
- Calendar
- Management Targets
- Data Providers/Compilers
- References
- Related Indicators
- Approval

The methodologies developed should be compiled to ensure that they meet sustainable reporting requirements. Key components to take into consideration in relation to sustainable reporting requirements include:

- Long term consistency, using representative and sustainable data collection practices; and
- Consistency of data sets required for comparison during all consecutive UN reporting years.

5.1.1 Methodology Report SDG Target 6.6 Observations

Acronyms

A suite of acronyms is included in the report on page vi, however many acronyms that appear in the text are not included in the acronym list. The omitted acronyms identified are summarised in Table 5-1.

Table 5-1 Omitted Acronym List

Acronym		Comment
CMAs	Catchment Management Agencies	
DRDLR	Department of Rural Development and Land Reform	DALRRD included in the list, however, differs to the acronym used in the report
FEPA	Freshwater Ecosystem Priority Areas	

Acronym		**Comment**
GFCS	Global Framework on Climate Services	
GSWE	Global Surface Water Explorer	
GSW	Global Surface Water	
GWLS	Groundwater Level Status	
INDC	Intended nationally determined contribution	
IUCN	International Union for Conservation of Nature	
IWRM	Integrated Water Resource Management	
MAMSL	Meters Above Mean Sea Level	
NBF	National Biodiversity Framework	
NBSAP	National Biodiversity Strategy and Action Plan	
NCA	National Capital Accounts	
NCCAS	National Climate Change Adaptation Strategy	
NDC	Nationally Determined Contributions	
NEMBA	Biodiversity Act (NEMBA, Act 10 of 2004)	
NPAES	National Protected Areas Expansion Strategy	
NRM	Natural Resource Management	
NSoW	National State of Water Report	
NWRS	South African National Water Resource Strategy	
NW&SMP	South African National Water and Sanitation Master Plan	
RDMs	Resource Directed Measures	
REC	Recommended Ecological Category	
REMP	The River Ecostatus Monitoring Programme	RHP in methodology report, does not exist anymore and should be The River Ecostatus Monitoring Programme
RSA	Republic of South Africa	
SAEON	South African Environmental Observation Network	
SAWS	South African Weather Service	
SEEA	System of Environment & Economic Accounting	
SEMA's	Specific Environmental Management Acts	
LDN	Land Degradation Neutrality	
UNCCD	United Nations Convention to Combat Desertification	
UNFCCC	UN Framework Convention on Climate Change	
USGS	United States Geological Survey	
WRC	Water Research Commission	

Typographical Errors

Various typographical errors have been identified in the text and will be compiled in a track change version of the document.

The cross referencing of tables within the text needs to be updated across much of the report.

5.2 Indicator SDG 6.6.1D(1a): Change in Spatial Extent of Rivers (In Development) Methodology Review

The SDG sub-indicator 6.6.1D(1a) is intended to monitor changes in the geographical extent of large rivers over time. This indicator is currently under development. The coverage of such water bodies does not solely comprise the river itself but also includes its surrounding riparian zone. Therefore, monitoring rivers is necessary to be able to identify changes in flow, which may influence water habitats. Currently, there are several gauge networks in South Africa that allow for changes in river flow to be monitored, however, the acquisition of spatial data is crucial to be able to identify the consequences of such changes in flow.

Appendix A of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(1a) indicator methodology, August 2021, was noted to still be under development. Table 5-2 summarises the methodology developed to date.

Table 5-2: SDG 6.6.1D(1a) Indicator Methodology

Indicator		Aim	Methodology
6.6.1	Change in the extent of water-related ecosystems over time: - use the image differencing to identifying spatial changes in surface overtime		
6.6.1.1 (UN - 6.6.1.a)	Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes and estuaries as a percentage of total land area	**Change in Spatial Extent of Rivers (6.6.1D (1a))**	
		To use the image differencing to identifying spatial changes in surface overtime	Developing a continuous spatial boundary for selected main rivers across the country. Next step, investigate the extent of mapped surface water for these rivers per the following: - Identification and selection of the imagery data - Determine the period i.e., same season/period - Selection and deployment of the change detection toolset - Processing of the images - Assessment of processed digital results

Currently the spatial extent of rivers is only mapped up until a 1:50000 km scale, hence, resulting in the provision of partial data records for large river bodies. Therefore, the development of a continuous spatial boundary for large river channels in South Africa is currently in progress. The spatial extent of these water bodies would then be monitored to identify any changes over time. This will be undertaken using image differencing, the same period or season, image processing and finally, an assessment of the processed results. The inclusion of data pertaining to the riparian zones would also be beneficial in providing indications of change. Furthermore, during data analysis and monitoring changes in spatial extent of rivers over time, it is important to be able to distinguish between the different causes of change.

It should be noted that the global methodology makes provision for measuring large rivers, however South African rivers are too narrow to be identified using the current satellite imagery and as such can't be measured. The only parameter that can currently be measured is length, which is unlikely to change. This present a challenge in terms of reporting the spatial extent of rivers.

5.2.1 Indicator SDG 6.6.1D(1a) Methodology Observations

The SDG 6.6 Methodology Report notes the following in relation to the development of SDG 6.6.1 (1a) "the intention of the 6.6.1 method was only to use river extent in special circumstances e.g., large, wide rivers that are not gauged e.g., the Ganges, Amazon etc., South Africa could potentially benefit from further exploration of this indicator as a means of tracking how much inundation there is at a given time and thus how much inundated habitat there is. Although South Arica does have gauges that provide data on flow changes, spatial data provides an indication of what this means in terms of the area of permanent water habitat that is either gained or lost, which impacts the health of freshwater species.”

5.2.2 UNEP SDG Target 6.6 (June 2020)

The South African Response to the UNEP SDG Target 6.6 (June 2020) states that, in the context of the global dataset representing less than 10% of South Africa’s spatial extent of rivers, “Moving forward South Africa will work towards preparing a baseline river area dataset for priority large rivers, against which the global change datasets could be applied.”

According to Stuart Crane of the UNEP (personal coms. 22 November 2022), the UN is utilizing global, consistent, satellite imagery for the calculations of the extent of rivers. The UN is aware of the challenges the current SDG 6.6.1 spatial extent of rivers poses to many countries. As a result, the UN is considering modifying the methodology to utilize rainfall and runoff orientated data to measure the flow in rivers rather than the spatial extent.

5.3 Indicator SDG 6.6.1D(1b) and SDG 6.6.1A(1c): Change in Spatial Extent of Wetlands, including Lakes, Vegetated Wetlands and Ephemeral Wetlands Methodology Review

The SDG sub-indicator SDG 6.6.1D(1b) and SDG 6.6.1A(1c) monitors changes in the spatial extent of wetlands, which comprises of lakes, vegetated wetlands and ephemeral wetlands. Vegetated wetlands include palustrine, peatlands and mangroves. Ephemeral wetlands refer to arid and seasonal wetlands, which only occur during certain periods. Lacustrine wetlands, which refer to open water bodies with fringing vegetation will also be monitored.

The United Nations Environment Programme (UNEP) provided earth observation data, with methodologies developed in South Africa used for the validation and assessment of these datasets. The validation results showed that the full extent of wetlands as represented by the global data underestimated the actual spatial extent of South Africa’s wetlands. Therefore, this sub-indicator is monitored using nationally derived datasets to better represent South Africa’s wetlands.

Appendix B of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(1b) and SDG 6.6.1A(1c) indicator methodology, Version 2, December 2020. Table 5-3 summarises the methodology developed to date

Table 5-3: SDG 6.6.1D(1b) and SDG 6.6.1A(1c) Indicator Methodology

<table>
<tr><th colspan="2">Indicator</th><th>Aim</th><th>Methodology</th></tr>
<tr><td>6.6.1</td><td colspan="3">Change in the extent of water-related ecosystems over time:
- use the image differencing to identifying spatial changes in surface overtime</td></tr>
<tr><td rowspan="2">6.6.1.1 (UN - 6.6.1.a)</td><td rowspan="2">Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes and estuaries as a percentage of total land area</td><td colspan="2">Change in Spatial Extent of Wetlands, including Lakes, Vegetated Wetlands, and Ephemeral Wetlands (6.6.1D (1b))</td></tr>
<tr><td>Two wetland types: Vegetated and Lacustrine (possibly lake). An additional wetland type is proposed as Ephemeral.
Areal extent of 75 estuarine lakes included the EFZ has been mapped in 2020. Changes in the areal extent of these lakes can be monitored, including bathymetry validation.</td><td>The national percentage (%) change in spatial extent will be calculated using the following formula
Percentage change in spatial extent = $100 * (\beta - y)/\beta$
β = the average national spatial extent from determined baseline period
y = the average national spatial extent of any other 5-year period</td></tr>
<tr><td></td><td></td><td colspan="2">Change in the Ecological Condition of Wetlands (6.6.1A (1c))</td></tr>
</table>

Indicator		Aim	Methodology
6.6.1.5 (UN - 6.6.1.d)	Change in the ecological condition of rivers, estuaries, lakes and wetlands	Measures the baseline condition that is expressed as the Present Ecological State (PES) the % value of the reach in comparison of the total river length. The baseline input data for the ecological condition of rivers expressed would be the 2011 PES EI and ES study.	The change in ecological conditions can be calculated using the following formula: Percentage Change in Ecological Condition $=100 * (\beta - y)\beta$ Where β = the ecological condition 2014 Where y = the ecological condition for any other period

5.3.1 Indicator SDG 6.6.1D(1b) Methodology Observations

The methodology is well structured, introducing the methodology and including definition and rational for the indicator, followed by the methodology and computational method used.

The methodology appears incomplete in relation to Section B4. Data Sources, Section B7. Management Targets and Section B8. Comments and Limitations. The inclusion of some text stating the relevant or lack of information in these sections would help improved the completeness of the methodology. It is understood that the team is working on setting the management targets, which have been challenging due to the use of different methodologies in the NBA 2011 and 2018 reports. The intention is that the next NBA report will help to set a new baseline data set around which management targets can be developed.

The cross referencing of tables within the text needs to be updated to reflect the Appendix numbering system.

Tables B2 and B3 include a key defining the role of the various data providers, however there is no variety in the indicators presented in the tables. Furthermore, the tables appear to be a repeat of one another when Table B2 is intended to present Data providers (as presented), while Table B3 is intended to present Data compilers, but is presenting Data providers.

Time Frame Proposed Change

A significant change to the global methodology is presented, in relation to the time frame for assessing change in spatial extent of ephemeral wetland systems, with the suggestion of a 10-year timeframe comparted to the global standardised 5-year timeframe. Taking into consideration the nature of the ephemeral wetlands found in over a third for the South African identified wetlands, makes this suggestion appropriate in the South African context, however this variation in timeframe may be confusing or appear to be an omission when comparing to global standardized data sets. South Africa should aim to align the reporting timeframe to the global 5-year reporting period, where possible, to ultimately align to the UN reporting standard in time.

Computation Method Error

The two formulas presented in the methodology under Section B2.1.1. and B 2.1.2. present two different calculations, as follows:

Section B2.1.1. Wetlands

Percentage Change in Spatial Extent=100x(β-γ)β×100

Where β = the average national spatial extent in 2000

Where γ = the average national spatial extent of any other subsequent 5-year period

Section B2.1.2. Lakes

Percentage Change in Spatial Extent=(β-γ)/β×100

Where β = the average national spatial extent from determined baseline period

Where γ = the average national spatial extent of any other subsequent 5-year period

Section 4.2 of this report summarises the method proposed by the UN for calculating the change in surface area of permanent and seasonal surface water. The second formula presented in Section B2.1.2. is aligned to the UN calculation, while the formula presented under Section B2.1.1 differs from the UN calculation. It is assumed that the second formula, being the UN calculation, is the formula that should be used in both calculations.

Data Sources

Data for monitoring the spatial extent of wetlands is acquired from national geodatabases. These datasets are then merged with national level datasets to locate overlapping areas, which are incorporated into mapping exercises to monitor the spatial extent of wetlands. This is undertaken through the National Wetland Map Version 5 (NWM5). However, due to certain limitations and a low confidence level, improvements will be made in an updated NWM i.e. Version 6. Baseline datasets are then derived for vegetated wetlands, ephemeral and lacustrine systems in NWM5. The national percentage change in spatial extent is, thereafter, determined for a five-year period. With regards to ephemeral wetlands, the use of a period that is at least 10 years is recommended to produce reliable results. These wetlands do not occur permanently in the year and need to be monitored for longer periods than vegetated wetlands, which occur throughout the year.

5.3.2 UNEP SDG Target 6.6 (June 2020)

The South African Response to the UNEP SDG Target 6.6 (June 2020) states that, in the context of the global dataset including 75 estuarine lakes which have been included in the Estuarine Functional Zone (EFZ), “will in future need to undertake further studies to validate and identify any other lakes that may exist in the country.”

5.3.3 Methodology Testing

The baseline data set for the extent of water related ecosystems at a point in time, including wetlands, reservoirs, lakes and estuaries as a percentage of total land area is available for 2018 data, see Figure 5-1. No follow up data sets are available, and as a result, no change in spatial extent has as yet been calculated in relation to the baseline.

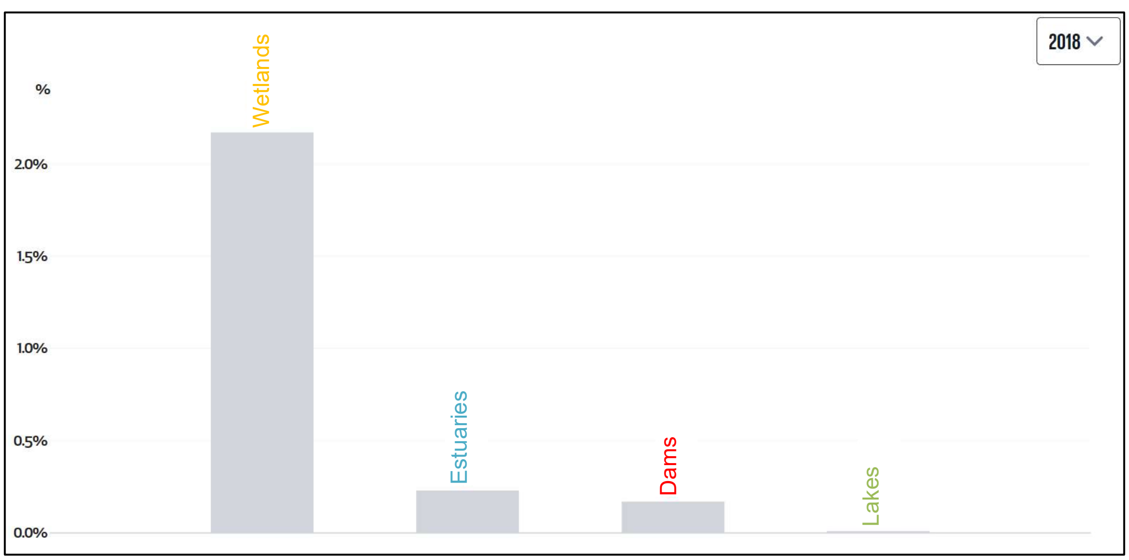


Figure 5-1 UN SDG 6.6/1D (1a) Extent in the spatial extent of water related ecosystems at a point in time, including wetlands, estuaries dams and lakes as a percentage of total land area

5.4 Indicator SDG 6.6.1D(1c), SDG6.6.1A(2) and SDG 6.6.1A(1b): Change in Spatial Extent (Open Water) of Estuaries Methodology Review

The sub-indicator SDG 6.6.1D(1c), SDG 6.6.1A(2) and SDG6.6.1A(1c) monitors changes in the extent of estuaries over time. It is domesticated based on circumstances in South Africa. The primary difference between the global and national (South Africa) indicators is the addition of monitoring changes in the Estuarine Functional Zone (EFZ). This zone is basically an area comprising of the estuary itself as well as additional characteristics, processes and surrounding habitats that allows for the functionality of the estuary. Therefore, while SDG 6.6.1 D (1c) has been domesticated, an additional indicator (6.6.1 A (2)) is also reported on in South Africa. In addition to being used to monitoring EFZ solely, the EFZ datasets can also be used to justify or support changes that occur in the estuary.

Appendix C of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(1c), SDG 6.6.1A(2) and SDG6.6.1A(1c) indicator methodology, Version 2, December 2020. Table 5-4 summarises the methodology developed to date.

Please note the numbering of SDG6.6.1A(1c) is reflected as indicator SDG6.6.1A(1b) elsewhere in the methodology report. Please verify and use a consistent numbering system for this indicator.

Table 5-4: SDG 6.6.1D(1c), SDG6.6.1A(2) and SDG 6.6.1A(1c) Indicator Methodology

Indicator		**Aim**	**Methodology**
6.6.1	Change in the extent of water-related ecosystems over time: - use the image differencing to identifying spatial changes in surface overtime		
6.6.1.1 (UN - 6.6.1.a)	Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes and estuaries as a percentage of total land area	**Change in Spatial Extent of Estuaries (6.6.1D (1c))**	
		The surface area of estuaries. It is measured in km^2 or hectares. This includes the entire functional zone and not only the open water area. The percentage change in area of estuaries from a baseline reference. For reporting such change, the previous extent, if known, and the period over which the change has taken place should be specified.	The surface area of estuaries. It is measured in km^2 or hectares. This includes the entire functional zone and not only the open water area. The percentage change in area of estuaries from a baseline reference. For reporting such change, the previous extent, if known, and the period over which the change has taken place should be specified.
		Change in the Extent of Estuarine Functional Zones (EFZ) (6.6.1A (2))	
		The South African estuarine functional zone (EFZ) is seen as the entire area associated with an estuary that ensures its functionality.	The extent of South African estuaries is based on available remote sensing data available through the CSIR and SANBI for the National Biodiversity Assessment, which is a 5 yearly project. Ramsar definition and classification is found in the document "Guidance on information on national wetland extent, to be provided in Target 8 National Wetlands Inventory of the Ramsar National Report for COP13".
		Change in the Ecological Condition of Estuaries (6.6.1A (1b))	

Indicator		Aim	Methodology
6.6.1.5 (UN - 6.6.1.d)	Change in the ecological condition of rivers, estuaries, lakes and wetlands	Measures the percentage change in the ecological condition of estuaries over time, defined from a baseline condition and expressed as the Present Ecological State (PES), the %value of the ecological state in comparison to the baseline ecological condition.	The method/model applies a modified Index of Habitat Integrity (IHI) approach; using existing, field verified data or data from research projects. In areas where no data exists, satellite data (Google Earth) will be used, local knowledge and expert opinion. The approach is based on assessing the degree of modification of the following criteria: - Instream habitat continuity - Riparian area or wetland habitat continuity - Potential instream habitat function, processes, and biota - Riparian or wetland zone structure and composition - Flow and flood regimes; and - Physico-chemical conditions

The disaggregation of data for estuaries is based on their biogeographical region and type of estuary that is being monitored. There are currently four biogeographical regions in South Africa, namely tropical, sub-tropical, warm temperate and cold temperate regions. Furthermore, there are a total of nine estuary types, which each have their respective characteristics that allow for the classification of an estuary. The methodology used to monitor the spatial extent of estuaries includes the acquisition of estuarine data from satellite sources, which is regarded as the baseline. The data sources include SPOT 5 imagery, Google Earth images, 5 m topographical contours and georeferenced 1:10000 ortho-photos. The change in the extent of estuaries is then determined using the baseline estuarine and current estuarine area, after which, the percentage change in the extent of estuaries can be calculated.

5.4.1 Indicator SDG 6.6.1D(1c), SDG6.6.1A(2) and SDG 6.6.1A(1b) Methodology Observations

The methodology is well structured, introducing the methodology and including definition and rational for the indicator, followed by the methodology and computational method used.

The cross referencing of tables within the text needs to be updated to reflect the Appendix numbering system. In addition, Table C3's heading to not reflecting the same caption style as the tabular captains within the methodology.

Tables which are split across pages need to include the header row, for ease of reading.

Table 1C effectively summarises the South African estuaries according to the classification system of van Niekerk et al (2019). The three types of micro-systems identified in van Niekerk et al (2019) should be summarized in a tabular format, like Table 1C, for consistency purposes.

Section 2.3 Concepts presents a summary of the data presented in Table C4. The areas and percentages presented should reference the date of the data being presents, i.e. 2018. The areas and percentages presented in the text do not corelate with the data presented in Table C4.

Computation Method

The computational method presented in Section C3.1 is presented in words, unlike similar methodologies. Utilisation of a formula for the calculation of the methodology would be preferable from a consistency perspective, as follows:

Change in the Extent of Estuaries=(β-γ)

Percentage Change in the Extent of Estuaries=(γ/β)x100

Where β = baseline estuarine area (ha or km^2)

Where γ = current reporting cycle estuarine area (ha or km^2)

The formula presented differs from the UN calculation of ((β-γ)/β)x100. The UN calculation presents a globally consistent data interpretation calculation and is therefore considered applicable for use from a global reporting perspective. Section 4.2 of this report summarises the method proposed by the UN for calculating the change in surface area of permanent and seasonal surface water. In order to maintain a consistent reporting approach for the indicators; inclusion of the UN calculations is pertinent for indicator SDG 6.6.1D(1c).

Data Sources

The data collected for this indicator in 2011 and 2018 is noted to have been collected form "various sources". In order to maintain a consistent and comparable data set, variability in the data sources and information obtained from these data sources could create false data changes, induced as a result of the data source rather than changes in the geographic extent of the surface water feature.

The technological advances in satellite imagery and image processing is resulting in significant advances in the available data and the integrity of that data. Global comparative reporting is therefore challenging and needs to be taken into consideration when comparing data sets.

5.4.2 UNEP SDG Target 6.6 (June 2020)

The South African Response to the UNEP SDG Target 6.6 (June 2020) states that, in the context of the global dataset not separating out the estuarine area from the other natural surface waters. "Should this (estuarine open water area) statistics become available an exercise would need to be undertaken within South Africa in order to verify the statistics as existing datasets within South Africa do not map open water extents for Estuaries but rather changes in the EFZ, which is undertaken in order to sufficiently inform management actions."

5.4.3 Methodology Testing

The baseline data set for the extent of water related ecosystems at a point in time, includes a comparison of the extent of the South African EFZ according to the 2011 and 2018 NBA (van Niekerk et al., 2012 and 2018). Table 5-5 utilizes the date presented in DWS SDG6.6 Methodology Report, Table 4C, and expands upon it based on the prescribed computation method presented in the methodology, with the results depicted in Figure 5-2 and Figure 5-3, respectively.

Table 5-5 A comparison of the extent of the South African Estuarine Functional Zone according to the 2011 and 2018 NBA (van Niekerk et al., 2012 and 2018)

Biogeographical Region	2011 NBA – Proportional EFZ (ha)	2018 NBA – Proportional EFZ (ha)	Change in the Extent of Estuaries (ha) (β-γ)	Percentage Change in Extent of Estuaries (γ/β)x100	UN Percentage Change in Spatial Extent (β-γ)/βx100
Cool Temperate	26,516	37,680	-11,164	142%	-42%
Warm Temperate	41,785	44,500	-2,715	106%	-6%
Sub-tropical	102,746	110,390	-7,644	107%	-7%
Tropical		8,170	-8,170	100%	
Total	171,047	200,740	-29,693	117%	-17%

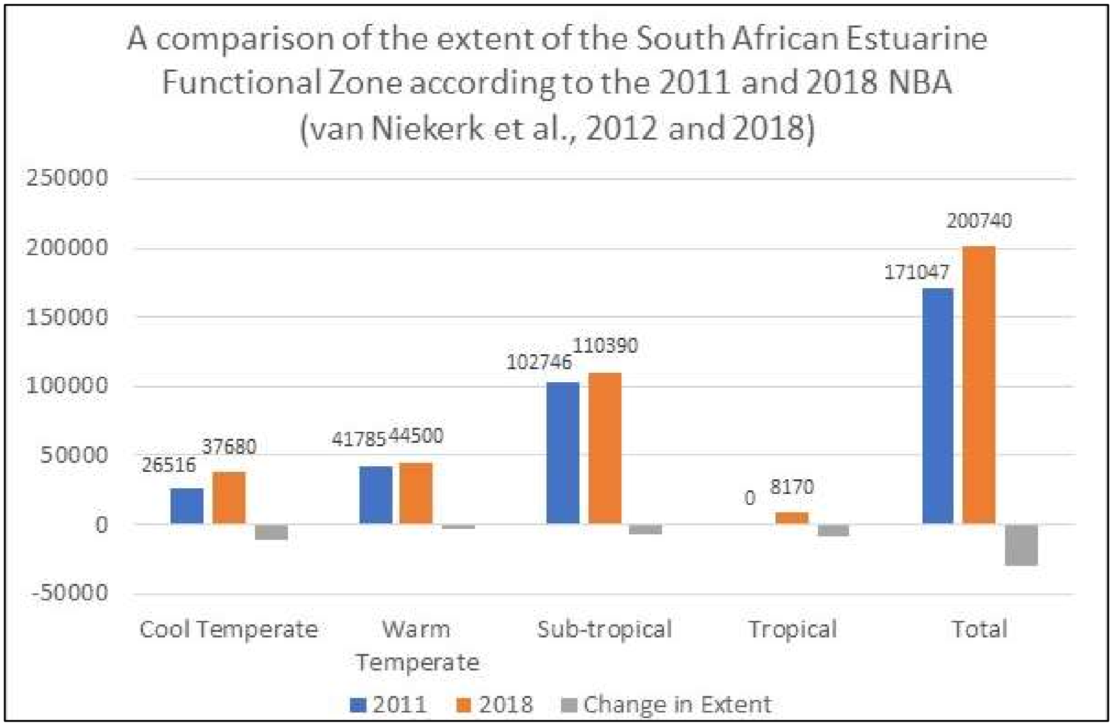


Figure 5-2 A comparison of the extent of the South African Estuarine Functional Zone according to the 2011 and 2018 NBA (van Niekerk et al., 2012 and 2018)

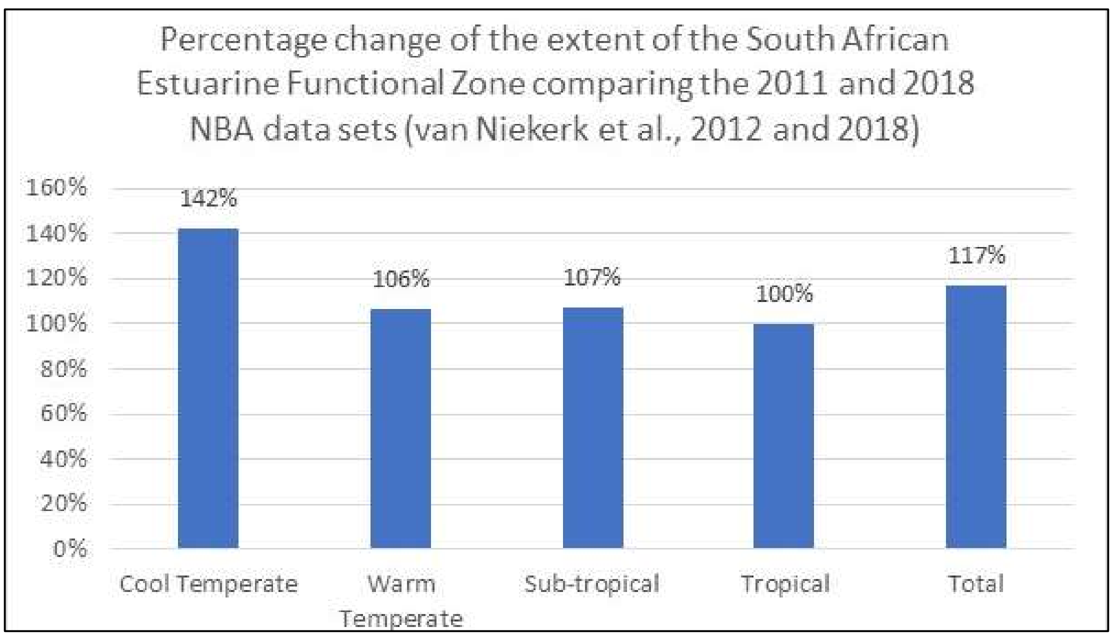


Figure 5-3 Percentage change of the extent of the South African Estuarine Functional Zone comparing the 2011 and 2018 NBA data sets (van Niekerk et al., 2012 and 2018)

The method proposed to calculate the change in spatial extent of the estuarine functional zone is considered to be a well thought through set of formulas, which present a usable data set for interpretation of changes going forward. However, the UN calculation presents a globally consistent data interpretation calculation and should therefore be considered for use, from a global reporting perspective. Figure 5-4 presents a results of the UN calculations when comparing the baseline spatial extent of the South African Estuarine Functional Zone to the subsequent data set (2018).

Please note this formula yields percentage change values as either positive or negative, which helps to indicate how spatial area is changing. According to the UN Water Sustainable Development Goal Monitoring Methodology Indicator 6.6.1 "If the value is shown as positive, the statistics represent an area gain while if the value is shown as negative, it represents a loss in surface area." Using the UN calculation for this dataset, suggests that the interpretation of the positive and negative figures in this calculation are contrary to the proposed interpretation. The data shows how spatial area changes, where a negative value, represents an area gain, while a positive value presents an area loss.

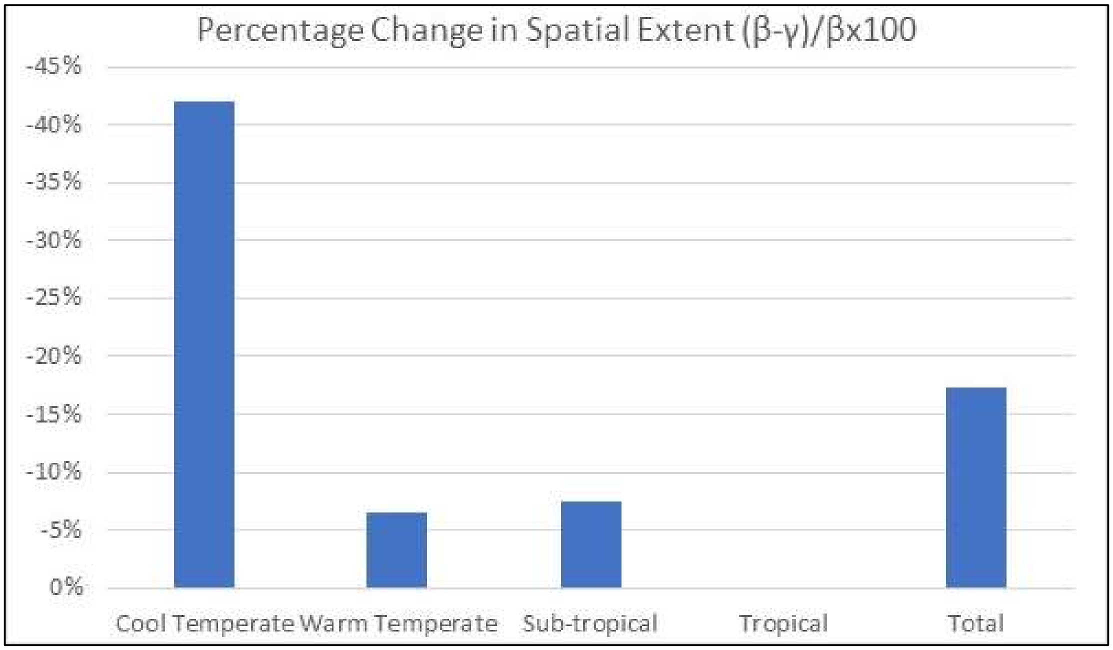


Figure 5-4 Percentage change of spatial extent of the South African Estuarine Functional Zone comparing the 2011 and 2018 NBA data sets

5.5 Indicator SDG 6.6.1D(1d): Change in Spatial Extent of Artificial Systems Methodology Review

SDG 6.6.1 D (1d) measures the change in the spatial extent of reservoirs over time. While these water bodies are man-made, they hold a significant amount of our freshwater resource. Therefore, monitoring the changes in the spatial extent of artificial systems is also crucial as it is representative of changes in water quantity levels. Drastic changes in water quantity will not only impact the availability of freshwater but may also affect ecosystem habitats and its functions.

Appendix D of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(1d) indicator methodology, Version 2, June 2021.

Table 5-6 summarises the methodology developed to date.

Table 5-6: SDG 6.6.1D(1d) Indicator Methodology

<table>
<tr><th colspan="2">Indicator</th><th>Aim</th><th>Methodology</th></tr>
<tr><td>6.6.1</td><td colspan="3">Change in the extent of water-related ecosystems over time:
- use the image differencing to identifying spatial changes in surface overtime</td></tr>
<tr><td rowspan="2">6.6.1.1 (UN - 6.6.1.a)</td><td rowspan="2">Change in the spatial extent of water-related ecosystems over time, including wetlands, reservoirs, lakes and estuaries as a percentage of total land area</td><td colspan="2">Change in Spatial Extent of Artificial Systems (Reservoirs) (6.6.1D (1d))</td></tr>
<tr><td>Measurement of the percentage change in the surface area of reservoirs over time from a predefined baseline, expressed as a % of the total land area</td><td>The baseline for artificial water bodies or Dams was captured using the aerial photography but the updating will be done using High Resolution Satellite Imagery such as:
• SPOT 67,
• Sentinel,
• Landsat 8 and
• Physical Measurements.
Advanced computing technology can be programmed to summarise all of these images and split the earth into land cover type pixels, one of which is open water.
Limitations include various versions of datasets. The other limitation is that not all artificial systems are accounted for.</td></tr>
</table>

The methodology currently used to monitor changes in the spatial extent of artificial systems incorporates the use of Landsat 8 satellite imagery. Initially, aerial photography was used to capture these images, however, this is currently in the process of being updated and will involve aerial photography being replaced by high resolution satellite data such as Sentinel and Landsat and SPOT 6 imagery. When monitoring one location, several satellite images may be required, however, this has become more applicable due to advanced computing technology. After the acquisition of data for each dam, these records will then be integrated to produce one dataset representing dams on a national level. The accuracy of this dataset is expected to be high due to the integration of different high-resolution imagery. This dataset will ultimately be used to derive the percentage change of the spatial extent of artificial systems over time using a predefined baseline.

5.5.1 Indicator SDG 6.6.1D(1d) Methodology Observations

The methodology is well structured, introducing the indicator including definition and rational for the indicator, followed by the methodology and computational method used as well as data sources etc.

The figure and table numbering and titles need to be updated to reflect the Appendix numbering system. Many of the tables and figures did not have headings or numbered headings.

Computation Method

The computational method presented in Section D2.1 is present, as follows:

Percentage Change in Spatial Extent=$(\beta\text{-}\gamma)\beta x100$

“Where β = the average national spatial extent from 2013-2017”

“Where γ = the average national spatial”

The formula presented differs from the UN calculation of $((\beta\text{-}\gamma)/\beta)x100$. The UN calculation is assumed to be the formula that this indicator intended to follow. Section 4.2 of this report summarises the method proposed by the UN for calculating the change in surface area of permanent and seasonal surface water. The formula presented in Section D2.1. differs from the UN calculation and is recommended to be amended accordingly.

The dataset will be reported as one national value as well as being segregated into tertiary catchment boundaries with associated attribute tables. The segregation of the data will be more meaningful as a dataset to inform decision making going forward.

Data Sources

The data collected for this indicator in 2011 and 2018 is noted to have been collected form “various sources”. In order to maintain a consistent and comparable data set, variability in the data sources and information obtained from these data sources could create false data changes, induced as a result of the data source rather than changes in the geographic extent of the surface water feature.

The technological advances in satellite imagery and image processing is resulting in significant advances in the available data and the integrity of that data. Global comparative reporting is therefore challenging and needs to be taken into consideration when comparing data sets.

Management Targets

The following target has been set for the SDG 6.6.1D(1d) with the aim being to “maintain / improve spatial extent when compared to average over time”.

The computational methods presented in Section D8 for the calculation of target and indictor spatial extant, respectively, are present, as follows:

Target Spatial Extent (T)=E/N

Where “E = Σ(spatial extent of 1st dataset + ... + Spatial extent of 2017 dataset)”

Where “N = Number of data sets from 1st dataset to 2017”

Indicator Spatial Extent(I)=C-T

Where “C = Current Spatial Extent” of Reporting Year

Where “T = Target Spatial Extent”

Comments and Limitations

As mentioned above under “Data Sources”, the authors of the SDG 6.6.1D(1d) methodology have noted the challenges being experienced associated with “having different versions of dam datasets in the Department of Water Sanitation”. Further challenges are identified are listed below:

- Not all dams are accounted for making reporting difficult on all dams in the country.
- Accuracy also differs per dataset, limiting the compilation of comprehensive national dam reporting.

The 2017 baseline data will reportedly be replaced when the integrating of different dam datasets has been completed. According to the SDG 6.6.1D(1d) methodology a new baseline was to be determined by February 2020, to accurately compare future updates.

5.5.2 UNEP SDG Target 6.6 (June 2020)

The South African Response to the UNEP SDG Target 6.6 (June 2020) states that, in the context of the extent of artificial systems (reservoirs) “the number and aerial extents are significantly underrepresented”.

Furthermore, in relation to the baseline data set, which reportedly included a drought year affecting 26% of the summer rainfall extent of South Africa, a recommendation “that changes be reported for South Africa against a mean value derived from 36 years of data (Pekel et al., 2016)”. Reportedly “The DWS has recently initiated a project to produce an integrated Dam layer”, expected to be available in early 2021.

5.5.3 Methodology Testing

The baseline and follow up data set for the extent of artificial systems (reservoirs) were not included in the SDG Target 6.6 Methodology Report. As a result, no calculation testing could be undertaken to verify the computational methods presented.

5.6 Indicator SDG 6.6.1D(2a) and 6.6.1D(2b): Lakes and Dams Affected by High Trophic and Turbidity States Methodology Review

This sub indicator for SDG 6.6.1D(2a) and SDG 6.6.1D(2b) aims to monitor the change in the number of lakes and dams affected by high trophic states and turbidity. Trophic states refer to the productivity of water-related ecosystems in terms of the amount of available nutrients. Turbidity is the measure of relative clarity of a liquid, being a measurement of the amount of light that is scattered by material in the water when a light is shined through a water sample. Therefore, this indictor is a measure of water quality.

The aim of this sub indicator is to monitor changes in the number of lakes and dams affected by high turbidity states. Turbidity states is also a measure of water quality. It refers to the cloudiness of water bodies, which is based on the number of particles or sediments present. Therefore, high turbidity levels are an indication of large amounts of sedimentation, which will ultimately result in poor water quality. The poor water quality is since accumulated sediments can impact water-related ecosystems by contaminating the water, thus affecting aquatic organisms, and also by preventing light from reaching aquatic plants.

Appendix E of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(2a) and SDG 6.6.1D(2b) indicator methodology, Version 1, September 2021, with an updated version provided in July 2022. Table 5-7 summarises the methodology developed to date.

Table 5-7: SDG 6.6.1D(2a) and SDG 6.6.1D(2b) Indicator Methodology

<table>
<tr><th colspan="2">Indicator</th><th>Aim</th><th>Methodology</th></tr>
<tr><td>6.6.1</td><td colspan="3">Change in the extent of water-related ecosystems over time:
- use the image differencing to identifying spatial changes in surface overtime</td></tr>
<tr><td rowspan="4">6.6.1.2 (UN - 6.6.1.c)</td><td rowspan="4">Number of lakes and dams affected by high trophic and turbidity states</td><td colspan="2">Change in the number of lakes and dams affected by High Trophic States (6.6.1D (2a))</td></tr>
<tr><td>To use in-situ measurements, supplemented by satellite imagery to identify spatial changes overtime</td><td>Trophic state is assigned using the SA criterion for the calendar year and the dam is classified (median annual Chl a) as either oligotrophic (0< x <10), mesotrophic (10< x <20), eutrophic (20< x <30) or hypertrophic (>30). Monthly deviation of the multiannual baseline is computed using the following equation:
(Month_average-Month_baseline) / Month_baseline x 100</td></tr>
<tr><td colspan="2">Change in the number of lakes and dams affected by High Turbidity States (6.6.1D (2b))</td></tr>
<tr><td>Measurements of the water clarity of lakes and reservoirs/dams</td><td>The data represent the number of lakes impacted by a degradation of their environmental conditions (i.e. showing a deviation in turbidity and trophic state from the baseline) compared to the total number of lakes within a country. The values produced account for different sized lakes.</td></tr>
</table>

Indicator		Aim	Methodology
			Annual deviation of the multiannual baseline is computed using the following equation: (Annual_average - Baseline) / Baseline x 100

5.6.1 Indicator SDG 6.6.1D(2a) and SDG 6.6.1D(2b) Methodology Observations

The methodology is reasonably structured, introducing rational for the indicator, followed by the methodology and computational method used.

The methodology appears incomplete in relation to Section 3. Disaggregation of Data for Management Purposes, Section 10. Comments and Limitations, Section 12. Additional Information and Section 5. Approval. The inclusion of some text stating the relevant or lack of information in these sections would help improved the completeness of the methodology.

The labelling of tables and figures as well as the cross referencing of tables and figures within the text needs to be updated to reflect the Appendix numbering system.

Computation Method

The computational method presented for SDG 6.6.1D(2a) and SDG 6.6.1D(2b) is presented in words, in accordance with the UN SDG Monitoring Methodology (Section 4.3). The computational methods presented in Section 2.2 for the calculation of trophic state and turbidity, respectively, are present, as follows:

(Month_average - Month_baseline) / Month_Baseline x 100

(Annual_average - Baseline) / Baseline x 100

The first formula proposed for use is consistent with the UN calculation presented a globally consistent data interpretation calculation. The second formula is a domesticated calculation that is likely to align with the local data sets to be used for reporting and data interpretation.

Data Sources

The data collected for this indicator in 2011 and 2018 is noted to have been collected form 3 spatial tiers, namely national, regional and local are perspectives. The technological advances in satellite imagery and image processing is resulting in significant advances in the available data and the integrity of that data. Global comparative reporting is therefore challenging and needs to be taken into consideration when comparing data sets.

5.6.2 UNEP SDG Target 6.6 (June 2020)

The South African National Department of Water and Sanitation (DWS) have a number of monitoring systems that are used to provide information for water resource management.

For the water quality, the UNEP SDG Target 6.6 (June 2020) report lists 21 reservoirs. The UNEP EO data does not correlate with the ground-truth monitoring networks NEMP and EONEMP, suggesting that the country does not have issues related to nutrient enrichment of lakes/dams during the period 2017-2019. “The data generated through EONEMP is based on sound rigorous ground-truth validation method/satellite data/algorithm procedures suitable to SA conditions.”

5.6.3 Methodology Testing

The baseline and follow up data set for the tropic state and turbidity were not included in the SDG Target SDG 6.6 Methodology Report. As a result, no calculation testing could be undertaken to verify the computational methods presented.

5.7 Indicator SDG 6.6.1D(3a) and 6.6.1D(3b): Change in the Quantity of Water (discharge in Rivers and entering Estuaries) Methodology Review

Appendix F of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(3a) and SDG 6.6.1D(3b) indicator methodology, Version 1, September 2021. Table 5-8 summarises the methodology developed to date.

Table 5-8: SDG 6.6.1D(3a) and SDG 6.6.1D(3b) Indicator Methodology

<table>
<tr><th colspan="2">Indicator</th><th>Aim</th><th>Methodology</th></tr>
<tr><td>6.6.1</td><td colspan="3">Change in the extent of water-related ecosystems over time:
- use the image differencing to identifying spatial changes in surface overtime</td></tr>
<tr><td rowspan="4">6.6.1.3 (UN - 6.6.1.b)</td><td rowspan="4">Change in the national discharge of rivers and estuaries over time</td><td colspan="2">Change in the water Quantity in Rivers (6.6.1D (3a))</td></tr>
<tr><td>Measure and observe cumulative flow volume data</td><td>The percentage change of Total cumulative flow volume will be calculated using the following formula
Percentage Change of Total cumulative flow volume = $(TC_{7\ present} – TC_{7\ normal\ years})/TC_{7\ normal\ years} \times 100$
Baseline data will be captured using data in Hydstra database</td></tr>
<tr><td colspan="2">Change in the water Quantity entering Estuaries (6.6.1D (3b))</td></tr>
<tr><td>Measure change in flow into estuaries for change in water quality</td><td>This methodology describes how change in Total Volume of the water occurs due to variation in Rainfall, Evaporation and abstraction. DWS has identified gauging stations which includes dams from which to select representative monitoring sites for a chosen period of seven years.
Baseline data will be captured using data in Hydstra database</td></tr>
</table>

5.7.1 Indicator SDG 6.6.1D(3a) and SDG 6.6.1D(3b) Methodology Observations

The methodology is well structured, introducing the indicator with the associated definitions, rational and concepts, followed by the methodology including the computational method used.

The methodology appears incomplete in relation to Section F9. Management Targets, Section F10. Display of Results, Section F11. Comments and Limitations and Section F13. Additional Information. The inclusion of some text stating the relevant or lack of information in these sections would help improved the completeness of the methodology.

Section F12. Implementation Calendar appears incomplete, stating “The table below describes how reporting on this sub-indicator will be improved over time”. No table of further information is provided in the methodology.

Some minor terminology improvements could be made to this methodology, for example “some groundwater ooze” should be rephrased to be more scientifically correct i.e. ’some groundwater is daylighting at’.

Time Frame Proposed Change

A change to the methodology is proposed, in relation to the baseline calculation by, “The baseline dataset will be determined as total cumulative flow volume over an identified period of seven ‘normal’ years.” The use of this methodology is contrary to scientific norms. The selection of “normal” years would have been based on a prior determined average. It would therefore be more scientifically correct to rather extend the baseline monitoring period over a longer period of time, to accommodate a sufficient time period to allow for periodic highs and lows to be normalized.

Typical time frames used in the UN global standardised are monitored over a 5 year time-frame. The proposed variation in time-frame may be confusing or appear to be an omission when comparing to global standardized data sets.

Computation Method

The computational method presented for SDG 6.6.1D(3a) and SDG 6.6.1D(3b) is presented in words. There is no computational method prescribed in the UN SDG Monitoring Methodology (Section 4.3). The computational methods presented in Section F3.1 of the SDG Target 6.6 Methodology Report for the calculation of total cumulative flow volume is present, as follows:

Percentage Change of Total cumulative flow volume=

(TC7 present −TC7 normal years) / TC7 normal years ×100

Where “TC7 normal years = total cumulative flow volume of seven normal years”

Where “TC7 present = total cumulative flow volume of seven present years”

Despite the lack of a UN calculation, provides an improved calculation of the percentage change of the “present” in comparison to the “baseline”, correcting the UN formula and making it more usable. Section 4.2 of this report summarises the method proposed by the UN for calculating the change in surface area of permanent and seasonal surface water.

Data Sources

The data to be used is reportedly available and collected from monitoring sites from the eight Hydro Regional Offices, where selected gauging stations have been selected to provide representative monitoring sites. The reliance on existing gauging stations will provide a valuable baseline data set, however the location and as a result the regional distribution of these sites may not provide a nationally representative dataset for the country.

5.7.2 UNEP SDG Target 6.6 (June 2020)

The UNEP SDG Target 6.6 (June 2020) report does not contain any data or review of water quantity or volumes in relation to SDG 6.6.1D(3a(or SDG 6.6.1D (3b).

5.7.3 Methodology Testing

The baseline and follow up data set for the change in the quantity of water (discharge in rivers and entering estuaries) were not included in the SDG Target SDG 6.6 Methodology Report. As a result, no calculation testing could be undertaken to verify the computational methods presented.

5.8 Indicator SDG 6.6.1D(4): Change in Groundwater Level Status Methodology Review

The aim of sub-indicator SDG 6.6.1D(4) is to monitor the change in groundwater level status (GwLS), DWS has domesticated this sub indicator based on the diversity and complexity of the South African aquifer system as well as ongoing seasonal fluctuations due to climate change. The changes to the quantity of groundwater within aquifers is important information for many countries that rely heavily on groundwater availability. For the purposes of Indicator 6.6.1 monitoring the changes to groundwater levels gives a good indication of changes to the water stored in an aquifer.

Appendix G of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1D(4) indicator methodology, Version 2, June 2021. Table 5-9 summarises the methodology developed to date.

Table 5-9: SDG 6.6.1D(4) Indicator Methodology

Indicator		Aim	Methodology
6.6.1	Change in the extent of water-related ecosystems over time: - use the image differencing to identifying spatial changes in surface overtime		
6.6.1.4 (UN – None)	Change in groundwater levels over time	**Change in Groundwater Levels over time (6.6.1D (4))**	
		Three tier steps process for data collection of which the Department of Water and Sanitation (DWS) are the custodians of the National Groundwater Level Monitoring Programme (NGLMP)	Monthly, quarterly or bi-annually data is collected and uploaded onto the DWS HYDSTRA database. Various formulas have been derived to calculate different aspects of the methodology. For change in quantity the following formula was used: Percentage Change in Quantity = $\frac{\beta-\gamma}{\beta} * 100$ Where β = historical 15-year reference groundwater level and γ = the average groundwater level of 5-year period of interest. For change in groundwater levels the above formula has been adjusted to be negative: Percentage Change in Groundwater Levels = - $\frac{\beta-\gamma}{\beta} * 100$ The Groundwater Levels Status percentage is shown below: Status = $[-1 * Dgw - Cgw/Dgw - Sgw]\%$

5.8.1 Indicator SDG 6.6.1D(4) and Methodology Observations

The methodology is well structured and well compiled with a thorough explanation and cross referencing to the methodology used as well as explanation of the thinking behind the methodology used.

The labelling of some tables and section cross referencing within the text needs to be updated.

The section and figure relating the biodiversity act, is understood to be included to help shape the connection between groundwater and sensitive floral areas. The paragraph does not clearly make this connection known, making this section seem incongruent with the methodology.

Computation Method

The computational method presented for SDG 6.6.1D(4) is presented in comparison to the UN methodology, with the reason for the proposed domestication of the indicator presented. Furthermore, the methodology has been tested which has highlighted the negative values potentially reported using the UN methodology, with the appropriate corrections made to the domesticated indicators. The computational methods presented in Section 3.7 of the UN SDG6.6.1 Indicator Methodology for the calculation of groundwater percentage change in quantity and groundwater level status, are present, as follows:

Percentage Change in Quantity = −(β-γ)/βx100

Where "β = historical 15-year reference groundwater level"

Where "γ = average groundwater level of 5 year period of interest"

Groundwater Level Status Percentage Change = [−1 x (Dgw−Cgw)/(Dgw−Sgw)]x100

Where Sgw = “Shallowest groundwater level”

Where Dgw = “Deepest groundwater level”

Where Cgw = “Current groundwater level”

The frequency of monitoring the GwLS in South Africa is collected monthly, quarterly or bi-annually and uploaded within 30 days of collection whereas our global counterparts the UN collects data during seasonal and wet/dry cycle influences however the UN recommends that monthly monitoring would provide optimal data to assess change within the aquifer more adequately.

Data Sources

The data collected for this indicator is sourced from the National Groundwater Level Monitoring Programme. Data is collected monthly, quarterly or bi-annually and uploaded to the DWS HYDSTRA database, which dates back to the 1940’s covering South Africa’s 65 geohydrological regions.

The methodology for monitoring the change in GwLS incorporates the use of HYDSTRA which is a database owned and maintained by DWS to eliminate an influx of information not verified and approved by professionals. Many challenges arise due to insufficient and untrained staff collecting data as well as issues in travel and procurement. Measuring the level of groundwater within an aquifer is done through the use of boreholes. DWS has selected certain geosites earmarked for monitoring, and these sites extend across the four hydrogeological systems, similarly the UN also had trouble choosing boreholes which adequately represent the total groundwater situation for an aquifer.

5.8.2 UNEP SDG Target 6.6 (June 2020)

For the groundwater levels, the UNEP SDG Target 6.6 (June 2020) report lists the discrepancies that develop through elevation differences while using the groundwater level status. The use of the individual borehole water level range used as a percentage will guide the DWS to re-evaluate the regional aquifer delineation and focus on sub aquifer scale.

5.8.3 Methodology Testing

The baseline data set for the groundwater levels, includes baseline calculated over a 15 year period (2000 to 2015) and groundwater level status calculated on a 5 year period thereafter. utilizes the date presented in UN Indicator 6.6.1 Methodology, Table 5A, and expands upon it based on the prescribed computation method presented in the methodology, with the results summarised for the aquifer regions presented in the UN Indicator 6.6.1 Methodology in Figure 5-5 and Figure 5-6, respectively.

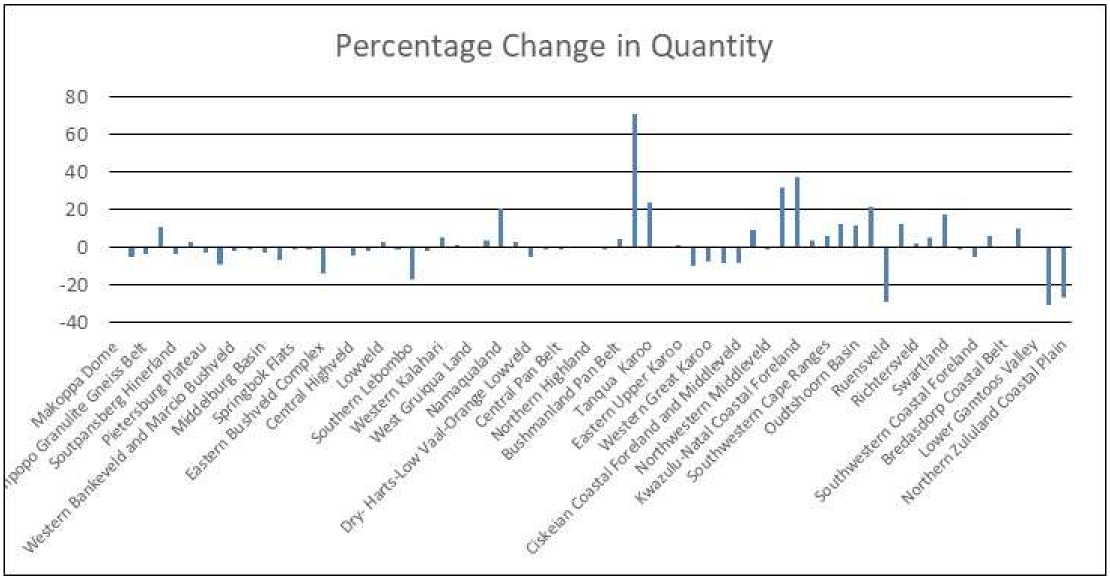


Figure 5-5 Percentage Change in Quantity (baseline (2000-2014) vs 5 yrs (2015-2019)

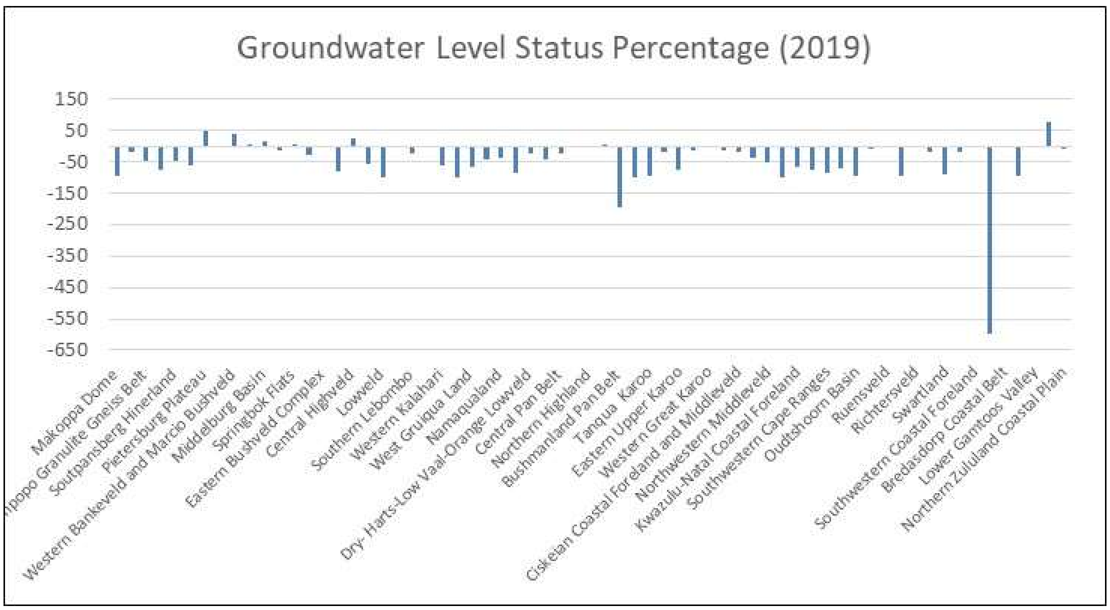


Figure 5-6 Groundwater Level Status Percentage Change

Management Targets

Management targets are dependent on the location of the hydrogeological system therefore the targets vary for regions along the coast as opposed to regions inland. The GwLS target is set at the 25th percentile and all regions should not drop below this set target.

5.9 Indicator SDG 6.6.1A(1a): Change in the Ecological Condition of Rivers Methodology Review

The sub-indicator SDG 6.6.1A(1a) is the only addition indicator identified within the South African context. This sub-indicator aims to monitor changes in the ecological conditions of extent of estuaries over time. It has been domesticated based on conditions in South Africa.

Appendix H of the Methodology Report Target 6.6: Water Related Ecosystems presents the SDG 6.6.1A(1a) indicator methodology, Version 2, November 2020. Table 5-10 summarises the methodology developed to date.

Table 5-10: SDG 6.6.1A(1a) Indicator Methodology

<table>
<tr><th colspan="2">Indicator</th><th>Aim</th><th>Methodology</th></tr>
<tr><td>6.6.1</td><td colspan="3">Change in the extent of water-related ecosystems over time:
- use the image differencing to identifying spatial changes in surface overtime</td></tr>
<tr><td rowspan="2">6.6.1.5 (UN - 6.6.1.d)</td><td rowspan="2">Change in the ecological condition of rivers, estuaries, lakes and wetlands</td><td colspan="2">Change in the Ecological Condition of Rivers (6.6.1A (1a))</td></tr>
<tr><td>Measures the baseline condition that is expressed as the Present Ecological State (PES) the % value of the reach in comparison of the total river length.
The baseline input data for the ecological condition of rivers expressed would be the 2011 PES EI and ES study.</td><td>The method/model applies a modified Index of Habitat Integrity (IHI) approach; using existing, field verified data or data from research projects. In areas where no data exists, satellite data (Google Earth) will be used, local knowledge and expert opinion. The approach is based on assessing the degree of modification of the following criteria:
- Instream habitat continuity
- Riparian area or wetland habitat continuity
- Potential instream habitat function, processes, and biota
- Riparian or wetland zone structure and composition
- Flow and flood regimes; and
- Physico-chemical conditions</td></tr>
</table>

The disaggregation of data for estuaries are based on their biogeographical region and type of estuary that is being monitored. There are currently four biogeographical regions in South Africa, namely tropical, sub-tropical, warm temperate and cold temperate regions. Furthermore, there are a total of nine estuary types, which each have their respective characteristics that allow for the classification of an estuary. The methodology used to monitor the spatial extent of estuaries includes the acquisition of estuarine data from satellite sources, which is regarded as the baseline. The data sources include SPOT 5 imagery, Google Earth images, 5 m topographical contours and georeferenced 1:10000 ortho-photos. The change in the extent of estuaries is then determined using the baseline estuarine and current estuarine area, after which, the percentage change in the extent of estuaries can be calculated.

5.9.1 Indicator SDG 6.6.1A(1a) and Methodology Observations

The methodology is well structured, introducing rational for the indicator, followed by the methodology and computational method used.

The indicator claims to include the change in the ecological condition of rivers, estuaries, lakes and wetlands, however the aim and methodology only refer to these calculation for rivers.

Computation Method

The computational method presented for SDG 6.6.1A(1a) is presented in words. The computational methods presented in Section H2.2 for the calculation of Ecological Condition Index (written in words) and the change in ecological condition, respectively, are present, as follows:

(Ecological Condition)x(Percentage River Length for ecological condition)=(Length-weighted score for rivers in each ecological condition) + (Ecological Condition Index)

Percentage Change in Ecological Condition$=(\beta-\gamma)\ \beta\times100$

“Where β = the ecological condition 2014”

“Where γ = the ecological condition for any other period”

The results are recommended to be displayed on maps for the various assessment scales or as simple pie charts.

The formula presented differs from the UN calculation of $((\beta-\gamma)/\beta)x100$, commonly used for SDG6.6. Targets. The UN calculation is assumed to be the formula that this indicator intended to follow. Section 4.2 of this report summarises the method proposed by the UN for calculating the change in spatial extent. The formula presented in Section H2.2. differs from the UN calculation and is recommended to be amended accordingly.

Data Sources

The data collected for this indicator will be based on Google Earth images and regional knowledge of the study team. It will be based on assessing land use in the targeted catchments and its impact on various, pre-defined, attributes of river ecosystems.

These tools include Google Earth, local knowledge, specialist opinion, previous high confidence Resource Directed Measures (RDM) studies (Reserves, Classification, RQO studies and/or tertiary studies), research conducted via recognised institutions (i.e., WRC, CSIR, Universities etc.). If these resources are used interchangeably, it will ensure that the model output is continuously updated and will make sure that the layers are not disaggregated. Continuity is key in this study as it will help identifying data gaps. The reporting on this indicator will follow a 10-year cycle.

5.9.2 Methodology Testing

The baseline and follow up data set for the change in ecological condition in rivers was not included in the SDG Target SDG 6.6 Methodology Report. The baseline data for this additional indicator is available in the 2011 WRC led study, where the ecological status of the rivers was determined.

Management Targets

The following target has been set for the SDG 6.6.1A(1a) with the aim being to “Maintain and or Improve the Ecological Condition of the priority water resources”.

The computational methods presented in Section D8 for the calculation of target and indictor spatial extant, respectively, are present, as follows:

Target Ecological Condition (T)= Gazetted TEC (preliminary recommended ecological category)

Indicator Spatial Extent(I)=C-T

Where “C = Ecological Condition of Reporting Year

Where “T = Target Ecological Condition”

It is stated that “It is not feasible to have one target for the whole country due to the diversity of river types in South Africa; based on geomorphological zones (Rowntree et al, 2000), ecoregions (Kleynhans et al. 2005), climate, flow regimes, etc. Thus, the management targets for the ecological condition of rivers will be based on the recommend condition for the river reaches/segments of the country’s network.”

Since this is an additional indictor there are no UN methods to comply with rather a baseline assessment conducted by DWS (2014) using the PES/EIS method.

5.10 Indicator SDG 6.6.1D(1): Change in the Spatial Extent of Water Related Ecosystems including Wetlands, Reservoirs, Lake and Estuaries as a Percentage of Land Area Methodology Review

The SDG 6.6.1D(1) indicator methodology is a stand-alone methodology issued in March 2022. Table 5-11 summarises the methodology developed to date.

Table 5-11: SDG 6.6.1D(1) Indicator Methodology

Indicator		Aim	Methodology
6.6.1.D(1) (UN - 6.6.1.a)	Change in the extent of water-related ecosystems including Wetlands, Reservoirs, Lake and Estuaries as a Percentage of Land Area	To protect and restore water related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	Percentage change in the surface area of wetlands (vegetated and unvegetated/arid), estuaries, reservoirs and lakes over time from a predefined baseline, expressed as a % of the total land area Percentage of Total Land Area = (Spatial extent of Reservoirs, Estuaries, Wetlands and Lakes/Total Land Area) x 100

5.10.1 Indicator SDG 6.6.1D(1) and Methodology Observations

The methodology follows a different format to most of the indicators compiled. A consistent approach to the indicator methodology development is recommended.

Computation Method

The computational method presented for SDG 6.6.1D(1) provides the computational method proposed to be used for the calculation of spatial extent of water related ecosystems including wetlands, reservoirs, lake and estuaries as a percentage of land area is present, as follows:

Percentage of Total Land Area = (Spatial extent of Reservoirs, Estuaries, Wetlands and Lakes / Total Land Area) x 100

The formula presented differs from the UN calculation of $((\beta-\gamma)/\beta)x100$, commonly used for SDG6.6. Targets. The UN calculation is assumed to be the formula that this indicator intended to follow. Section 4.2 of this report summarises the method proposed by the UN for calculating the change in spatial extent. The formula presented in SDG 6.6.1D(1) differs from the UN calculation and may provide a more representative method for presenting the data, however it is recommended that the UN formula also be included to accommodate the global reporting requirements.

Data Sources

The content of this methodology is limited, and therefore the ability to review the data sources and defensibility of the data collection in relation to the computational method is similarly limited. The information provided in relation to the data sources for this indicator is summarised below/

Surface area is determined based on data from various databases and inventories which have collected data between 2006 -2016. Change is noted to be monitored, in relation to 2016, which is regarded as the set baseline.

The spatial extent of reservoirs is determined based on monitored areas for reservoirs during 2014, 2015 and 2016, representing 4% of the dams in South Africa that have a storage capacity of more than 50 000 cubic metres and a wall height of more than five metres.

5.10.2 Methodology Testing

The baseline and follow up data set for the change in spatial extent of water related ecosystems over time was not included in the methodology. As a result, no calculation testing could be undertaken to verify the computational methods presented.

Management Targets

The following target has been set for the SDG 6.6.1D(1) with the aim stated as follows “By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes”.

This target it commendable while being challenging to quantify and therefore achieve. Perhaps this was the intention of the target, and therefore it is recommended that the target be defined as being a progress monitoring target rather than an achievable and quantifiable target. For example how would protection and restoration be quantified, i.e. some work in an area (alien clearing or litter collection?), defining areas as protected areas or nature reserves or observed changes in status of areas, through works undertaken?

5.11 SDG 6.6 Development of Additional Indicator

Domestication of the indicators has allowed South Africa to identify one possible additional indicator based on existing country monitoring programmes.

Additional South African indicators identified during this review process were to be highlighted and would require a process of testing with available data. Based on the review of the methodologies developed to date for South Africa, one possible additional sub-indicator has been identified during this review, for consideration, summarised in Table 5-12.

Table 5-12 Additional SDG 6.6 Methodologies for Consideration

Indicator		Features	UN Global Reporting
6.6.1.(1b) (UN - 6.6.1.a)	Change in spatial extent of water related ecosystems – vegetated wetlands (mangroves)	Surface area Annual and multi-annual changes in mangrove area (2000-2016) Statistics aggregated at national, sub-national & basin scales	In 2020, global data on mangrove extent per country, as a subset of wetlands (coastal wetlands) was also available within the sdg661 data portal and consequently, mangrove data was presented separately. In the coming years as a result of advancing satellite and data production technologies, it is foreseen that disaggregated datasets for other wetland typologies will become available (UN-Water, 2020).

The spatial extent of mangroves is currently incorporated into the SDG 6.6.1D(1b) methodology, however the available data and UN methodologies would appear to provide an opportunity to separate this indicator out from the groupie wetland indicator reporting. There is no particular need to create a separate mangrove methodology, unless this is considered necessary by the particular team involved in the data collection, collation, aggregation and reporting.

6 South African SDG 6.6 Methodology Challenges and Limitations

SDG target 6.6 is a global indicator, which monitors the extent and quality of the water-related ecosystems using global data tools and products. Data gaps associated with national datasets developed through long-term monitoring poses challenges at times. Furthermore, changes in monitoring methodologies of these ecosystems presents challenges for comparing data sets. The use of global data products has made it possible to bridge these gaps associated with the acquisition of data. This duel data gathering system is also beneficial on a national level as countries can incorporate both globally available data and national data to monitor water-related ecosystems.

Indicator SDG6.6.1D (1a)

The UN global methodology for Indicator SDG6.6.1D (1a) (Change in Spatial Extent of Rivers) makes provision for measuring large rivers, however South African rivers are too narrow to be identified using the current satellite imagery and as such can't be measured. The only parameter that can currently be measured is length, which is unlikely to change. This presents a challenge in terms of reporting the spatial extent of rivers. According to Stuart Crane of the UNEP (personal coms. 22 November 2022), the UN is aware of the challenges the current SDG 6.6.1 spatial extent of rivers poses to many countries. As a result, the UN is considering modifying the methodology to utilize rainfall and runoff orientated data to measure the flow in rivers rather than the spatial extent.

Indicator SDG 6.6.1D (1d)

Indicator SDG 6.6.1D (1d) (Change in Spatial Extent of Artificial Systems) presents challenges associated with different versions of dam datasets, including:

- Not all dams are accounted for in the country.
- Dataset accuracy differs, limiting comprehensive national dam reporting.

To assist with addressing these challenges a new baseline has been proposed to be determined by February 2020, to- allow for consistent reporting and accurate comparisons going forward.

A further challenge in relation of target setting for this Indicator SDG 6.6.1D (1d) is associated with the purpose of dams. Dams are designed as storage facilities to be used during dry periods; therefore, dam levels are expected to fluctuate with seasonal use. Setting a target to accommodate change in extent is therefore contrary to their purpose and use.

Indicator SDG 6.6.1D (4)

The data collected for the Indicator SDG 6.6.1D (4) (Change in Groundwater Level Status) presents many challenges due to insufficient and untrained staff collecting data as well as issues in travel and procurement. Furthermore the selection of boreholes to adequately represent the total groundwater situation for an aquifer provides further challenges in order to develop a representative dataset.

Indicator SDG 6.6.1D(3a) and SDG 6.6.1D(3b)

A change to the methodology is proposed, in relation to the baseline calculation whereby, the baseline dataset will be determined as total cumulative flow volume over an identified period of seven 'normal' years. The selection of "normal" years would have been based on a prior determined average. It would therefore be more scientifically correct to rather extend the baseline monitoring period over a longer period, to accommodate a sufficient time period to allow for periodic highs and lows to be normalized.

Typical time frames used in the UN global standardised are monitored over a 5 year time-frame. The proposed variation in time-frame may be confusing or appear to be an omission when comparing to global standardized data sets.

Indicator SDG 6.6.1D(1)

The following target has been set for the SDG 6.6.1D(1) with the aim stated as follows "By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes".

This target it commendable while being challenging to quantify and therefore achieve. Perhaps this was the intention of the target, and therefore it is recommended that the target be defined as being a progress monitoring target rather than an achievable and quantifiable target. For example how would protection and restoration be quantified, i.e. some work in an area (alien clearing or litter collection?), defining areas as protected areas or nature reserves or observed changes in status of areas, through works undertaken?

Calculation Challenges

The UN method of computation, against which many of the indicators are compared provides a calculation of the percentage change of spatial extent, using the following formula:

Percentage change in wetland extent (β-γ)/β×100

Where β = the spatial wetland extent for the baseline reference period.

Where γ = the spatial extent for the reporting period.

Please note this formula yields percentage change values as either positive or negative, which helps to indicate how spatial area is changing. According to the UN Water Sustainable Development Goal Monitoring Methodology Indicator 6.6.1 "If the value is shown as positive, the statistics represent an area gain while if the value is shown as negative, it represents a loss in surface area." Using the UN calculation, suggests that the interpretation of the positive and negative figures in this calculation are contrary to the proposed interpretation i.e. a negative value, represents an area gain, while a positive value presents an area loss.

The UN calculation however presents a globally consistent data interpretation calculation and is therefore considered applicable for use from a global reporting perspective. In order to maintain a consistent reporting approach for the indicators; inclusion of the UN calculations is considered pertinent.

The following SDG6.6.1. methodologies contain errors in the UN calculation used or omitted the UN calculation from the methodology:

- Indicator SDG 6.6.1D(1b);
- Indicator SDG 6.6.1D(1c);
- Indicator SDG 6.6.1D(3a) and SDG 6.6.1D(3b);
- Indicator SDG 6.6.1A(1a); and
- Indicator SDG 6.6.1D(1).

Overall Challenges

The overall challenge faced in reporting against the UN SDG 6.6. methodologies is that the historical data sets were largely not compiled for the particular purpose prescribed by the UN. However, the UN SDG 6.6. global reporting provides a platform for the amalgamation of the locally generated data sets into a standardised reporting system. The UN reporting requirements are intended to benchmark countries in the global context, while not necessarily providing data that is immediately useful at a local level.

The domestication of indicators in the South African context allows for the development of useful standardized reporting criteria to provide country wide statistics against which national changes can be assessed, to allow for appropriate responses to be actioned if necessary. The domestication of indicators in South Africa is well advanced, however it is necessary to be selective of the number of indicators developed, to ensure that good quality reporting is possible for all indicators.

7 Target Setting for SDG 6.6 Indicators

According to the UN Integrated Monitoring Guide for SDG 6, Step-by-step monitoring methodology for indicator 6.6.1 on water related ecosystems "The 2030 Agenda for Sustainable Development specifies that all SDG targets "are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but considering national circumstances."

The global ambition of the Target 6.6 is to "protect and restore" ecosystems (without any numeric specification), and it is up to each country to set their own targets in this regard, i.e., to determine what is an acceptable change in ecosystem extent, quantity and health, and when and how management intervention should be introduced. The Aichi Target for 2020 was to have information from monitoring the indicators for 6.6.1 that could guide countries to manage, protect and restore these ecosystems, in keeping with the Aichi Biodiversity Targets of the Convention of Biological Diversity, which set out a number of objectives for ecosystem management. The three primary Aichi Biodiversity Targets that are of relevance to SDG 6.6.1:

Aichi Target 5

The rate of loss of all natural habitats, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. Two of the recommended and possible indicators are:

- Sub-indicators UN 6.6.1.a: "Trends in extent of selected biomes, ecosystems and habitats", and
- Sub-indicators UN 6.6.1.d: "Trends in condition and vulnerability of ecosystems".

Aichi Target 14

Ecosystems that provide essential services (including services related to water), and contribute to health, livelihoods, and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable. One of the recommended and possible indicators is:

- Sub-indicator UN 6.6.1.b: "Trends in proportion of total freshwater resources used"
  (Also aligns with Indicator SDG 6.4.1 and 6.4.2).

Aichi Target 15

Ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification. One of the recommended and possible indicators is:

- Sub-indicators UN 6.6.1.a and 6.6.1.d: "Status and trends in extent and condition of habitats that provide carbon storage".

The setting of management targets or objectives for water-related ecosystems extent has become a global priority. While the SDG process sets out to monitor the percentage change in water-related ecosystems extent over time, it will be incumbent on countries to set Targets for this change, to determine what an acceptable change is and when and how management intervention should be introduced.

To assist countries to set targets and objectives for management, Table 7-1 provides a way of considering all ecosystem data relative to the "natural" or reference condition. The method for each sub-indicator and overall 6.6.1 indicator, can be considered in terms of an Ecological Class, which describes the extent of deviation from the natural or reference condition and which in turn can be considered in terms of the implications for the sustainable use of that ecosystem. These categories and the divisions between them are purely subjective but can be used to support management conditions.

Table 7-1 Ecological Classes that show the relation of the ecosystem to its natural condition (UN Step by step monitoring methodology for SDG Indicator 6.6.1, 2017)

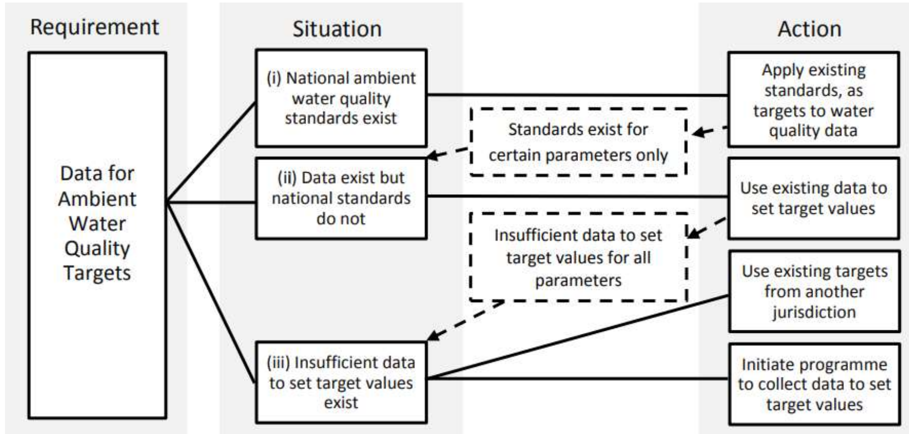
Ecological Class	Description	Deviation from natural	Sustainability
A	Unmodified natural	<10%	Highly sustainable
B	Largely natural with insignificant changes to the ecosystem	>10-20%	Highly sustainable
C	Moderately modified. Loss and change of natural habitat and biota have occurred but the basic ecosystem functions are unchanged	>20-40%	Locally sustainable but threatens global stability
D	Largely modified. A large change to habitat, biota and ecosystem functions has occurred. The ecosystem continues to provide services of value but is no longer representative of the natural situation	>40-60%	Border-line sustainable. Corrective actions are strongly recommended
E	Seriously modified. The loss of habitat, biota and ecosystem function is extensive, and most services are lost to society	>60%	Undesirable Urgent renewal is required

NOTE: The Ecological classes specified in this table do not completely match the DWS system. What is defined at Ecological Class E in this table actually represents Ecological categories E and F in the DWS system.

Table 7-2 summarizes the sub-indicator targets for each of the UN SDG 6.6.1 indicators reflecting possible global and national targets. These targets are purely suggestions to consider while the development of properly derived targets should be part of the global and national agenda.

Table 7-2 Target recommendations for each SDG 6.6.1 Sub-indicator (UN Step by step monitoring methodology for SDG Indicator 6.6.1, 2017)

UN Indicator	Global Target	Proposed National Target
6.6.1	The global aspiration of Target 6.6 is to protect and restore ecosystems (in agreement with Aichi Biodiversity Targets 5,14,15) i.e., there should be no further degradation of water-related ecosystems from the 2017 baseline.	Countries may set their own targets. Two options are available: - Ideally there should be no further degradation of water-related ecosystems from the 2017 baseline. - As in the Aichi Biodiversity Target 5, where countries have economic needs then degradation rates should be at least halved.
6.6.1.A – Spatial Extent	No-net-loss as promoted by the Ramsar Convention. Aichi Biodiversity Target 5 aims to reduce rate of loss almost to zero.	Many countries have set a no-net-loss policy as promoted by Ramsar. Countries may set an alternative target, but this must be justified, and as described by Aichi Biodiversity Target 5, the rate of loss should at least be halved but ideally approach zero. Aichi Biodiversity Target 15 aims to restore 15% of degraded ecosystems that store carbon (wetlands, peat).
6.6.1.B – Quantity of Water	The global ambition is to protect and restore ecosystems, i.e., water withdrawals should not damage the integrity of ecosystems. Aichi Biodiversity Target 5 promotes that habitat loss is reduced to zero (or at least to half), and Target 14 requires that essential ecosystems are restored and safeguarded.	Targets for quantities of water ideally should be established for each river and tributary, for lakes and groundwater, based on priorities in the basin and sub-basin. These should aim to protect the integrity of water-related ecosystems based on their environmental flow requirements. Aichi Biodiversity Targets also apply (5, 14)

UN Indicator	Global Target	Proposed National Target
6.6.1.C – Water Quality		
6.6.1.D – Ecosystem Health	The global ambition is to protect and restore ecosystems. Thus, there should be no reduction of the 2017 baseline. Aichi Biodiversity Target 5 promotes that habitat loss is reduced to almost zero, and Target 14 requires that essential ecosystems are restored and safeguarded.	Targets for the health or state of ecosystems ideally should be established for key river, lakes and for priority wetlands based on priorities in the basin and sub-basin. The guideline presented in Section 5.2 may be used. Aichi Biodiversity Targets also apply (5, 14).

8 Methodology Considerations

From the review of current methodologies that have been implemented for monitoring changes in the extent of water-related ecosystems, it is evident that there are certain limitations that need to be addressed to produce more representative datasets and ensure that these ecosystems are well monitored to sustain them in the long term. To identify possible solutions to these limitations, the methodologies currently in place for indicator 6.6.1 in the United Nations (UN) and United Kingdom (UK) were reviewed. From the review of the methodologies across these different nations, it is evident that the methods involved in monitoring changes in the extent of water-related ecosystems are similar. The basis of these methods involves the derivation of the percentage change in relation to the baseline and current situation of the water bodies. However, while the methodologies are practically the same, differences between the acquisition of the datasets in the UN, UK and SA occur.

8.1 Data Sets

South Africa has domesticated several of the sub-indicators to monitor SDG 6.6.1, however, there is a need for more continuous datasets rather than the provision of statistics at a point in time, to be able to make more representative comparisons with the global datasets. The country can achieve this by collaborating with the UNEP to improve upon the datasets that are produced at a global scale.

In 2020, an innovative platform was launched by UNEP. This platform (Freshwater Ecosystems Explorer) is freely accessible and includes high resolution geospatial datasets for monitoring water-related ecosystems. The platform also provides access to existing national datasets pertaining to these ecosystems. The data can be viewed using geospatial maps; however, the availability of these datasets is dependent on the type of water-related ecosystem that is being analysed. Together with the FEE platform, the Global Surface Water Explorer (GSWE) is also being used in the UN and UK for the acquisition of data for monitoring water-related ecosystems. It was developed by the Joint Research Centre (JRC), UNEP and Google. This platform is similar to the FEE platform, however, the GSWE platform constrains data to official high-water mark boundaries to exclude coastal water estimates and eliminate concerns associated with persistent cloud cover.

While these platforms are useful for the provision of data to monitor changes in the extent of water-related ecosystems, these global datasets are not suitable for South African water bodies. For example, the validation results obtained for the wetlands global dataset showed that the full extent of wetlands, as represented by the global data, underestimated the actual spatial extent of South Africa's wetlands by 87 %. Therefore, this sub-indicator is currently being monitored using nationally derived datasets to represent the country's wetlands more accurately. However, from the UN 2021 progress report, it is expected that improvements will be made in the next two years due to the current concerns with the resolutions of the datasets being used.

8.1.1 Satellite Imagery

Landsat imagery at a 30 m spatial resolution is currently being used to derive data for water-related ecosystems. These images are able to classify large areas of surface water, however, are too coarse to identify smaller water bodies.

The UK carried out an assessment using SPOT imagery with a high resolution of 6 m to evaluate the influence of different resolutions in identifying differently sized water-related ecosystems. In order to assess this, SPOT 6 m imagery was upscaled to 10 m, 20 m and 30 m. It was deduced that the 30 m resolution is too coarse to identify small water bodies. For the 10 m resolution, it was expected that smaller water features will also be identified, which was the case, however, due to the finer resolution detail, other features that have similar reflectance properties such as road networks were being misclassified as water features. The 20 m resolution was the best option as the imagery was able to identify smaller water features than the 30 m resolution and the extent of misclassification is not as much as the 10 m resolution.

Therefore, the 30 m Landsat imagery may have been one of the reasons attributing to the poor representation of South African wetlands when using the global datasets. However, developments are currently taking place to ensure the use of higher resolution Sentinel data together with Landsat imagery for future datasets to produce more accurate outcomes. This may result in more representative and continuous globally available datasets for South Africa's water-related ecosystems.

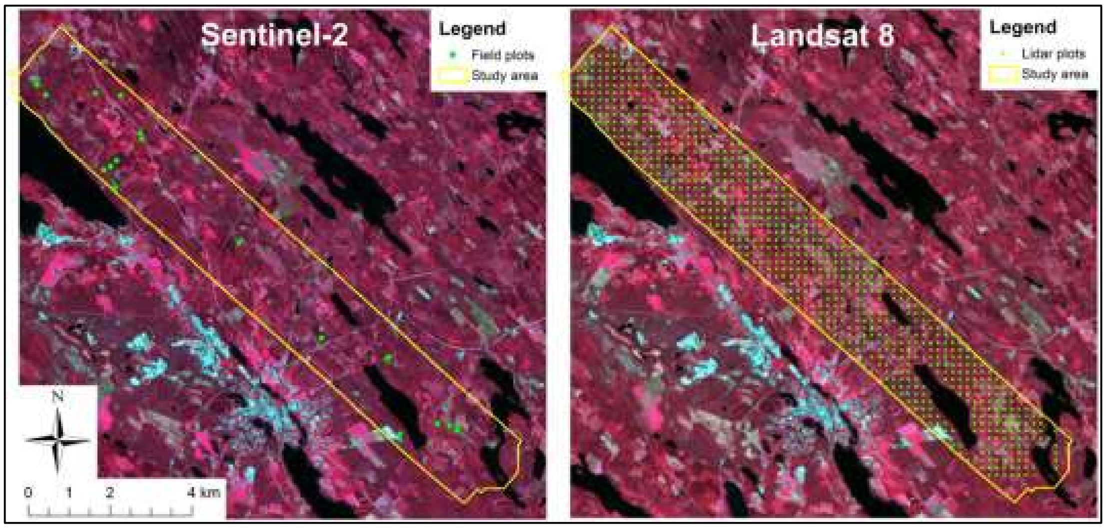


Figure 8-1 Sentinel-2 compared to Landsat 8 Imagery

8.2 Water Quality

With regards to the water quality of these water-related ecosystems, methodologies for monitoring changes in the number of lakes and dams affected by high trophic and turbidity states are still in progress. Currently, the secchi disc depth is being used to obtain measurements for monitoring turbidity of water bodies, however, these measurements will only be available for the areas that have been sampled. For monitoring the trophic status, data is currently generated using the NEMP.

An alternative field method of collecting turbidity date is through the use of telemetry systems. Telemetry is the in situ collection of measurements or other data at remote points and their automatic transmission to receiving equipment for monitoring. This has limitations in relation to the installation and maintenance of the devices, while providing direct field data.

Therefore, the use of satellite-based earth observations acquired from both Landsat and Sentinel imagery is highly recommended. This imagery can be used to derive chlorophyll α (Chl) and total suspended solids (TSS) data. Chl can provide an indication of the extent of eutrophication in water bodies. TSS can be used to determine the extent of sedimentation.

Should a change in methodology be considered appropriate in the future, it is essential to correlate the old and new methodologies through the overlapping sets of observations i.e. Secchi to Satellite imagery, to ensure an ongoing consistent reporting approach.

8.3 Data Efficiency

The use of data platforms that can be used to process and acquire data at a more efficient rate is recommended. The GSWE platform uses Google Earth Engine (GEE) to process datasets. This platform can process large amounts of data within a short space of time and several functions are available to process the data for a desired outcome. For example, the GSWE data is processed using a mask function on GEE to remove pixels that did not produce data due to cloud cover.

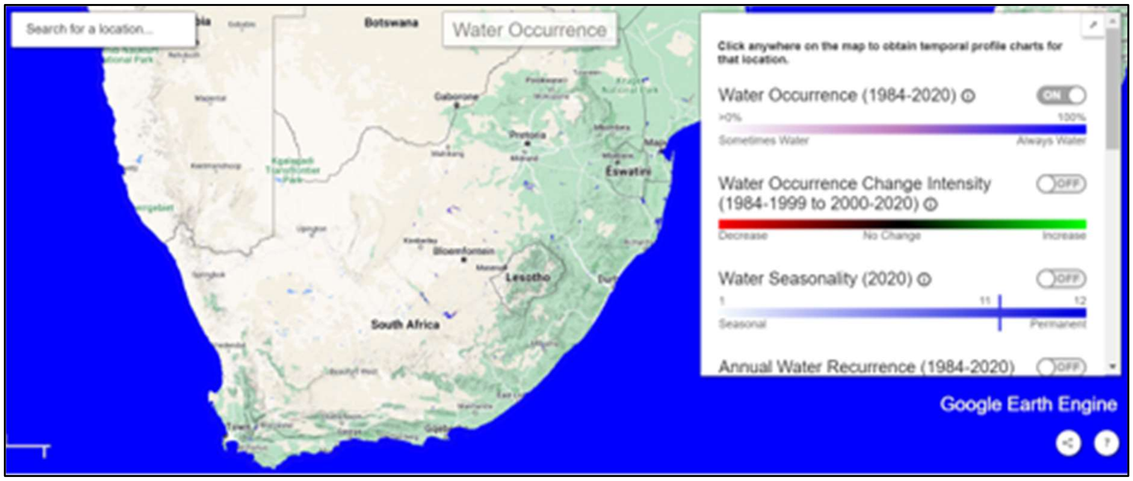


Figure 8-2 GSWE platform

9 Conclusions and Recommendations

The SDG Target 6.6. – Water Related Ecosystems Methodology Report is a well compiled report, incorporating extensive material from both a global and national perspective.

South Africa has extensive datasets developed over many years of work, in relation to water related ecosystems. The challenge faced in reporting against the UN SDG 6.6. methodologies is that the historical data sets were largely not compiled for the particular purpose prescribed by the UN. However, the UN SDG 6.6. global reporting provides a platform for the amalgamation of the locally generated data sets into a standardised reporting system. The combined data sets are therefore comparable in relation to other global data sets, which helps to benchmarking South Africa in the global context.

The South African methodologies generated in relation to SDG 6.6. water related ecosystems, have largely been created based on historical data sets to develop the baseline data set, against which future monitoring updates are compared. These methodologies may require updating as further data is compiled, and should be robust enough to accommodate technological advances, to improve on the reporting efficiencies to supplement historical date reporting systems.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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APPENDIX C: SDG TARGET 6.B ASSESSMENT AND DRAFT SDG INDICATOR 6.B.2 METHODOLOGY

Reviewed Methodology Report for SDG 6.b

Report Prepared for

Water Research Commission

Report Number 582205/04

Report Prepared by

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Reviewed Methodology Report SDG 6.b

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by the Water Research Commission (WRC). The opinions in this Report are provided in response to a specific request from WRC and the Department of Water and Sanitation to do so. SRK has exercised all due care in reviewing the available information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

Abbreviation	Definition
DAC	Development Assistance Committee
DWS	Department of Water and Sanitation
GLAAS	Global Analysis and Assessment of Sanitation and Drinking Water
IWRM	Integrated Water Resources Management
OECD	Economic Co-operation and Development
PD/GG	Participatory Development and Good Governance
SDG	Sustainable Development Goal
SRK	SRK Consulting South Africa (Pty) Ltd
UN	United Nations
WASH	Water, Sanitation and Hygiene
WGI	Water Governance Initiative
WHO	World Health Organisation
WRC	Water Research Commission
WSA	Water Service Authority

1 Introduction and Approach

South Africa is one of 193 countries committed to achieving Sustainable Development Goal (SDG) 6: Clean Water and Sanitation. The entity responsible for the management of SDG 6 policy, plans and implementation programs is the Department of Water and Sanitation (DWS). In adopting the goal, the DWS adopted existing indicators (carried over from the United Nations (UN) Millennium Development Goals (MDGs), domesticated new indicators, and defined additional indicators (where required).

South Africa has committed to the achievement of the 17 SDGs by 2030. SDG 6 aims to ensure clean water and sanitation for all by 2030. Some of the SDG 6 targets and indicators are well established (those carried over from the MDGs in 2000), while others are less established (those introduced with the adoption of the SDGs or in the years following adoption). At a global level, specialists in various international agencies developed methodologies for all the SDG targets and their indicators. In May 2017 the UN released the first round of the Step-by-step Methodology Reports for each of the indicators. Revisions of these methods have subsequently been published through updated methodology reports and captured in the 2018 Synthesis Reports for each indicator. At a national level, countries were encouraged to domesticate these methods and to set targets that are relevant to their context and resources, while maintaining consistency with the targets set out in the SDGs.

While South Africa has developed methodologies to domesticate our indicators, some of the indicators are still not being measured in a meaningful way that shows and drives progress against the targets. For some of these indicators, an assessment, and potentially, a revision of these methodologies is required. For others, new methodologies are required to be developed. In addition, several new indicators are required, and a solid founding methodology is required for the new indicators. Research by a multidisciplinary team with a deep understanding of water resources management in the SA context is required to achieve these research outputs.

1.1 SDG 6 Adoption in South Africa

SDG 6 has been divided into 8 targets, which are then divided into indicators. The intent of setting the targets and defining the indicators is to monitor progress in achieving SDG 6. The DWS, works closely with several other branches of government, as well as other organisations, to measure and report on the indicators. The objective of monitoring and reporting on the indicators is to effect real change in the water and sanitation landscape in South Africa, by informing policy formulation and aiding decision-making.

South Africa's monitoring of, and performance against, the SDG 6 indicators has shown slow uptake of policies and actions developed for water and sanitation. South Africa published a Community Survey in 2016 (StatsSA, 2016), an SDG Baseline Report in 2017 (StatsSA, 2017), an SDG Country Report in 2019 (StatsSA, 2019), and a General Household Survey in 2019 (StatsSA, 2019). In addition, South Africa has established a Goal Tracker website (StatsSA, 2021). These documents show that several indicators are not tracked, that data continuity is poor for some indicators, and that there is a lack of consistency in tracking some indicators.

The DWS and Water Research Commission (WRC) has identified problematic indicators within SDG 6, resulting in the appointment of an SDG 6 working group, under SRK Consulting South Africa's (Pty) Ltd (SRK's) leadership, to evaluate targets, indicators, and methodologies for SDG 6.6, 6.3 and 6.b; and to propose improvements where shortfalls are identified. These gaps/shortfalls will inform the development and definition of new additional indicators, where required; using existing data (where available) and investigating new data sources (where data are not available).

2 Scope of Work

Research Task 3.a: Situation assessment, reviewed methodology for SDG 6.b (Task Leader: Giulia Barr. Team: Bjanka Korb, Lindsay Shand and Simon Lorentz):

1. The developed methodology to measure the current indicator SDG 6.b.1 will be reviewed, taking into consideration the methodology given by the UN and assessing if it is applied in the most pragmatic and rational way.
2. Current progress against the 6.b.1 indicator will be assessed.
3. The way in which the methodology and results influence national decision-making (if at all) will be evaluated. Checks will be done to see if the indicator has inspired policy-level changes in the years since its adoption.
4. The DWS approach towards compliance with the method of computations and indicator requirements for 6.b.1 will be assessed.
5. The statistical correctness and scientific validity of the method for 6.b.1 will be assessed.
6. Recommendations for amendments and improvements will be compiled, and where appropriate, alternative methodologies recommended.

Research Task 3.b[1]: additional new indicators for SDG 6.b (Task Leader: Giulia Barr. Team: Bjanka Korb, Lindsay Shand and Simon Lorentz):

1. A new indicator 6.b.2 and its method of computation will be developed, which will measure the level of community involvement related to 6.b.1. Consideration will be given to data that is currently accessible.
2. Recommendations for additional information in future management targets for 6.b.2 will be compiled.
3. Data analysis and syntheses will be conducted in collaboration with DWS and StatsSA, taking cognisance of the possible linkages with other SDGs relating to community involvement in water management to avoid any duplication of reporting by SA. Regular virtual meetings will take place with key DWS representatives to facilitate this collaboration.
4. DWS will be assisted with selecting and developing methods for additional country level indicators where gaps have been identified.
5. The following strategies would need to be reviewed as part of this research task, and any new indicators developed (for community involvement in water management) would need to be aligned with related indicators in these strategies:
   a. Agenda 2063
   b. National Development Plan
   c. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
   d. National Water Resource Strategy 3
   e. National Water and Sanitation Master Plan (Volume 1-3)

[1] Research Task 3b will be undertaken as a separate task following Research Task 3a.

3 SDG 6.b Methodology Background

SDG target 6.b was set to encourage community participation in water and sanitation management. Indicator 6.b.1 is a global indicator, which tracks the level of stakeholder participation in the management of water and sanitation in a country. The stakeholder participation refers to a process or procedure in which individuals and communities can significantly contribute to management decisions and directions. The indicator also currently incorporates information regarding the existence of procedures in law or policies relating to the participation of service users and communities, the level of participation, separated according to sectors (e.g. drinking water, sanitation, hygiene promotion and water resources planning and management).

According to the WRC, “the existing methodology for target 6.b requires critical review”. Part of the review is to determine the value of the current SDG 6.b indicator for influencing national decision making i.e. will the method proposed be both useful for global reporting and at the same time have a real influence nationally? Where appropriate, the statistical correctness and scientific validity of the methods are to be evaluated. Recommendations for amendments and improvements will be made, and where appropriate, alternative methodologies may be recommended.

In addition to the need for peer review and finalization of the methodology report for SDG 6.b, DWS need to:

1. Set management targets for SDG 6.b; and
2. Select and develop methods for additional, country level indicators for SDG 6.b.

3.1 SDG 6.b Methodology

Target 6.b works towards ensuring the needs of all people in terms of water and sanitation are being met through the participation of local communities in water and sanitation planning and management. It is essential for relevant stakeholders to be involved to ensure that identified technical and administrative solutions are feasible for specific socioeconomic contexts, provide a full understanding of impacts of development decisions, and encourage local ownership of implemented solutions to ensure they are sustainable.

The implementation of all other SDG 6 targets is supported by target 6.b through the promotion of local community involvement, which is also an essential component of the Integrated Water Resources Management (IWRM).

Target 6.b has one global indicator, as summarised in Table 3-1.

Target 6.b

“Support and strengthen the participation of local communities in improving water and sanitation management”

Table 3-1: SDG 6.b Global Target and Indicator

Target 6.b	**Indicator**	
Support and strengthen the participation of local communities in improving water and sanitation management	6.b.1	Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

As part of target SDG 6.2, countries are required to adopt policies and implement resources that will advance equitable, human rights-based, sustainable development. This should incorporate a renewed and strengthened global partnership to achieve the following:

- Addressing social, economic and environmental aspects through an integrated approach.
- Expanding on existing commitments and governance structures, while reinforcing previous successes through new initiatives.
- Reinforcing consistency in the implementation of a universal post-2015 agenda, that influences resources across diverse funding mechanisms.
- Strengthening governance and accountability frameworks, promoting multi-stakeholder engagements that include financing, technology innovation and diffusion, and capacity building for people and institutions.

Data sources used for monitoring target 6.b are presented in Table 4-1.

Table 3-2: Data sources used for monitoring target 6.b

Data source	Approach
Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) and TrackFin	GLAAS • Provides information on governance, monitoring, human resources and nuancing in the water, sanitation and hygiene (WASH) sector. • Surveys are conducted biannually, led by the World Health Organisation (WHO). • Data is collected from 94 countries (mostly low and lower-middle income countries). • Inputs (human resources and finance) and the enabling environment (laws, plans and policies, institutional and monitoring arrangements) required to sustain and expand WASH systems and services to all, especially to the most disadvantaged population groups, are monitored. • Factors associated with progress are analysed to identify drivers and restrictions, highlight knowledge gaps, and assess strengths and challenges within countries. • The aim is to assist government-led platforms to enhance collaboration across various sectors, institutions and influences and requirements in WASH service delivery. • National governments participating in the survey, fill out a questionnaire, preferably supported by a multi-stakeholder review.
	TrackFin • Assists countries in tracking their financing with regards to the WASH sector based on standard classifications. • Assists in developing a set of WASH accounts and indicators that are presented in a comparable format.
Organisation for Economic Co-operation and Development (OECD) Creditor Reporting System	• The OECD Development Assistance Committee (DAC) collects data through the OECD Reporting System based on the standard methodology and definitions in accordance with member countries and other aid providers. • Data is mainly obtained at an activity level and includes numerous parameters that allow disaggregation by provider and recipient country, type of finance and type of resource provided. • Some data on the policy objectives targeted by individual projects is available. • Data for essentially all high-income countries as bilateral donors, an increasing number of middle-income aid providers, and multi-lateral lending institutions.
OECD Water Governance Indicators	• A set of water governance indicators are currently being developed by the OECD, within the implementation strategy of the OECD principles on water governance. • A bottom-up approach within the OECD water governance initiative (WGI), and a technical platform, gathering over 100 members from

Data source	Approach
	the public, private and non-for-profit sectors will carry out the development of indicators. • A framework to understand if water government systems are performing optimally and assistance in adjusting them where required, are provided by the 12 principles. • The principles consider water governance as a range of political, institutional, and administrative rules, practices and processes through which decisions are taken and implemented, stakeholders can express their interests and have their concerns considered, and decision-makers are held accountable for water management. • The OECD water governance indicators are required to assess: 1. Framework conditions 2. Water governance performance 3. Impact of water governance.
IWRM	• IWRM is used to manage water in a co-ordinated manner. • Various users and uses in a given situation are taken into account, with the aim of maximising positive social, economic and environmental impacts. • Water bodies (such as catchments and aquifers) are used as the principal unit of water management, and stresses decentralisation of governance structures and active stakeholder participation in decision making. • Country surveys on the status of the implementation of the IWRM were undertaken during 2007 and 2011. • The surveys included: 1. The extent to which an enabling environment has been established for IWRM. 2. The structure and performance of an institutional framework in supporting the IWRM processes. 3. The extent to which management instruments/tools are applied. • Questions related to IWRM were merged into the GLAAS survey.
Public Protector Reports	• Local data and reports are used to build from live experiences of stakeholder participations. • Inactions and recommendations
South African Human Rights Reports	
Presidential Imbizos Report	
Citizenship Survey Reports	
CoGTA Survey Reports	
Non-Governmental Reports (e.g. SERI)	

The global methodologies for SDG 6.b have been reviewed as these form the basis for the SDG reporting against which South Africa is required to report and is assessed globally. A brief overview of the UN monitoring methodologies used for the indicator is summarised below.

3.2 Methodology

The GLAAS questionnaire provides information on the availability of suitable procedures in laws or policies regarding the participation of water users and communities in planning programmes. Countries that have available data from their local administrative unit level are required to provide data on the number of local administrative units regarding policies and procedures for local participation, based on the following:

i. The existence of policies and procedures.

ii. The operational level of the policies and procedures.

iii. The number of local administrative units assessed.

iv. The total number of units in the country.

The indicator is calculated as follows:

$$\frac{\textbf{Number of local admin units with operation policies and procedures for local participation (ii)}}{\textbf{Total number of local administrative units in the country (iv)}}$$

A low participation of local communities in water and sanitation management is indicated by a low indicator value. A high indicator value would therefor indicate a high level of participation and a greater ownership of water and sanitation management.

3.3 Supporting Indicators

Previous GLAAS surveys have incorporated a question regarding the presence of clearly defined procedures in laws or policies at a national level for local participation in planning programmes. The extent of this participation has also been incorporated. Responses from the surveys are disaggregated for urban and rural sanitation, drinking water supply and hygiene promotion.

Countries that do not have available data from the local administrative unit level, will need to report on the following supporting indicators, to determine trends over time:

- Presence or absence of clearly defined procedures in law or policy for participation by service users/communities in planning programs in WASH management, in a country.
- Presence or absence of a high level of users/communities participating in planning programs in WASH management, in a country.

A policy marker system has been developed to capture common policy objectives across sectors that also include Participatory Development and Good Governance (PD/GG). Activities targeted to a policy objective are identified and information on the degree to which the agreed policies are implemented by members in their aid programmes is provided, with three possible values:

- Principal objective
- Significant objective
- Not targeted to the policy objective

An activity intended to enhance aspects of participatory development, democratisation, good governance, and respect of human rights, should be classified as PD/GG oriented. Specific measures promoting one or more of the following PD/GG aspects should be incorporated into the activity:

- Participatory development – Establishing new systems, structures or institutions that can play an active and influential role in determining decisions that affect the lives of groups, communities, or people in a country.
- Democratisation – integrating participation and pluralism (including the right for opposition) into a country's political life and providing a basis for the government's legitimacy.
- Good governance – The accountability, efficiency and effectiveness of the official sector, an independent judiciary, the rule of law, and effective, responsible, and equitable administration at all government levels.
- Human rights – Strengthening the respect for and facilitating the implementation of internationally agreed human rights through specifically designed actions.

3.4 Data Sources

GLAAS collects information on the availability of clearly defined procedures in laws or policies for participation by service users, at a national level. The indicator will build on the data collected for the status of IWRM reporting of SDG indicator 6.5.1, especially regarding the presence of formal stakeholder structures established at a sub-catchment level. The OECD WGI are expected to be assist in providing additional information on local participation.

It has been proposed that the information gathered by GLAAS should be used as a representation, until data can be better consolidated and channels for reporting are established.

4 SDG 6.b Methodology Review

The methodology document reviewed for SDG 6.b reporting was required for the WHO document entitled "Methodological Note: Indicators and Proposed Monitoring Framework for Means of Implementation Targets for Sustainable Development Goal 6" (WHO, March 2017).

The global methodology for SDG 6.b has been reviewed and is applicable and relevant to the South African water context. The data utilised for the formulation of the global data sets is required to be reviewed at a local level to determine the validity of the global data sets presented by the WHO.

4.1 SDG6.b Methodology Review Feedback

There is little data available globally at a local administrative unit level that would allow for a direct computation of SDG 6.b.1. The current methodology is therefore too broad to be able to determine any material indication on the percentage of local administrative units within the country that have been established, and operational policies and procedures for participation of local communities in water and sanitation management.

The following areas requiring improvement and gaps have been highlighted during the review of the current methodology:

- The current indicator for the target does not fully encompass the outcome for target 6.b – support and strengthen the participation of local communities on improving water and sanitation management.
- The indicator is not a true representation of the level of support and participation in a country and does not determine if the current support and participation of local communities is sufficient to improve management of water and sanitation in the country.
- The current indicator also does not incorporate the level of implementation of procedures in law or policies in a country.
- There is currently no way of measuring whether local communities are being included in targets or aspects in the country's procedures in law or policies.
- The impact of a local community's participation towards a particular project is also not measured.

South Africa currently does not have any existing domesticated methodologies for SDG 6.b and is only using the global methodology. South Africa has been submitting their Integrated Development Plans and using the data from these to report on the country's progress. Based on this, South Africa has been reporting at 100% on the Global Goal Tracker. South Africa's Water Service Authorities (WSAs) are considered as local administrative units according to the target requirements. WSAs' procedures in law and policies ensure that local communities are incorporated throughout the life of a project.

5 Methodology Considerations

The review of the current methodology that has been implemented to improve the participation of local communities in improving water and sanitation management has indicated a few limitations that need to be addressed to provide a better understanding of the community's engagements. There is a need to refine the monitoring of the target, as the current indicator and methodology is very high level and does not give a good indication of the level of participation of local communities in South Africa.

The data requirements are also very limited and do not provide sufficient representation of the status quo of the country. A systematic indicator framework to measure stakeholder engagement for inclusive water governance has been suggested by the OECD, to collect data at both national and provincial levels i.e. at different scales. Possible data sources or monitoring mechanisms that could be used by countries have also been suggested by the WHO and include the following:

- Collection of information through a municipal census (municipalities should cover both urban and rural localities and the government should already have plans to conduct periodic censuses of municipalities) or through a representative sampling of municipalities.
- Inclusion of one or more questions in a community module in a national survey (such as the Living Standards Measurement Study).
- Inclusion of the indicator in administrative data or WASH MIS (a web- based software that supports management of WASH data from all national districts, including data collection, entry, validation, structuring and storage), which can be collected at a local administrative level.
- Use of focus groups and/or community discussions on local participation with key stakeholders and members of the general public.
- Collection of information through existing projects undertaken at a local administrative unit level.
- Use of innovative data collection methods such as crowd sourcing or SMS surveys.

These considerations and the outcomes from the review will be used to identify additional new indicators for SDG 6.b for the next task to follow.

6 Conclusions and Recommendations

The global SDG Target 6.b methodology report (WHO, March 2017) is a well compiled report, allowing for the incorporation of extensive material from both a global and national perspective. This report is however only in its draft form and should therefore be finalised.

There are no domesticated methodologies available for South Africa and the country is currently using the draft global methodology report. While the current methodology report for SDG 6.b is very comprehensive, a few limitations have been identified, especially in terms of the data requirements and suitability of the current indicator outcomes in meeting the target requirements.

Further investigations into the target requirements and indicators should be identified and implemented to further assist in meeting the requirements for SDG 6.b, and to assist in measuring the target's performance. Research Task 3b will focus on the identification of additional new indicators for SDG 6.b and will be undertaken as a separate component of the WRC SDG 6.6 project to follow.

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Additional New Indicator for SDG 6.b

Report Prepared for

Water Research Commission

Report Number 582205/05

Report Prepared by

February 2023

Additional New Indicator for SDG 6.b

Water Research Commission

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List of Abbreviations

Abbreviation	Definition
AU	African Union
AWARD	Association for Water and Rural Development
CMA	Catchment Management Agency
DWS	Department of Water and Sanitation
IWRM	Integrated Water Resources Management
MDG	Millennium Development Goal
MTSF	Medium-Term Strategic Framework
NDP	National Development Plan
NWRS	National Water Resource Strategy
NW&SMP	National Water and Sanitation Master Plan
SDG	Sustainable Development Goal
SRK	SRK Consulting South Africa (Pty) Ltd
UN	United Nations
WASH	Water, Sanitation and Hygiene
WRC	Water Research Commission

1 Introduction and Approach

South Africa is one of 193 countries committed to achieving Sustainable Development Goal (SDG) 6: Clean Water and Sanitation. The entity responsible for the management of SDG 6 policy, plans and implementation programs is the Department of Water and Sanitation (DWS). In adopting the goal, the DWS adopted existing indicators (carried over from the United Nations (UN) Millennium Development Goals (MDGs), domesticated new indicators, and defined additional indicators (where required).

South Africa has committed to the achievement of the 17 SDGs by 2030. SDG 6 aims to ensure clean water and sanitation for all by 2030. Some of the SDG 6 targets and indicators are well established (those carried over from the MDGs in 2000), while others are less established (those introduced with the adoption of the SDGs or in the years following adoption). At a global level, specialists in various international agencies developed methodologies for all the SDG targets and their indicators. In May 2017 the UN released the first round of the Step-by-step Methodology Reports for each of the indicators. Revisions of these methods have subsequently been published through updated methodology reports and captured in the 2018 Synthesis Reports for each indicator. At a national level, countries were encouraged to domesticate these methods and to set targets that are relevant to their context and resources, while maintaining consistency with the targets set out in the SDGs.

While South Africa has developed methodologies to domesticate our indicators, some of the indicators are still not being measured in a meaningful way that shows and drives progress against the targets. For some of these indicators, an assessment, and potentially, a revision of these methodologies is required. For others, new methodologies are required to be developed. In addition, several new indicators are required, and a solid founding methodology is required for the new indicators. Research by a multidisciplinary team with a deep understanding of water resources management in the South African context is required to achieve these research outputs.

1.1 SDG 6 Adoption in South Africa

SDG 6 has been divided into 8 targets, which are then divided into indicators. The intent of setting the targets and defining the indicators is to monitor progress in achieving SDG 6. The DWS, works closely with several other branches of government, as well as other organisations, to measure and report on the indicators. The objective of monitoring and reporting on the indicators is to effect real change in the water and sanitation landscape in South Africa, by informing policy formulation and aiding decision-making.

South Africa's monitoring of, and performance against, the SDG 6 indicators has shown slow uptake of policies and actions developed for water and sanitation. South Africa published a Community Survey in 2016 (StatsSA, 2016), an SDG Baseline Report in 2017 (StatsSA, 2017), an SDG Country Report in 2019 (StatsSA, 2019), and a General Household Survey in 2019 (StatsSA, 2019). In addition, South Africa has established a Goal Tracker website (StatsSA, 2021). These documents show that several indicators are not tracked, that data continuity is poor for some indicators, and that there is a lack of consistency in tracking some indicators.

The DWS and Water Research Commission (WRC) has identified problematic indicators within SDG 6, resulting in the appointment of an SDG 6 working group, under SRK Consulting South Africa's (Pty) Ltd (SRK's) leadership, to evaluate targets, indicators, and methodologies for SDG 6.6, 6.3 and 6.b; and to propose improvements where shortfalls are identified. These gaps/shortfalls will inform the development and definition of new additional indicators, where required; using existing data (where available) and investigating new data sources (where data are not available).

1.2 SDG 6.b Background

Target 6.b works towards ensuring the needs of all people in terms of water and sanitation are being met through the participation of local communities in water and sanitation planning and management. It is essential for relevant stakeholders to be involved to ensure that identified technical and administrative solutions are feasible for specific socioeconomic contexts, provide a full understanding of impacts of development decisions, and encourage local ownership of implemented solutions to ensure they are sustainable.

The implementation of all other SDG 6 targets is supported by target 6.b through the promotion of local community involvement, which is also an essential component of the Integrated Water Resources Management (IWRM).

Target 6.b

"Support and strengthen the participation of local communities in improving water and sanitation management"

2 Scope of Work

Research Task 3.a[1]: Situation assessment, reviewed methodology for SDG 6.b (Task Leader: Giulia Barr. Team: Bjanka Korb, Lindsay Shand and Simon Lorentz):

1. The developed methodology to measure the current indicator SDG 6.b.1 will be reviewed, taking into consideration the methodology given by the UN and assessing if it is applied in the most pragmatic and rational way.
2. Current progress against the 6.b.1 indicator will be assessed.
3. The way in which the methodology and results influence national decision-making (if at all) will be evaluated. Checks will be done to see if the indicator has inspired policy-level changes in the years since its adoption.
4. The DWS approach towards compliance with the method of computations and indicator requirements for 6.b.1 will be assessed.
5. The statistical correctness and scientific validity of the method for 6.b.1 will be assessed.
6. Recommendations for amendments and improvements will be compiled, and where appropriate, alternative methodologies recommended.

Research Task 3.b: additional new indicators for SDG 6.b (Task Leader: Giulia Barr. Team: Bjanka Korb, Lindsay Shand and Simon Lorentz):

7. A new indicator 6.b.2 and its method of computation will be developed, which will measure the level of community involvement related to 6.b.1. Consideration will be given to data that is currently accessible.
8. Recommendations for additional information in future management targets for 6.b.2 will be compiled.
9. Data analysis and syntheses will be conducted in collaboration with DWS and StatsSA, taking cognisance of the possible linkages with other SDGs relating to community involvement in water

[1] Research Task 3a was undertaken as a separate task prior to Research Task 3b. Refer to SRK Report 582205/04, November 2022.

management to avoid any duplication of reporting by South Africa. Regular virtual meetings will take place with key DWS representatives to facilitate this collaboration.

10. DWS will be assisted with selecting and developing methods for the additional country level indicator where gaps have been identified.
11. The following strategies would need to be reviewed as part of this research task, and any new indicators developed (for community involvement in water management) would need to be aligned with related indicators in these strategies:
    a. Agenda 2063
    b. National Development Plan
    c. Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)
    d. National Water Resource Strategy 3 (draft)
    e. National Water and Sanitation Master Plan (Volume 1-3)

3 Strategy Reviews

Available strategies have been reviewed to ensure that new indicators developed for community involvement in water management are aligned with related indicators in the strategies. This section includes the outcomes from the reviews.

3.1 Agenda 2063

The Agenda 2063 is "a shared strategic framework for inclusive growth and sustainable development and a global strategy to optimise the use of Africa's resources for the benefit of all Africans". The framework has been set to be achieved in the next fifty years (until 2063) at continental, regional and national scales, and was agreed upon by the African leaders in 2013 through the 50th Anniversary Solemn Declaration during the commemoration of the 50th Anniversary of the Organisation of African Unity. Agenda 2036 is a people-driven initiative that converts ideals into concrete objectives, milestones, goals, targets and actions/measures.

The 50 year period has been separated into five ten-year plans, which includes certain goals and targets to be achieved. These goals and targets are mainly set out to achieve the development of seven aspirations that ultimately aim to ensure sustainable socio-economic growth and include:

1. A prosperous Africa based on inclusive growth and sustainable development.
2. An integrated continent, politically united based on the ideals of Pan-Africanism and the vision of Africa's Renaissance.
3. An Africa of good governance, democracy, respect for human rights, justice and the rule of law.
4. A peaceful and secure Africa.
5. An Africa with a strong cultural identity, common heritage, values and ethics.
6. An Africa, whose development is people-driven, relying on the potential of African people, especially its women and youth, and caring for children.
7. Africa as a strong, united, resilient and influential global player and partner.

The First Ten-Year Implementation Plan has already been implemented, extending from 2014 until 2023. The latest progress has been reported in the second biennial report, detailing each country's performance, which involves an assessment of the actual value derived for 2021 against the base value (2013) and the expected value (2021). The methodology pertaining to these three aforementioned data points, includes various analyses for specified indicators and involves multi-stakeholder participation. Significant progress has been made towards achieving the targets of the First Ten-Year Implementation Plan of Agenda 2063. This is evident from the reports provided from 38 of the 55 African Union (AU) Member States.

A communication strategy is in place for Agenda 2063 that addresses the lack of effective use of communication tools used by previous strategies and frameworks. The main objective of this strategy is "to engage the African citizenry and institutions for ideas generation/sharing, participation in periodic development/revision of the results framework, participation in the monitoring and evaluation and more importantly their owning of the Agenda 2063" (African Union Commission, 2015).

Agenda 2063 has taken into consideration the SDGs in the development of goals (African Union Commission, 2015). Agenda 2063's goal that links to SDG 6.b is to ensure environmentally sustainable and climate resilient economies and communities. One of the targets for this goal is for all households/communities and government entities to be aware and to lead sustainable lifestyles with regards to the use of water (African Union Commission, September 2015).

Aspiration 1 of Agenda 2063 has the most relevance with regards to water resources management. Goals 6 and 7, presented in Table 4-1, focus particularly on protecting the environment and ecosystems to ensure the sustainability of all natural resources. Both these goals align with SDG 6. Goal 6 prioritizes the blue economy to accelerate economic growth, improve livelihoods and create job opportunities for citizens while preserving the health of oceans. It is inclusive of several sectors to ensure a holistic approach toward decision-making procedures pertaining to the sustainable use of ocean resources. Currently, the health of ocean ecosystems is declining, which urges the need to protect and rehabilitate these water bodies. Oceans provide services such as marine transport, fisheries, tourism and several others, all of which are key to promoting economic growth. Therefore, protecting ocean ecosystems while benefitting from the services it provides is imperative.

Table 3-1: Agenda 2063 Goals relating to SDG 6

Aspiration	Agenda 2063 Goal		Agenda 2063 Priority Areas
A Prosperous Africa, based on Inclusive Growth and Sustainable Development	6	Blue/ocean economy for accelerated economic growth	Marine resources and energy
			Port operations and marine transport
	7	Environmentally sustainable and climate resilient economies and communities	Sustainable natural resource management and Biodiversity conservation
			Sustainable consumption and production patterns
			Water security
			Climate resilience and natural disasters preparedness and prevention
			Renewable energy

Note: Source – https://au.int/agenda2063/goals

3.2 National Development Plan

The aim for the National Development Plan (NDP) is to eliminate poverty and reduce inequality by 2030. The plan provides a broad strategic framework to guide key choices and actions for South Africa. South Africa's history emphasizes the importance of unity and social cohesion in ensuring social and economic growth and development. This is a prerequisite for eliminating poverty and inequality in the country. The NDP sets out several priorities to reduce poverty and inequality by 2030. It is a strategic framework that uses a holistic approach involving multi-stakeholder participation to ensure success in achieving its goals by 2030. The National Planning Commission is an advisory body appointed in 2010 to specifically focus on developments toward the NDP. This commission highlighted several challenges mainly pertaining to inequalities amongst citizens which includes:

- Few employed citizens
- Poor quality of education for black people
- Poor infrastructure developments
- An unstable economy
- Poor quality of public services
- A divided society
- High levels of corruption

Despite living eighteen years into democracy, these aforementioned challenges still exist, which emphasizes the need to accelerate progress and create a more inclusive economy. Transforming the economy is necessary to ensure that opportunities provided to citizens are based on their education and ability and not on their race and gender. While South Africa has advanced post-apartheid by working towards an inclusive society, poverty and inequality still remain a major concern in the country. Furthermore, the country's population is continuously increasing, which emphasizes the need for a faster-growing economy. As a result. The NDP aims on addressing the following:

- Economy and employment
- Economic infrastructure
- Environmental sustainability and resilience
- Inclusive rural economy
- South Africa in the region and the world
- Transforming human settlements
- Improving education, training and innovation
- Health care for all
- Social protection
- Building safer communities
- Building a capable and developmental state
- Fighting corruption
- Nation-building and social cohesion

To reach these goals, a multi-stakeholder approach is necessary, and to make significant progress towards reducing poverty levels and inequality, it is crucial that all citizens work together to develop a capable state. The NDP sets out several targets to be achieved by 2030 to make faster progress in creating a more fair, prosperous and equitable South Africa.

In the process of ensuring a faster-growing economy to eradicate poverty and inequality, it is important to do so in an environmentally sustainable manner. While benefiting from the country's mineral wealth, the environment is generally disregarded. South Africa is provided with many services from its oceans, soil, water and biodiversity. Therefore, priority needs to be given towards the protection of the environment, which is equally important in creating a better standard of living.

The purpose of the NDP is to secure the future of all South Africans. The action plan aligns with the Constitution, which sets out the rights and duties of its citizens. Both the NDP and Constitution elaborate the right of citizens to have access to sufficient safe water. While the primary focus of the NDP is to promote economic growth to overcome poverty and inequality, water resources management is also prioritized as it is a critical component in ensuring economic growth. The water-related actions set out in the NDP are presented in Table 4-2.

Table 3-2: SDG 6 Relevant NDP Objectives and Actions for South Africa

Chapter		Action		
3	Economy and Employment	5	Increase the benefit to the country of our mineral resources by	Increasing rail, water and energy infrastructure
4	Economic Infrastructure	24	Water Resources	Comprehensive management strategy including an investment programme for water resource development, bulk water supply and wastewater management for major centres by 2012, with reviews every five years
		25	Water Resources	Complete phase 2 of the Lesotho Highlands water project by 2020
		26	Water Resources	Development of several new water schemes to supply urban and industrial centres, new irrigation systems in the Umzimvubu river basin and Makhathini Flats, and a national water conservation programme to improve water use and efficiency
		27	Water Resources	Create regional water and wastewater utilities, and expand mandates of the existing water boards (between 2012 and 2017)
7	South Africa in the Region and the World	41	Implement a focused regional integration strategy with emphasis on:	Strengthening regional cooperation in food and energy markets and water management

The strategies outlined in Table 4-2 focus on ensuring economic stability, which requires improved water-related infrastructure and sustainable management of the resource. A particular focus is placed on wastewater management and infrastructure, which strongly aligns with SDG 6.b. Poor infrastructure leads to increased amounts of waste in our water bodies posing a serious health hazard to citizens and affecting the economy. In addition to the need for better infrastructure, the development of new irrigation systems is prioritized. The agricultural sector uses a large proportion of water resources; therefore, efficient irrigation systems are necessary to prevent wastage of water.

While Table 1.2 highlights all the water-related actions necessary to promote economic growth, the NDP also aims at ensuring environmental sustainability and resilience. While benefitting from the services provided by the environment, it is important to do so in a sustainable manner without degrading the health of our ecosystems. This aspect aligns with SDG 6 focusing on protecting and managing water-related ecosystems. Economic growth relies heavily on water-related ecosystems for freshwater resources. Climate change is currently a major concern and is being accelerated by increased greenhouse gas emissions. As a result, weather patterns are changing, which means that rainfall as a source of water is becoming more unreliable. In such instances, water-related ecosystems such as wetlands, rivers and lakes become more necessary, emphasizing the importance of maintaining such water bodies.

3.3 Medium Term Strategic Framework: Outcome 10 Phase 2 (draft)

South Africa has been involved in several initiatives, all leading to a common purpose, which is to improve the quality of life in a sustainable manner. These initiatives include Agenda 2030, Agenda 2063 and achieving the targets associated with the SDGs. The goals of the initiatives have formed the basis of the NDP, which outlines the nation’s long-term goals and provides methods that can be implemented by the country to ensure a faster and more equitable growing economy. South Africa has made significant progress toward achieving the targets of the NDP. The country has made a mark internationally through its participation in the UN, AU and several other representative bodies.

The NDP aligns with and is supported by the Medium-Term Strategic Framework (MTSF). The MTSF reviews the initiatives put forward by the NDP and sets out a realistic plan for achieving those targets. Whilst the 2014-2019 MTSF focussed on outlining a plan to implement the NDP, the 2019-2024 framework looks specifically into the government priorities set out by the president in 2019. The limitations and challenges experienced in the past were considered and used as a guide toward the initialization of the 2019-2024 MTSF. The government outlined a total of seven priorities, which cover all the aspects considered important for South Africa's development. A great amount of planning and initiative will be dedicated to achieving each of these seven priorities, which include:

1. A capable, ethical, and developmental state
2. Economic transformation and job creation
3. Education, skills, and health
4. Consolidating the social wage through reliable and quality basic services
5. Spatial integration, human settlements, and local government
6. Social cohesion and safe communities
7. A better Africa and world

Each of these priorities has specific outcomes, interventions, and indicators, which ultimately align with the overall aim of the priority. To achieve the goals set out in each of the aforementioned priorities, a holistic approach will be necessary to reach the best possible outcome. This will include participation from the government, multiple stakeholders, and society. In the process of implementing the outlined plan, priority will be given to women, youth, and people with disabilities. The seven priorities are aligned with the three pillars of the NDP. These three pillars include:

1. Achieving a more capable state
2. Driving a strong and inclusive economy
3. Building and strengthening the capabilities of South Africans

The seventh priority aims at establishing a better Africa and world. To ensure a better future for all, change will have to take place. Increasing opportunities to ensure economic growth is a crucial priority. This will involve many strategies including achieving equality among communities, a good governance system, increasing exports, growth in the tourism sector, increasing trade, and enhancing the implementation of the SDGs, Agenda 2030 and Agenda 2063.

As outlined in the review above, the MTSF is an action plan for implementing the initiatives set out in the NDP. A focus of the MTSF includes the enhanced national implementation of the SDGs. With alignment to SDG 6, there are certain outcomes in the MTSF that prioritizes water resources management. One of the outcomes under priority 2 aims at promoting water security by reducing delays in water use licenses. To prevent wastage of water resources, water users require authorization, which is undertaken through a water use license application. However, there has been delays in issuing water use licenses, which is mainly due to a lack of capacity in the DWS. Therefore, the MTSF aims to reduce the timeframe for processing these applications.

With regards to priority 5 of the MTSF, there are a few outcomes relating to water resources. Priority 5 places focus on rural communities, which are exposed to high levels of poverty and inequality. These communities do not have access to good quality basic services including clean water. As a result, the MTSF has set out a target to improve ecological infrastructure, which is a key source of freshwater. Assessing water treatment works is also prioritized to ensure good water quality. While water treatment works are essential due to drinking water shortages, poor conduction can result in the contamination of water bodies, which poses a health hazard to both humans and ecosystems. Current water legislations will also be reviewed to evaluate current water ownership and governance to be able to make more equitable and sustainable decisions. This will aid in identifying illegal uses of water resources, which would prevent wastage as well as the degradation of the environment.

From the aforementioned factors, it is evident that there is a need for enhanced management capacity to overcome the growing pressures placed on water resources. This includes the development of human resource capacity to allow individuals to gain the skills that are necessary for effectively managing water resources. Furthermore, to implement the strategies set out in the MTSF such as the rehabilitation of ecological infrastructure, investments will be required to support such interventions. An effective water management system, the protection of the natural water environment and working together in a holistic manner are all crucial aspects in achieving water security and sustaining the resource in the long term.

3.4 National Water Resource Strategy 3 (Draft)

The National Water Resource Strategy (NWRS) assists in the implementation and operationalising of the National Water Act (Act 36 of 1998) (NWA), which also binds authorities and institutions implementing the Act. The strategy also assists in managing water across all sectors with the aim of achieving the national government's development objectives.

NWRS 1 was published in 2004 and NWRS 2 was published in 2013, that consisted of a blueprint for water resources management in South Africa. NWRS 3 builds onto the previous two editions and the revision of the strategy is being developed to assist with the following:

- Facilitate the proper management of the nation's water resources
- Provide a framework for the protection, use, development, conservation, management and control of water resources for the country as a whole
- Provide a framework within which water will be managed at local, regional or catchment level, in defined water management areas
- Provide a framework for strengthening the regulation of the water and sanitation sector
- Provide information about all aspects of water resource management
- Identify water-related development opportunities and constraints
- Provide opportunities for the implementation of innovative technologies and solutions

NWRS 3 aims to ensure the protection and management of water resources to enable equitable and sustainable access to water and sanitation services in support of socio-economic growth and development for the well-being of current and future generations in South Africa. The strategy is also aimed at all sectors and stakeholders that are involved in the use and impact on South Africa's water resources. Strategic objectives and actions are outlined to be carried forward for resourcing and implantation in the National Water and Sanitation Master Plan (NW&SMP), aligning with the NWA.

The SDGs form one of the key areas that are focused on in the NWRS 3. An alignment between SDG 6 and NWRS 3 has been indicated as essential in achieving the required goals and targets for South Africa and to improve the effectiveness of the national response.

3.5 National Water and Sanitation Master Plan (Volume 1-3)

South Africa is a water-scarce country, experiencing approximately 30% of the global average annual rainfall. The country is currently undergoing a water crisis due to the low rainfall distribution, which is further exacerbated by several factors including climate change, population growth, poor infrastructure, deterioration in water quality, lack of human capacity, and numerous other factors. This has a detrimental impact on the sustainability of water resources in the long term, ultimately minimizing economic growth and affecting the lives of all citizens. Therefore, it is of utmost importance that the country overcomes this water crisis through the implementation of effective strategies to ensure a sufficient supply of good-quality freshwater resources in the future. Several initiatives have been implemented, which place a focus on monitoring water bodies and developing strategies to address the current crisis. These include the NDP, MTSF, National Water Resource Strategy, and Agenda 2063. Additionally, the SDGs, particularly SDG 6, aim to ensure the provision and sustainable management of water resources for every citizen. Each of these initiatives has its respective targets in order to achieve its goals. The NW&SMP aligns with all the aforementioned initiatives and sets out a strategic framework to ensure the country achieves the water-related targets and goals that are put forward. The key objectives of this plan include:

- Resilient and fit-for-use water supply
- Universal water and sanitation provision
- Equitable sharing and allocation of water resources
- Effective infrastructure management, operation, and maintenance
- Reduction in future water demand

To carry forward this plan of ensuring the sustainability of water resources, the inclusion of multiple stakeholders all working together will be a crucial step. The time frame for the implementation of the different strategies set out in the NW&SMP is between the present until 2030. During this time frame, the plan will be evaluated and updated where necessary. This will be based on factors such as additional inputs from stakeholders, amendments to the targets that have been set out, and available budgets. The NW&SMP will be led by DWS and will also involve participation from other governmental institutions, the public sector, and society. There are two main categories, the first being water, and sanitation management and the second being an enabling environment, which each consists of six priorities that must be addressed to ensure water security. These priorities are presented in Table 4-3.

Table 3-3: The twelve elements of the NW&SMP

Water and Sanitation Management	Enabling Environment
Reducing water demand and increasing supply	Creating effective water sector institutions
Redistributing water for transformation	Managing data and information
Managing effective water and sanitation services	Building capacity for action
Regulating the water and sanitation sector	Ensuring financial stability
Improving raw water quality	Amending the legislation
Protecting and restoring ecological infrastructure	Enhancing research, development and innovation

Population growth accelerates the need to reduce the demand for water and increase its supply to ensure that all citizens have access to an adequate quantity of water. In addition to population growth, other factors such as climate change, improper planning, poor infrastructure, and water wastage negatively impact water supply. The agricultural sector utilizes most of the water supply (≈ 61%), however, there are several concerns regarding this usage. While this sector is a major contributor toward food supply, job creation, and the GDP of the country, there are concerns such as water wastage due to inefficient irrigation scheduling options, unlawful abstraction, and low tariffs. Furthermore, climate change impacts are expected to increase the water demand of the agricultural sector due to increased temperatures, which will make rainfed agriculture more unreliable. Therefore, it is important to eliminate any issues that currently exist to ultimately prevent water wastage. The average domestic consumption also needs to be reduced to ensure water efficiency and equity. There are currently several strategies that have been implemented to increase water supply and lower its demand. These include the Water Administration System Release Module for more efficient irrigation scheduling and the National Strategy for Water Reuse to promote the reuse of water at all scales. Other solutions to increase the supply of quality freshwater resources include desalination and maintaining ecological infrastructure.

Transformation regarding the distribution of water resources is necessary to ensure the equitable allocation of water for productive purposes and that all citizens have access to clean water and sanitation. The impacts of the apartheid era are still affecting the lives of citizens. Black farmers own a very small percentage of commercial farms, which are also relatively smaller in size when compared to the commercial farms owned by white farmers. As a result, less attention is given to black farmers regarding access to water resources. Therefore, DWS and the Department of Agriculture, Forestry and Fisheries will work together on developing strategies to make water available for black farmers.

While significant progress has been made in providing households with water supply and sanitation services, the reliability regarding access to these basic services remains an issue. Poorly maintained Water Treatment Works and Wastewater Treatment Works are among the key concerns regarding public health. While several strategies have been initiated over the years, the supply of water and sanitation services remains a concern due to the lack of human and institutional capacity, financial restraints toward maintaining infrastructure, and poor management. To effectively manage the provision of water and sanitation services to all citizens, more appropriate interventions are required such as upskilling technical staff and finding better funding strategies to improve and maintain water-related infrastructure.

Regulation of water use is necessary to ensure the efficient use and sustainability of the resource. The DWS oversees regulating water resource use across South Africa. Despite efforts that have been put into place regarding this element, water wastage is still a great concern. Therefore, the implementation of better strategies is needed. Some possible actions include identifying and prosecuting unauthorized abstractors, setting a cap on water use, and developing by-laws to ensure the protection of the natural water environment. Improving raw water quality also aligns with managing water resources effectively. Water quality is affected by both point-source and non-point source discharges. Poor water quality has many detrimental impacts on the economy, society, and environment. Implementing solutions to ensure that all water users utilize and discharge water resources in a sustainable manner is crucial. Furthermore, the development of more reliable water-related infrastructure is required. Ensuring good water quality is of great importance, therefore, monitoring the quality of water on a frequent scale must be undertaken to avoid long-term consequences.

The protection and restoration of ecological infrastructure is also a key element in ensuring water and sanitation management. South Africa's ecological infrastructure consists of a wide range of ecosystems that provide many services to both the economy and society. Many of these ecosystems, however, are being severely degraded due to poor practices, an increasing population, and the spread of alien invasive species. This has resulted in many consequences such as communities being more prone to flood disasters and increased costs to maintain infrastructure. Therefore, it is important to prioritize the protection of ecological infrastructure due to the number of benefits they provide. DWS has been working with the South African Biodiversity Institute and the Council for Scientific and Industrial Research to be able to locate and ensure the protection of key water sources.

The second category of the NW&SMP focused on strengthening the capability of the country to ensure that it has the ability and resources necessary to overcome the water crisis and ensure water security. The first priority involves creating effective water-related institutions. DWS is the lead institution regarding the distribution and management of water resources. There are several other institutions that also play a critical role in management including the Department of Co-operative Governance and Traditional Affairs and the National Treasury. The latter provides grants and financial assistance toward the provision of water resources and the management of municipal services. Amendments to water-related institutions are necessary to promote more efficient regulation of water and sanitation services. Additionally, while DWS leads the process, a more decentralised approach is needed in managing water resources.

Managing data and information is crucial to reach more decisive outcomes and ensure better planning for the sustainability of water resources. Gathering information regarding water use and the key activities affecting this resource, on a consistent basis will aid in better decision-making among stakeholders and create a more adaptive approach. There are currently a number of information systems that exist such as HydroNET, the Water use Authorization and Registration Management System, and the National Integrated Water Information System. However, to keep up with the changing circumstances, continuous improvements and the development of modernized information systems are needed to expand on knowledge to better monitor and manage water resources.

To create more effective institutions, building human capacity is essential. Skills development allows for staff to have the necessary expertise to be able to have a good understanding pertaining to water resources and carry out the key functions to sustainably manage and operate the sector. Currently, there is a shortage of qualified individuals within water-related institutions. Additionally, graduates entering the working environment do not have the necessary practical skills. The lack of skilled professionals makes it difficult to undertake key functions in the water sector. Therefore, developing high-end skills, providing training for recent graduates, and expanding on knowledge are all crucial in building capacity to ensure a well-skilled workforce.

Water-related institutions abide by two acts, the NWA and the Water Services Act. The NWA aims to ensure that the country's water resources are protected, used sustainably, conserved, managed, and controlled. The Water Services Act aims to provide all citizens with access to basic water supply and sanitation services to ensure good human health and well-being. Amending these aforementioned legislations as well as other existing acts is necessary to align the with current circumstances in order to derive a more sustainable outcome. Current concerns that exist in these legislations revolve around the ownership of water-related and sanitation infrastructure and services, water use authorization, the protection of ecological infrastructure, and the regulation of water resources. These aspects need to be addressed and amended accordingly.

The NW&SMP prioritizes all the key elements that need to be addressed to ensure the sustainability of water resources. It is evident that all these elements that form part of the NW&SMP either directly or indirectly relate to SDG 6. Therefore, this plan is crucial in achieving the goals and targets set out in SDG 6 to allow for the management of water resources more effectively. To carry forward this plan, participation from the government, multiple stakeholders from both the public and private sectors, and civil society are crucial. Owing to the many factors that negatively impact water resources, the NW&SMP acts as an urgent response to overcome these issues and sustain the resource in the long term.

4 Data Analysis

In order to achieve sustainable development, consistency is required between the development of policies and the providers of development assistance (Fourie, 2018). The difficulty comes in achieving this consistency. Analyses and peer review research have been undertaken on policy documents and on the Policy Coherence for Development movement. Five guidelines have been identified to be of relevance for South Africa, which include:

i. Prioritising political buy-in

ii. Safeguarding country ownership of development priorities

iii. Using and improving existing institutional structures and processes

iv. Stimulating cooperation across government departments by using an issue-based approach

v. Including a long-term and transnational perspective when considering policy impacts

It has been determined that water resource management requires integrated approaches to sustainable development (Fourie, 2018). Trade-offs have also been identified resulting from water and sanitation management, therefore stressing the importance of improving water and sanitation management efforts. An example of the trade-offs is regarding the link between water management and food security. Improved water management will result in an increase in the access of clean water, improving the output of agricultural yields.

Programmes and organisations exist within South Africa that support community based projects and initiatives in achieving sufficient water and sanitation management through local community participation, which supports the aim for SDG 6.b. These programmes and organisations include:

- The Mvula Trust
- The Association for Water and Rural Development (AWARD)
- Tsogang Water & Sanitation (Tsogang)

4.1 The Mvula Trust

The Mvula Trust was established in 1993 and is a non-profit organisation that specialises in community based projects, which include programmes for water and sanitation and water management in rural areas. These projects assist poor communities in achieving access to a reliable and safe water supply and empower communities to play a stronger oversight role through the measurement, advocacy and impact management of water resources.

A formal agreement and co-operative partnership is in place between the Mvula Trust and DWS, who assists the organisation with funding for various projects. A community management and demand responsiveness approach has been developed by the organisation that has completed over 250 water reticulation projects through the Community Based Project Management Approach and has completed thousands of sanitation programmes in seven of the nine South African provinces.

The organisation works with the local government to engage with communities through public education on water demand management practices. This also provides a sense of ownership and responsibility for the responsible management of water and sanitation services at a community level. The Mvula Trust also provides support to municipalities in understanding the importance of water conservation and works with the municipalities towards obtaining infrastructure investments in rural wastewater treatment and appropriate technologies. The municipalities' support offered by the organisation is undertaken in close co-operation with DWS to develop institutional capacity and implement policies and legislation around water and sanitation provision. Catchment Management Agency (CMA) forums have also been set up and supported by the Mvula Trust.

The Mvula Trust continues to provide a valuable platform through the combination of community based project management and policy, practice and implementation, to ensure that communities (especially rural communities) remain the focus for water and sanitation agendas.

4.2 AWARD

AWARD is a non-profit organisation that specialises in multi-disciplinary, participatory, research based project implementation, focusing on addressing sustainability, inequality and poverty issues. The organisation mainly focuses on north-eastern catchments such as the Olifants River Basin but also does work in other catchments across the southern African region. The aim is to develop, test and inform new and suitable ways to manage water and biodiversity, contributing to sustainable futures for all, to be achieved through the following:

- Research-based, participatory enquiry and implementation
- Communicating and sharing learnings and findings
- Influencing and supporting institutions with responsibility for policy and implementation
- Working with approaches that support the livelihoods of the vulnerable and poor
- Adopting innovative approaches that support transformation in line with the vision
- Adopting systemic approaches in support of catchment-based water resources management and regional biodiversity initiatives
- Adopting a social learning orientation towards capacity development

A support for water security and water resources protection is provided by AWARD through a transboundary IWRM. Policies that have been developed in South Africa support decentralisation, stakeholder participation and catchment (or basin) approaches. AWARD has focused efforts on supporting DWS through the proposal to alter the CMAs in South Africa from late 2017 into 2018, and attention was turned to stakeholder networks and support for the DWS regional offices. The organisation has indicated that catchment management forums need to structure participation from stakeholders in a manner that is meaningful, open and democratic. Guidelines to guide stakeholder involvement in water resource management processes have been developed by AWARD, which will also assist in establishing a forum with clear functions and purpose.

4.3 Tsogang

Tsogang was established in 1994 and is a non-profit organisation that mainly focuses on the water, sanitation and hygiene (WASH) sector and works with various stakeholders and individuals to improve the life of community members. The organisation mainly works within Limpopo, Mpumalanga and Kwa-Zulu Natal. Work is created through water, sanitation and community development projects and to capacitate communities, especially remote rural communities. Tsogang provides infrastructure facilities for water, sanitation, communal and household gardens, and also offer capacity building, coaching, mentoring, monitoring and evaluation. The organisation works with government departments, municipalities, traditional authorities, community organisations, individual households, other non-profit organisations and supported local based entrepreneurs to participate in capacity building programmes. Contributions are recognised by the WASH sector at a local, national and global scale.

The organisations objectives include:

- Developing innovative, appropriate and sustainable projects in vulnerable communities
- Developing accredited training courses and conducting training to increase community participation
- Developing staff capacities in engaging with and developing relationships with stakeholders including government, local service providers, businesses, non-profit organisations and communities
- Educating and training underprivileged children and youth of daily wage workers for a better future
- Water cycle management and conservation through organisations that employ the youth so they can live their dreams for themselves and their families
- Environmental conservation through education and employment to provide people with an inner strength to lead a better life.

5 SDG 6.b Development of Additional Indicator

Domestication of the indicators has allowed South Africa to identify one possible additional indicator based on existing country programmes. The additional South African indicator identified during this review process were to be highlighted and would require a process of testing with available data.

5.1 Additional Indicator

Based on the review of the methodology developed to date for SDG 6.b, one possible additional sub-indicator has been identified during this review, for consideration, summarised in Table 5-1.

Table 5-1: Additional indicator SDG 6.b.2

Indicator		Features
6.b.2	Level of community involvement in improving water and sanitation management	Considerations should be provided for the following: • Stakeholder and community engagements • Organisations • Community projects and initiatives

5.2 Proposed Methodologies

The proposed methodologies to calculate the identified additional indicator, SDG 6.b.2 include measurements for stakeholder engagements and data collection at both national and provincial scales. The proposed methodology consists of a two-fold calculation in order to obtain a

The first calculation considers the percentage in the amount of water and sanitation management projects that involve community participation over the total number of water and sanitation management projects. The second calculation considers the percentage of communities that are involved in water and sanitation management projects over the total number of communities.

The indicator can be calculated as follows:

First calculation:

$$\frac{a}{b} \textbf{ X 100}$$

Where:

a = Number of water and sanitation management projects incorporating community participation

b = Total number of water and sanitation management projects

Second calculation:

$$\frac{c}{d} \textbf{ X 100}$$

Where:

c = Number of communities involved in water and sanitation management projects

d = Total number of communities

The percentages can be calculated per municipality, province, or for the country as a whole. This will also assist in providing data at a range of scales, assist in comparisons between municipalities, regions and provinces to give a better representation of the country's status quo and better understand where further assistance may be required. The percentages calculated can be presented graphically to assist with reporting.

5.3 Potential Data Sources

Possible data sources or monitoring mechanisms for additional information in future management targets for 6.b.2 may include the following:

- Municipal census or a representative sampling of municipalities.
- Undertaking a national survey.
- Formally minuted stakeholder engagement through the catchment management forums.
- Formally minuted community engagements on local participation with key stakeholders and members of the general public.
- Collection of information through existing projects undertaken at a local administrative unit level (i.e., using existing data obtained from the Mvula Trust, AWARD and Tsogang).

6 Conclusions and Recommendations

The new indicator SDG 6.b.2 will provide a more accurate representation of the participation of local communities in improving water and sanitation within South Africa and will also provide a more accurate representation of the status quo of the country in achieving SDG 6.b.

The South African methodologies generated in relation to SDG 6.b.2 focusing on the level of community involvement in improving water and sanitation management within South Africa, have largely been created based on gaps identified during the SDG 6.b existing methodology review. These methodologies may require updating as further data is identified and compiled, and should be robust enough to accommodate technological advances, to improve on the reporting efficiencies to supplement historical date reporting systems.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Methodology:
Indicator SDG 6.b.2 – Local community involvement related to 6.b.1

Version 1, February 2023

Goal 6:	Ensure availability and sustainable management of water and sanitation for all
Target 6.b:	Support and strengthen the participation of local communities in improving water and sanitation management.
Indicator 6.b.2:	Performance of local community involvement in improving water and sanitation management

B1 THE INDICATOR

B1.1 Organisations and Institutions

Department of Water and Sanitation (DWS)

The Mvula Trust

The Association for Water and Rural Development (AWARD)

Tsogang Water and Sanitation (Tsogang)

Water and sanitation forums

Catchment management forums

Local municipalities

B1.2 Definition

SDG target 6.b aims for local community participation in water and sanitation planning management. Indicator 6.b.1 is a global indicator, which tracks the proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management. Local administrative units refer to non-overlapping subdistricts, municipalities, communes or other local community-level units covering both urban and rural areas to be defined by the government. Policies and procedures for participation of local communities in water and sanitation management define a mechanism by which individuals and local communities can meaningfully contribute to decisions and directions on water and sanitation management.

The proposed methodology for Indicator 6.b.2 is *"Performance of Local Community Involvement in Improving Water and Sanitation Management"* in terms of the application of policies and guidelines (Table B.1). The stakeholder participation refers to a process or procedure in which individuals and local communities can significantly contribute to management decisions and directions. The indicator also incorporates information regarding the existence of procedures in law or policies relating to the participation of service users and local communities, the level of participation, separated according to sectors (e.g. drinking water, sanitation, hygiene promotion and water resources planning and management).

Table B.1: Phrase by phrase interpretation of Indicator 6.b.2

Indicator 6.b.2	Normative interpretation
"Performance of Local Community Involvement in Improving Water	*"Performance of"* Tracking and compliance monitoring.
	"Community" Groups of interacting people living in a common location.

Indicator 6.b.2	Normative interpretation
and Sanitation Management"	*"Involvement"* Involvement implies a mechanism by which individuals and communities (volunteers, community members, public-private partnerships, professional bodies, local municipalities) can meaningfully contribute to decisions and directions on water and sanitation planning that affect them or can be affected by them.
	"Improving Water and Sanitation Management" Implies an increase over time from a point of reference, of all aspects of water and sanitation.

B1.3 Rationale

Tracking the participation of local communities in improving water and sanitation management is vital to ensuring that the needs of everyone in the local community are met, including the most vulnerable. It is also essential to ensuring the long-term sustainability of water and sanitation solutions, i.e. the choice of appropriate solutions for a given social and economic context based on a full understanding of the impact of a certain development decision and on local ownership of solutions. This indicator, by assessing the degree of participation of local communities, thus informs the sustainability of water and sanitation management in a country and at local levels.

B1.4 Concepts and Terms

The concepts and definitions used in the methodology have been based on existing international frameworks and glossaries unless indicated otherwise below.

Cumulative: Increase in quantity by successive additions.

Change: Change refers to a shift from one condition to another; in this case it refers to a change in cumulative volume over time, in relation to a point of reference, within a water-related ecosystem.

Disaggregation: Data can be disaggregated by subnational regions as well as by urban/rural regions, providing information on equity.

Local communities: Groups of interacting people living in a common location

Participation: Participation implies a mechanism by which individuals and local communities can meaningfully contribute to decisions and directions on water and sanitation planning that affect them or can be affected by them.

B2 COMMENTS AND LIMITATIONS

Measurement of whether local communities are being included as per policy/guideline intentions or the impact their participation would be towards a particular project needs to be measured in terms of a standardized measurement unit and methodology e.g. measurement in terms of cost/benefit, sustainability, numbers of local community members employed etc.

Some of the measurement criteria are objective, and therefore may not be comparable.

B3 METHODOLOGY

B3.1 Computation Method

The proposed methodology includes measurement of stakeholder engagement and data collection at national, provincial and local scales. The proposed methodology consists of three calculations.

B3.1.1 Formulas

The first calculation considers the percentage of the number of water and sanitation management projects that involve local community participation over the total number of water and sanitation management projects. The following Equation *(1)* is used:

First calculation:

$$\frac{a}{b} \text{ X } 100$$

Where:

a = Number of water and sanitation management projects incorporating local community participation

b = Total number of water and sanitation management projects

The second calculation considers the percentage of local communities that are involved in water and sanitation management projects over the total number of local communities. The following Equation *(2)* is used:

Second calculation:

$$\frac{c}{d} \text{ X } 100$$

Where:

c = Number of local communities involved in water and sanitation management projects

d = Total number of local communities

The third calculation considers the percentage of WSAs that have procedures/processes for the participation of local communities in place over the total number of WSAs. The following Equation *(3)* is used:

Third calculation:

$$\frac{e}{f} \text{ X } 100$$

Where:

e = Number of WSAs have procedures/processes for the participation of local communities in place

f = Total number of WSAs

The percentages can be calculated per municipality, province, or for the country, as a whole. This will also assist in providing data at a range of scales, assist in comparisons between municipalities, regions, and provinces to give a better representation of the country's status quo and provide an understanding of where further assistance may be required. The percentages calculated can be presented graphically to assist with reporting.

In terms of progressive monitoring, countries can start with a qualitative estimation and gradually move towards more accurate quantitative estimations and assessments of the degree of stakeholder participation at the subnational level. Table B.2 presents examples of progressive monitoring.

Table B.2: Progressive Monitoring of Indicator 6.b.2

Indicator 6.b.2	Progressive Monitoring
"Performance of Local Community Involvement in Improving Water and Sanitation Management"	*First step* Qualitative estimation of degree of stakeholder participation at the national level.
	Second step Quantitative estimation of the total number of local administrative units and qualitative estimation of the degree of stakeholder participation in each of them.
	Third step Quantitative assessment of the degree of stakeholder participation.

To align to the UN global reporting standard for SDG 6.b.1 the proposed frequency of national data collection and reporting should be every two to three years.

B3.2 Treatment of incorrect and missing data

Missing data can be averaged out per monitoring period to provide a trend to minimise spikes created by missing data.

B3.3 Sources of discrepancies

Outdated community data sets and human errors

B4 DISAGGREGATION OF DATA FOR MANAGEMENT PURPOSES

The datasets from the potential data sources as recommended in B5 will be disaggregated by subnational regions (municipal and provincial) as well as by urban/rural regions to provide information on equity.

A later disaggregation of the provincial data sets into catchments may provide an improved perspective around local community involvement at a catchment scale.

B5 POTENTIAL DATA SOURCES

The recommended potential data sources or monitoring mechanisms of information of future management targets for 6.b.2 may include the following:

- Municipal census or a representative sampling of municipalities.
  - Latest municipal census.
  - Data that can be accessed from censuses and municipalities includes population groups/communities and their access to water and sanitation.
- Undertaking a national survey.
  - The survey can be undertaken online or in person.
- Formally minuted stakeholder engagements through the catchment management forums, and water and sanitation forums, where present.
  - These may inform the current and planned projects that may be in place within the catchments.
  - A record of community representation may also be beneficial to indicate where further engagements may be required.
  - Data and information can be gathered from the Integrated Development Plans and Water Services Development Plans.
  - It is important to determine which catchment management forums are still active and which are inactive.
  - It is also important to determine which water and sanitation forums are active.
- Formally minuted community engagements on local participation with key stakeholders and members of the general public.
  - These may inform the current and planned projects that may be in place within local communities.
  - A record of community representation may also be beneficial to indicate where further engagements may be required.
- Non-governmental organizations (NGOs)
  - NGOs such as the Citizen's Voice can also be a potential source of data.
  - Identify if the organisation covers required areas to be assessed.
  - Identify community forums that exist within WSAs that can provide data.
- Water and sanitation management projects and programmes
  - Data sharing opportunities from projects and programmes that are either planned, in progress, in place or completed.
  - Identify projects/programmes within each phase of implementation that can be used as data sources for the methodologies. A list of certain identified projects/programmes are presented in Table B.3.

Table B.3: Identified water and sanitation management projects/programmes

Project/programme	Phase
The Mvula Trust Water Management and Maintenance Programme	In progress
The Mvula Trust Sustainable Water & Sanitation	In progress
AWARD's RESILiM-Olifants Programme	In progress
AWARD's Networks for Farmers	In progress
AWARD's Wise Use of Wetlands	In progress
AWARD's Save the Sand Programme (SSP)	In progress
AWARD's Securing Water to Enhance Local Livelihoods (SWELL) Programme	In progress
AWARD's Bio-Smart	In progress
AWARD's Water Quality-Health Project in the Inkomati Basin	In progress
Tsogang's Multiple Use Water Services Programme (MUS)	In progress
Tsogang's Climate Change Adaptation Programme	In progress
Tsogang's Construction Education & Training Authority (CETA)	In progress
Tsogang's Water, Sanitation and Hygiene (WASH) In 9 Schools (WATERAID)	In progress
Tsogang's Covid-19 Interventions	Completed
Tsogang's Covid 19 Interventions in Six Schools	Completed
Working for Water (WfW)	In progress
Khanyisa Projects	In progress
Coke Ville	Completed
Ecolab Johannesburg South Africa Water Stewardship Project	In progress
South Africa Contextual Water Target Setting Pilots	In progress
The Upper uMngeni Super Catchment project	In progress
SUSFARMS Initiative- Sustainable Sugar Cane in South Africa	In progress
Durban, reducing water stress by reusing wastewater	In progress
Environmental Art project	In progress
MEGHDOOT Water from Air Systems	In progress
Project Khula: Protection Freshwater Resources while Improving the Livelihoods of Disadvantaged Sugarcane Growers in South Africa	Completed
South Africa Contextual Water Target Setting Pilots	In progress

F1.1. Collection process

Collection of information through existing projects undertaken at a local administrative unit level (i.e., using existing data obtained from the Mvula Trust, AWARD, Tsogang, water and sanitation forums, catchment management forums, local municipalities, etc.).

The data is generated on a quarterly basis, then audited later by DWS Head Office.

B6 DATA AVAILABILITY

B6.1 Description (Source data)

Various difficulties and limitations surrounding data collection and upload can exist namely:

- Issues in procurement and travel
- Insufficient staff
- Untrained staff

- Access control
- Financial constraints, etc.

B6.2 Time series

The reporting on this indicator will follow a 2 to 3-year cycle.

B7 DATA PROVIDERS

DWS (different components), local and provincial municipalities, national government initiatives, Department of Forestry, Fisheries and Environment (DFFE) associated with development initiatives and public consultation.

B8 DATA COMPILERS

DWS with support and input from local and provincial municipalities as well as the DFFE. DFFE are primarily responsible for analysing data in relation to new development within the water and sanitation sector through the National Environmental Management Act.

Table B.4: SDG 6.b.2 Summary of Data and Information Compilers

Data Provider	SDG 6.b.2
DWS	X
DFFE	X
Local Municipalities	x
Provincial Municipalities	x

X = Lead role player
x = supporting role player
- = No role

B9 MANAGEMENT TARGETS

Collecting information about stakeholder participation in water resource management requires integrated approaches to sustainable development (Fourie, 2018). Trade-offs have also been identified resulting from water and sanitation management, therefore stressing the importance of improving water and sanitation management efforts. Table B.5 summarises potential links between global and national indicators and targets for SDG 6.b.2.

Table B.5: SDG 6.b.2 Indicator and Targets from Global and South African Literature

Global and National Indicators for 6.b.2	Targets
Medium-Term Strategic Framework (MTSF)	
PRIORITY 2: Spatial Integration, Human Settlements and Local Government	
2024 Impact: Achieving spatial transformation through improved integrated settlement development and linking job opportunities and housing opportunities	
No. of bulk water supply projects implemented (completed)	51 bulk water and wastewater supply project phases completed of which: 9 were sanitation services and 42 were for water supply
2024 Impact: Rapid land and agrarian reform contributing to reduced asset inequality, equitable distribution of land and food security	
% of land reform projects with secure water rights	90%
National Water and Sanitation Master Plan (NW&SMP)	
1.4 Regulating the water and sanitation sector	
1.4.7 Develop and implement municipal bylaws to protect water quality.	Publication of updated bylaws that includes Project of Raw Water Quality
1.4.9 Establish a mechanism for applying administrative penalties	Strengthening Compliance and Enforcement training modules to build the capacity of EMIs in-house Strengthen the CME, finalisation of the Strategy and Implemented Plan Appoint Environmental Management Inspectors (EMI) to conduct CME
1.5 Improving raw water quality	
1.5.10 Formalise governance frameworks to support engagements on water quality management (SA10, SA11, SA12, SA13, SA14, SA15, SA54 & SA61)	Build from IGR framework and SADC protocols
National Biodiversity Strategy and Action Plan (NBSAP)	
SO 3. Biodiversity considerations are mainstreamed into policies, strategies, and practices of a range of sectors	
Number of compliance inspections conducted	By 2019, 14 500 compliance inspections conducted.
Number of enforcement actions undertaken for non-compliance with environmental legislation	By 2019, 1 500 completed criminal investigations handed to the NPA for prosecution (for EMI Institutions) and 3 100 administrative enforcement notices issued for non-compliance with environmental legislation.
SO 6. Effective knowledge foundations, including indigenous knowledge and citizen science, support management, conservation, and sustainable use of biodiversity	
Single portal exists through which all biodiversity information can be accessed	By 2016, the single portal is established, and it is being populated

B10 DISPLAY OF RESULTS

There are various ways of displaying results. Examples of some of the variations are presented in this section. The data in the graphs below is fictitious for demonstration use.

The performance of local community involvement in water and sanitation management can be displayed on maps for the various assessment scales as presented in Figure B.1. More in-depth assessments can also be done to compare the current condition against the management targets as illustrated in Figure B.2.

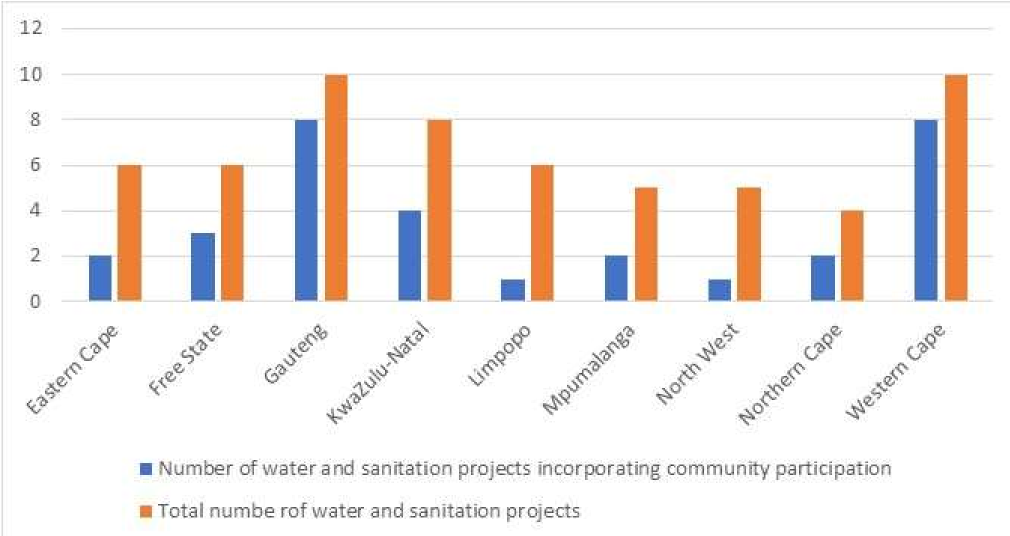

Figure B.1: Example of Provincial community involvement in water and sanitation management

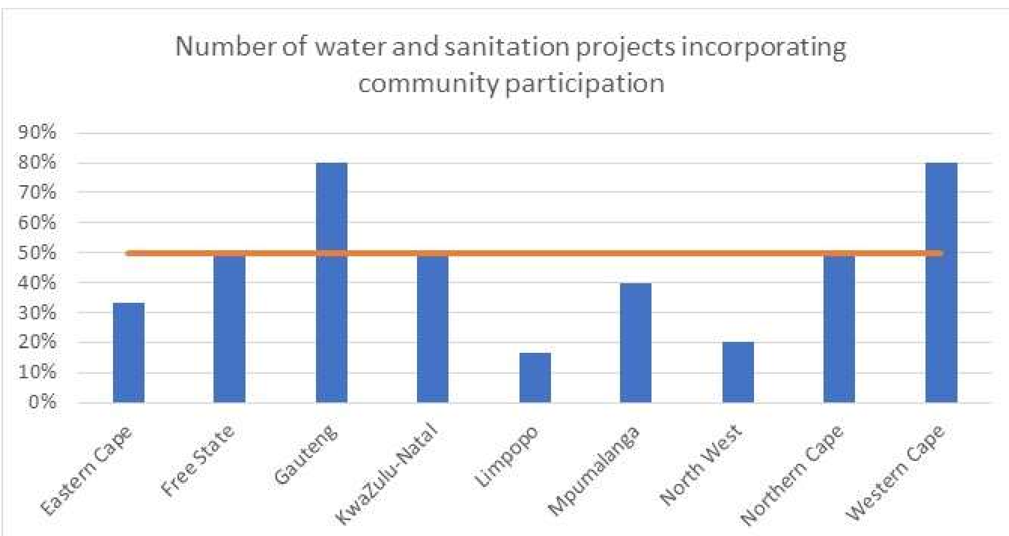

Figure B.2: Example of Provincial target setting and tracking of local community involvement in water and sanitation management

B11 COMMENTS AND LIMITATIONS

Data collection in relation to local community involvement in water and sanitation management has not been tracked as an indicator prior to 2023.

It is important that the same methods are used by all reporting agencies from which data is obtained for DWS's use when conducting the new assessments and that the methods, approaches, and interpretations be captured in a document for comparisons and future updates. The methods as they are implemented will need to be updated and written up, with a guideline, to make it easy for future studies.

B12 IMPLEMENTATION CALENDAR

Table B.6 describes how reporting on this indicator will be improved over time:

Table B.6: Improvement in the Availability of Data and Information for Indicator 6.b.2

Indicator	**Tier 1** **First step of progressive monitoring and information handling**	**Tier 2** **Second step of progressive monitoring and information handling**	**Tier 3** **Third step of progressive monitoring and information handling**
SDG 6.b.2 *"Performance of Local Community Involvement in Improving Water and Sanitation Management"*	Qualitative estimation of degree of stakeholder participation at the national level.	Quantitative estimation of the total number of local administrative units and qualitative estimation of the degree of stakeholder participation in each of them.	Quantitative assessment of the degree of stakeholder participation.
	End 2023	End 2024	Data collection on an annual basis to be reported on every 2 to 3 years (e.g. 2024, 2026, 2028 etc.)

Table B.7 below contains a summary of due dates and responsibilities for key implementation activities that apply to the roll-out of the Indicator methodology.

Table B.7: Key Implementation Activities and Due Dates to be Completed for Indicator 6.b.2

Implementation Activities		**Due Date**	**Responsibility**
1	Methodology Finalised	June 2023	DWS
2	National quantitative estimation of stakeholder participation	December 2023	DFFE, DWS
3	Local administrative units' quantitative estimation of stakeholder participation	December 2024	Implementing agent, DWS, DFFE
4	Data collection process and reporting	2 to 3 years (e.g. 2024, 2026, 2028 etc.)	DWS, DFFE

B13 ADDITIONAL INFORMATION

The data generated through the application of this methodology will be used to assist in validating the effectiveness of SDG 6.b.1 submitted by the UN, as part of the SDG process.

B14 METHODOLOGY REPORT COMPILERS

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