Evaluating the quality of water use licence application technical reports for solar power plants in the Free State Province

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Dissertation accepted in partial fulfilment of the requirements for the degree *Master of Environmental Management* at the North-West University

Supervisor: Dr HJ Moolman

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DECLARATION

I, Earl Daniels, hereby attest that this dissertation is the product of my own research and has not been submitted in whole or in part to any other university for credit toward any degree.

Earl Craig Daniels

27.07.2026

Date

DEDICATION

To my wife, Shahida Daniels, thank you for your endless patience, encouragement, sacrifices and for keeping our home intact while I pursued this degree. Your support has been the pillar of my post graduate academic journey.

My children, Shazia, Earlshahn and Jozearl, may this dissertation be a reminder to you that it is never too late to achieve great things in life and that anything is possible.

To my parents in-law, Wayne and Sharon Rothmann, thank you for the impeccable roles you had fulfilled thus far in assisting me to overcome my personal challenges through my academic journey.

To my father, Clive Daniels, thank you for complementing the acquisition and use of my knowledge with your much needed wisdom.

To my mother, Dolores Daniels, thank you for shaping my character and building the academic foundation that made this degree possible. I share this achievement with you.

To God be the Glory.

PREFACE AND ACKNOWLEDGEMENTS

"*If you think the economy is more important than the environment, try holding your breath while counting your money.*" (McPherson, 2013)

I would like to thank God Almighty for granting me the strength, wisdom, and peace to undertake and complete this dissertation through all challenges and difficulties.

I want to thank my wife, Shahida Daniels, for supporting and encouraging me through every step of this process with emotional and mental support. This one is for both of us.

I am grateful for the priceless advice and knowledgeable inputs from my lecturers and fellow students.

I want to acknowledge and thank my research supervisor, Dr. Jurie Moolman, for his dedication, patience, advice, and academic input throughout my research. I am forever grateful.

I would also like to thank my parents and siblings for encouraging and standing by me throughout my studies.

To my children: You are the reason I am breathing, thank you.

ABSTRACT

Globally, water resources are under pressure due to anthropogenic activities. One of the major contributors is the energy sector, driven by the increasing need for reliable electricity generation. In response to the environmental degradation of traditional electricity generation, renewable energy initiatives such as solar power plants are increasingly proposed in many countries, including South Africa. Semi-arid provinces in South Africa, such as the Free State province, have attracted solar power plant development due to abundant solar radiation resources. However, the province is known for threatened endemic biodiversity, protected areas, and stressed water resources. Despite the sustainable nature of solar power plants, they are not developed without environmental impacts, especially on water resources. The National Water Act (Act 36 of 1998) provides for the licensing of activities that may have negative impacts on water resources. This licensing process entails the submission of a Water Use Licence Application (WULA) technical report that is subjected to the scrutiny of the competent authority before the licensing of water uses. However, recently, the completeness and substantive quality of report content have been questioned. Therefore, this research aimed to evaluate the quality of WULA technical reports for solar power plants in the Free State province and to offer recommendations to improve their quality.

The evaluation followed a case study approach in which a sample of eight WULA technical reports was evaluated against the criteria of an adapted review package. The evaluation results revealed an overall satisfactory performance (A-C=51%; D-F=49%) with omissions identified in certain sub-categories. Review area 1 (description of the development) and review area 2 (specialist assessment of impacts) performed predominantly satisfactorily in their sub-categories. Whereas review area 3 (alternatives and impacts) performed average, and review area 4 (communication of results) displayed unsatisfactory performance. Overall, subcategories that performed unsatisfactorily include the baseline conditions, waste, alternatives, public participation, the inclusion of non-technical summaries, assessment of impact significance, commitment to mitigation, report layout, presentation, and emphasis of information. The satisfactory performing categories are site description, environmental description, definition of impacts, identification of impacts, prediction of impact magnitude, scope and effectiveness of mitigation, and report emphasis.

To address the gaps in quality of the WULA technical reports, it is recommended that Environmental Assessment Practitioners (EAPs) be provided with the final project designs to understand the project holistically and scope in all possible potential impacts into the WULA for all relevant specialist studies to be submitted. The appointed EAPs and specialists should adopt

a project life cycle approach in their assessments of water-related impacts. The Department of Water and Sanitation (DWS) should continually conduct workshops in the water sector related legislation for applicants to include all legal requirements, climate change, and emergencies in their WULAs. The required DWS Risk Assessment Matrix must be templated to include waste-related impacts and impacts on Interested and Affected Parties.

Key terms: quality, water use licence application technical reports, solar power plants, Free State province

LIST OF ABBREVIATIONS

ALCRP	Adapted Lee and Colley Review Package
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
IPPs	Independent Power Producers
IRP	Integrated Resource Plan
MW	Mega Watts
NDP	National Development Plan
NEMA	National Environmental Management Act 107 of 1998
NERSA	National Energy Regulator of South Africa
NFEPA	National Freshwater Ecosystems Priority Areas Project
NWA	National Water Act 36 of 1998
NWP	White Paper on a National Water Policy
NWRS	National Water Resource Strategy
NWU	North-West University
OES	One Environmental System
REDZ	Renewable Energy Development Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessments
UN	United Nations
WULA	Water Use Licence Application

KEY DEFINITIONS

Environment: *The surroundings within which humans exist that are made up of land, water, and the atmosphere in which plant, animal life, and micro-organisms are found, partly, in combination and in their interrelationships, including the physical, chemical, aesthetic, and cultural properties of the aforementioned that affect human health and wellbeing (RSA, 1998a).*

Sustainable development: *Meeting the needs and aspirations of present generations without jeopardising the ability of future generations to meet theirs (Brundtland, 1987).*

Photovoltaic systems: *Photovoltaic cells that are enabled through conductor materials in modules to release and gather electrons when exposed to solar radiation, then ultimately generate large quantities of electricity when many modules are connected (DFFE, 2016).*

Watercourse: *A watercourse is defined as being a river, spring, perennial or non-perennial natural channel, a channelled or unchanneled wetland, lake, or dam, or any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse through its characteristics, which include its bed and banks (RSA,1998b).*

Regulated area of a watercourse: *The regulated area of a river, spring, natural channel, lake, or dam extends up to the outer edge of the 1:100-year flood line from the middle of these watercourses. In the absence of a determined 1:100-year flood line, the regulated area is 100 meters from the edge of the watercourse if it is the first identifiable bank filled flood bench. A 500-meter radius from the delineated boundary of a wetland or pan constitutes its regulated area (DWS, 2017a).*

Water use: *The taking and storing of water, activities which reduce stream flow, waste discharges and disposals into water resources, activities which impact detrimentally on a water resource, altering a watercourse, removing underground water for certain purposes, and using water for recreation purposes (RSA, 1998b).*

Water use licence application technical report: *This report encompasses water use registration forms, specialist studies, and a public participation report (RSA, 2017).*

Report quality: *Report quality is the level of report comprehensiveness, objectiveness, truthfulness, and relevant information regarding the proposal (Scheepers, 2019).*

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CHAPTER 1 INTRODUCTION

1.1. Background

Unsustainable anthropogenic practices such as fossil fuel-sourced energy generation have led to environmental pollution and ecological degradation and are reducing the planet's resilience to the negative impacts of climate change (UNEP, 2011). In response to these practices, the United Nations (UN) has formalised requirements and established international agreements and treaties to alleviate climate change causes and effects (PAGE, 2017). The 1992 UN Summit in Rio De Janeiro introduced the concept of sustainable development, which aims to protect the environment for present generations to meet their needs without compromising future generations' needs (CBD, 2017). It is envisaged that this generational environmental equity will be met by integrating natural environmental protection and socio-economic development (Nel & Alberts, 2018). United Nations signatories adopted a plan in which they established Sustainable Development Goals (SDGs) and their related targets to protect the planet, end poverty, and obtain peace and security (Breuer, *et al*., 2023). There are two water-related SDGs, namely SDG 6 (clean water and sanitation) and SDG 14 (life below water), hence countries adopted these goals in their pursuit to ensure access to clean water, sanitation and the protection of water resources (Aljaghoub, *et al*., 2022; UNEP, 2011; Watanabe, 2020). In the pursuit of realising the SDGs, several international policy changes have been proposed, none more than the transition to a Green Economy. A Green Economy is one in which public and private funds are directed to investments in the development of low-carbon and resource-efficient infrastructure in the central economic sectors of a country (UN, 2011). Many countries, including South Africa, adopted the Green Economy concept to address critical issues in water and energy resource inefficiencies (Economic Development Department, 2011; PAGE, 2017; UNEP, 2011).

South Africa is attempting to convert its economic sectors, including its fossil fuel-driven energy sector, into a renewable energy sector, as it is evident that renewable energy has the potential to have fewer negative impacts on the environment, especially impacts on water resources (Aljaghoub, 2022; Economic Development Department, 2011; Soydan, 2021). South Africa also has very high potential for solar energy radiation, and it is estimated that the country receives more than double the solar radiation of, for example, Germany (Scheepers, *et al*., 2019). This high potential for solar energy generation has led to the installation of approximately 3 260 Mega Watts (MW) of solar energy (DMRE, 2025; Eskom, 2026). Some examples include the Khi Solar One concentrated solar tower (CSP) in the Northern Cape province, the Dreunberg photo voltaic (PV) solar power plant in the Eastern Cape Province, and the Virginia 4 Solar Park PV solar power

plants in the Free State province (DEA, 2015; DEE, 2025b; DMRE, 2021; Mabele, 2021; Mukumba & Chivanga, 2023).

However, the development (planning, design, construction, operation, and decommissioning) of such solar power plants has negative environmental impacts, especially on water resources (DEA, 2015; Soydan, 2021; Turney & Fthenakis, 2011). It is therefore necessary to ensure that water-related impacts are considered, assessed, and mitigated throughout all development phases (Dhar, 2020; Turney & Fthenakis, 2011). This is done by means of a Water Use License Application (WULA) process, which requires compilation of a WULA technical report that encompasses information on a proposed development and environmental specialist study information to inform WULA application forms, public consultation, and ultimately the decision to issue a water use licence (DWS, 2017).

1.2. Problem statement and rationale for the research

Water is one of the most valuable resources as it contributes to socio-economic development through industrial processes, agricultural production, and energy generation (Counsell, 2022). Traditional fossil-fuelled energy generation is a major contributor to impacts on natural environmental elements, especially water resources (Aljaghoub, *et al*., 2022; PAGE, 2017). Renewable energy developments, such as solar power plants, are found to be a potentially less polluting energy source, however, it still proves to have water resource-related impacts (Centre for Renewable and Sustainable Energy Studies, 2025). Several of these solar power plant developments are proposed and operational in South Africa (DMRE, 2025).

In an attempt to accelerate the rollout of renewable energy developments in the country, Renewable Energy Distribution Zones (REDZ) have been established in areas with high solar radiation potential, including the Free State province. These REDZ also serve to minimise potential renewable energy development-related impacts and expedite their licencing processes (DEA, 2018b; Joubert & Rushton, 2025). Several solar power plant developments are already operational, and numerous others are proposed in the Free State province, which is a province known for its sensitive endemic biodiversity and stressed water resources (DEE, 2025b).

Water resource-related impacts associated with solar power plants may potentially be minimised through permitting instruments such as the WUL (Centre for Renewable and Sustainable Energy Studies, 2025; Soydan, 2021). A WUL is obtained through a WULA process which requires a technical report submitted by the applicant (DWS, 2007b; DWS, 2017; DWS, 2023). This WULA technical report informs the decision-makers on the potential water-related impacts, proposed mitigation, and public concerns related to the application (DWS, 2017; Moolman, *et al*., 2023). However, recently scholars have questioned the quality of WULA technical reports that inform

decision-making and have since been subject to investigation (Moolman *et al*., 2023; Moolman *et al.,* 2025). Based on the problem statement above, this research aims to evaluate the quality of the WULA technical report for solar power plants in the Free State province.

1.3. The research aim and objectives

This research aims to evaluate the quality of WULA technical reports for solar power plants in the Free State province. To achieve this aim, the following three research objectives have been defined:

- To adapt a quality review package for reviewing the quality of selected WULA technical reports for solar power plants in the Free State province.
- To evaluate the quality of selected WULA technical reports for solar power plants in the Free State province against the adapted quality review package.
- To make recommendations to improve the quality of the WULA technical reports.

1.4. Scope of the research

The research scope delineates the research by clarifying what it will include and exclude and to assists the researcher in focusing time and resources on the aim and objectives of the research (Hassan, 2024; Scribbr, 2026). This research only included evaluating selected WULA technical reports and no other reports associated with any other authorisation. The selected WULA technical reports are only for solar power plants in the Free State province and exclude all other renewable energy projects in any other province in South Africa.

This research included an adapted version of the Lee and Colley Review Package (LCRP). The LCRP has initially been designed to review the quality of Environmental Impact Assessment (EIA) reports but has been adapted to review report quality from different sectors such as Biodiversity Impact Assessment (BIA) (Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023), EIA for projects affecting wetlands (Retief, *et al*., 2008) and on Ecological Reserve Inputs in EIA reports (De Jager, 2022) amongst others.

1.5. Assumptions and limitations relating to the research

The following assumptions and limitations have been identified for the research.

- Temporal limitations

The GN.R. 267, Regulations regarding the procedural requirements for water use licence applications and Appeals, was published in 2017. Therefore, the timeframe for selected WULA technical reports is set between 2017 and 2024. This limitation is addressed by specifically obtaining approved WULA technical reports that were drafted during this period.

- Case study limitations

The study was limited to solar power plant cases only, and no other renewable energy was considered. This research focused only on evaluating the quality of WULA technical reports and did not attempt to explain the specific reasons for the quality. In overcoming this limitation, the reviewer only focused on presenting the review outcomes that were generated through applying the criteria set in the Adapted Lee and Colley Review Package (ALCRP).

- Reviewer limitations

This research was limited to only one reviewer. The reviewer is part of the Eskom Distribution Free State Operating Unit (Eskom) design review team, with the responsibility of reviewing environmental documents that are submitted to Eskom by Independent Power Producers (IPPs) such as Basic Assessment Reports, Environmental management Programmes, Environmental Authorisations, Water Use Licences and other relevant permits and licences; for them to obtain access to the Eskom electrical grid in the Free State province.

The reviewer is well-versed in the requirements of the WULA processes, having served as an Eskom EAP for more than 12 years. The reviewer applied the said review and Eskom in-house EAP working experience, environmental management knowledge, skills, and competencies in this document review research.

1.6. Potential contribution of the research

This WULA technical report quality evaluation research endeavoured into a specific sector, solar power plants, and a specific study area, the Free State province. An Adapted Lee and Colley Review Package, which included water-related legislation, best practice guidelines and similar previous studies, was developed to evaluate the solar power plant WULA technical report content quality. The recommendations in Chapter 5 of this report can contribute to improving the drafting of WULA technical reports for solar power plants in the South African context.

1.7. Structure and outline of the dissertation

Chapter 1 – Introduction

This chapter introduces the research topic, problem statement, and their relation to the aim of this research. In addition, this chapter elaborates on the research aim and its set objectives. Lastly, the scope of the research, research limitations, and its potential contributions are also outlined in this chapter.

Chapter 2 – Literature review

This chapter provides an interpretation of key resources related to the research topic, aim, and objectives. The topics were covered in headings and sub-headings in the overview to explain how renewable energy contributes to sustainable development (international and South African status of renewable energy; its water-related impacts that need to be managed), command-and-control instruments in various countries to sustainably manage impacts that renewable energy developments, such as solar power plants, inflict on water resources. A discussion on the regulated WULA process, i.e., South African water-related legislation, with its associated WULA technical report, took place. Finally, this chapter discusses the status of report quality in different sectors and the reasons why the WULA technical report quality needs to be investigated.

Chapter 3 – Methodology

This chapter outlines the research design, including the case study selection, and the methods implemented for data collection, report evaluation, data analysis, and how the results were discussed and presented in this report.

Chapter 4 – Results and discussions

This chapter presents the results of the report quality review, including report weaknesses and strengths. The review outcome of all the respective review areas is presented in this section.

Chapter 5 – Conclusion

This chapter provides the conclusion and recommendations of this research in relation to all research objectives.

CHAPTER 2 LITERATURE REVIEW

2.1. Introduction

This chapter will discuss sustainable development and how the adoption of renewable energy contributed to the environmental performance of different countries. A short discussion on general environmental impacts related to solar power plant developments will be outlined. There will be an in-depth discussion on how the South African renewable energy legal framework enabled the implementation of renewable energy sources in the country. The REDZ will shortly be discussed as a strategic enabling initiative that is implemented in South Africa. Thereafter, this chapter will discuss the growth of renewable energy capacity on a national and provincial level and how solar power plants are found to have the best prospects until 2029 in South Africa. Since solar power plants are not without impacts on water resources, a literature review on the solar power plant impacts on water resources will be carried out. The need and reasons for WUL, including an international and South African WULA systems, will be discussed. The literature review will also provide for an in-depth discussion of the legislation that mandates the South African WUL system, including the different water use authorisations. The WULA-related legislation and best practice guideline documents will also be outlined in terms of the process requirements. A discussion on the practice, background, and South African findings of the report quality review will follow. The need to conduct a report quality review on WULA technical reports is addressed in the conclusion of the chapter. Finally, the literature review findings will be summarised in a chapter summary.

2.2. Towards sustainable development through renewable energy

The UN formalised requirements and established international agreements and treaties in an attempt to address environmental degradation (PAGE, 2017). Sustainable development formally set off during the 1992 Rio declaration (CBD, 2017). The concept of sustainable development consists of including three environmental pillars (natural, social, economic) in the consideration of development (Nel & Alberts, 2018, RSA, 1998b). Sustainable development set human interests at the forefront by promoting the protection of natural resources, cultural and heritage resources, responsible socio-economic development, waste management and the development of renewable energy sources (RSA, 1998b). All UN signatory governments were compelled to materialise the Sustainable Development Goals (SDGs) and targets after the 2015 UN conference, which delivered the SDGs (Ravn Boess, *et al*., 2021). Two of the SDGs are water related i.e. SDG 6 (clean water and sanitation) and SDG 14 (life below water), therefore countries opted to strife for sustainable development (UN, 2011).

It was found that the renewable energy sector can contribute to sustainable development by reducing air quality degradation, slowing down global warming, and ultimately control climate change in a context of pollution and ecological degradation (Aljaghoub, *et al*., 2022; UNEP, 2011). Therefore, the UN signatories shifted their economic development from a fossil fuel source base to renewable sources to avoid the degradation of the earth's natural capital, reduce poverty, and ensure food security, amongst other SDGs (UNEP, 2011).

The increase in global population growth contributes to an increased human need for food, water, fibre, and energy, which leads to exhaustion of ecosystems and their provisioning services (Salman & Martinez, 2015). The negative impacts that emanate from fossil fuel-sourced energy, coupled with contemporary geopolitical influences, raise the uncertainty of whether the global energy demand can sustainably be met by fossil fuels (Dhar, *et al*., 2020). It is therefore recommended that renewable energy sources should be mixed with fossil fuels to concurrently meet the interests of humans and the natural environment (Dhar, *et al*., 2020).

Many nations are moving in the direction of employing renewable energy resources such as hydropower, wind farms, and solar power plants to generate electricity and coincide with the goal of obtaining the lowest level of environmental degradation (Islam, *et al*., 2024). The installation of solar power plants is increasingly expanding with an expected capacity of 4 500 Gigawatt by 2050 (Aljaghoub, 2022; Dhar, *et al*., 2020). In support of this forecast, it was found that the use of solar energy increased exponentially after the year 2010 (Figure 1) (OWID, 2026).

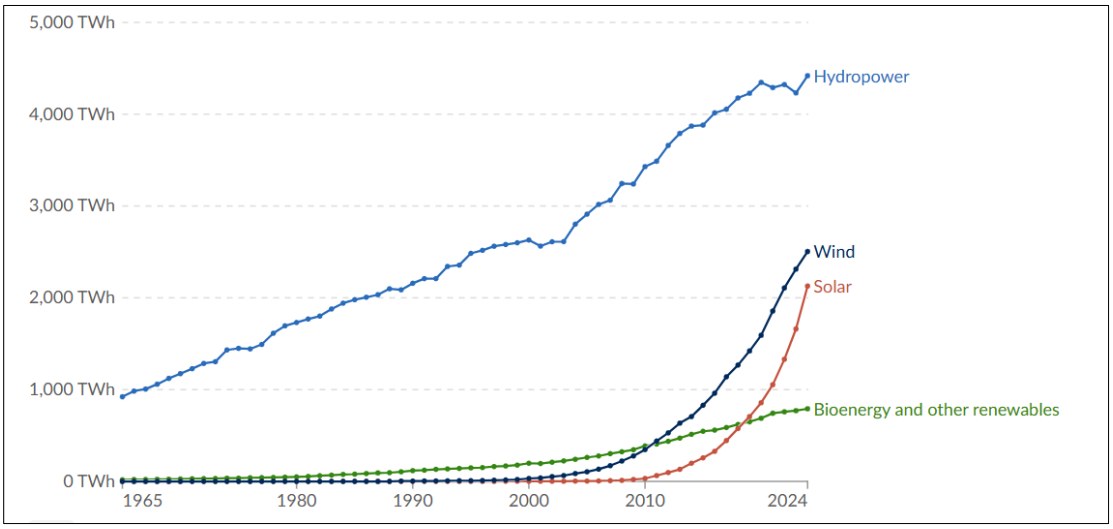


Figure 1: The use of solar energy sources globally (OWID, 2026)

Many countries worldwide, including those in the European Union, North America, China, and Africa, are making advances in clean energy by exploring ways to move away from fossil fuels and

incorporating alternative energy sources into their energy mixes, such as solar energy (Climate Group RE100, 2020; GBB, 2026). However, the RE100 Climate Group reported that its 2020 survey revealed that many countries face renewable energy growth challenges due to regulatory, spatial, and cost challenges (Climate Group RE100, 2020). The majority of developed countries still depend mainly on fossil fuels but are making notable efforts to change to renewable energy sources (GBB, 2026).

2.2.1. Enabling legislation to expand renewable energy

Efforts to transition the energy sector to renewable energy must be complemented by enabling conditions which encompass amongst others, policy framework, norms, fiscal measures and infrastructure (UNEP, 2016). The introduction of renewable energy can successfully be carried out through an energy policy that addresses energy security and climate change through mediums of law and regulations (ACEN, 2024). Renewable energy policy framework will ensure the governance and processing of relevant approvals and permits to commission renewable energy projects while taking cognisance of public concerns and environmental requirements (Al-Sarihi & Mansouri, 2022; European Commission, 2026). The policy framework for renewable energy encapsulates the possibility for renewable energy-related governmental subsidies, renewable energy financial incentives, power purchase agreements, geographical areas to accelerate renewable energy installations and the defragmentation of government entities (Al-Sarihi & Mansouri, 2022; European Commission. 2026). Governments are adopting strategic policies to expedite the introduction of renewable energy such as the Renewable Energy Directive of the European Union, the feed-in tariffs and fixed payments for renewable energy of Germany; and the tax incentives in the Philippines (ACEN, 2024).

It was found that African countries developed more green activities such as renewable energy facilities by establishing national strategies which materialise transformative actions that cascade down into development plans (UNEP, 2016). The South African government also introduced a policy framework that enabled the introduction, acceleration and implementation of renewable energy as outlined below.

2.2.2. Renewable energy policy framework of South Africa

South Africa’s economic growth is almost unavoidably dependent on fossil fuel-based power generation mediums, which contribute to greenhouse gas (GHG) emissions that exacerbate climate change, against which developing countries possess low resilience due to factors such as poverty and infrastructure deficiencies (Scheepers, *et al*., 2019). As a UN signatory, South Africa

ratified the Kyoto protocol and the 2016 Paris agreement, which consist of objectives to decrease GHG, poverty, and secure energy supply sustainably (Segger, 2016).

South Africa established targets for renewable energy in their White Paper on the Energy Policy in 1998 (DMRE, 1998). Following the Johannesburg Summit on Sustainable Development in 2002, an integrated national resources plan was developed, which outlined the measures to meet the set renewable energy targets in furtherance of sustainable development (DMRE, 2025; Winkler, 2005). In 2003, the White Paper on Renewable Energy was formulated, in which renewable energy targets, set in the 1998 White Paper on the Energy Policy, were reviewed to consist of commitments to invest equally in renewable energy technologies in relation to other energy source options (DMRE, 2003). The National Climate Change Response Strategy for South Africa, as agreed by UN governments, was established in 2004 (DWAF, 2004). The Electricity Regulation Act (ERA) (Act 4 of 2006) was promulgated and made provision under Section 35(4) for state organs to procure new electricity generation capacity (RSA, 2006). Thereafter, in 2008, South Africa established the Renewable Energy Policy. Consequently, the National Energy Act (Act 34 of 2008) was promulgated, which elaborates on the importance of the renewable energy sector with specific reference to the solar energy sector (RSA, 2008a). The Integrated Energy Plan of 2008 outlines objectives and targets to create an energy mix to integrate renewable and traditional energy sources (DMRE, 2025). The government of South Africa committed to the noxious gas emission targets at the Copenhagen Conference of the Parties in 2009, after which it introduced Renewable Energy Feed-in Tariffs in the same year (DEA, 2011). In 2010, the Integrated Resources Plan 2010 – 2030, as mandated by the ERA, was then introduced to formalise the renewable energy targets that were set in the 2003 White Paper on Renewable Energy (DMRE, 2003; DMRE, 2016; RSA, 2006)

Following the UN Framework Convention on Climate Change (UNFCC) agreements that occurred in 2011 in Durban, the South African government responded with commitments in its National Climate Change Response Policy of 2011 (DEA, 2011). The National Development Plan (NDP), which included renewable energy development targets for 2030, was also released in 2011 (NPC, 2012). The NDP effected the adoption of the Green Economy Accord 2011, which makes provision for initiatives that contribute to green initiatives, in all sectors, including the energy sector, such as solar power plants (EDD, 2011; PAGE, 2017). The Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) was introduced in 2011 to formalise the way South Africa procures renewable energy from independent power producers through their renewable energy power plants (DMRE, 2025). The National Infrastructure Plan was released in 2012 with targets for key economic infrastructure to complement the NDP (DCIS, 2024; DPWI,

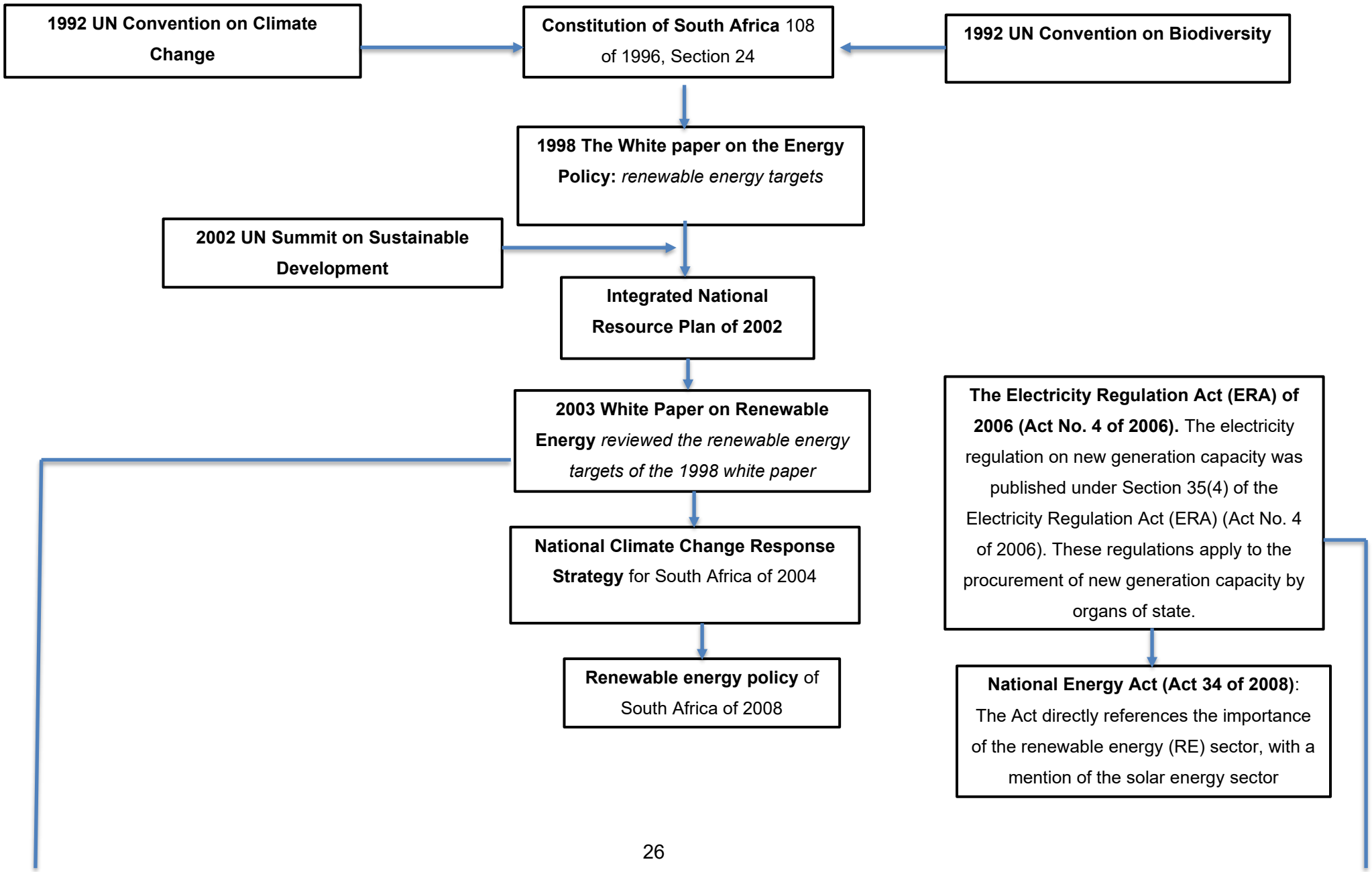
2020). Thereafter, the Infrastructure Development Act (Act 23 of 2014) was promulgated and makes provision for Strategic Infrastructure Projects (SIPs) to be identified and implemented as a matter of national importance (DCIS, 2024; DPWI, 2020).

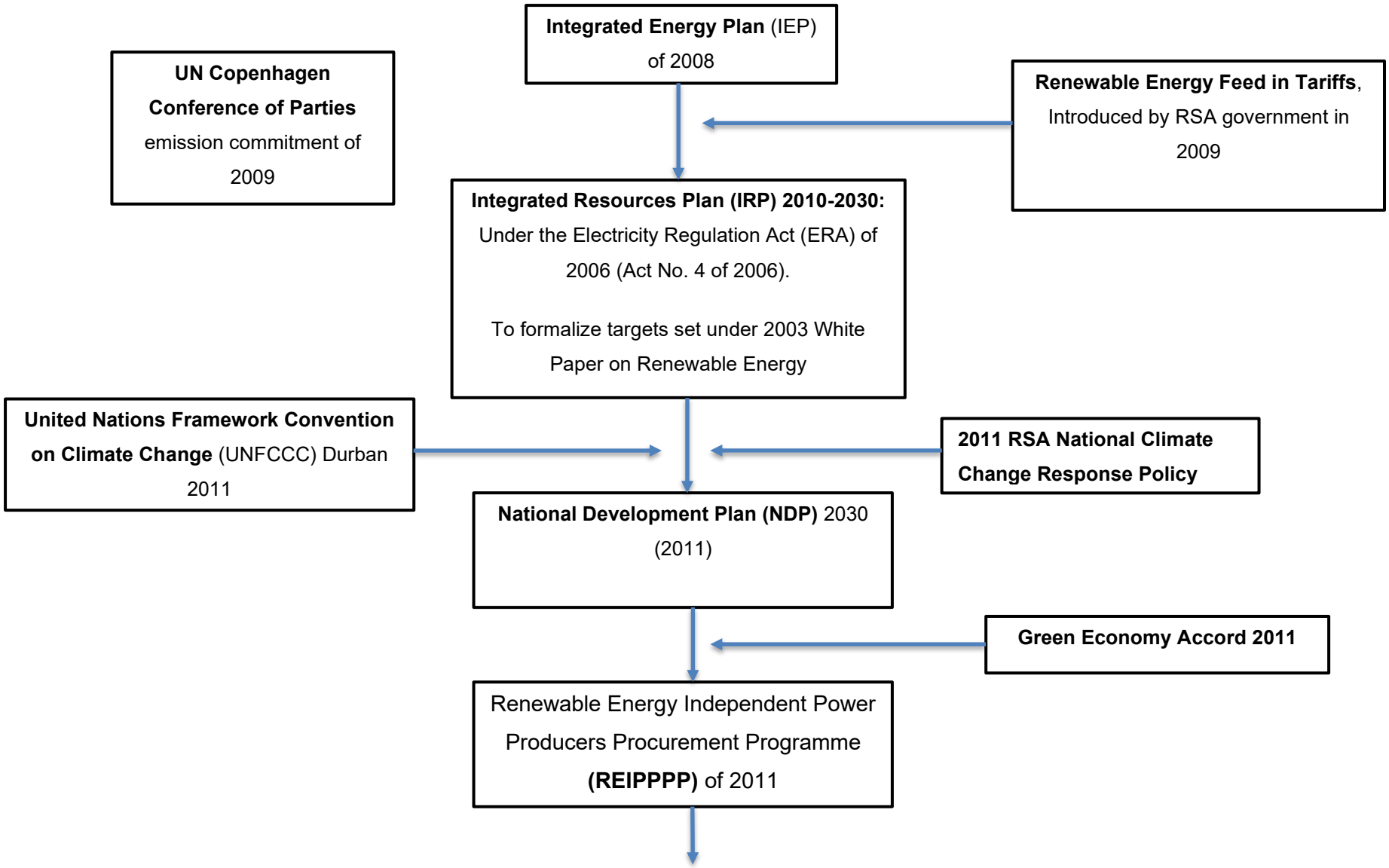
In support of the SIPs, an Integrated Energy Plan was released in 2016, which serves as a long-term energy framework that aims to guide the drafting of energy-related policies and set a framework for energy sector regulations (DMRE, 2016). The Integrated Energy Plan, therefore, effected the 2017 amendments to legislation and regulations, such as the inclusion of Section 2(4)(a)(vi) of the National Environmental Management Act (Act 107 of 1998) (NEMA) that makes provision for environmental protection against renewable energy development impacts (DEA, 2014; DMRE, 2016). The National Climate Change Bill was released in 2018 to further support the implementation of renewable energy and the establishment of Strategic Transmission Corridors that were published in Government Notice Regulation (GNR) 113 of 2018 as part of efforts to streamline and expedite the authorisation process for renewable energy projects (Joubert & Rushton, 2025; DFFE, 2018a; RSA, 2022). The 2003 White Paper on Renewable Energy makes provision for an Integrated Resources Plan for Electricity (IRP) in 2023, which formulates South Africa's long-term electricity demands and how generating capacity, timing, cost, and types can be applied to meet the set electricity objectives and targets by 2030 (DMRE, 2003; DMRE, 2024). As part of the framework set for energy sector regulations in the 2016 IEP, the 2017 National Water Act (Act no. 36 of 1998) (NWA): Regulations regarding the procedural requirements for water use licence applications and appeals (Notice 267) was introduced in 2017 as an official guideline for the water use licence application process (RSA, 2017). The 2023 GA regulations were amended to include Appendix D1, which makes provision for renewable energy plants to be generally authorised under certain thresholds and sizes (DWS, 2023). The Climate Change Act (Act 22 of 2024), which emanates from the National Climate Change Bill of 2018, mandates development in South Africa to consider climate change throughout all development phases (RSA, 2024).

Following international agreements made in 1992 at conventions such as the UN Convention on Climate Change and the Convention on Biological Diversity, Section 24 of the Constitution of South Africa, 108 of 1996, protects the environmental rights of everyone and promotes ecologically sustainable development within South Africa (RSA, 1996). The NEMA was promulgated as the main Environmental Management framework of South Africa. Sustainable Development principles are found in Section 2 of NEMA and mandate duty of care for the environment in Section 28 (RSA, 1998a). The National Water Act (Act 39 of 1998) was also introduced in 1998 for the government to ensure that equitable, sustainable, and efficient management of water resources takes place in the interest of the public (RSA, 1998b). The NEMA: Specific Environmental Management Acts

(SEMAS) that were promulgated between 2003 and 2008 were amended in 2017 to include renewable energy-related regulations (RSA, 1998a).

The above-mentioned international and South African enabling renewable energy-related white papers, policies, strategies, plans, and legislation are denoted in the temporal schematic diagram below (Figure 2):


1992 UN Convention on Climate Change
Constitution of South Africa 108 of 1996, Section 24
1992 UN Convention on Biodiversity
1998 The White paper on the Energy Policy: renewable energy targets
2002 UN Summit on Sustainable Development
Integrated National Resource Plan of 2002
2003 White Paper on Renewable Energy reviewed the renewable energy targets of the 1998 white paper
National Climate Change Response Strategy for South Africa of 2004
Renewable energy policy of South Africa of 2008
The Electricity Regulation Act (ERA) of 2006 (Act No. 4 of 2006). The electricity regulation on new generation capacity was published under Section 35(4) of the Electricity Regulation Act (ERA) (Act No. 4 of 2006). These regulations apply to the procurement of new generation capacity by organs of state.
National Energy Act (Act 34 of 2008): The Act directly references the importance of the renewable energy (RE) sector, with a mention of the solar energy sector


Integrated Energy Plan (IEP) of 2008
UN Copenhagen Conference of Parties emission commitment of 2009
Renewable Energy Feed in Tariffs, Introduced by RSA government in 2009
Integrated Resources Plan (IRP) 2010-2030: Under the Electricity Regulation Act (ERA) of 2006 (Act No. 4 of 2006).
To formalize targets set under 2003 White Paper on Renewable Energy
United Nations Framework Convention on Climate Change (UNFCCC) Durban 2011
2011 RSA National Climate Change Response Policy
National Development Plan (NDP) 2030 (2011)
Green Economy Accord 2011
Renewable Energy Independent Power Producers Procurement Programme **(REIPPPP)** of 2011

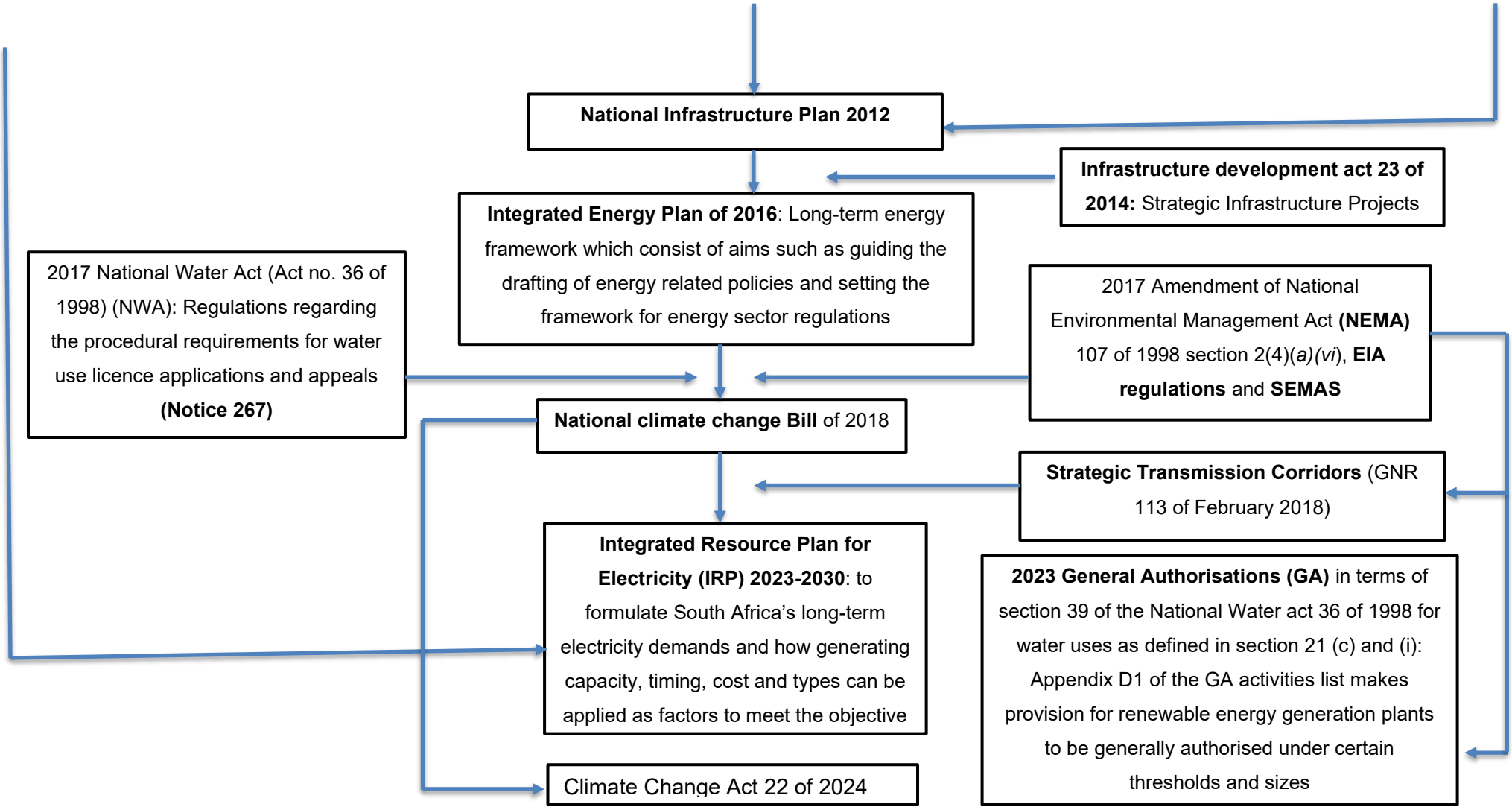


Figure 2: Overview of enabling South African renewable energy policy framework

(Own creation, 2025. Based on DCIS, 2024; DEA, 2014; DFFE, 2018a; DMRE, 1998; DMRE, 2003; DMRE, 2016; DMRE, 2024; DMRE, 2025; DPWI, 2020; DWAF, 2004; DWS, 2023; EDD, 2011; Joubert & Rushton, 2025; NPC, 2012; PAGE, 2017; RSA, 1996; RSA, 1998a; RSA, 1998b; RSA, 2006; RSA, 2008a; RSA, 2022; RSA, 2024; South Africa, 2011; Winkler, 2005)

The permit and authorisation processes and timeframe have been found to be a hurdle for infrastructure development in South Africa (Humby, 2015). Minister Marthinus van Schalkwyk commented in 2006 that EIAs should be quicker, simpler and better in the face of an ever-evolving world economy, political pressure and increase in climate change effects (Nel & Alberts, 2018). President Cyril Ramaphosa also requested that the WUL processes for infrastructure such as renewable energy, must be expedited (Ngeleza, 2023). To address these infrastructure licencing challenges, the South African government approved Strategic Transmission Corridors across the country in which renewable energy plants can be authorised under a combined EA and WUL application that decreases project cost and time (DFFE, 2018b; DFFE, 2021; IAIAsa, 2023).

2.2.2.1. Renewable Energy Distribution Zones

Five Strategic Transmission Corridors (STC), also known as REDZ, including the central corridor that is aligned through the South-Western to the North-Western Free State (Figure 3) (Joubert & Rushton, 2025). The existence of the REDZ corridors is based on the notion of expediting the timeframe for environmental approvals in the process of developments such as renewable energy projects (Humby, 2015; Nel & Alberts, 2018).

These corridors are the results that were produced through Strategic Environmental Assessment (SEA) undertaken by the Department of Environmental Affairs and other stakeholders, such as the Council for Scientific and Industrial Research (CSIR) (DEA, 2018b). The REDZ proactively caters to the renewable energy developments and their associated impacts in the provinces over which they are aligned (DEA, 2018b).

An SEA is a relatively high level study which is not focused on site specific impacts that arises from project activities hence, project level EIAs must still be carried out based on the outcome of an SEA to determine potential project impacts and design mitigation measures accordingly (Morrison-Saunders & Retief, 2012; Nel & Alberts, 2018). The residual impact levels were found to be generally low on all environmental sensitivities, including water resources, after mitigation, when renewable energy projects are undertaken in the REDZ corridors (DEA, 2018b).

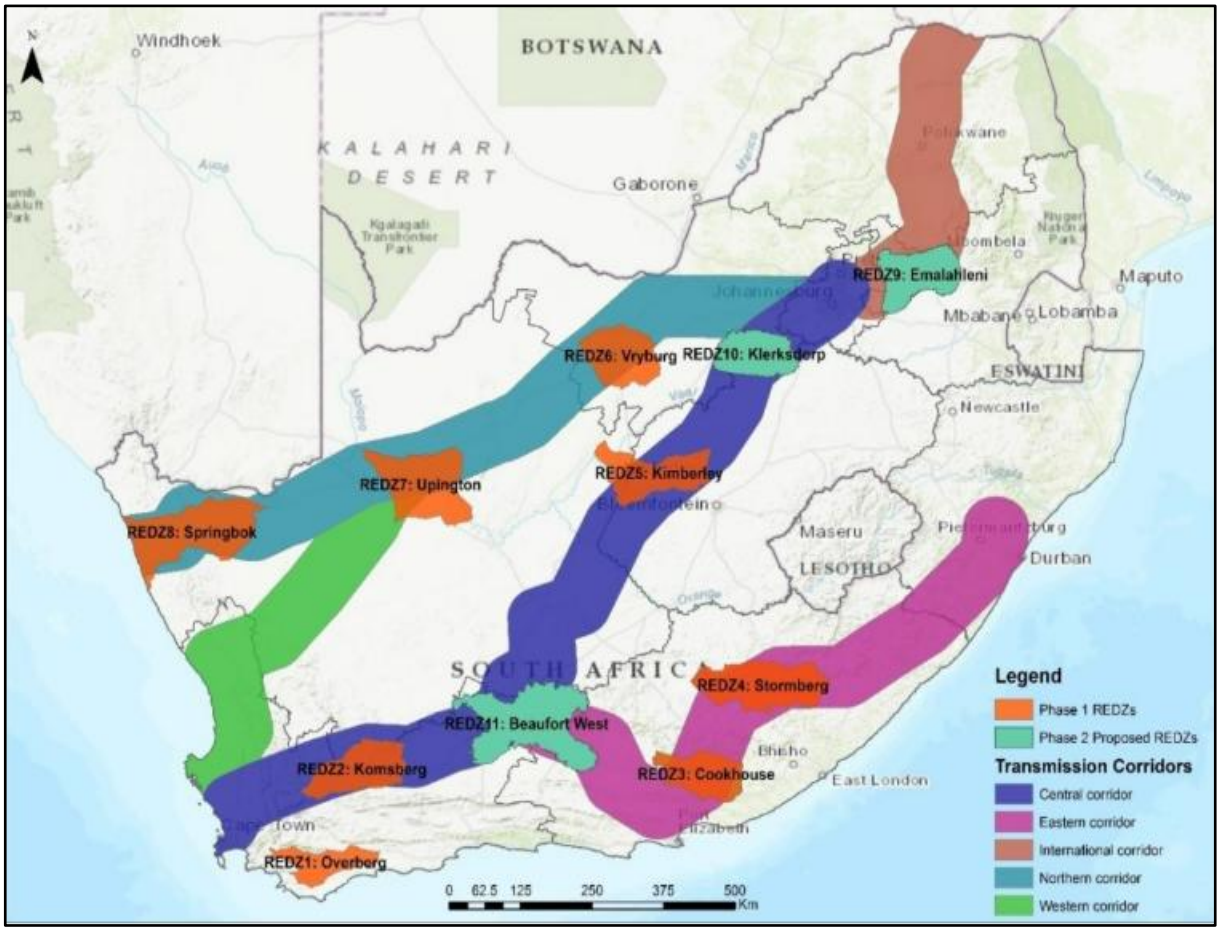


Figure 3: Renewable Energy Distribution Zones and Strategic Transmission Corridors of South Africa (Joubert & Rushton, 2025)

2.2.3. Renewable energy growth in South Africa

The South African Integrated Resource Plan (IRP) envisage an energy mix by 2050 which only includes 1400 Mega Watts of fossil fuel energy and anticipates to increasingly introduce renewable energy resources such as wind energy, solar power plants, hydroelectricity, battery storage and bioenergy in response to climate change effects, high greenhouse gas (GHG) emissions, energy security and loadshedding amongst others (DMRE, 2025).

Based on the renewable energy generating capacity commitments published in the IRP 2025, a total of 8 690 Giga Watt of renewable energy capacity will be generated by the public sector by 2029 (DMRE, 2025). Solar power plants make up the least of this public sector's committed generating capacity, with only 735 MW, whereas battery storage systems contribute the most with 3 743 MW (DMRE, 2025).

The private sector's committed renewable energy generation capacity contributes the most, with a total of 13,892 MW, of which solar power plants add 7 018 MW (Figure 4) (DMRE, 2025). Fifty-five percent of this committed renewable energy projects are already in construction or at budget quotation stage, and the remaining 45% are in the grid capacity allocation determination stage (DMRE, 2025). This is an indication that solar power plants are planned to be installed and operated in high numbers in South Africa.

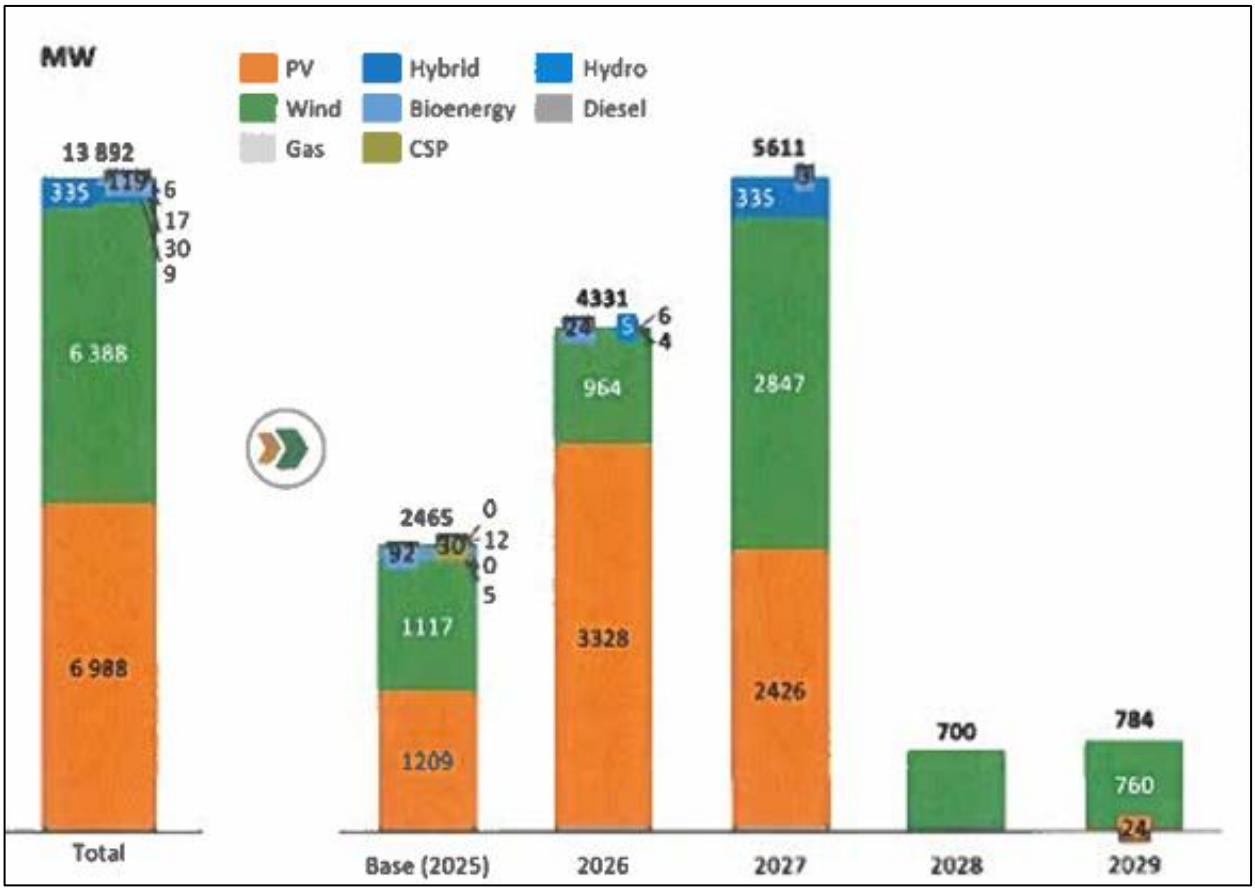


Figure 4: South African committed private generating capacity (DMRE, 2025)

On a provincial level, the REIPPPP reported that 6 918 MW capacity is online from renewable energy sources, with Northern Cape Province being the highest (3 703 MW) and Kwazulu-Natal Province the least (0 MW) (DEE, 2025a). Although the North West Province has more online capacity than the Free State province, more projects are in construction and procurement in the Free State compared to the North West province. This makes the Free State province the fourth favoured province for renewable energy plant installations (DEE, 2025a). In terms of solar power plants online, procured and in construction, the Free State province has the third most solar power plants in South Africa (Figure 5) (DEE, 2025a).

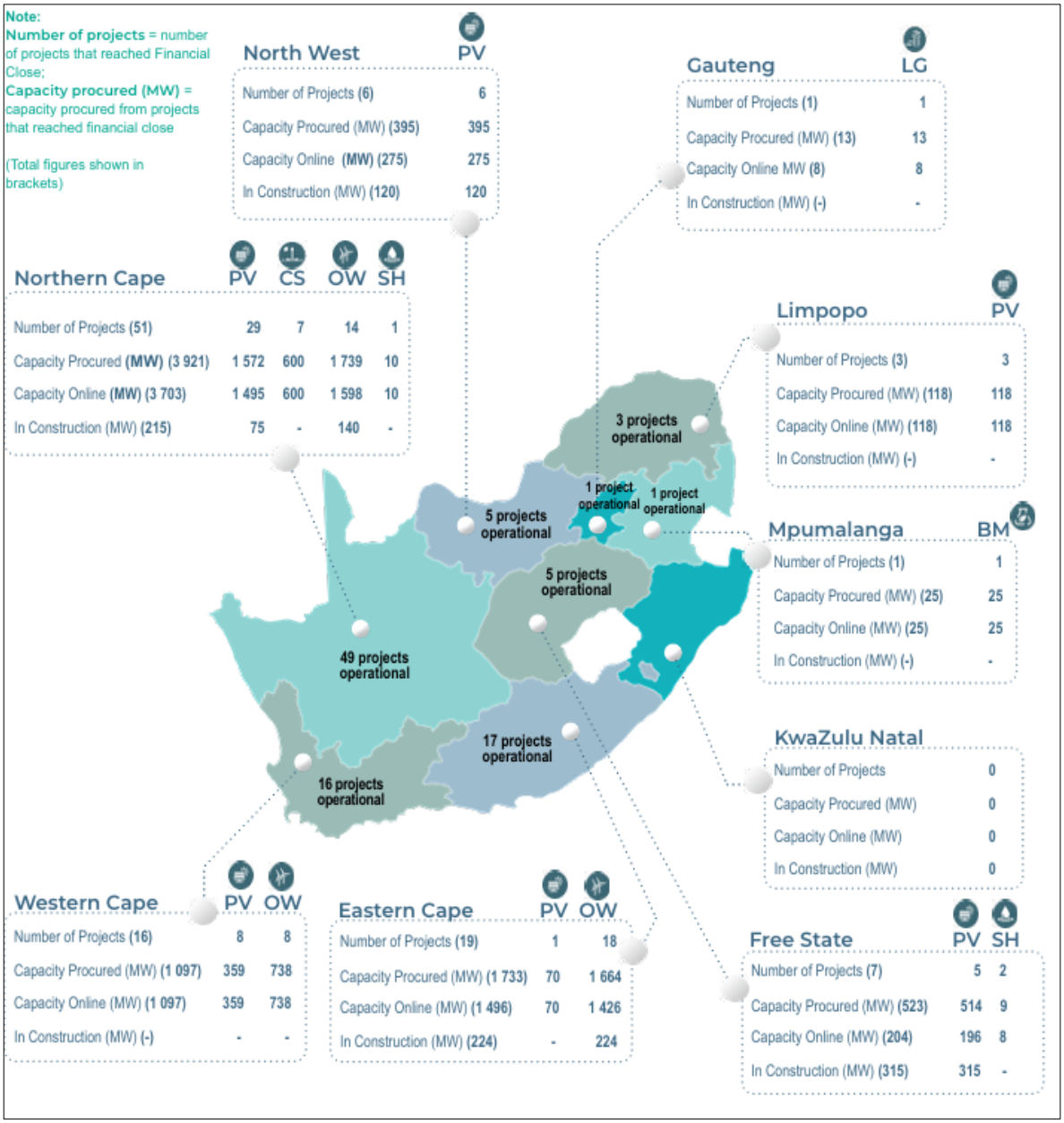


Figure 5: The number of public-procured solar power plants per province in South Africa (DEE, 2025a)

2.3. Environmental impacts associated with solar power plant developments

Solar power plants have intrinsic lower direct impacts on environmental elements than fossil-fuelled but they do inflict impacts such as habitat loss, biodiversity decline, land and water pollution through chemicals in panels and construction processes and the over usage of water during the maintenance phase of the plant (Dhar, *et al*., 2020).

Selecting an optimal proposed location to develop solar power plants is found to be a challenge. A study conducted to develop an optimal site selection criterion for solar power plants in Turkey and Bangladesh revealed that construction and maintenance phase impacts can affect the biotic and abiotic environment (Figure 6) (Bracken, *et al*., 2015; Islam, *et al*., 2024; Vo & Vo, 2021).

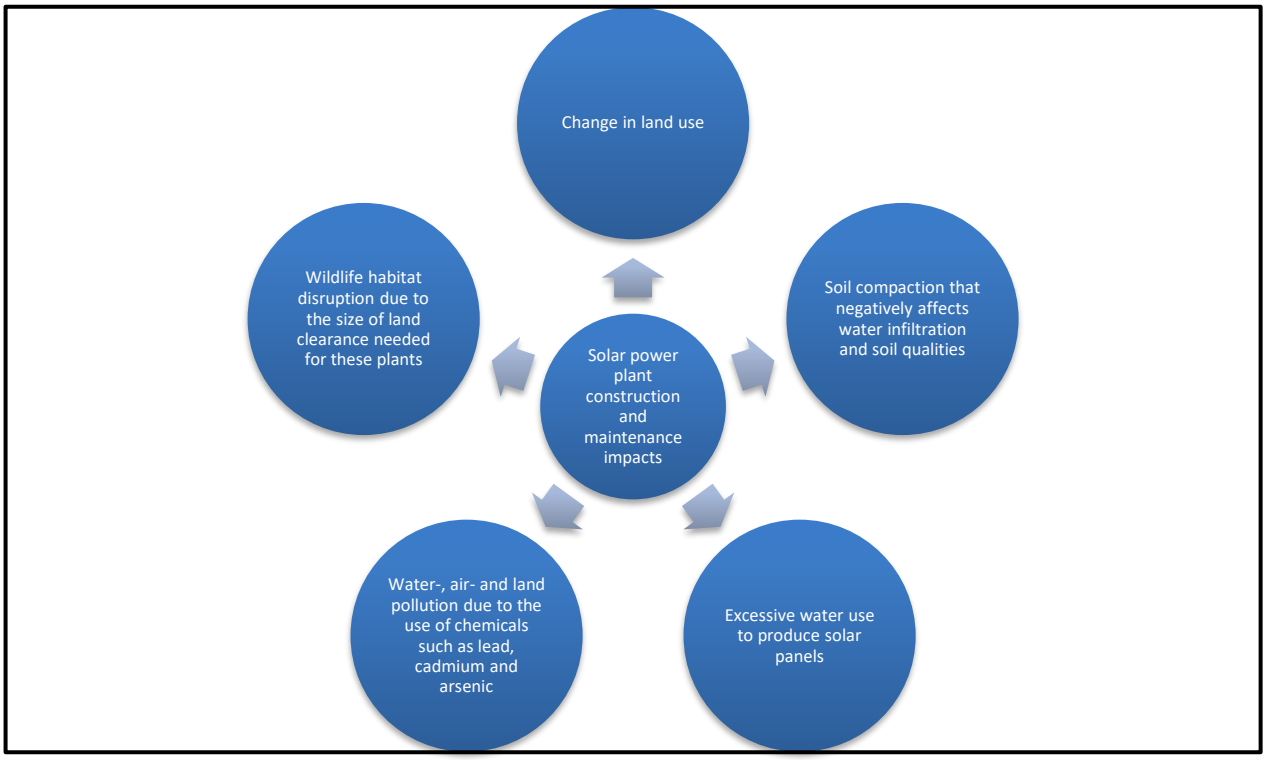


Figure 6: Impacts related to solar power plants (Own creation, 2025. Based on Bracken, et al., 2015; Islam, et al., 2024; Vo & Vo, 2021)

When solar power plants are being built in ecologically sensitive areas then potential biodiversity loss such as bird fatalities, loss of ecologically important plant species and loss of food production land can occur through activities in all its development phases (design, construction and maintenance phases) (Bracken, *et al*., 2015; Islam, *et al*., 2024; Vo & Vo, 2021).

In addition to the site location factor, the preservation of ecosystem health and its functions is a challenge found in solar power plant development (Salman & Martinez, 2015). This is seen in literature such as the study done on the Zambezi and Chad River basins, which recommended that an ecosystem-services-based approach should be carried out throughout all development phases of renewable energy plants to identify and minimise their impacts on ecosystem elements (Salman & Martinez, 2015). The following section will discuss the potential impacts that solar power plants have on water resources.

2.3.1. Water resources-related impacts associated with solar power plant developments

The development of solar power plants requires water throughout all its life cycles which leads to impacts such as water consumptions and water pollution through hazardous substances in its panels (Dhar, *et al*., 2020; Scheepers, *et al*., 2019) (Figure 6).

Semi-arid countries with low water availability in certain regions experience pressure on their freshwater ecosystems such as rivers and wetlands due to development (Van Deventer, *et al*., 2019). Water consumption during construction and operation phase, in areas where a lack of continuous water supply is present, can have a negative impact on the water security and sustainability of that area (Bošnjaković, *et al*., 2023). Water use is required for dust suppression during site grading and to clean dust particles off solar panels during operation for optimal absorption of radiation to generate electricity (Bošnjaković, *et al*., 2023; Dhar, *et al*., 2020; Scheepers, *et al*., 2019).

Water pollution can occur during the operation of the solar plant through damaged cadmium and lead filled panels or accidental fires that causes cadmium particles to fall in water resources (Bošnjaković, *et al*., 2023; Dhar, *et al*., 2020; Scheepers, *et al*., 2019). Developers use chemicals such as hydrofluoric acid and sulfuric acid to clean panels which can run off into and contaminate water resources and groundwater (Bošnjaković, *et al*., 2023; Dhar, *et al*., 2020; Scheepers, *et al*., 2019). Herbicides used during maintenance phase for vegetation management can run off into water resources and causes water pollution (Bošnjaković, *et al*., 2023). Given the potential water related impacts that solar power plants can have on water resources, it is necessary for these impacts to be investigated, assessed and mitigated through instruments such as the water use licence.

The following section provides an overview of water use authorisation processes from an international context and will then discuss the WULA process as an instrument for mitigating negative impacts associated with solar power plants from a South African context.

2.4. The authorisation of water uses

This section discusses the governance and management of water resource and how water-related impacts are regulated through systems from an international and South African context through legislation and government guideline documents.

2.4.1. Water use authorisations from an international context

Water laws are introduced in countries to govern and manage their water resource allocation sustainably, which is widely referred to as water use (Van Koppen & Schreiner, 2014). The water use licensing systems usually include authorities such as organs of states to licence the impacts on water resources, which encompasses impacts on watercourses (rivers, lakes, wetlands, natural channels, springs, dams), groundwater and aquifers (Ngeleza, 2023; RSA, 1998b; Van Koppen & Schreiner, 2014). Many African countries, including South Africa, used to manage their water resources with a governmental system known as riparian rights that was integrated into the property rights of landowners, but South Africa changed to a system that provides for appropriation rights and public allocation rights (Counsell, 2022; Van Koppen & Schreiner, 2014; Zheng, *et al*., 2021).

Water rights and licensing systems are named differently across countries as their legal systems, political regimes, social context, water resource quantities, and qualities differ (Zheng, *et al*., 2021). In Australia, it is referred to as the Water Licencing System; the United States of America (USA) calls it the National Pollutant Discharge Elimination System, and New Zealand refers to their system as resource consent (Moolman, *et al*., 2023; Van Koppen & Schreiner, 2014; Zheng, *et al*., 2021). The common primary purpose of water use licensing is to regulate non-consumptive uses of water resources, such as recreational uses, riparian habitat, and biodiversity, as well as consumptive uses, such as the amount of water withdrawal from a water resource and the level of pollution (Counsell, 2022).

The following sub-section is outlining how the South African water use authorisation system is designed through their legal framework.

2.4.2. South African legal framework for water use authorisations

This section provides an overview of the legal framework in South Africa that enables the licencing of water use through national legislation and best practice guidelines.

2.4.2.1. Constitution of South Africa 108 of 1996

The South African water sector legislation emanates from Sections 24, 27, and 33 of the Constitution of South Africa, which equally protects its citizens' rights against environmental pollution and degradation by proposed developments such as solar power plants, as follows:

- Section 24 protects the right for everyone in the country to have legal and other measures that prevent pollution, promote conservation, and secure ecologically sustainable development, and the right to have access to sufficient water (DWAF, 1997; RSA, 1996).
- Section 27 protects the right of South African citizens to have access to sufficient food and water (RSA, 1996).
- Section 33 protects the rights to administrative action that are lawful, reasonable, and procedurally fair (RSA, 1996).

The environmental rights in the Constitution are realised through the National Environmental Management Act (Act 107 of 1998) that was promulgated in 1998 as the main framework of how Environmental Management will transpire in South Africa in line with sustainable development principles (RSA, 1998a).

2.4.2.2. National Environmental Management Act (Act 107 of 1998)

The NEMA, which is the main Environmental Framework in South Africa, gives effect to Section 24 of the Constitution, and it encompasses environmental management principles such as sustainable development and environmental protection (RSA, 1998a). The NEMA Section 2(4)(a)(i) and (r) states that disturbance of ecosystems and biodiversity loss must be avoided or mitigated, which should give rise to management and planning procedures that address significant anthropogenic impacts on vulnerable and stressed ecosystems such as watercourses and coastal shores (RSA, 1998a).

This act makes provision for sustainable development in Chapter 2, and it states in Section 2(4)(a)(vi) that development should use and exploit renewable resources but should not place the integrity of ecosystems, where they are proposed, in jeopardy (RSA, 1998a). Part of the NEMA:

EIA regulations amendments that were done in listing notice 1, 2, and 3 (GNR 983, 984), was to specifically include thresholds for the development of renewable energy plants (DEA, 2014; DFFE, 2021). Thereafter, the DFFE published a guideline to conduct EIA for renewable energy projects 2015 (DFFE, 2015). In addition to these EIA policy adjustments, for the Environmental Authorisation (EA) of solar power plants, the Department of Forestry, Fishery and the Environment (DFFE) published REDZ in terms of NEMA Section 24(a) and (b) (DFFE, 2018b). Solar power plants are only subject to a Basic Assessment (BA) process when they are located in the REDZ strategic geographical areas (DFFE, 2018b). In 2021, the DFFE published a procedure to guide the application and decision-making for wind and solar power plants, provided they occur in REDZ (DFFE, 2021).

The NEMA provides for the protection and conservation of watercourses (RSA, 1998a). Specific Environmental Management Acts of which the National Water Act (Act 36 of 1998) forms part of, to regulate the water sector of South Africa in line with the concept of sustainable development as principled in NEMA (RSA, 1998a; RSA 1998b).

2.4.2.3. National Water Act (Act 39 of 1998)

The NWA is mainly a SEMA which purpose is, amongst others, to protect the quality of water resources in the interest of all water users (RSA, 1998b). Section 41 of the NWA mandates that there must be a process for WULA, which resulted in regulations for the procedure to carry out the water use licence application process and appeals (RSA, 1998b).

According to the National Water Act 36 of 1998, section 21, these water uses entail:

a) “taking water from a water resource
b) storing water
c) impeding or diverting the flow of water in a watercourse
d) engaging in a stream flow reduction activity contemplated in section 36
e) engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1)
f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall, or other conduit
g) disposing of waste in a manner that may detrimentally impact a water resource
h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process
i) altering the bed, banks, course, or characteristics of a watercourse

j) removing, discharging, or disposing of water found underground if it is necessary for the efficient
k) continuation of an activity or for the safety of people; and
l) using water for recreational purposes" (RSA, 1998b).

- Section 22(1) of the NWA defines and outlines permissible water uses. These are water uses that are permitted to continue without a licence (RSA, 1998b). Permissible water uses may continue in line with the following provisions in the NWA Section 22(1):

  "A person may only use water –
  (a) without a licence –
  (i) if that water use is permissible under Schedule I:
  (ii) if that water use is permissible as a continuation of an existing lawful use; or
  (iii) if that water use is permissible in terms of a general authorisation issued under section 39:
  (b) if the water use is authorised by a licence under this Act: or
  (c) if the responsible authority has dispensed with a licence requirement under subsection (3)" (RSA, 1998b).
- Subsections 2 to 10 of the NWA Section 22 outlines the conditions under which the permissible water use must be utilised by users.
- Subsection 2 elaborates on the fact that users must comply with the conditions with the authorisation for the water use and that it can be limited, restricted and/or prohibited in terms of any legislation (RSA, 1998b). This subsection also imposes that the disposal or discharge of waste and wastewater during the water use, as per Section 21 (f), (g), (h) or (j), must be managed in line with any waste norms and standards, legislation or best practice guidelines (RSA, 1998b). The NWA also requires that water must not be wasted and that any seepage or run-off water must be returned to its original water resource, during permissible water use (RSA, 1998).
- Subsection 3 states that the relevant authority may provide requirements for this water use given that the water use will promote the purpose of the NWA (RSA, 1998b).
- Subsection 4 makes provision that the permissible water use can be included in a single licence with other authorisations that are granted by other competent authorities (RSA, 1998b).
- Subsection 5 states that permissible water use can be authorised in line with Section 17 if the application is lodged before:

"(b) a catchment management strategy in respect of the water resource in question has been established:

(c) a classification system for water resources has been established

(d) the class and resource quality objectives for the water resource in question have been determined; or

(e) the Reserve for the water resource in question has been finally determined" (RSA, 1998b).

- Subsection 6 outlines that any person that was eligible to apply for an existing lawful use in terms of Section 32, who's application was refused or authorised to use less water than they need for economic viability, may claim compensation for their financial loss (RSA, 1998b).

- Subsection 7 states that the amount for compensation must be determined according to Section 25 (3) of the Constitution and to provide for the Reserve, rectify over-allocation of water from the water resource and to rectify a disproportionate use of water (RSA, 1998b).
- Subsection 8 provides for Water Tribunals to lodge a claim within six months of the authority's decision to grant the water use (RSA, 1998b).
- Subsection 9 states that the Water Tribunals have authority to determine the amount of the compensation to be paid (RSA, 1998b).
- Subsection 10 allows the for the compensation from the relevant authority then to be in the form of water (RSA, 1998b).
- The NWA Section 38 enables the responsible water use authority to publish general authorisation in the government gazette to allow registering certain restricted activities on certain water resources for a certain category of persons in certain geographical areas or duration (RSA, 1998b). The Minister of Water Affairs and Sanitation is therefore granted the authority to declare certain activities as controlled activities in a government gazette which is subject to public consultation processes set out in subsection 3 (RSA, 1998b).
- Section 38(4) mandates that all the existing and newly determined controlled activities must be listed and published in the notice mentioned in subsection 1 (RSA, 1998b).
- Section 40 of the NWA outlines the provision for a procedure which individuals must follow to launch applications for a licence to use water for the activities as set out under Section 21 of the NWA (RSA, 1998b). This section of the NWA states that the relevant

authority may decline the application for water use if the water use is qualified as existing lawful use or general authorisation (RSA, 1998b).

- Section 40 mandates the following for licence applications:

  "(1) A person who is required or wishes to obtain a licence to use water must apply to the relevant authority for a licence.
  (2) Where a person has made an application for an authorisation to use water under another Act and that application has not been finalised when this Act takes effect, the application must be regarded as being an application for a water use under this Act.
  (3) A responsible authority may charge a reasonable fee for processing a licence application, which may be waived in deserving cases.
  (4) A responsible authority may decline to consider a licence application for the use of water to which the applicant is already entitled by way of an existing lawful water use or under a general authorisation." (RSA, 1998b).

- The procedure for WULA applications is recorded in Section 41 of the NWA which states in subsection (1) that the application must:

  (a) be captured in the registration forms
  (b) must contain all the required information
  (c) must be accompanied by a registration fee that is determined by the competent authority (RSA, 1998b).

- Section 41(2)(a) mandates that the competent authority must require that all requested information must be submitted by a given date, an impact assessment of the proposed scope on the water quality of the water resource and that the competent authority must approve a person to assess the information that is provided by the applicant (RSA, 1998b).

- Section 41(2)(b) states that the competent authority may also conduct an investigation of the impacts that the proposed scope might have of the use, protection, development, conservation, management and control of the affected water resource (RSA, 1998b).

- The NWA requires under Section 41(2) (c), (d) that the competent authority must allow the application to be subject to public review and invite comments from any Interested and Affected Party (I&APs); and allow the applicant to make any representation of any part of the application (RSA, 1998b).

- The competent authority may direct that the WULA information assessments undergo Environmental Impact Assessment for EA as required by NEMA Section 24(5) and 44 (RSA, 1998a; RSA, 1998b).
- The competent authority may require a public review process in line with Section 41(4)(a) to ensure that all I&APs has been informed and that any person with interest on the land will not be negatively affected by the proposal, which entails:

  "(a) to give notice in newspapers and other media—
  (b) describing the licence applied for;
  (ii) stating that written objections may be lodged against the application before a specified date, which must be not less than 60 days after the last publication of the notice.
  (iii) giving an address where written objections must be lodged; and
  (iv) containing such other particulars as the responsible authority may require" (RSA, 1998b).
- Section 41(5) (a), (b) mandates that the competent authority must consider aligning the WULA application with permit and authorisation process in the Minerals and Petroleum Resources Development Act (MPRDA) and NEMA (RSA, 1998b).
- The NWA Section 41(6) makes provision for applicants to lodge an appeal against authority decisions that arise from the above-mentioned integrated process (RSA, 1998b).

2.4.2.3.1. Water Use Licence Applications and appeals process regulations (GN.R. 267)

Section 26 of the NWA makes provision for a procedure and regulations on the use of water in South Africa, to be established (RSA, 1998b). Section 26(1)(k) in the NWA states that the minister may prescribe procedural requirements and regulations for WULA and appeals, to protect water quality, riparian habitat, water flow, and aquatic biodiversity of water resources (RSA, 1998b). The Minister of the DWS published the *water use licence application and appeals regulations* (Government Notice Regulation 267, Government Gazette 40713 dated 24 March 2017) which is adopted as the main guidance for WULA in South Africa (DWS, 2017; Moolman, *et al*., 2023). The requirements in the said regulations highlight that:

- An activity is only subjected to the WULA process if it is not an Existing Water Use, Schedule 1 use or permissible in terms of Section 23 of the NWA which dispense of the WULA process, if the activity is already authorised under any other act, such as the NEMA, for its intended purpose (Ngeleza, 2023).

- The outcome of the initial required pre-application meeting or site visit will determine the required WULA information, including the technical reports for the proposed WULA (Figure 7) (DWS, 2017). This risk-based approach was adopted in the December 2016 GA 509 General Authorisation (GA) regulations to determine the supporting specialist assessments that must be carried out in support of the WULA and to determine the application route to be followed for authorisation (DWS, 2023; Matlala, 2023).
- A WULA process must be followed if the outcomes of a completed DWS risk assessment matrix for a proposed development are medium to high risk (DWS, 2017; DWS, 2023).
- The requirement for a WULA technical report is stipulated under Section 11 of the general process to follow in licensing water uses, which is based on administrative and scientific information provided through the specialist risk determination in likelihood, extent, and magnitude of impacts on water resources (DWS, 2007; DWS, 2017).The WULA regulations define a WULA technical report as the water use forms, public participation report, and specialist studies (DWS, 2017).

The DWS published the Generic public participation guidelines in 2001 as a best practice guideline for the compilation of the required public participation report (DWAF, 2001). The DWS is mandated to make an informed decision regarding the licensing of water uses within a period of 90 days based on the submitted information and public participation outcomes (Figure 7) (DWS, 2007). A WULA must be compiled and submitted with a technical report accompanied by the relevant application forms and a public participation report (informed by all technical supporting documents) on request of the authority within a practicable, reasonable period after the pre-application meeting or site visit.

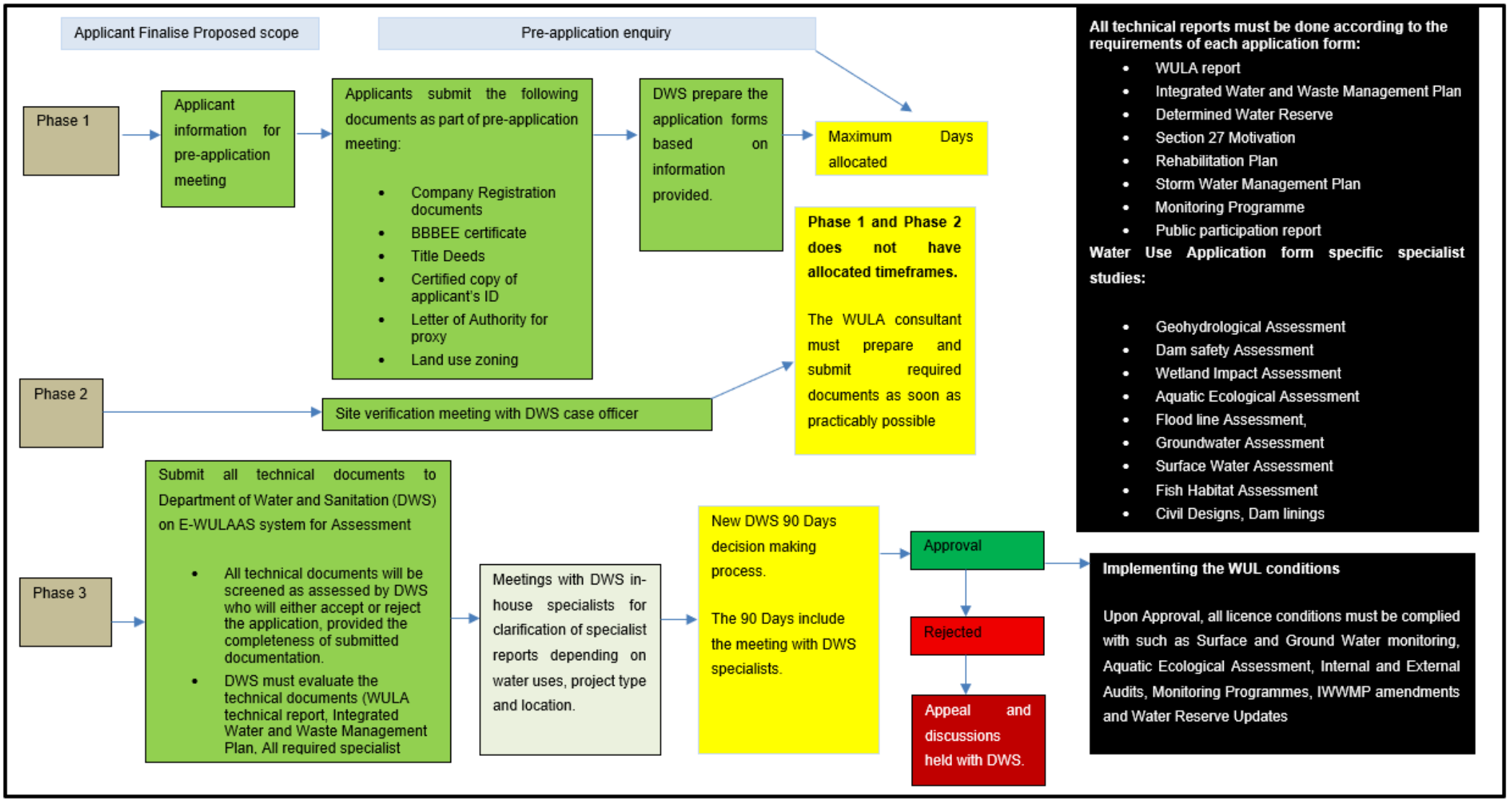


Figure 7: Water Use Licence Application process with Timelines (Own creation, 2025. Based on DWS, 2007b; DWS, 2017; RSA, 1998b)

2.4.2.3.2. Guidelines for generic water use authorisation processes

The external guideline for generic water authorisation application processes was developed in 2007 to guide applicants and the DWS application reviewers in the WULA process (DWS, 2007a). The internal guideline for generic water authorisation processes was also introduced in 2007 but later superseded by the DWS electronic water use licence application and authorisation system (e-wulaas) for the processing of WULAs and registration of other water use authorisations within the DWS (DWS, 2025a; Moolman, *et al*., 2023). The minimum requirements to register a general authorisation and their associated guideline documents can be seen in Table 1 below:

Table 1: Minimum requirements for the registration of General Authorisation

Documents required to support a WULA	Guiding tools to complete the DWS Risk Assessment Matrix
Master Layout map denoting all proposed activities in relation to delineated watercourses.	A Practical field procedure for delineation of wetland and riparian area.
Applicable WULA registration forms.	The Risk Matrix, excel spreadsheet, and the method that was used in the Risk Assessment.
A Risk Assessment Matrix that was completed by a suitably qualified South African Council for Natural Scientists (SACNASP) professional.	Assessment of activities and/ or developments that affect wetlands.
Any applicable information to substantiate assessments.	Guideline or the determination of buffer zones for rivers, wetlands and estuaries.

(Own creation, based on DWS, 2023)

2.5. Water Use Licence Application

South Africa has an administrative process to licence water uses as there are eleven water uses listed under Chapter 4, Section 21 of the NWA which are surface and underground consumptive uses, the using of water to transport waste, impeding or diverting the natural flow of water, altering the bed or banks of watercourses (rivers, springs, lakes, dams, wetlands, natural channels) and flow reduction of water in streams, that are subjected to a WULA process to obtain WUL before their commencement (Kapangaziwiri, *et al*., 2018; Moolman, *et al*., 2023; RSA, 1998b).

2.5.1. Water Use Licence Application process requirements

The WULA process can follow the non-waste-discharge related water uses or the waste-discharge related water uses, which must be accompanied by an Integrated Water and Waste Management

Plan (IWWMP) that presents information such as a short- and long-term management strategy, an impact assessment, and its related monitoring plan (DWS, 2007b).

These supporting documents are regarded as specialist reports, which ought to be drafted in line with specialist reporting best practices. The NEMA: EIA regulations of Annexure 6 outline a best practice for a specialist report's content structure (DEA, 2014). The DFFE, in their Integrated Environmental Management Series 4 document, released a best practice guideline on how specialist studies should be carried out (DEAT, 2002c).

Water uses related to solar power plant activities are found in Section 21(a), (f), (g), and (j), which are activities that can possibly result in waste or wastewater to contaminate water resources (Figure 8) (RSA, 1998b). The water use forms of these activities must be accompanied by an IWWMP as part of the supporting documents (DWS, 2017). Solar power plant activities usually trigger NWA Section 21 (a), (c), (g) and (i) water uses, which must form part of the water use forms that must be accompanied by a wetland impact assessment reports, groundwater studies and public participation report as applicable information to substantiated assessments (DWS, 2017; DWS, 2023; Matlala, 2023). The aforementioned required documentation constitutes a WULA technical report according to the GN.R. 267 (DWS, 2017).

2.5.2. Water Use Licence Application technical report

The WULA regulations define the term "water use licence application technical report" as inclusive of water use registration forms, public participation reports, and specialist studies (DWS, 2017). Management of the water use licencing process is a holistic approach that encompasses the organisational and technical aspects of the process to promote fairness of administrative justice (Myburgh, 2018). The WULA procedure explicitly states in Section 11(1) that a technical report, including any relevant specialist studies and water use forms, must be submitted to the responsible authority for them to consider the application (DWS, 2017). All the respective NWA Section 21 water uses have their distinct registration forms in which specific specialist reports are required (Figure 8) (DWS, 2017).

As per Regulation 4, 5, and Annexure A of the WULA regulations, the required supporting information, such as a wetland delineation report, geohydrological reports, flow reduction reports, public participation reports, NWA Section 27 motivation, etc., with contents as prescribed in the WULA regulations, ought to be requested by the DWS case officers after a pre-application intervention with the applicant (DWS, 2017).

The Assessment of impacts and mitigations is carried out within the specialist reports, and the rest of the NWA principles are being assessed in registration forms, which also inform the overall level of impact on ecology, economy, and Interested and Affected Parties (I&APs) (DWS, 2017; RSA, 1998b).

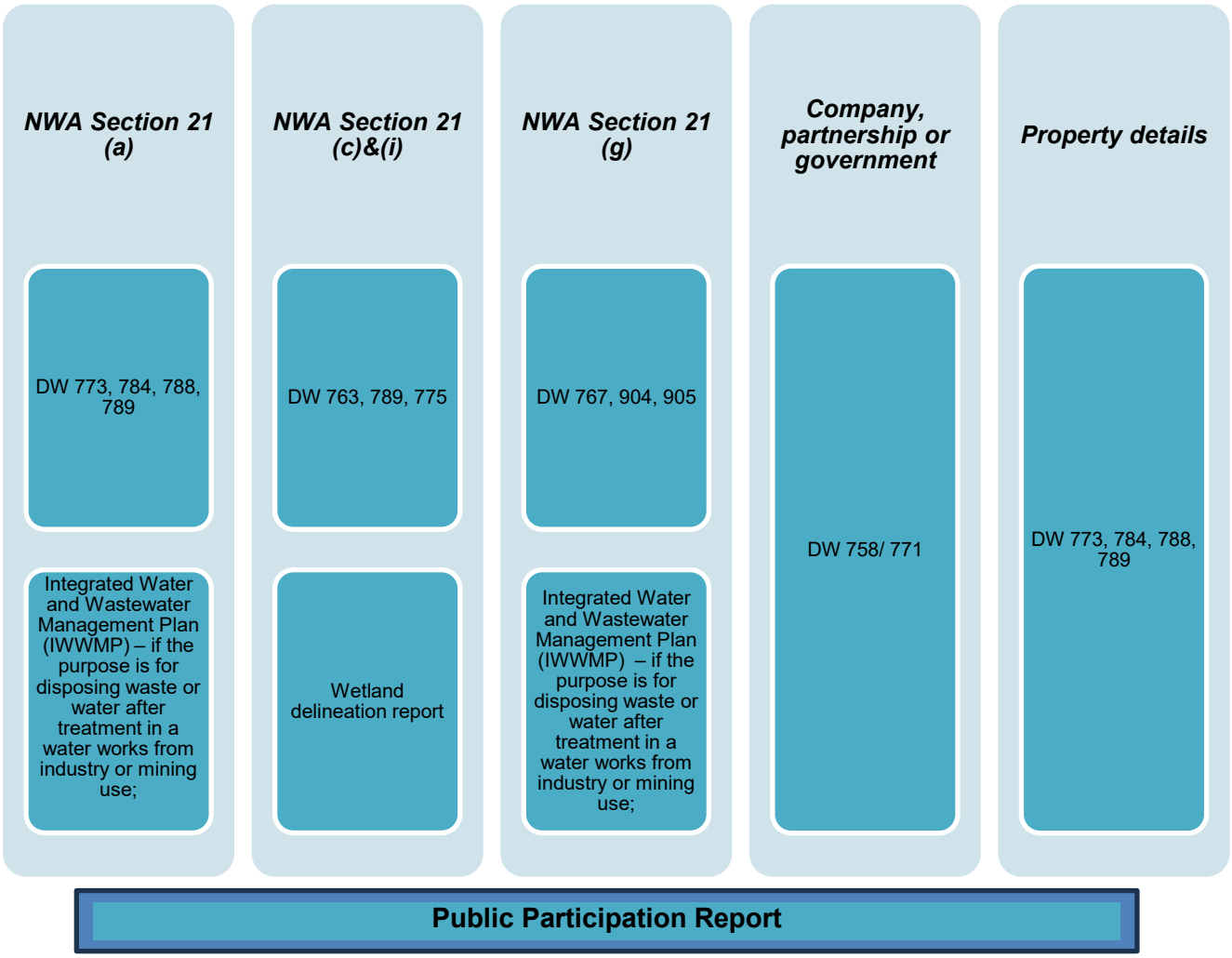


Figure 8: Example of WULA technical report content required (Own creation, based on DWS, 2017)

The NWA, Section 41(4) mandates that a public participation process must be included as part of a water use licence application (RSA, 1998b). This public participation process is regulated in Section 17 of the WULA procedure, with specific reference to a public participation report that should form part of the WULA technical report (DWS, 2017).

The WULA technical report is therefore the core requirement in the application process for the licencing of NWA Section 21 water uses (DWS, 2017). In the instance of a WULA, administrative

justice compels authorities to make licensing decisions based on the quality of WULA technical reports because the WULA process is incumbent on the South African administrative water rights permitting system (Moolman, *et al.*, 2023). The quality of WULA technical reports will be discussed in section 2.8. below.

2.5.2.1. Introduction of the Water Use Licence Application summary report

The president announced in the 2020 State of the Nation Address (SONA) that the WULA process has been expedited from 300 days to 90 days due to the backlog of WULAs, which hindered economic development in South Africa (Ngeleza, 2023). This change led to the appointment of Operation Vulindlela, which gave technical advice to the DWS, which changed the Department's business process, templates, and standard operating procedures, amongst others (Ngeleza, 2023).

One important change that was made in the DWS standard operating procedure was that applicants must populate all the required information that may be in the different required technical reports into one WULA summary report to minimise errors made by officials when recording the information from various technical reports into the system and to expedite the process (DWAF, 2007; Ngeleza, 2023). This WULA summary report is mainly requested by DWS officials to expedite the application processing (DWAF, 2007).

The quality of technical reports in support of WULs has been found to be questionable as it presented incompleteness, insufficient public involvement, weak specialist assessments, non-compliance to relevant guidelines and are generally insufficient for authority decision (Moolman, *et al.*, 2025). The practice of report quality evaluation is devised to address the quality of technical report content.

2.6. The practice of report quality evaluation

2.6.1. Background of report quality evaluation research

The international debate around impact assessment has evolved over the past decades from "What is impact assessment?" to "How to do impact assessment?" which encompasses the investigation of, amongst others, the quality of impact assessment systems, reports, and processes (Retief, 2010). Good quality reports have been found to present complete assessment results, provide accurate, complete, and valid information, make reviewers conversant with the project and its location, reveal assessment limitations, and assess the impact and significance of all proposed project alternatives (Scheepers, *et al.*, 2019). Decisions to authorise restricted activities are subject to the content quality found in the assessment reports (Sandham & Pretorius, 2008). The quality of

decisions made by authorities to license detrimental activities is therefore subjected to the quality of reports that furnish them and the I&APs with information regarding possible project impacts and aid the proponent to minimise their impacts on environmental themes (Bond, *et al*., 2016; Scheepers, *et al*., 2019).

Relevant authorities authorise or reject proposals based on the extent to which minimum environmental legal requirements and sector-specific best practice guidelines are met in the assessment report content of proposed developments, which can have significant potential impacts on water resources (Alberts, *et al*., 2022a).

However, over the recent years, the quality of the reports has been questioned and has since been the subject of investigation (Alberts *et al*., 2019; Cashmore *et al*., 2004; Lawrence 1997; Sadler, 1996; Sandham *et al*., 2013).

2.6.2. South African findings on report quality

The quality of reports has also become an alarming element in South Africa in recent years, as part of the debate in Environmental Management. The general concern around report quality is evident as much report quality review research have been carried out in various sectors such as ecology, water and energy sectors in aquatic ecosystem related disciplines such as Biodiversity Impact Assessments (BIA), wetland impact assessment reports, solar power plants and the quality of ecological reserve reports in EIAs in South Africa (De Jager, 2022; Hallatt *et al*., 2015; Hildebrandt & Sandham, 2014; Matlala, 2025; Retief, *et al*., 2008; Scheepers, *et al*., 2019; Wentzel, *et al*., 2023).

The Lee and Colley Review Package (LCRP) has been adapted for EIAs in South Africa by Sandham and Pretorius in 2008, and then Hallat, *et al*. (2015) designed the first adapted LCRP to review the quality of BIA reports in South Africa in 2014 (Hallatt *et al*., 2015; Sandham & Pretorius, 2008). Wentzel and Swanepoel created the Adapted Lee and Colley Review Packages for their studies in sensitive biodiversity areas (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023).

The Adapted Lee and Colley Review Packages were also utilised for report quality reviews in different sectors in South Africa, which revealed improving results over time (Table 2) (De Jager, 2022; Hallatt *et al*., 2015; Sandham & Pretorius, 2008; Scheepers, *et al*., 2019; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Below are findings from impact assessment report quality review research completed in different sectors:

2.6.2.1. Report quality in Impact Assessments

The Environmental Impact Assessment report quality in the solar plant sector indicated improvement over the years from 2011 to 2017, with a C grading and above as equivalent to similar studies in South Africa (Scheepers, *et al*., 2019). The author further posited that the main weaknesses found generally in South Africa are found under waste management, definition of impacts, and prediction of impact magnitude (Scheepers, *et al*., 2019).

A study on Ecological Impact Assessment report quality review highlighted that the reports reflected generally satisfactory results with main weaknesses stemming from analytical elements such as the prediction of impacts, determining impact magnitude and significance; and the identification of alternatives, project description, baseline environmental status, and monitoring (De Jager, 2022). However, the author mentions that the better-performed areas amongst all included are baseline conditions, identification of potential impacts during scoping, and the project description (De Jager, 2022).

Biodiversity Impact Assessment report quality evaluations in South Africa, generally indicates that the main weaknesses are in the description of the project, inclusion of alternatives, inclusion of legal aspects, stakeholder consultation and impact monitoring over time whereas the better performing areas were in the presentation adequacy and sufficiency of information, clarity of the reports, description for the baseline environment and recommendation for impact management (Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023).

Table 2: Report quality review results in different sectors in South Africa

Number of reports reviewed: 32	Number of reports reviewed: 6	Number of reports reviewed: 16	Number of reports reviewed: 26	Number of reports reviewed: 7	Number of reports reviewed: 7
North-West EIAs (Sandham & Pretorius, 2008)	***Biological pest control (Sandham et al., 2013)***	***Biodiversity Impact Assessment (Wentzel, et al., 2023)***	***Biodiversity Impact Assessment (Hallatt et al., 2015)***	***Solar Photovoltaic projects (Scheepers, et al., 2019)***	***Ecological Reserve reports (De Jager, 2022)***
Overall report quality: 3 reports scored B (75%) – Generally satisfactory and complete with minor omissions and inadequacies.	Overall report quality: 4 reports scored D (66%) – Just unsatisfactory due to omissions or inadequacies.	Overall report quality: 7 reports scored C (45%) – Just satisfactory, despite omissions or inadequacies.	Overall report quality: 5 reports scored B (19%) – Generally satisfactory and complete with minor omissions and inadequacies.	Overall report quality: 1 report scored A (14%) – Generally performed well with no important tasks left out.	1 report scored – A (14%) – Generally performed well with no important tasks left out.
		3 reports scored B (20%) – Generally satisfactory and complete with minor omissions and inadequacies.	14 reports reflected a C (54%) – Just satisfactory, despite omissions or inadequacies.	3 reports scored B (43%) – Generally satisfactory and complete with minor omissions and inadequacies.	4 reports scored B (57%) – Generally satisfactory and complete with minor omissions and inadequacies.
		4 reports scored D (25%) – Just unsatisfactory due to omissions or inadequacies.	7 reports reflected a D (27%) – Just unsatisfactory due to omissions or inadequacies.	3 report scored C (43%) – Just satisfactory, despite omissions or inadequacies	1 report scored C (14%) – Just satisfactory, despite missions or inadequacies.
		2 reports scored E (13%) – Very unsatisfactory, important task(s) poorly done or not attempted.			1 report scored D (14%) – Just satisfactory, despite omissions or inadequacies.

(Own creation, based on De Jager, 2022; Hallatt *et al.*, 2015; Sandham & Pretorius, 2008; Sandham, et al., 2013; Scheepers, *et al.*, 2019; Wentzel, *et al.*, 2023)

Specialist report quality reviews in South Africa have revealed similar weaknesses in reports across different sectors such as BIA reports, Social Impact Assessment (SIA) and Ecological Impact Assessments reports by using ALCRPs (

Table 3) (Hallatt, *et al*., 2015; Hildebrandt & Sandham, 2014; Retief, *et al*., 2008).

Table 3: Common weaknesses found in different specialist assessment reports

Environmental Impact Assessment report quality	Biodiversity Impact Assessment report quality	Social Impact Assessment report quality
Review Area 1: Time and timeframe the study is conducted	Review Area 1: Baseline information	Review Area 1: Social baseline description
Review Area 1: Description of the project and activities in certain sectors	Review Area 1: Project description	Review Area 2: Defining, identifying and prediction of impact significance
Review Area 2: Prediction of impact magnitude and significance	Review Area 2: Impact predictions on ecological processes in an area	Review Area 3: Identifying alternatives to improve on sustainability with positive impacts
Review Area 3: Methods employed to identify alternatives and the effectiveness of these methods	Review Area 3: Mitigation measures not being project specific	Review Area 4: Communication of results related to prominence and emphasis
Review Area 1: Provision of adequate project design information	Review Area 2: Monitoring plans not always found in BIAs	Review Area 4: Non-technical report
	Review Area 2: Cumulative impacts	

(Own creation, 2025, based on Chanthy & Grünbühel, 2015; Hallatt, *et al*., 2015; Hildebrandt & Sandham, 2014; Retief, *et al*., 2008; Sandham & Pretorius, 2008; Söderman, 2006; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023)

Various authors have found that report quality in South Africa has improved over time due to the increased EIA practices, specialist EIA experience; and increase in experience, knowledge and familiarity of the regulated application processes by EAP (De Jager, 2022; Myburgh, 2018; Scheepers, *et al*., 2019).

2.7. Water Use Licence Application technical report quality review

The WULA process is still a new process internationally in relation to other regulatory processes, with very limited research data available, especially in the aspect of report quality review, because it is still being refined in many countries around the world (Myburgh, 2018). A study on the quality

of WULA technical reports in support of WULAs in general, in which detailed recommendations were listed, was carried out in 2025 and obtained an overall good performance (Moolman, *et al*., 2025). The authors evaluated two review areas (review area 1: completeness and review area 2: substantive quality) with their related Key Performance Areas (KPAs) and Key Performance Indicators (KPIs) (Moolman, *et a*l., 2025). The evaluation results presented good performance in review area 1 in terms of completeness of documentation, technical information, mitigation and public participation (Moolman, *et al*., 2025). However, areas of concern surfaced in KPAs related to the description of the environment, determined water uses, determination of key impacts and significance on water resources (Moolman, *et al*., 2025). Review area 2 performed well in describing the activity, socio-economic considerations, scoping and public participation (Moolman, *et al*., 2025). The reports did not perform well in their substantive quality of impact significance and determining mitigation measures (Moolman, *et al*., 2025).

The authors made recommendations to improve the quality of technical reports which included consistent practices, especially in terms of when and how to apply for different water uses (Moolman, *et al*., 2025). Their recommendation regarding the inclusion and integration of information entailed including important environmental features to ensure good transition from environmental description and impacts identification to secure efficient mitigation of potential impacts on water resources from all involved specialists (Moolman, *et al*., 2025). The recommendation on “need for guidance” entailed that more clarification and guidance regarding the methodology to determine impact significance, should be provided for impact mitigation to be better addressed in the technical reports (Moolman, *et al*., 2025). It was recommended that more meaningful public engagement should be carried out in involving the I&APs in the decision-making process for licencing (Moolman, *et al*., 2025). The following section discusses the Adaptation of the Lee and Colley Review Package, to make it suitable for the evaluation WULA technical reports.

2.7.1. The Lee and Colley Review Package for WULA technical report quality evaluation

To achieve the set aim of this research, adoption of the LCRP is proposed. However, the LCRP will need to be adapted to be compatible with water sector-specific requirements and will be explained in the following section. The adapted LCRP will involve South African legal requirements for the WULA process, best practice guidelines, and similar sector-specific report quality review research as described below (Lee, *et al*., 1999).

Reviewing the quality of WULA technical reports includes its associated water use forms, public participation, and different specialist reports (DWS, 2017). An ALCRP will review whether the correct application forms for the different water uses were used in the report as required in GNR 267 (DWS, 2017). The required Risk Assessment Matrix (RAM) must also form part of the WULA technical report as required by General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21 (c) and (i), GN 4167 of 2023 (GA Regulations) and therefore needs to be included in the review criteria (DWS, 2023). The minimum required information for the Department of Water and Sanitation (DWS) to assess a WULA, as required in the GA Regulations, Appendix A, will be considered in the ALCRP to review completeness of the report (DWS, 2023).

The GA is another form of Water Use Authorisation (WUA) that was introduced through the DWS, General Authorisations in terms of Section 39 of the NWA for water uses as defined in Section 21 (c) or Section 21 (i) (as amended) (GA Regulations) (DWS, 2023). This type of water use authorisation is only applicable to the NWA Section (c) (impeding or diverting the flow of water in a watercourse) and Section (i) (altering the bed, banks, course, or characteristics of a watercourse) (RSA, 1998b). There are conditions related to the abovementioned generally authorised listed activities, such as the renewable energy generation activity in Appendix D1, which makes the activity eligible for GA registration if the plant, including the footprint of its wastewater discharge infrastructure, does not have a direct impact on a watercourse (DWS, 2023).

The DWS developed a Section 21 (c) and (i) water use risk assessment protocol that must be completed on the provided DWS template by a SACNASP aquatic specialist, to determine the risk level of a proposed development on the water resource quality (DWS, 2023).

A low-risk level outcome will then allow the water use to follow the GA registration process, in which a WULA summary report, wetland specialist assessment and groundwater study report, amongst other minimum required information, can be requested by the DWS case officer to review the application for registration (Table 1) (DWS, 2023).

The Department of Water and Sanitation issued External guidelines on the Generic Water Use Licence Application process, which states that a brief application report, which is also known as a WULA summary report, can be submitted to expedite the processing period of applications (DWAF, 2007). The WULA summary report is serving as a guide to the compiled required supporting documents to highlight their pivotal points for decision making (DWAF, 2007).

The following paragraph will discuss the EIA as an instrument in South Africa to identify and evaluate potential environmental impacts of projects on priceless ecosystems like wetlands, which are susceptible to detrimental impacts from projects (Retief & Sandham, 2008). Therefore, the specialist studies requirements found under EIA will also be used as criteria to evaluate WULA technical report quality.

The National Environmental Management Act: Environmental Impact Assessment regulations of 2014 as amended (NEMA: EIA regulations), GNR982, Annexure 3 outlines the contents of an Environmental Impact Report (EIR), which is a similar compilation of different information, similar to that of a WULA technical report (DEA, 2014). Therefore, the structure of the LCRP that was initially designed to review EIR Reports can be adapted to review WULA technical reports (Hallatt *et al*., 2015; Matlala, 2025; Wentzel, *et al*., 2023). Annexure 6 of the NEMA: EIA Regulations and the 2001 Integrated Environmental Management guideline series 4, specialist studies (DEAT specialist studies) guidelines, provides the details of what a specialist report should contain. The NEMA: EIA Regulations, DEAT information series guideline for specialist studies and the South African National Association for Standards (SANS) ISO 14001 standard will be used in the criteria to review the impact identification, impact significance rating, and mitigation in the WULA technical report (DEAT, 2002c; RSA, 1998a; SANS, 2015).

The ALCRP, designed by Sandham and Pretorious in 2008, adapted and used by Retief, *et al*., 2008; Hallatt, *et al*., 2015; Swanepoel, *et al*., 2019 and Wentzel, *et al*., 2023 will be adapted and utilised in this research to establish the criteria by which the WULA technical reports will be reviewed. The criteria will be in line with, but not limited to, those listed in (Table 4) below:

Table 4: References used to adapt the LCRP to review WULA technical reports quality

National legislation	Best practice guidelines	Previous report quality research papers
National Water Act (Act no. 36 of 1998)	External guideline: Generic water Use authorisation application process (DWS, 2007b).	*The effectiveness of water Use authorisation systems as a policy implementation instrument* (Moolman, *et al*., 2023).
GNR 982 National Environmental Management Act: Environmental Impact Assessment regulations of 2014 as amended (RSA, 1998a).	The requirements in the Department of Water and Sanitation (DWS) template for the Water Use Licence Application summary report (DWS, 2017).	*The quality of Ecological Reserve Inputs in Environmental Impact Assessments for water resource development projects in South Africa* (De Jager, 2022).
GNR 267 under the National Water Act: Regulations regarding the procedural requirements for water use licence applications and appeals (RSA, 1998b).	Department of Environmental Affairs and Tourism (RSA). 2002c. Specialist studies. Integrated environmental management information Series, 4. (Department of Fishery, Forestry and Environmental Affairs, 2002c).	*A critical evaluation of the quality of biodiversity inputs to environmental impact assessments in areas with high biodiversity value: experience from the Cape Floristic Region* (Hallat, *et al*., 2015).
National Water Act (Act no. 36 of 1998): General authorisation in terms of Section 39 of the national water act 36 of 1998 for water uses as defined in Section 21(c) or Section 21 (i). (Notice 4167). Government Gazette, 49833:208, 8 December (DWS, 2023).	Risk Management: Guidelines. Pretoria: SABS Standards Division (SANS, 2019).	*The quality of environmental impact reports for projects with the potential of affecting wetlands in South Africa* (Nel & Alberts, 2018).
	Reviewing the quality of environmental statements and environmental appraisals (Lee, et al., 1999).	*The improvement of environmental impact assessment report quality for solar photovoltaic projects in South Africa* (Scheepers, *et al*., 2019).
		Explanations for the quality of biodiversity inputs to Environmental Impact Assessment (EIA) in areas with high biodiversity value (Swanepoel, *et al*., 2019)
		Evaluating the quality of wetland impact assessment reports for coal mines in Mpumalanga. Potchefstroom: North-West University. (Dissertation – MA) (Matlala, 2025)

(De Jager, 2022; DFFE, 2002c; DWS, 2007a; DWS, 2007b; DWS, 2017; DWS, 2023; Hallat, et al., 2015; Lee, et al., 1999; Matlala, 2025; Moolman, et al., 2023; Nel & Alberts, 2018; RSA, 1998a; RSA, 1998b; SANS, 2019; Scheepers, et al., 2019; Swanepoel, et al., 2019)

2.8. Chapter summary

In conclusion, the investigated literature reveals the need to evaluate the quality of WULA technical reports, as this was identified as a gap in the report quality research. The basis for this is the goals of the globally adopted concept of sustainable development which suggested the need for water resources quality and quantity to be protected from degradation and pollution to sustain life on earth. It was found that the energy sector has an immense impact on water resource quality through different types of pollution and climate change, which defies the water-related sustainable development goals. Renewable energy, such as solar power plants, was introduced and adopted in various countries to reduce the impact of the energy sector. However, literature found that it does not come without environmental impacts, especially on water resources. Many countries established and enforced water sector related legislation including South Africa such as the NWA, which regulates the use and impacts on water. The process to apply for a water use licence in South Africa is also regulated with requirements such as the submission of a WULA technical report. The determination that the content quality of impact assessment reports, such as the WULA technical report, determines the quality of authority decisions in issuing licences to proposed developments. Literature, therefore, found that a need arises for the quality of WULA technical reports to be evaluated and recommendations made to improve their quality. Improving the quality of these reports will ultimately contribute to mitigating the impacts that solar power plants have on water resources. The LCRP can be effective in the evaluation of WULA technical reports when applying water-related legal requirements, best practice guidelines, and the outcomes of similar studies to design its evaluation criteria.

CHAPTER 3 METHODOLOGY AND STUDY AREA

3.1. Introduction

This chapter focuses on the methodology that was adopted and implemented to achieve the aim of the research. In outlining the methodology of the research, this chapter will discuss the research approach and design, case study selection, an overview of the ALCRP and its development. Further discussions will entail data collection, analysis, data representation and results presentation. The research and ethical considerations will also be discussed in this chapter.

3.2. Research approach and design

A case study approach was selected to review the quality of WULA technical reports for solar power plants in the Free State province. This qualitative approach is preferred in research that involves the evaluation of documents to avoid a mathematical evaluation of the content (May & Pope, 2000; Wentzel, *et al*., 2023). Literature also suggests that following a case study approach does not generate quantitative statistical data but rather to provide empirical clarity on theoretical concepts (Yin, 2018).

The adoption and implementation of a case study approach entailed case study design, case selection, data gathering, development of an ALCRP, report quality review and analysis which was to comprehend, present the results, and to discuss them in literature form.

The theory of generalisation of findings was tested by the selection of multiple cases and the use of a well-documented data analytical tool that allowed a systematic approach to evaluate documents and to obtain findings that could be replicated in another context (Mays & Pope, 2000; Yin, 2003). This evaluation tool is explained in section 3.6.1. below.

3.3. Case study design

A case study approach was adopted to reach the aim of this research. Scholars found that case study approaches are appropriate to carry out evaluation-based research (Alberts, *et al*., 2022b; Moolman, *et al*., 2025). A case can be in the form of an individual, small groups, organisations, or projects (Yin, 2018). In this instance, a detailed case study design was used to apply replication logic which is to use a criterion that enable the prediction of the same results within similar contexts (Yin, 2018). This research adopted a multiple-case embedded design as the number of WULA technical reports is not known which avoided the researcher to claim representation of the sample

(Moolman, *et al*., 2025; Yin, 2018). This case study design consisted of multiple cases with multiple units of analysis (Moolman, *et al*., 2025).

3.3.1. Case study selection and justification

Water Use Licence Applications for solar power plants in the Free State province have been selected as a case study. The Free State province is the province that host the third most publicly procured, constructed and commissioned solar power plant projects by December 2025 (DEE, 2025a). Due to the province's semi-arid nature, its level of radiation is conducive for solar energy generation. The National Energy Regulator of South Africa (NERSA) reported in February 2026 that the Free State province registered the most private renewable energy projects (27) from 2022 until February 2026 (Figure 9) (The Outlier, 2026). Consequently, various WULA technical reports were submitted in support of WULs for these developments in the Free State. It was therefore found that the Free State province is a justifiable study area for the purpose of this research.

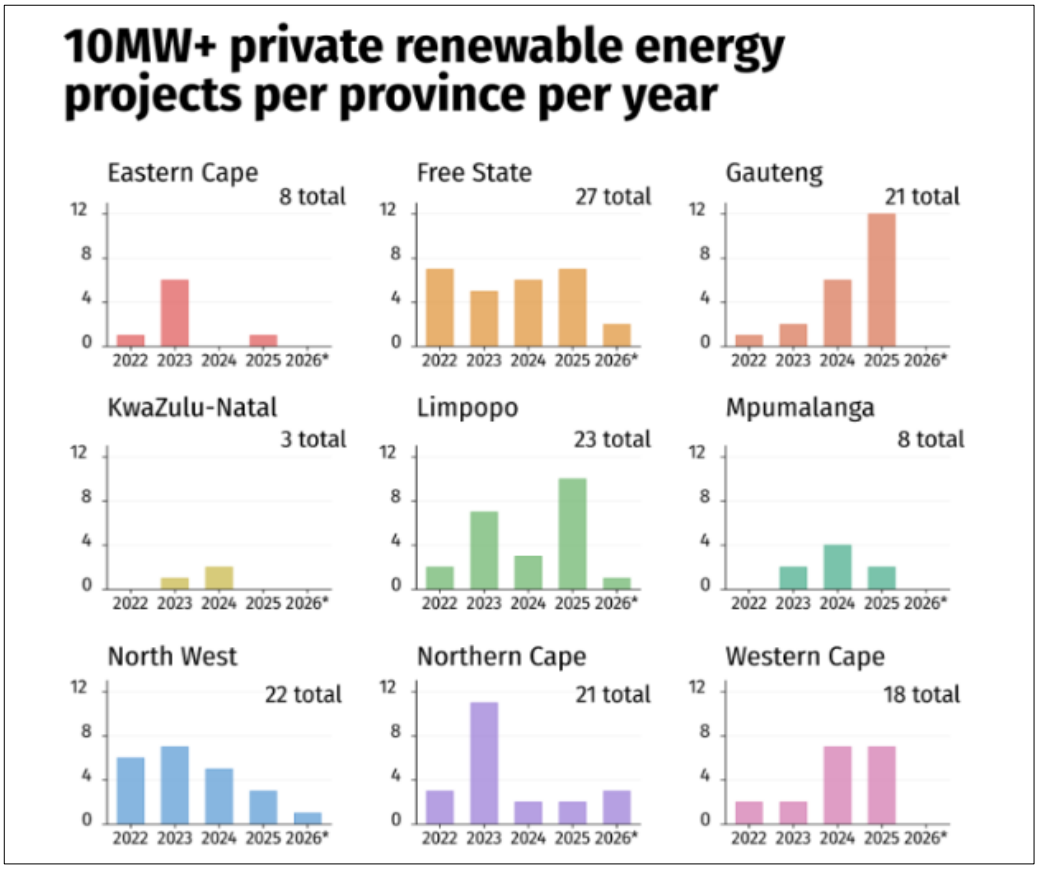


Figure 9: Number of solar power plants per province (The Outlier, 2026)

Renewable Energy Distribution Zones have been established through SEAs which determined renewable energy plants related key environmental impacts and mitigations in these corridors (Joubert & Rushton, 2025). The results of these SEAs presented relatively low impacts on environmental elements, such as water resources, that can arise from renewable energy projects in these corridors (DEA, 2018b). The renewable energy related environmental authorisation, licence and permit processes can therefore be fast tracked due to proactive SEAs that were carried out to establish the REDZ (DEA, 2018b).

The Central corridor REDZ is aligned over the South-Western to the North-Western areas of the Free State province (Figure 3) (Joubert & Rushton, 2025). Several solar power plant developments are proposed and constructed in the Central REDZ corridor and are subjected to the WULA process. The Free State province is a good study area for this research.

3.3.2. Description of the study area

The Free State province is the geographical study area from which the selection of WULA technical reports was made due to ease of access to the reports and the time constraint for the research. The province is in central South Africa and surrounded by six provinces (DESTEA, 2016). The greater part of the Free State province is covered with the critically endangered grassland biome (Neke & Du Plessis, 2004). In addition, the Free State is rich in biodiversity in which various ecologically important plant and animal species form ecosystems (DESTEA, 2016; Rutherford, *et al*., 2006).

Some of South Africa's biggest dams are found in the Free State province such as the Gariep Dam, Vaal Dam and Van Der Kloof, Krugers Drift Dam which are located in the Vaal and Orange River catchment areas (VOCMA, 2024). Various freshwater systems are found on 1.5 million hectares of the Free State, as modelled in the Free State Biodiversity Plan in 2016 (DESTEA, 2016). This province is rich in agricultural crop and livestock farming with the highest produce of maize, sunflower, wheat, soybeans, and potatoes in the country, mainly through irrigation with water from freshwater and underground water (FM, 2024). Many national protected and conservation areas are in the province such as the Golden Gate Highlands National Park, Maloti-Drakensberg Transfrontier Conservation and Development Area; and Clarens Private Nature Reserve (DFFE, 2026). This study area is appropriate as it is water sensitive and targeted for renewable energy development technology such as solar power plants (DEE, 2025b).

3.3.3. Case selection

The selection of cases in the case study research was found by scholars to be about optimising the information in small samples and that the case selection be based on the content envisaged to be found in them (Flyvbjerg, 2006). The case study research method focused on gathering information from cases and comparing it with what was found in previous or similar studies (Eisenhardt,1989). The sampling of cases from a chosen population for theoretical reasons may be to replicate previous cases or to inform emergent theory (Eisenhardt,1989). In this instance, the WULA technical reports represented the population, and WULA technical reports for solar power plants represented the emergent theory to be studied.

The sampling of cases does not represent the entire population but is rather based on context-dependent knowledge, which is beneficial for research and human learning (Flyvbjerg, 2006; Yin, 2018). There is no standard sample size for case study research; therefore, the acceptable size for case study research has been found by scholars to be between four and ten cases (Moolman, *et al*., 2025; Eisenhardt,1989). The sample size for this research was eight solar power plant WULA technical reports obtained from consultants, due to the DWS not always requesting these reports from consultants after their pre-application meetings. These reports were obtained from eight different consultants to make a justifiable sample for this research.

3.3.4. Selection criteria for cases

The selection criteria were as follows:

- WULA technical reports that were drafted by different consultants.
- Only WULA technical reports associated with a successful outcome.
- Only WULA technical reports associated with solar power plants in the Free State province.
- WULA technical reports drafted between 2017 and 2024 were selected.

3.4. An overview of the Lee and Colley Review Package

The LCRP have previously been adapted to conduct report quality evaluation in different sectors such as BIAs (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023) and Ecological Impact Assessment (De Jager, 2022) amongst others, based on a generic EIR review package that was designed by Sandham and Pretorius in 2007 to evaluate the quality of EIAs in the Norh-West Province (Sandham & Pretorius, 2008).

To achieve the set aim of this research, adoption of the LCRP to evaluate the quality of WULA technical reports is proposed. Post adoption of the LCRP, it was adapted to be compatible with WULA technical report content requirements and is explained in the following section (Matlala, 2023). This research therefore used an ALCRP to evaluate the quality of WULA technical reports for solar power plants in the Free State which is in relation to objective 1 of this research.

The LCRP is structured in a hierarchy of four levels, in which level 4 is the overall score, level 3 the review areas, level 2 the review categories, and level 1 the subcategories (Lee and Colley, 1992; Wentzel, *et al*., 2023). These levels are allocated with performance ratings that can be applied for quality evaluation of water sector-specific reports through adapting the categories and subcategories based on water sector legal requirements, best practice guidelines, and existing ALCRPs from similar previous studies (Figure 10) (Retief, *et al*., 2008 Wentzel, *et al*., 2023).

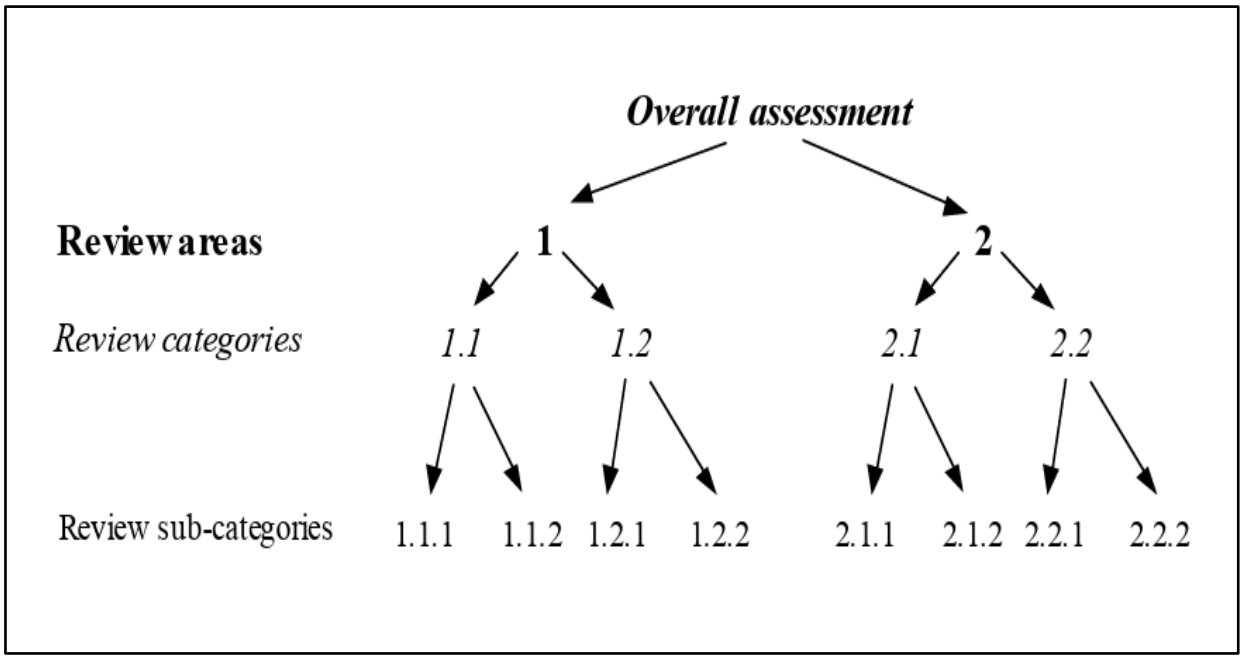


Figure 10: A schematic representation of the Lee and Colley Review Package category hierarchy (Lee *et al*., 1999)

The overall document quality review is based on descriptions that are coded with symbols from A to NA, to rate the conformance levels of the reports against the set criteria in the LCRP (Wentzel, *et al*., 2023). The symbol rating and description system in the ALCRP consists of descriptions that will make the findings qualitative in nature (Table 5) (Lee, *et al*., 1999; Retief, *et al*., 2008).

Table 5: Description of assessment symbols allocated to categories and subcategories

Symbol	Explanation
A	Generally, well performed with no important tasks left incomplete.
B	Generally satisfactory and complete with only minor omissions ad inadequacies.
C	Can be considered just satisfactory, despite omissions and/or inadequacies.
D	Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions or inadequacies.
E	Not satisfactory due to significant omissions or inadequacies.
F	Very unsatisfactory, important task(s) poorly done or not attempted.
NA	Not applicable, The Review Topic is not applicable, or it is irrelevant in the context of this Statement.

(Source: Lee, *et al*., 1999)

The highest rating for each review area across all reports was used as the performance level of the review area (Lee, *et al*., 1999). A collation sheet formed part of the package, which entails all the recorded ratings for all the review areas, categories, and subcategories for all the selected reports (Matlala, 2025; Wentzel, *et al*., 2023). Subcategories were scored on a scale from A to NA, in which NA meant that the criteria element in the LCRP did not apply to the report content (Matlala, 2023; Wentzel, *et al*., 2023). The Satisfactory levels were according to the LCRP symbolic scoring system (A, B, C, D, E, F, NA). The symbols from A to C represent a generally satisfactory performance (A: very satisfactory, B: satisfactory, and C: just satisfactory), and the symbols D to F represent an unsatisfactory performance (Retief, *et al*., 2008).

3.4.1. Adapting the Lee and Colley Review Package

This section relates to objective 1: To adapt a quality review package for reviewing the quality of selected WULA technical reports for solar power plants in the Free State province.

The development of an adapted quality review package involved modifying the LCRP categories and subcategories in line with relevant minimum legal requirements, best practice guidelines, and similar previous quality review studies. The adapted review areas, categories, and subcategories served as criteria to evaluate the eight WULA technical reports (water use form information recorded in the WULA summary reports, wetland impact assessment reports, public participation reports) for solar power plants in the Free State.

The ALCRP was designed based on the structure of the LCRP that was created to evaluate EIAs for projects that can affect wetlands, by Retief, *et al*. (2008) (Table 6). This review package was found to be suitable to review the quality of water-related reports, which made it compatible to the ALCRP for this research (Table 6).

Table 6: The Adapted Lee and Colley Review Package as developed by Retief, et al. (2008)

Review Area 1 **Description of the development, local environment and baseline conditions**		**Review Area 2** **Identification and evaluation of key impacts**	
1.1 DESCRIPTION OF THE ENVIRONMENT		***2.1 DEFINITION OF POTENTIAL IMPACTS***	
1.1.1	Identification of applicant	2.1.1	Assessment of significant potential impacts
1.1.2	Purpose and objective of development	2.1.2	Non-standard operating conditions
1.1.3	Description and nature of activity/ development	2.1.3	Deviation from baseline
1.1.4	Description of site	2.1.4	Beneficial impacts
1.1.5	Proposed location	2.1.5	Indirect effects
1.1.6	Description of processes and technology employed	2.1.6	Cumulative and secondary impacts
1.1.7	Expected rate of production	2.1.7	Stakeholders engagement
1.1.8	Raw materials used during different phases	2.1.8	Agreement between consultant and specialist report(s)
1.1.9	Availability water and materials	***2.2. IDENTIFICATION OF IMPACTS***	
1.2. SITE DESCRIPTION		2.2.1.	Assess impacts in all phases
1.2.1	Site plan	2.2.2	All possible impacts identified
1.2.2	Description land use	***2.3. SCOPING***	
1.2.3	Duration of phases	2.3.1	Example of notice in media
1.2.4	Expected workers and visitors	2.3.2	Onsite Notice
1.2.5	Access to site and transport	2.3.3	Identify affected people
1.2.6	Infrastructure required	2.3.4	Identify interested people

1.3 WASTES		2.3.5	Procedures for participation
1.3.1	Quantities and disposal routes	2.3.6.	Provision for I&AP views
1.3.2	Disposal and handling	2.3.7	List of issues identified
1.4 ENVIRONMENT DESCRIPTION		2.3.8	Notification criteria for participation
1.4.1	Likely area to be affected	2.3.9	All the views as addendum
1.4.2	Biophysical description of site	2.3.10	Key impacts for further study
1.4.3	Biological processes	***2.4. PREDICTION OF IMPACT MAGNITUDE***	
1.4.4	Social characteristics	2.4.1	Prediction of impact magnitude
1.4.5	Current cumulative impacts	2.4.2	Express prediction of impacts
1.4.6	Location in hydro-geographical basin	2.4.3	Express predictions of impact in measurable quantities with confidence limits
1.4.7	Water and wetland issues	***2.5 ASSESSMENT OF IMPACT SIGNIFICANCE***	
1.4.8	Consider Ramsar attributes	2.5.1	Impact on community
1.5 BASELINE CONDITIONS		2.5.2	Significance: duration, intensity, etc.
1.5.1	Important components of the affected environment	2.5.3	Method: ranking significance
1.5.2	Interaction and effect of project on environment	2.5.4	Uncertainties and lack of data
1.5.3	Wetland specialist	**Review Area 4 COMMUNICATION OF RESULTS**	
1.5.4	Socio-economic benefits	***4.1. LAYOUT (information)***	
1.5.5	Replacement costs of goods produced by the wetland	4.1.1	Introduction of project and aim of EIA
1.5.6	Data on wetland variations	4.1.2	Information logically arranged
1.5.7	Current and potential wetland functions, values and uses	4.1.3	External sources acknowledged
1.5.8	Benefits to society	***4.2 PRESENTATION (information)***	
1.5.9	Ecosystem / catchments boundaries for EIA	4.2.1	Presentation of information
1.5.10	Wetlands in area described	4.2.2	Statement as an integrated whole
1.5.11	National wetland inventory	4.2.3	Presentation of the report as an integrated whole

1.5.12	Ramsar status verified
1.5.13	National wetland policy
1.5.14	Data sources mentioned
1.5.15	Methods for wetland functions
Review Area 3 ALTERNATIVES AND MITIGATION OF IMPACTS	
3.1 ALTERNATIVES	
3.1.1	Methods to identify alternatives
3.1.2	Description of range of alternatives
3.1.3	Minimum of two alternatives
3.1.4	Discussion and reasons for final choice
3.2 SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES	
3.2.1	Mitigation measures considered
3.2.2	Mitigation includes alternatives
3.2.3	Mitigation measures clearly defined
3.2.4	Effectiveness of mitigation

4.3 EMPHASIS (impacts)	
4.3.1	Significant adverse and beneficial impacts
4.3.2	Statement must be unbiased

By following this evaluation process, data was collected from the WULA technical reports, which generated report quality performance levels. The performance level of each review area, category, and subcategory was recorded in a collation sheet (Annexure B).

3.4.1.1. Legal requirement as inputs in the ALCRP

The NWA Section 26(1)(k) makes provision for a procedure and regulations for a WULA process, hence the Government Notice Report (GNR) 267 under the NWA: Regulations regarding the procedural requirements for Water Use Licence Applications and appeals was published in 2017 in which a WULA technical report is required for proposed developments to obtain a WUL for activities that will potentially impact water resources (Malherbe, *et al*., 2020; Matlala, 2025). Since the WULA technical report is required by law, the review criteria considered water-related legislation of South Africa as referenced in the ALCRP (Annexure A).

The following Acts and regulations were consulted for requirements:

- The National Water Act (Act 36 of 1998) sections as referenced in Annexure A.
- National Water Act (Act 107 of 1998): General authorisation in terms of Section 39 of the National Water Act 36 of 1998 for water uses as defined in Section 21(c) or Section 21 (i) (Notice 4167). Government Gazette, 49833:208, 8 December (Ngeleza, 2023).
- GNR 267 under the National Water Act (Act 36 of 1998): Regulations regarding the procedural requirements for water use licence applications and appeals (RSA, 1998b).
- GNR 267 under the National Water Act (Act 107 of 1998): Regulations regarding the procedural requirements for Water Use Licence Applications (WULA) and appeals (DWS, 2017).
- GNR 982 National Environmental Management Act: Environmental Impact Assessment regulations of 2014 as amended (National Environmental Management Act, 1998).

Annexure A is the ALCRP for this research which contains the adapted criteria in its subcategories for the evaluation of WULA technical reports in line with water related legal requirements, best practice guidelines and findings of similar previous studies. The ALCRP contains sections from the NWA, WULA regulations, NEMA: EIA regulations, GA regulations and the National Environmental Management: Waste Act (Act 59 of 2008) (minimum legal requirements) (NEM: WA) that were applied as criteria to evaluate the quality of subcategories in review areas (Annexure A). The inclusion of the WULA related legal framework, land uses; and key development processes,

activities, products and infrastructure was evaluated against the requirements in the WULA regulations (Annexure A). WULA technical report content requirements for waste management were also evaluated against the requirements in the minimum legal requirements (Annexure A). The description of the environment was evaluated against the requirements in the minimum legal requirements (Annexure A). Review area 2 (Identification and evaluation of key impacts) was evaluated against the requirements in the minimum legal requirements and the DEAT guideline for specialist studies (Annexure A). Impacts of climate change as a required specialist assessment have been evaluated against the requirements in the NWA (Annexure A). The inclusion of the IWWMP was evaluated against the requirements in the WULA regulations (Annexure A). Review area 3 (Alternatives and mitigation) evaluated the level of consideration, assessment and comparison of alternatives against the requirements of the WULA regulations and the NEMA: EIA regulations (Annexure A). The ALCRP contains criteria for emergencies and unexpected severe impacts or events as required by the minimum legal requirements (Annexure A). Rehabilitation and monitoring of impacts on water resources are also evaluated against requirements in the minimum legal requirements (Annexure A).

3.4.1.2. Previous studies as inputs in the ALCRP

The ALCRP for this research was primarily based on the structure of the Retief, *et al*. (2008) report quality review package which was used to evaluate EIAs for projects that can affect wetlands. The ALCRPs of similar studies related to the water sector, such as content quality evaluation of Wetland Impact Assessment reports, have been used as evaluation criteria throughout the ALCRP of this research (Annexure A). The outcomes of the following similar previous studies have been used to form part of the criteria in the subcategories of the ALCRP (Annexure A):

- Environmental Impact Assessment Reports (EIR) for projects in the North-West Province by Sandham and Pretorious in 2008, EIRs for projects that affect wetlands (Retief, *et al*., 2008).
- Reviewing the quality of technical reports in support of water use licence applications (Moolman, *et al*., 2025).
- Biodiversity Impact Assessment reports by Hallatt, Wentzel, Swanepoel respectively (Hallatt *et al*., 2015; Retief, *et al*., 2008; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023).
- Ecological Impact Assessment reports by De Jager (De Jager, 2022).
- Wetland Impact Assessment reports for coal mines in Mpumalanga by Matlala in 2023 (Table 12).

3.4.1.3. Best practice guidelines as inputs to the ALCRP

In addition to sector-specific minimum legal requirements, best practice guidelines were used to determine whether reports were drafted with objectivity and were professionally sound in nature (Wentzel, *et al*., 2023). The ALCRP evaluation criteria include the DWS introduced best practice guideline that was introduced in 2007 (Annexure A). This DWS guideline is mainly used to evaluate the review areas on development, environmental and baseline conditions description, which are related to the WULA process (Annexure A). Review area 4 (communication results) was mainly evaluated against requirements in the DEAT guideline on specialist studies (Annexure A). Best practice guidelines included as part of the ALCRP evaluation criteria:

- The requirements in the Department of Water and Sanitation (DWS) template for the WUL summary report.
- Department of Water Affairs and Forestry (RSA). 2007b. External Guideline: Generic Water Use Authorisation Application Process.
- Department of Environmental Affairs and Tourism (RSA). 2002c. Specialist studies. Integrated environmental management information Series, 4.

This research made changes to the categories and subcategories found in the Retief, *et al*. (2008) ALCRP to align it with the minimum legal requirements and best practices for drafting WULA technical reports (Water Use Application Forms, public participation report, specialist reports) in the South African context (Table 8) (Annexure A) (Matlala, 2023). The inclusions were also made to meet the criteria for required information in the WULA administrative process, and the different water use registration forms. The references that were used to include subcategories in the ALCRP can be found in (Annexure A).

Table 7: Subcategories added to the Retief, et al. (2008) review package to establish an Adapted Lee and Colley Review Package for the WULA technical report quality review package

Review Area 1 DESCRIPTION OF THE DEVELOPMENT, LOCAL ENVIRONMENT AND BASELINE CONDITIONS	
1.1. DESCRIPTION OF THE DEVELOPMENT	
1.1.7.	Details of EAP who prepared the WULA technical report (Water Use Application Forms)
1.1.8.	Declaration of independence by the EAP (Water Use Application Forms)
1.1.9.	Are the all the relevant Water Uses listed in the report? (Water Use Application Forms)
1.2. DESCRIPTION OF THE PROPOSED SITE: On site land requirements of development and duration of each land use	
1.2.1.	Master layout map depicting the development site and activities (Water Use Application Forms, Specialist studies)
1.2.5.	Land development permits and licences required for the development to continue e.g. land and services servitude agreements, land use change approvals, Community Resolutions (Water Use Application Forms, Specialist studies)
1.2.6.	Method statements of activities affecting watercourses (Water Use Application Forms, Specialist studies)
1.3. WASTES: Estimated types and quantities of wastes which might be produced and proposed disposal routes to the environment described.	
1.3.2.	Proposed handling/treatment, disposal and disposal routes to the water resource (Specialist studies, IWWMP)
1.3.3.	Integrated water and wastewater management report content (Specialist studies, IWWMP)
1.3.4.	Requirements of waste permits (Water Use Application Forms)
1.4.2.	Maps, Plans and Photographs (Specialist studies)
Review Area 2 IDENTIFICATION AND EVALUATION OF KEY IMPACTS	
2.3. PUBLIC PARTICIPATION: Key impacts should be identified, and main investigation cantered on these	
2.3.1.	Genuine attempt to contact public and special interest groups to appraise them of project (Public participation report)
2.3.2.	Collect, arrange and integrate comments and concerns of I&APs (Public participation report)
2.3.3.	Key impacts on I&APs identified and integrated into the WULA technical report (Public participation report)
2.4. PUBLIC PARTICIPATION: Likely impacts on water resources and society.	

Impacts should be described in exact terms where possible.	
2.4.2.	Methods predicting impact magnitude on water resources and society clearly described (Specialist studies)
2.5. ASSESSMENT OF IMPACT SIGNIFICANCE: *Estimation of expected significance of impacts for society*	
2.5.5.	Justification of impact significance rating (Specialist studies)
2.6. SPECIALIST ASSESSMENT IMPACTS: ***Estimation of expected significance of impacts on focus areas***	
2.6.1.	Identify sources of and impacts of climate change (Specialist studies)
2.6.2.	Identify water use impacts on stream flow reduction (Specialist studies)
2.6.3.	Identify water use impacts on underground water (Specialist studies)
2.6.4.	Identify water use impacts on watercourses as defined by the National water act 36 of 1998 (Specialist studies)
2.6.5.	Identify water use impacts of civil design (Specialist studies)
2.6.6.	Identify water use impacts on ecological processes (Specialist studies)
2.6.7.	Identify water use impacts on Agriculture (Specialist studies)
2.6.8.	Identify impacts of wastewater on watercourses (IWWMP)
Review Area 3 **ALTERNATIVES AND MITIGATION**	
3.1. ALTERNATIVES: Feasible alternatives should be considered	
3.1.1.	Alternatives identified for unexpectedly severe adverse impacts or events (Specialist studies, Public Participation report)
3.2. SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES: ***All significant adverse impacts should be considered for mitigation***	
3.2.1.	Consider mitigation of all significant adverse impacts in WULA required technical reports, construction monitoring programmes and rehabilitation programmes. (Specialist studies, Public Participation report)
3.2.4.	Indication of residual impacts that cannot be mitigated (Specialist studies, Public Participation report)
3.2.5.	Inclusion of Environmental emergency response plans (Specialist studies, Public Participation report)
Review Area 4 **COMMUNICATION OF RESULTS**	
4.1.3.	Adequacy of conclusions
4.2. PRESENTATION: Information should be accessible to the non-specialist	
4.2.2.	Technical terms, acronyms, initials defined
4.3. EMPHASIS: Information should be represented without bias	
4.3.3.	Opinion as to whether the activity should/should not be authorized

4.4. NON-TECHNICAL SUMMARY: Clearly written non-technical summary of main findings	
4.4.1.	Non-technical summary of main findings and conclusion
4.4.2	Summary must cover all main issues

The following table is the ALCRP, that was generated through this research, with all it's review areas, categories and subcategories. The review areas that are regularly used in other quality evaluations such as specialist expertise, legislative framework and methodology, were not considered because these aspects are found throughout the ALCRP subcategories of this research (Table 8) (Annexure A).

Table 8: Adapted Lee and Colley Review Package for Water Use Licence Application technical report quality review

Review Area 1 **DESCRIPTION OF THE DEVELOPMENT, LOCAL ENVIRONMENT AND BASELINE CONDITIONS**		**Review Area 2** **IDENTIFICATION AND EVALUATION OF KEY IMPACTS**	
1.1 DESCRIPTION OF THE DEVELOPMENT		***2.1. DEFINITION OF IMPACTS: Potential impacts of development on water resources***	
1.1.1	Purpose and objectives of development	*2.1.1*	Scoping of all possible project impacts (negative and positive) on the water resources
1.1.2	Location, design and size of proposed development	*2.1.2*	Identify and describe interaction of water resource impacts from different WULA technical reports
1.1.3	Physical footprint development within receiving environment	***2.2 IDENTIFICATION OF IMPACTS: Criteria used for identification of all significant impacts***	
1.1.4	Nature and expected rate of construction activities in the proposed development	2.2.1	Impact identification methodology
1.1.5	Nature and quantity of raw materials needed during different development phases	***2.3. PUBLIC PARTICIPATION: Key impacts should be identified, and main investigation cantered on these***	
1.1.6	Identification of the applicant	*2.3.1*	Genuine attempt to contact public and special interest groups to appraise them of project
1.1.7	Details of EAP who prepared the WULA technical report	*2.3.2*	Collect, arrange and integrate comments and concerns of I&APs
1.1.8	Declaration of independence by the EAP	*2.3.3*	Key impacts on I&APs identified and integrated into the WULA technical report

1.1.9	Are the all the relevant Water Uses listed in the report?	***2.4. PREDICTION OF IMPACT MAGNITUDE: Likely impacts on water resources and society (Impacts)should be described in exact terms where possible***	
1.2 SITE DESCRIPTION: On site land requirements of development and duration of each land use		*2.4.1*	Data used to estimate magnitude of main impacts and gaps in data clearly indicated
1.2.1	Locality map depicting the development site, activities in relation to delineated watercourses	*2.4.2*	Methods predicting impact magnitude on water resources and society clearly described
1.2.2	Description of existing land uses and existing lawful uses on the proposed site.	*2.4.3*	Express predictions of impact in measurable quantities with confidence limits
1.2.3	Duration of the development phases	***2.5. ASSESSMENT OF IMPACTSIGNIFICANCE: Estimation of expected significance of impacts for society***	
1.2.4	Key related activity, processes, products and infrastructure	*2.5.1*	Assessment of impacts
1.2.5	Land development permits and licences required for the development to continue e.g. land and services servitude agreements, land use change approvals, Community Resolutions	*2.5.2*	Impact significance determination and rating on affected ecological processes and I&APs
1.2.6	Method statements of activities affecting watercourses	*2.5.3*	Consideration for mitigation of ecological and social impacts
1.3 WASTES: Estimated types and quantities of wastes which might be produced and proposed disposal routes to the environment described		*2.5.4*	Significance of impacts in terms of national and international quality standards
1.3.1	Estimated types and quantities of wastes and rate of production	*2.5.5*	Justify the method of impact significance rating
1.3.2	Consideration/description of alternative processes, technology designs, layout and operating conditions	***2.6 SPECIALIST ASSESSMENT IMPACTS: Estimation of expected significance of impacts on focus areas***	
1.3.3	Methods of obtaining quantity of residuals and wastes	*2.6.1*	Identify sources of and impacts of climate change
1.3.4	Requirements of waste permits	*2.6.2*	Identify water use impacts on stream flow reduction
1.3.5	Requirement of air emission license	*2.6.3*	Identify water use impacts on underground water
1.4 ENVIRONMENT DESCRIPTION: Area and location likely to be affected by development proposal.		*2.6.4*	Identify water use impacts on watercourses as defined by the National water act 36 of 1998

1.4.1	Description of the overall environment	*2.6.5*	Identify water use impacts of civil design
1.4.2	Indication of likely area to be affected by development.	*2.6.6*	Identify water use impacts on ecological processes
1.4.3	Maps, plans and photographs.	*2.6.7*	Identify water use impacts on Agriculture
1.4.4	Indication of key environmental sensitive areas/elements in the area.	*2.6.8*	Identify impacts of wastewater on watercourses
1.5 BASELINE CONDITIONS: Description of effected environment as it is currently and as it could be expected to develop if project were not to proceed			
1.5.1	Identification and description of important components of the affected environment.		
1.5.2	Existing data sources searched and utilized.		
1.5.3	Local land use plans, policies consulted, and other data collected to determine baseline conditions		
Review Area 3 ALTERNATIVES AND MITIGATION		**Review Area 4 COMMUNICATION OF RESULTS**	
3.1 ALTERNATIVES: Feasible alternatives should be considered		***4.1 LAYOUT OF THE REPORT***	
3.1.1	Consideration/description of alternative sites	*4.1.1*	Purpose and scope of the WULA technical report
3.1.2	Consideration/description of alternative processes, technology designs, layout and operating conditions	*4.1.2*	Structure of the information
3.1.3	Alternatives identified for unexpectedly severe adverse impacts or events	*4.1.3*	Adequacy of conclusions
3.1.4	Comparative assessment of all alternatives identified	*4.1.4*	Reference to the required specialist reports
3.2 SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES: All significant adverse impacts should be considered for mitigation.		***4.2 PRESENTATION: Information should be accessible to the non-specialist***	
3.2.1	Consider mitigation of all significant adverse impacts in WULA required technical reports, construction monitoring programmes and rehabilitation programmes.	*4.2.1*	Comprehensible presentation of information (avoiding obscure language)
3.2.2	Mitigation measures considered should include alternatives, administrative mitigation, engineering mitigation, resource mitigation, construction mitigation	*4.2.2*	Technical terms, acronyms, initials defined
3.2.3	Extent of effectiveness of mitigation when implemented	*4.2.3*	Presentation of the report as an integrated whole
3.2.4	Indication of residual impacts that cannot be mitigated	***4.3 EMPHASIS: Information should be represented without bias***	

3.2.5	Inclusion of Environmental emergency response plans	*4.3.1*	Prominence and emphasis to potentially severe impacts
3.3 COMMITMENT TO MITIGATION		*4.3.2*	Statement must be unbiased
3.3.1	Developer must clearly commit to mitigation measures	*4.3.3*	Opinion as to whether the activity should/should not be authorized
3.3.2	Monitoring arrangements should be proposed in each technical report	***4.4 NON-TECHNICAL SUMMARY: Clearly written non-technical summary of main findings***	
3.3.3	Inclusion of Proposed Rehabilitation programme to remedy/mitigate adverse impacts on the water resource quality.	*4.4.1*	Non-technical summary of main findings and conclusions
		4.4.2	Summary must cover all main issues

(De Jager, 2022; DEA, 2014; DEAT, 2002a; DWS, 2007b; DWS, 2017; DWS, 2023; DWS, 2025b; Hallatt *et al*., 2015; Hildebrandt & Sandham, 2014; Moolman, *et al*., 2023; Retief, *et al*., 2008; RSA, 1998a, RSA, 1998b; RSA, 2008; DWAF, 2004; Scheepers, *et al*., 2019; Swanepoel, *et al*., 2019; Wentzel, *et al*, 2023;)

The data were collected into a collation sheet by evaluating the WULA technical report sample with the ALCRP. The criteria were set in the review areas, categories and subcategories that were used to extract data from the WULA technical reports in the form of performance ratings.

3.5. Data analysis: Adapted Lee and Colly Review Package

The reviewed results were analysed to identify common trends in the WULA technical report quality of solar plant projects in the Free State province. A hierarchical list of described symbols A, B, C, D, E, F, and Not Applicable (NA) were utilised to record qualitative results (Lee, *et al*., 1999; Retief, *et al*., 2008).

The Not Applicable (NA) symbol was allocated when the applicable water uses did not require certain specialist studies that are listed in the ALCRP. The different water uses require different water use application forms and specialist studies, which might not apply to certain solar power plant activities (DWS, 2007).

Qualitative data analysis was done by using the ALCRP described codes in each ALCRP subcategory. The sample of eight Free State province proposed solar power plant WULA technical reports were reviewed against the requirements in the ALCRP subcategories. The symbol that was mostly found in a subcategory was used to determine the quality level in each category (Lee, *et al*., 1999). If the symbols were scored equally, then the score found between them was used as the score. The symbol that was mostly found in a category determined the quality level of each review area (Lee, *et al*., 1999). Where the symbols in the categories scored equally, then the symbol mostly found in the sub-categories, was allocated to the category level. The overall quality level of

a WULA technical report was determined by the symbol mostly found in the review areas of the report. The data analysis results were thereafter represented in various ways to present research findings.

3.6. Results presentation

The overall strengths and weaknesses of each review area were presented in the format of text paragraphs, Tables, graphs, and histograms (Hallat, *et al*., 2015; Moolman, *et.al*., 2023; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). The overall performance results were represented in a bar graph in which satisfactory performance is presented in a green bar and unsatisfactory performance in a red bar (Figure 11). The overview of the overall evaluation results was represented in percentages in Tables 9 and 10. The overall performance per review areas was provided in a 100% stacked column in which ratings are colour coded (Figure 12). The ratings (A, B, C, D, E, F, NA) for each review area, category and subcategory were recorded in a collation sheet in which the different ratings area colour coded from green to grey (Annexure B). The collation sheet denotes the list of WULA technical reports and the year they were drafted (Annexure B). The rating data for all review categories was recorded in the collation sheet with their respective colour coding (Annexure B). The review results will be consolidated upon completion and packaged into two categories, which are satisfactory and non-satisfactory results (Table 9) (Matlala, 2025; Retief, *et al*., 2008). Colour coded Bar graphs were employed to represent the performance of the respective review areas, in percentage from A to NA.

Table 9: Review results categories

Rating	Definition
A-C	Satisfactory
D-F	Unsatisfactory

(Source: Matlala, 2025; Retief, *et al*., 2008)

Appealing figures can be used to explain research findings and to assist readers in comprehending the information (Yin, 2018). This research presentation therefore utilised graphs and charts to denote the results of each review area, for it to be compared to cases from other studies.

Previous similar research findings with alternative arguments on review areas were discussed in a discussion section that supported or opposed the findings from this research (Yin, 2018). The results were compared to local and international trends to depict similarities and differences in

quality of the WULA or water-related reports for permitting of water uses, globally (Hallat, *et al*., 2015).

3.7. Ethical considerations

Gatekeeper permission was required to access and collect samples, as these WULA technical reports are linked to Water Use Authorisations (WUAs) with sensitive information, which might not be allowed to enter the public domain. Formal requests have been submitted to the Department of Water and Sanitation (DWS), Free State province regional office, to obtain a sample of eight WULA technical reports and their associated WUAs. However, DWS was overly concerned that confidentiality of report information would not be maintained in line with the provisions made in the Protection of Personal Information Act (Act 4 of 2013). The largest electricity utility in South Africa has thereafter been approached and requested to source WULA technical reports that were handed over to them by solar power plant IPPs as relevant solar power plant infrastructure must be maintained by the electricity utility. The information has been successfully obtained for research purposes from the electricity utility's Research, Training, and Development department.

3.8. Chapter summary

The report quality review research followed a case study method with an ALCRP to evaluate the quality of WULA technical reports that were submitted by solar power plant developers to obtain water use licenses for their solar power plants in the Free State province. A number of eight cases (reports) from eight consultants was the target sample size. The reports were retrieved from the consultants and the largest South African electricity utility through formal requests. The review was carried out by a single reviewer, with justifications listed in Chapter 1.

CHAPTER 4 RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter outlines the results of the report quality evaluation conducted on eight WULA technical reports that supported the WULAs of solar power plants in the Free State province. This was done to realise the second set objective, which is to evaluate the quality of WULA technical reports for solar power plants in the Free State province, against the ALCRP as outlined under section 3.4.1. above. The evaluation methodology is discussed in Chapter 3 above. The evaluation results will be discussed in detail and compared to the results of similar previous studies in this chapter.

The evaluation results of the eight cases from more than five different consultants have been consolidated into a collation sheet (Appendix B). According to the evaluation results, the overall performance of the WULA technical report was satisfactory (A-C). A detailed discussion of the evaluation results is found hereafter.

4.2. Overall report quality evaluation results

The evaluation of the eight WULA technical reports resulted in the quality findings that are recorded in the collation sheet (Annexure B). The overall results across all four review areas found that out of the 560 developed sub-categories, 285 of them scored an A-C (satisfactory), and 275 scored D-F (unsatisfactory). Most of the reports (51%) have a satisfactory (A-C) overall score, whereas 49% rated unsatisfactory (D-F) (Figure 11).

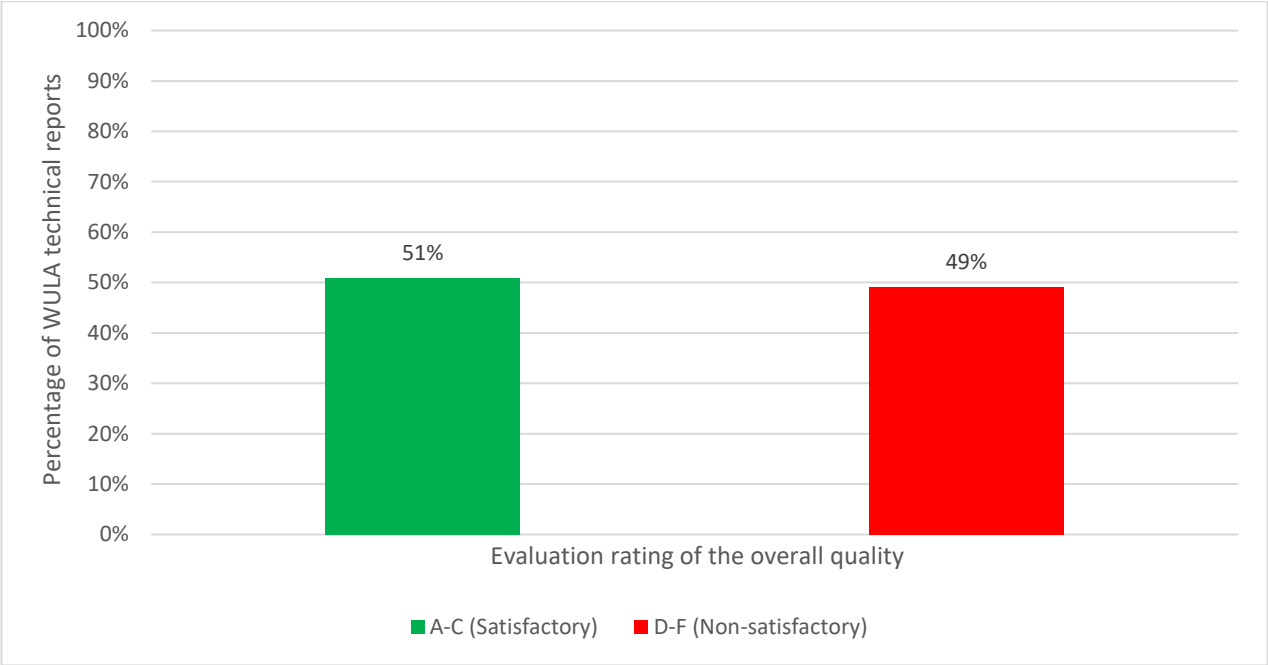


Figure 11: Overall quality of the WULA technical reports

Table 10: Overall rating percentage per review area

Review area No.	*Review Area*	*Rating %*						
		A	***B***	***C***	***D***	***E***	***F***	***NA***
1	Description of the development, local environment and baseline conditions	31	14	19	15	11	9	0
2	Identification and evaluation of key impacts	14	9	24	30	9	11	9
3	Alternatives and mitigation	5	13	26	20	14	28	0
4	Communication of results	5	13	26	35	21	21	0

The ratings per review area were presented and it was found that review area 1 (Description of the development, local environment and baseline conditions) and 2 (Identification and evaluation of key impacts) performed better than review area 3 (Alternatives and mitigation) and review area 4 (Communication of results) (Table 10). Review area 1 scored 31% As and 9% Fs, mostly due to good explanations of the development, local environment and the environmental baseline conditions. Review area 2 obtained the second most As (14%) but also a high percentage of Fs (11%) as the waste and public-related impacts on water resources were mainly omitted from the identification and evaluation of impacts (Table 10). Review area 3 performed the worst with only 5% As and 28% of Fs as alternatives were not sufficiently considered and compared. Review area 4 also performed poorly with 5% As and 21% Fs. This review area scored the most Es (21%) with omissions found in conclusions and executive summaries.

Table 11: Overview of review area results in percentage, with overall satisfactory (Green) and unsatisfactory (Red) performance ratings

Review Area	Rating %													
	A	*B*	*C*	*D*	*E*	*F*	*NA*	*A-B%*	*B-C%*	*A-C% Satisfactory*	*C-D%*	*D-E%*	*E-F%*	*D-F% Unsatisfactory*
1. Description of the development, local environment and baseline conditions	31	14	19	15	11	9	0	45	33	64	34	26	20	35
2. Identification and evaluation of key impacts	14	9	24	30	9	11	9	23	33	47	54	39	20	50
3. Alternatives and mitigation	5	13	26	20	14	28	0	18	39	44	46	34	42	62
4.Communication of results	5	13	26	35	21	21	0	18	39	44	61	56	42	77

Table 11 presents an overview of review area results in percentages. The evaluation results were further grouped into two categories named satisfactory performance (A-C) which is colour coded in green and unsatisfactory performance (D-F) which is colour coded in red (See The performances per review area presented that review area 1 performed 61% satisfactory and 31% unsatisfactory. Review area 2 performed borderline unsatisfactory with 47% (A-C) and 50% (D-F). The lack of alternatives in the reports resulted in review area 3 to perform unsatisfactory with 44% (A-C) and 62% (D-F). Unlike other evaluation studies, review area 4 performed the most unsatisfactory with 44% (A-C) and 77% (D-F).

4.3. Discussion of results per review area

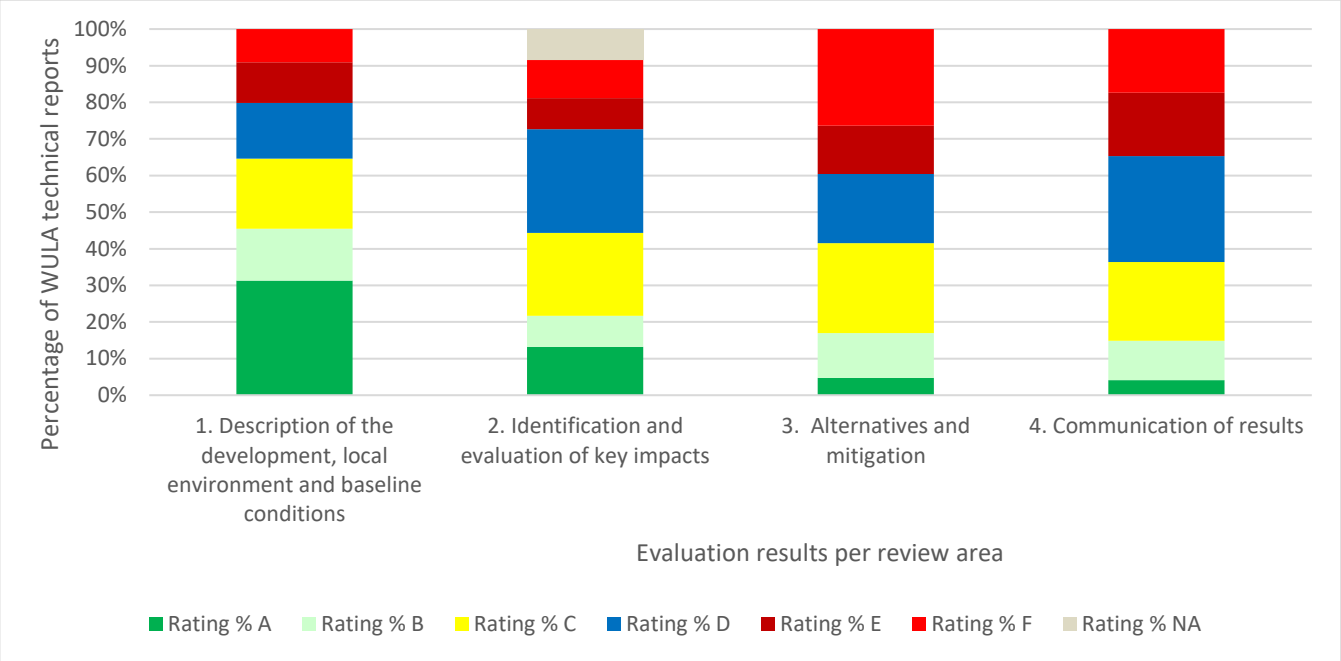


Figure 12: Results of the four review areas

Results found during case study research must be discussed thoroughly to provide a clear indication if the results are similar or different from similar previous studies (Yin, 2018). The author further suggests that, for case study research, researchers should explore alternative thoughts from previous studies and include to assist in explaining research findings (Alberts *et al.*, 2022b; Moolman, *et al.*, 2025; Yin, 2018). This section provides a thorough discussion of the quality review results per review area. The required DWS Risk Assessment Matrix, in addition to the WULA technical report content, was also considered in the evaluation (DWS, 2023). According to the threshold descriptions in Appendix D1 of the GA regulations of 2023, the selected cases of solar power plant developments could be generally authorised and were issued with GAs that were subjected to the WULA technical reports as defined above (DWS, 2023). The results are divided

into four review areas, namely (i) description of the development, local environment, and the baseline information, (ii) identification and evaluation of key impacts, (iii) alternatives and mitigation, and (iv) communication results.

Review area 1 (description of the development, local environment, and baseline conditions) obtained A-C (very satisfactory); review area 2 was rated A-C and D-F performance equally; review areas 3 and 4 performed unsatisfactory (Table 11). The most omissions were made in review areas 3 and 4 (Figure 12).

4.3.1. Review area 1: Description of the development, local environment and baseline conditions

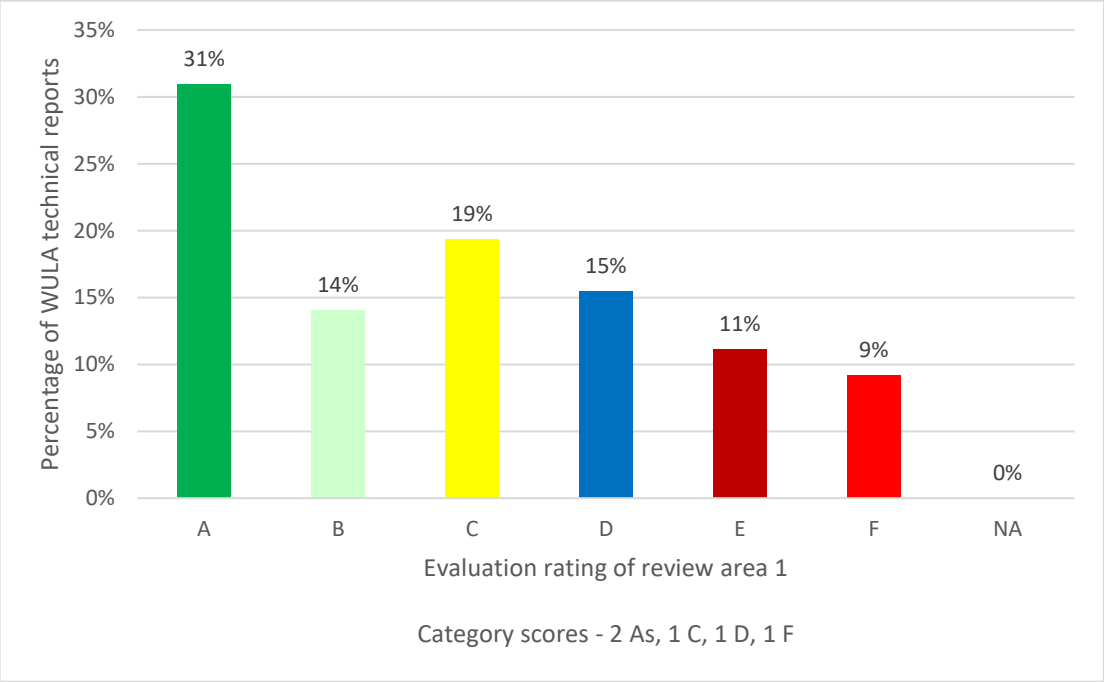


Figure 13: Review area 1 evaluation results

The evaluation results for review area 1 are denoted in Figure 13. The purpose of this section is to outline the quality evaluation results of how the development, the local environment, and the baseline conditions have been described in the WULA technical reports. The discussion will entail the main weaknesses and strengths found in relation to the findings of similar previous studies. The results are therefore related to the quality evaluation of the five descriptive subsequent categories, i.e., description of the development, site description, wastes, environment description, and baseline conditions.

The subcategories in review area 1 scored mostly 61% A-C and 39% D-F, which resulted in a satisfactory performance. The categories in review area 1 scored an A (satisfactory) with 2 As, 1 C, 1 D, and 1 F (Figure 13). This brought the final score for review area 1 to an A, which falls under a satisfactory result.

It is imperative for information regarding the details of a development in relation to water resources to be provided for decision makers to license a proposed development in a manner that the water resources and watercourse characteristics will not suffer detrimental impacts (Myburg, 2018; RSA, 1998b). The National Water Act 39 of 1998 (NWA) requires that WULAs provide for the need and desirability of the proposed project; and the NWA Section 27 motivation of the development (Moolman, *et al*., 2023; RSA, 1998b). The 2007 External Guideline: Generic Water Use Authorisation Application and Appeals process requires that the WULA technical report encompass the regional and national importance of the development in line with local and national policy objectives (DWS, 2007b). The submission of all necessary documentation constitutes the completeness of the application, which is important for the efficient processing of licences (Moolman, *et al*., 2025; Myburg, 2018).

Category 1.1. Regarding the description of the development performed well with an overall score of A (6 As, 2 Bs, 1 C) (Annexure B). Subcategory 1.1.2. (description of the design and size of the proposed development) obtained an unsatisfactory score D-F (2 As, 2 Cs, 4 Ds) due to most cases in the main WULA technical reports omitting full development design plans and only including maps denoting the location of infrastructure on one alternative proposed site (Annexure B). A study on Wetland Impact Assessment (WIA) report quality evaluation found that most specialists understand how imperative it is to include details such as the site location, coordinates, maps, photographs, and environmental characteristics (Matlala, 2025). The required WIA reports included pictures of the different watercourses, but in the main WULA technical report pictures were not included. This is consistent with a study conducted in 2016 that found that only a few reports indicated a comprehensive and clear understanding of the proposed development, as some reports included a vague section for project description (Swanepoel, *et al*., 2016; Wentzel, *et al*., 2023). Contrary to these findings, there were also studies that found reports to perform well with an acceptable level of omissions, and another study revealed that this is due to final designs being handed to consultants to inform the WULA process (Matlala, 2025; Moolman, *et al*., 2025).

In addition, the entire WULA technical reports and supporting specialist reports did not include the water use registration forms (water use forms) or their numbers. Appendix A of the External Guideline: Generic Water Use Authorisation application process requires that all supplementary

forms indicated in the water use forms must be marked off in the water use forms, correctly filled in, signed, and included in the application (DWS, 2007b). Subcategory 1.1.2. dealt with evaluated development design and size information that must be recorded in the required water use forms. DWS water use forms and their related numbers that are generally required to be completed for solar power plant WULAs are listed in Figure 7 in Chapter 2. The Water use forms are completed on the Department of Water and Sanitation (DWS) Electronic Water Use Licence Authorisation Application System (e-WULAAS) (Moolman, *et al*., 2023). All eight reports omitted to refer to the submitted water use form numbers. This finding is consistent with a recent report quality evaluation that found that additional water uses were marked in the relevant registration forms in an application to add water uses to an existing application, but the applicant omitted to submit WULA technical reports for the additional water uses, under the guidance of the relevant authority, which is inconsistent with the DWS guideline documents (DWS, 2007b; DWS, 2017; Moolman, *et al*., 2025).

Another common weakness found was that the 21 SG digit code of each land parcel where the water use is going to take place was omitted from all 8 cases under subcategory 1.1.2. (DWS, 2017). Contrary to this finding, a Wetland Impact Assessment (WIA) report quality study revealed that 92% of the reports performed well in including details such as the 21 SG digit code, municipalities, coordinates, etc. (Matlala, 2025).

The business, production volumes, turnover, development cost, and development schedule as required by subcategory 1.1.5, scored 1 A, 1 B, 1 C, 3 Ds and 2 Es, which resulted in an unsatisfactory performance (Annexure B). The required company details, such as a certified copy of the business registration certificate, title deeds, and/or permission to occupy, a certified copy of the letter of authority, proof of water use licencing fee payment, a certified copy of the Broad-based Black Economic Empowerment (BBBEE) certificate, and other material information such as applicant details were omitted from 5 out of 8 reports. The nature of production processes and the expected rate of production were also mainly omitted from the reports. It was found in this study that the amounts of raw material to be used during the project were limited to the amounts of underground water to be extracted, as assessed in the underground water study reports. This finding is consistent with an EIA report quality study done, which found that estimated project phases, production, transport, and the estimated number of workers were, in most cases, not even attempted, which led to an unsatisfactory result (Retief, *et al*., 2008). However, there is an argument that specialists usually see the inclusion of the details as a duplicate because the EIA documents already contain this information (Hallat, *et al*., 2015). Subcategory 1.1.8, which scored 2 C, 1 D, 1 E and 4 Fs, is unsatisfactorily completed due to most of the reports omitting the declaration of independence by the EAP who compiled the consolidated WULA technical report for submission

(Annexure B). This omission is inconsistent with the requirement for specialist report content in the EIA regulations (DEA, 2014). However, the specialist reports, such as WIA, did consist of a declaration of independence by the specialists. This omission is consistent with what Wentzel, *et al*. (2023) found in their studies. Various previous report quality studies found the contrary in this report aspect, with satisfactory performance due to all the reports consisting of declaration of independence statements to indicate objectivity, validity, and credibility of the information (Hallat, *et al*., 2025; Matlala, 2025; Swanepoel, *et al*., 2016).

Category 1.2. (site description) obtained an overall score of B (2 As, 3 Cs, 1 E) (Annexure B). Subcategory 1.2.3. requires that WULA technical reports include the duration of development phases. This is based on the NWA, Section 27(k) requirement that the probable duration of any undertaking on which a water use is to be authorised (RSA, 1998b). Previous similar studies and the 2017 regulations for the procedure for water use licence and appeals process in line with the NWA Section 26(1)(k) and Section 41, require that a description of the lifespan of all activities on the proposed site should be provided (De Jager, 2022; DWS, 2017). The DWS requires that submissions encompass proposed development activities and their schedules; omitting some of the project phases and their details is a noteworthy omission (DWS, 2007b). This subcategory scored 1 A, 1 B, 3 Cs, 2 Es and 1 F (unsatisfactory), as three out of the eight reports totally omitted to provide all the project phases and their durations while another three partially omitted this information (Annexure B). The planning and design phases of the projects were omitted from all WULA technical reports. Subcategory 1.2.5. also suffered major omissions of required licences and permits, such as the Environmental Authorisations (EA), possible waste permit, possible protected plant species permits, protected tree permits, land use rezoning, etc., with a score of 2 Bs, 2 Cs, 2 Ds, and 2 Es (Annexure B). This omission of legal requirements is consistent with Hallat, *et al*. (2015); Swanepoel *et al*. (2016) and Wentzel, *et al*. (2023) who found the inclusion of legal requirements unsatisfactory in their studies. However, another study found the inclusion of legal requirements to be satisfactory and argues that most specialists understand the inclusion of legal requirements in their studies (Matlala, 2025). Yet, the EAP made these omissions from the consolidated WULA technical report in this case study.

Furthermore, the rest of the subcategories under site description obtained A-C (satisfactory) performance except for subcategory 1.2.6. An unsatisfactory performance D-F (2 As, 1 C, 2 Ds, 3 Es) was detected due to method statements omitting activities related to certain water uses, such as Section 21 (a) and (g) (Annexure B). The absence of method statements that are related to waste-generating activities and activities that impact the I&APs also contributed to the subcategory performing average.

Category 1.3. which is basically on waste generation, handling, transportation, and disposal has unsatisfactory performance (1 E, 4 Fs) across all its sub-categories (Figure 13). The regulations regarding the procedural requirements for water use licence applications and appeals process requires that an Integrated Waste and Waste Water Management Plan (IWWMP) be included for water uses such as Section 21(a) which regulates the taking of water from a water resource and Section 21(g) for activities that might dispose of waste in a manner which may detrimentally impact on a water resource (DWS, 2017). The requirements and waste management tools such as a waste management plan and waste disposal registers for all waste streams as required for storage, collection and transportation of waste by the National Environmental Management: Waste Act 59 of 2008 (NEM: WA) Part 5 Section 21, 22, 23, 24, 25, were not taken into account in three out of the eight reports and partially in the other five reports (RSA, 2008). All eight cases omitted the amounts of raw materials to be used during borehole establishment, the recyclable materials that conservancy tanks are made of, G6 gravel material for main backfilling of storm water channel construction, in concrete production, spillage of fuels, lubricants, and other chemicals from construction equipment. This poor performance on waste is consistent with an EIA study done for projects that affect wetlands, in which the result for inclusion of waste was found to be 1 F (Retief, *et al*., 2008). This omission of waste-related impacts can be due to the specialist's scoping method, which does not include all the envisaged potential impacts throughout the project life cycle (Moolman, *et al*., 2025). This scoping gap usually causes certain key impacts to be omitted from the DWS Risk Assessment Matrix for assessment and in the WULA technical main report (Moolman, *et al*., 2025). Another reason for this omission is that there might be a lack of attention to potential cumulative and indirect impacts that can cause irreversible damage to water resources (Wentzel, *et al*., 2023).

Category 1.4. through which a description of the affected area was evaluated, scored an average overall score of 2 A-C and 2 D-F was obtained. The proposed best practice in report quality is to provide the location of the catchment, description of the biophysical elements, geographical dynamics of the environment, socio-cultural aspects, and current cumulative impacts found in the area (De Jager, 2022). Subcategory 1.4.1. (description of the overall environment) performed relatively well with 5 As, 1 C, and 2 Ds regarding the inclusion of required specialist studies, such as WIA and hydrological reports (Annexure B). Subcategory 1.4.2. dealing with indication of likely area to be affected by the proposed development performed satisfactorily (A-C). The content of the required WIA reports in this study excluded fauna and avifauna assessment, but rather overemphasised botanical issues in six out of the eight reports. This is anomalous to the requirements set out under EIA regulations, Section 2(g)(iv) of the EIA regulations, Appendix 2, which requires that reports must include the environmental attributes associated with the

alternatives, focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects (DEA, 2014). This study found that the inclusion of maps, plans, and photos across all supporting technical reports, which indicate the sensitivities in relation to the proposed development elements, was not consistent with the EIA regulations requirement. The sensitivities in relation to the proposed developments were not consistently denoted in the supporting technical reports through maps, plans, and photos as regulated by the EIA regulations (DEA, 2014).

The last evaluated descriptive category, category 1.5, pertains to the baseline conditions (description of the current state of the affected environment and its expected state if the proposed development were not to proceed). The overall score for category 1.5. is unsatisfactory (D-F) with 1 C, 1 D, and 1 E (Annexure B). It is required that information regarding the on-site, surrounding environment, other upstream and downstream water, properties, health and safety of the public, and resource quality must be provided as part of a WULA (DWS, 2023). Literature suggests that a description of the location where the water use is proposed must include the interaction and effect of the proposed development on the entire environment (De Jager, 2022; Moolman, *et al*., 2023). The DWS Regulations regarding the procedural requirements for water use licence applications and appeals process entail a site inspection and/or pre-application meeting, whose function is to verify the existing condition of the water resources and other environmental elements on site (DWS, 2017). The DFFE developed a regulated environmental screening tool that must be submitted with all assessments for EAs in South Africa, which can be applied as best practice in WULA assessments, as it is the only official regulated environmental screening tool currently available in South Africa (DEA, 2004, DEA, 2014, DEA, 2020).

Amidst the importance of baseline assessment in specialist and technical reports, it was found that subcategory 1.5.1. still scored 2 As, 1 B, 1 D and 1 E. Subcategory 1.5.3. (local land use plans, policies consulted, and other data collected to determine baseline conditions), scored 2 As, 3 Bs, 1 C, and 2 Es, which contributed to a satisfactory score (A-C). However, the reviewer scored this subcategory as unsatisfactory (D-F) due to the magnitude of omissions (2 Es), which are the main sources for baseline information. The contributing omissions were the omission of avifauna and other fauna from the baseline information in four of the eight reports. This is inconsistent with the requirement in the GA regulations of 2023, which regulates impacts on watercourses such as the resource quality of wetlands, which entails aquatic biota such as water birds, especially the endangered to critically endangered red data listed bird species (DWS, 2023). The effectiveness of impact assessment depends on how baseline data (biological, social, and physical aspects) are identified and evaluated to determine the potential impacts of the proposed development (Wentzel, *et al*., 2023). A study on the quality of ecological reserve inputs into EIA, which controversially rated

the subcategory on baseline conditions as satisfactory. The aforementioned study highlighted that the ecological reserve of a water resource entails its aquatic ecosystems, biodiversity, and its ecological processes, but the study only took fish, macroinvertebrates and riparian vegetation into account in its evaluation of the present ecological state of watercourses (De Jager, 2022). Biodiversity Impact Assessment reports evaluated by Swanepoel, *et al*. (2016) highlighted a weakness that certain reports did not go into detail on specific biodiversity themes, such as red data listed species. Another BIA study, which allocated a satisfactory score to baseline information, indicated that baseline conditions are comprehensively included, but the accuracy is unclear (Hallat, *et al*., 2015). A report quality review study done on the quality of WIA reports for mines in Mpumalanga found that the baseline assessment was satisfactory, but it only included geology, climate, topography, and soils as key baseline details for wetlands (Matlala, 2023). This study found that five out of the eight reports omitted socio-economic information and watercourse-related heritage resources, such as palaeontology resources from the WIA reports and the consolidated WULA technical reports. Sufficient and relevant existing data sources were utilised to gather baseline information in most of the reports, but five out of the eight reports omitted information regarding the presence of waste and public interests.

4.3.2. Review area 2: Identification and evaluation of key impacts

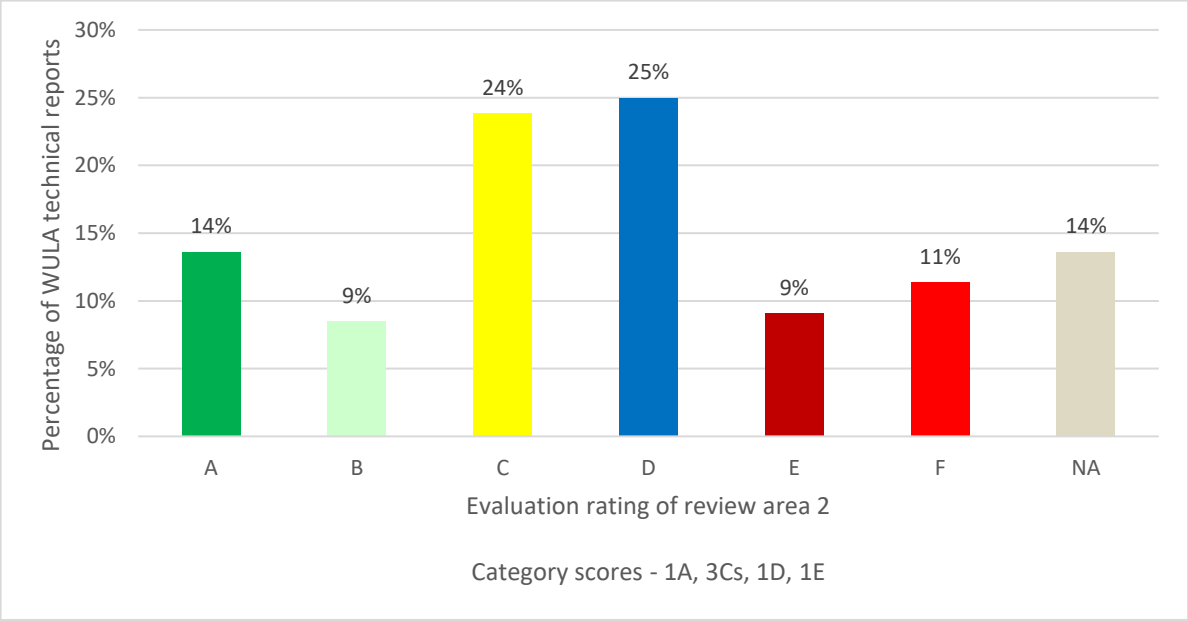


Figure 14: Review area 2 evaluation results

The evaluation results for review area 2 are displayed in Figure 14. This review area obtained a satisfactory overall score of A-C (24 As, 15 Bs, 42 Cs, 44 Ds, 16 Es, and 20 Fs) out of 176

subcategories (Annexure B). The categories in review area 2 scored an A-C (satisfactory) with 1 A, 3 Cs, 1 D and 1 E (Figure 14). The process of defining potential impacts was average, which cascaded into the process of identifying potential project impacts, which was found unsatisfactory in two reports because the public-related impacts and waste-related impacts were not considered amongst the identified potential impacts.

The requirement for public consultation stems from the phenomenon that the government of South Africa replaced the colonial riparian law, that was linked to property rights, with the NWA which mandates the state to function as the public water trustee that must make water use related decisions in the public's interest (Van Koppen & Schreiner, 2014). The evaluation results show that a public participation report, which functions as material information to substantiate the application, was mainly omitted in the cases (DWS, 2007b; DWS, 2023). It is an international challenge to obtain public participation in water-related issues, as the public is mainly concerned with their immediate needs, such as employment (Moolman, *et al*., 2025). This study identified that impacts related to the public have not been identified in the scoping through the Section 21 (c) and (i) wetland impact assessment, DWS Risk Assessment Matrix; however, the Section 21 (a) groundwater study reports indicated the potential impact on the I&APs through water extraction volumes. This is consistent with the findings in the Sandham and Pretorius study, which indicates that water-related impacts on communities are widely conducted through SIA, but this is not the case in South Africa (Sandham & Pretorius, 2008).

The widely found weakness in public consultation was also detected in this study. The weaknesses in review area 2 were found in subcategories 2.3.2. (Collect, arrange, and integrate comments and concerns of I&APs and 2.3.3. (Key impacts on I&APs identified and integrated into the WULA technical report). Both scored unsatisfactory (D-F) due to some WULA and specialist reports omitting the possible impacts that might affect the I&APs, such as insufficient public concern collection, inadequate notification of the proposed process, and the omission of comments and response registers. In this study, subcategory 2.3.2 obtained 2 Cs, 2 Ds, 3 Es and 1 F; and subcategory 2.3.3. obtained 2 Ds, 1 E, and 5 Fs, which collectively constitute unsatisfactory performance (Annexure B).

The factors that contributed to the abovementioned poor public consultation performance can be ascribed to the absence of the WULA public participation reports and the water-related issues in the associated EIA public participation notifications, which caused public issues not to be recorded in the WULA technical report. A previous study found that certain specialist study recommendations are not usually made into the main WULA report, which is similar to the public concerns and waste-

related assessments that did not make it into the WULA technical reports of this study (DWS, 2007; Moolman, *et al*., 2025; Wentzel, *et al*., 2023).

The estimation of impact magnitude and the assessment of impact significance were affected by the negligence of scoping in public impacts and waste-related impacts; hence, a C (just satisfactory) performance was obtained, respectively, for these categories. Subcategory 2.6.1. the assessment of climate change impacts performed poorly (D-F) in the eight WULA technical reports with 1 A, 2 Cs, 1 D and 4 Fs (Annexure B). The NWA, Section 9(d) states that a catchment management strategy must take climate into account (RSA, 1998b). Therefore, the Vaal-Orange Water Management Area's (WMA) strategy, under which WULs are issued, takes cognisance that climatic conditions vary across the WMA and climate change could impact the water resources in the WMA (VOCMA, 2024). A previous study included climate change in their report review package as part of the environmental characteristics that should be discussed in a specialist report (Matlala, 2023). This finding is consistent with the phenomenon that various report quality review studies did not take cognisance of climate change in their report quality review packages (De Jager, 2022; Hallat, *et al*., 2015; Moolman, *et al*., 2025; Swanepoel, *et al*., 2016; Wentzel, *et al*., 2023).

Subcategory 2.6.5. performed average (1 A, 2 Cs, 2 Ds, 1 E), but the reviewer found it unsatisfactory (D-F) due to the omission of adequate civil designs in specialist studies and the WULA technical reports (Annexure B). This is related to the finding that not all project phases are represented in the water-related impact assessment of proposed projects (Moolman, *et al*., 2025). The category 2.6. on the inclusion of the relevant specialist assessments, scored satisfactory (A) with two NA (Not-Applicable) subcategories related to stream flow reduction, which is for water uses related to deforestation and agricultural assessments, which is related to irrigation practices (DWS, 2017).

4.3.3. Review area 3: Alternatives and mitigation

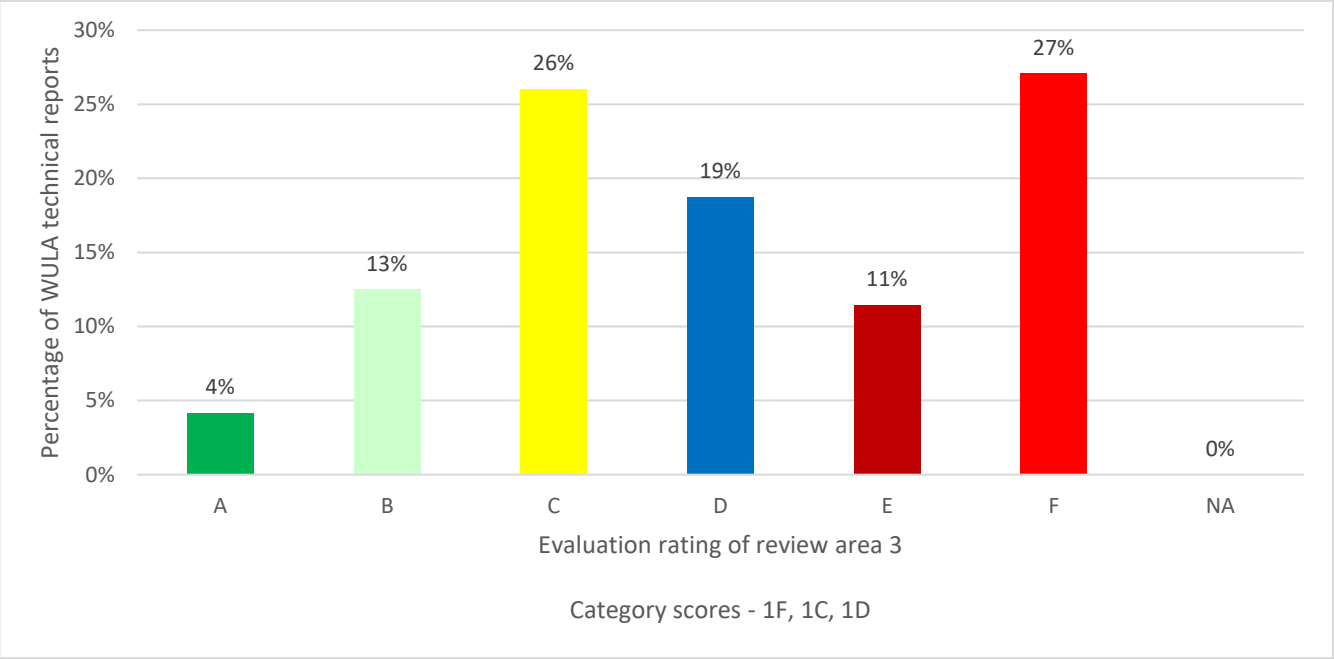


Figure 15: Review area 3 evaluation results

Review area 3 performed unsatisfactorily (D-F) which totals to a score of 57% (Figure 15). The scores per category were recorded as 1 C, 1 D and 1 F (Figure 15) (Annexure B). Considering alternatives is required in the regulations regarding the procedural requirements for water use licence applications and appeals process, to provide for the hierarchy of impacts with preferences to water resources (DWS, 2017). Previous similar studies required in their report quality evaluation packages that reasonable alternatives be included (Hallatt *et al*., 2015; Swanepoel, et al., 2019; Wentzel, *et al*., 2023). Section 3(n) in Appendix 3 of the NEMA: EIA regulations requires that the final proposed alternatives are aligned to the mitigation measures that are identified through the assessment (DEA, 2014). Alternatives that ought to be evaluated include the property or location where the activity is proposed to be undertaken, the type of activity to be carried out, the design or layout of the activity, the technology to be used in the activity, operational aspects of the activity, and the option of not doing anything (DEA, 2014).

It was found that subcategory 3.1.1 (consideration of description of alternative sites) performed satisfactorily (A-C) with 2 As, 3 Bs and 2 Cs (Annexure B). The identification of preferred project sites by the applicants caused the poor consideration of alternative site locations amongst the cases. However, in 6 of the 8 cases, alternative sites have been considered through the introduction of buffers for the different water resources. Subcategory 3.1.2. (mitigation measures considered

should include alternatives, administrative mitigation, engineering mitigation, resource mitigation, and construction mitigation) obtained similar scores with four out of eight reports not considering operating conditions alternatives such as the type of technology, technical design, and layout of the facilities equipment. Subcategories 3.1.3 (alternatives to address unexpected severe impacts and events) and 3.1.4. (comparative assessment of all alternatives identified) obtained satisfactory performance (A-C) with mostly just satisfactory scores (7 Cs, 1 A) (Annexure B). The 'just satisfactory' scores were obtained due to the omission of alternatives for unforeseen severe conditions and reports not including comparison of alternatives to determine a final best practicable option (Hallatt *et al*., 2015). A study on ecological reserve report quality review is in contrast with this study, as it found that consideration of alternatives scored satisfactory (86%) because the specialists had a good understanding of the project scope (De Jager, 2022; Retief, *et al*., 2008). The finding in this study is consistent with various previous studies that found that the subcategory on alternatives was the worst performing due to omitting consideration of alternatives or considering it partially (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). The omission of certain prescribed alternatives is an international trend, as it is found that only certain alternatives are considered, such as activity alternatives and biodiversity attributes (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019).

Some studies found that the inadequacy of considering alternatives can be ascribed to the "stand-alone" nature of specialist reports, which causes a disconnect between technical specialist reports and the main assessment report, such as a WULA report (Hallatt *et al*., 2015; Moolman, *et al*., 2025;). Category 3.2. (the scope and effectiveness of mitigation measures) performed satisfactorily (A-C) with 4 Cs and 1 F (Figure 15). The subcategories on the substance of mitigation obtained 'just satisfactory' scores (C), mainly due to the waste and public-related impacts not being scoped into the key impacts, which cascaded down into the mitigation measures.

The GA regulations require that emergency measures must be included in Environmental Management Plans, Rehabilitation plans, Storm Water Management Plans, and Risk Assessments (DWS, 2023). Subcategory 3.2.5. (inclusion of environmental emergency response plans) obtained an unsatisfactory performance (D-F) of 2 Es and 6 Fs due to the omission of emergency response measures across the eight cases for pollution, emergency alterations, and emergency structures (Annexure B) (DWS, 2023).

Category 3.3. (commitment to mitigation measures) obtained an unsatisfactory performance (D-F) with 2 Ds and 1 E in its three subcategories. Section 30(1)(v) of the NWA requires applicants to provide any appropriate security, such as a commitment to mitigation measures related to any

obligation or potential obligation associated with a licence to be issued under the NWA (RSA, 2008b). Subcategory 3.3.1. performed unsatisfactory (D-F) with 1 C, 2 Ds, 3 Es and 2 Fs (Annexure B). The finding was due to three of the cases omitting the applicant commitment totally, and the rest consisted of incomplete commitments, such as only committing to rehabilitation and the lawful disposal of waste. Some of the consolidated WULA technical reports only referred to commitments made in their related EIA report. Subcategory 3.3.2 indicated a lack of monitoring arrangements in the cases, as three cases omitted monitoring totally from the consolidated WULA technical report. Monitoring measures were found in the required Wetland Impact WIA and in some of the groundwater study reports.

The scope and effectiveness of mitigation measures were assessed very well in certain studies, but it was also found otherwise in other studies (Retief, *et al*., 2008; Sandham & Pretorius, 2008). Some authors are ascribing the inadequacies of mitigation measures to the inclusion of generic mitigation measures in the WULA technical report (Moolman, *et al*., 2025). A study on WIA report quality ascribed the unsatisfactory inclusion of monitoring reports to resource constraints or a lack of long-term environmental performance monitoring (Matlala, 2025).

4.3.4. Review area 4: Communication of results

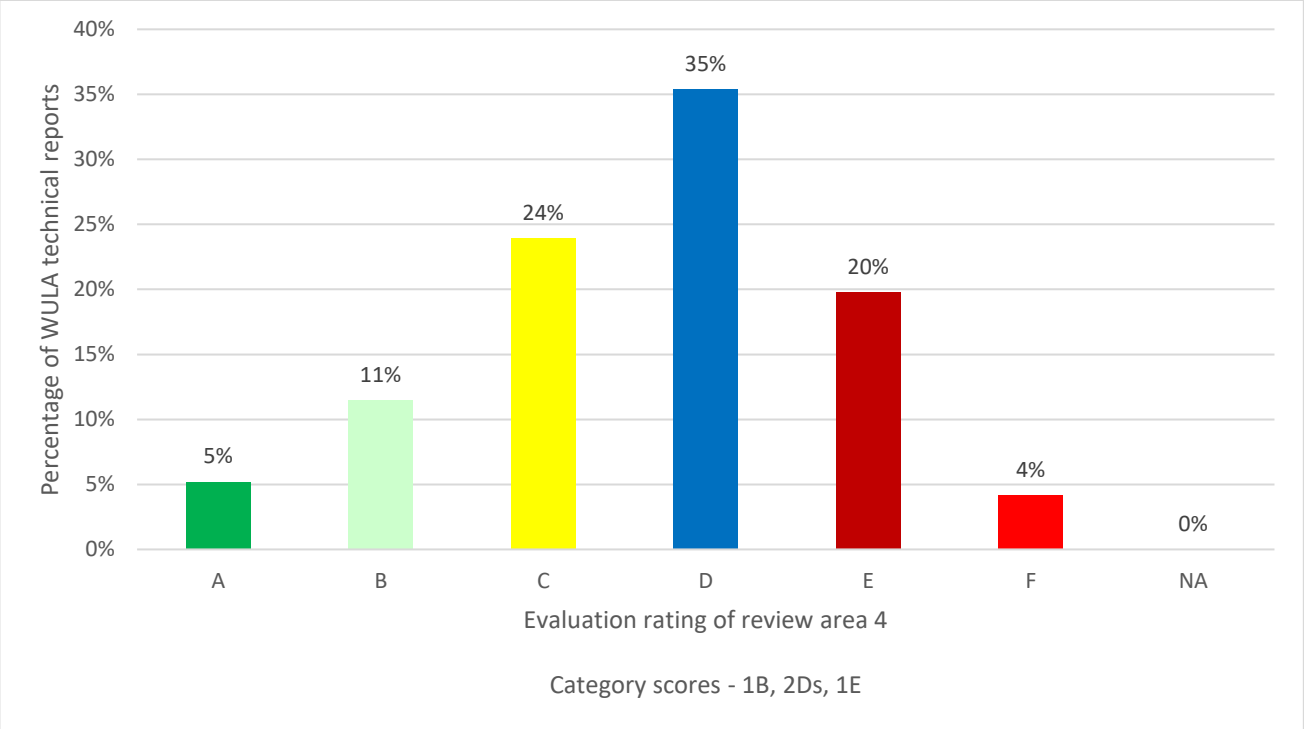


Figure 16: Review area 4 evaluation results

This review area evaluated the layout of the reports, the understandable presentation, whether the emphasis was without bias, and to what extent a clearly written non-technical summary was available in the reports for the non-technical readers. This review area performed unsatisfactorily (D-F) in its category level with 1 B, 2 Ds and 1 E as 35% of the reports scored a D and 20% an E (Figure 16). This unsatisfactory result is inconsistent with the imperative that assessment results be communicated correctly and logical, as it is vital to include the necessary emphasis without bias, to assist the decision makers in making good decisions (De Jager, 2022). The findings of specialist investigations need to be communicated to authorities and I&APs in a logical and easily understandable manner for authorities to make appropriate decisions on the application (DEAT, 2002c). It is required of EAPs to integrate the different specialist findings into an integrated whole for the readers to comprehend the findings of impact assessment (DEAT, 2002c). Previous similar studies include in their evaluation criteria that adequate summaries, including a summary of the impact assessment with potential implications of findings, should form part of the report (Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Furthermore, Appendix 3(3)(q) of the NEMA: EIA regulations requires that a motivated opinion of whether authorisation should be granted or not must be included. If the opinion is to authorise, then conditions should be suggested for the authorisation (DEA, 2014).

Subcategory 4.1.1. on the purpose and scope of the WULA technical reports, obtained a satisfactory performance (A-C) with 3 As, 1 B, 3 Cs and 1 D; in which all eight reports had a description of purpose and scope for the WULA technical reports (Annexure B). The scope, however, omitted the reporting on the required IWWMP and the public participation report. Subcategories 4.1.2 and 4.1.3 both performed unsatisfactorily (D-F). These poor performances was due to the omission of the subsequent IWWMP, and public participation reports affected the logical flow in all eight reports because certain water uses and impacts were omitted from the WULA technical reports, such as impacts on other water users and water pollution. Conclusions are mainly omitted from the consolidated WULA technical reports, and the conclusions found in the required WIA are inadequate as they lacked information on impacts related to waste, fauna, avifauna and impacts on public-related interests. A finding in a previous study, which is consistent with this study, found that conclusions for longer chapters have been omitted from specialist reports (De Jager, 2022). Subcategory 4.1.4. on references, scored satisfactory (A-C) even though certain critical references have been omitted from most of the WULA technical reports, such as the DWS External guideline, GA regulations, and the DWS regulations on the procedure for WULA and appeals process. The main consolidated WULA technical report did not have good in-text referencing. Report referencing has been included as an entire review area in a study on WIA reports for mines in Mpumalanga, and it was found that 100% of reports contained adequate

referencing (Matlala, 2025). The author concluded that credibility, validity, and transparency are ascribed to the level of referencing (Matlala, 2025).

Category 4.2. focuses on the presentation of information and has also obtained a poor performance (D-F) with 2 Ds (Annexure B). The description of the proposed activities needs to be explained in non-obscure language for it to be understandable to the authorities and I&APs (Moolman, *et al*., 2023; De Jager, 2022). It was found that in most cases, the activities are well described to explain the triggered water uses. The omission of the required IWWMP for NWA Section 21(g) water use and the public participation report was the weakness because the absence of their content affected the presentation of information as a whole. Technical terms, initials, and acronyms were well explained in five out of the eight consolidated WULA technical reports, as the other reports only define acronyms in their supporting specialist reports.

Previous studies suggest that category 4.3. on report emphasis, must not lobby for any point of view other than for the environment (Retief, *et al*., 2008; Sandham & Pretorius, 2008). The subcategory 4.3.2. obtained an unsatisfactory performance (D-F) with 2 Cs and 5 Ds. This is due to the statements being biased towards positive impacts and lingering on the low impacts found by their completed required DWS Risk Assessment Matrix. In three of the eight WULA technical reports, the statement did not address residual impacts and suggest compensation for impacts on water resources, as they only had one predetermined proposed position for the solar power plant site location. Subcategory 4.3.3. on the opinion as to whether authorisation should be granted or not, is one of the two best performing sub-categories, with all eight cases obtaining a satisfactory result (A-C) with 8 As.

Category 4.4. on the non-technical summary, obtained an unsatisfactory score (D-F) with 1 D and 1 E. The subcategory obtained an E due to 1 D, 4 Es and 3 Fs. The DFFE published an Integrated Environmental Management series 4 guideline on specialist studies that states that a non-technical executive summary must be generated to summarise executable actions (DEAT, 2002c). The non-technical executive summary is also important to summarise the results of all findings, conclusions, and recommendations made by the various specialists (Swanepoel, *et al*., 2019). Previous similar studies suggest that a clear and concise non-technical summary allows decision-makers and I&APs to make good decisions in authorising impacts (Moolman, *et al*., 2025; Wentzel, *et al*., 2023).

It was found that all eight WULA technical reports omitted the non-technical summary report from the consolidated WULA technical report. The supporting WIA specialist reports did include a non-technical summary in six reports with noteworthy omissions, hence subcategory 4.4.1. performed poorly (D-F). The WULA technical reports omitted proposed conditions for the authorisation as best

practice recommends, but this was probably because the solar power plants were approved to follow the GA registration route, which consists of generic conditions. The EIA documents were used as a reference in two of the cases, but the specialist recommended conditions for the EA and not for the Water Use Licence. This is in line with what previous studies found: specialist recommendations do not always make it into the consolidated WULA technical report (Moolman, *et al*., 2025; Swanepoel, *et al*., 2019). The phenomenon that causes subcategory 4.4.2. to perform unsatisfactory (D-F) with 1 D, 4 Es and 3 Fs, is that the conclusions that were made in some of the WULA technical reports and all specialist reports did not consist of waste management and public-related impacts. Various studies did, however, conclude that adequate non-technical summaries have been included in reports (Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023).

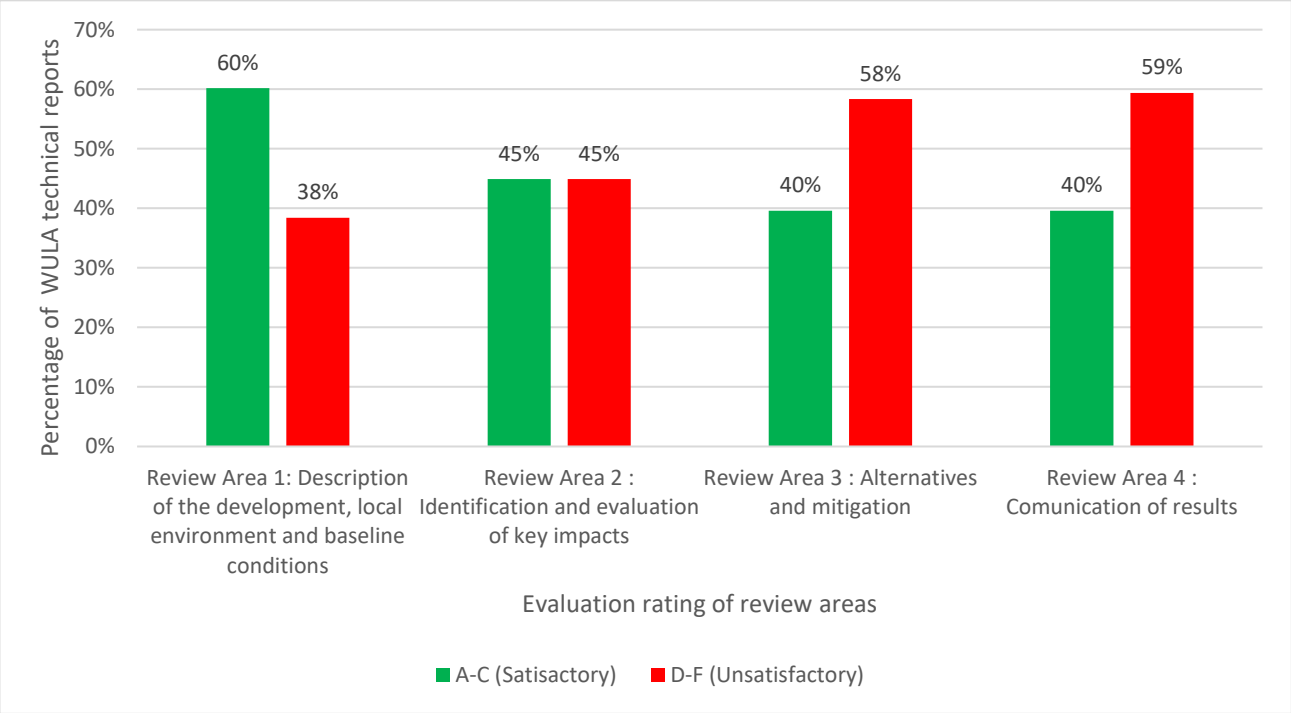


Figure 17: Review area summary results

The summary of the review results is denoted in Figure 17. The study concluded that one descriptive review area and one substantive review area scored the highest satisfactory results. Review area 1 (description of the development, local environment, and baseline conditions) scored a total of 60% satisfactory and 38% unsatisfactory results; and Review area 2 (identification and evaluation of key impacts) scored 45% for both satisfactory and unsatisfactory, which resulted in an average performance. The lack of 100% total was due to some Not Applicable (N/A) scores.

Review area 3 (alternatives and mitigation) scored 58% unsatisfactory, with 28 Fs against 21 F ratings in review area 4 (communication results). Review area 4 had the most omissions, which led to it obtaining a 59% unsatisfactory performance (Figure 17).

The overall result of this study is in contrast with similar previous studies, which found review areas 1 and 4 to be most satisfactory with the least omissions as they are descriptive in nature (Lee, *et al*., 1999; Moolman, *et al*., 2025; Retief, *et al*.,2008). Previous studies also found review areas 2 and 3 to be the most demanding areas, hence the usually low rating (De Jager, 2022; Lee, *et al*., 1999; Matlala, 2023; Moolman, *et al*., 2025; Retief, *et al*., 2008; Wentzel, *et al*., 2023)

The satisfactory overall result of this research is in line with the Biodiversity Impact Assessment (BIA) report quality reviews done by Wentzel *et al*. (2023) and Swanepoel *et al*. (2019), which found overall results of just satisfactory. Most of the identified similar previous studies results indicated a satisfactory overall result across all review areas (Appendix C) (Hallat, *et al*., 2015; Matlala, 2023; Retief, *et al*., 2008).

4.4. Weaknesses of WULA technical report quality

Based on the evaluation results, the following weaknesses for the WULA technical report quality were determined:

- The appended collation sheet displays how the categories performed which cascaded down into the subcategories (Annexure B). Review area 1: Subcategory 1.1.2. (project description and design) did not cover all activities of the proposed development and was found to be vague in various supporting technical reports and in the main WULA technical reports. The water use registration forms, in which design and size details are supposedly recorded, were not mentioned in all reports. Subcategory 1.1.5. on the nature of production processes and expected rate of production, performed poorly because the reports only included plant construction and operation water, and omitted other raw materials needed to construct infrastructure on the plants. Subcategory 1.1.8. scored unsatisfactory as most of the reports omitted a declaration of independence by the EAP who consolidated the WULA technical report for submission. Subcategory 1.2.3. scored unsatisfactory as the reports did not address all project phases by omitting the planning and design project phases, which defied the project life cycle approach that is necessary for impact assessment (DWS, 2017). Subcategory 1.2.6. omitted method statements related to activities related to certain Water uses, such as NWA Section 21 (a) and (g). Category 1.3. on waste generation, transport, and disposal failed dismally with a poor

score in all five of its sub-categories. The absence of a required IWWMP contributed largely to this weakness. Subcategory 1.4.2 (indication of the likely area to be affected by the proposed development) indicates a poor performance as the consolidated WULA technical reports and supporting specialist reports mainly omitted socio-economic issues and water-related heritage.

- Review area 2: Subcategory 2.3.2. and 2.3.3. obtained poor performance due to the absence of a public participation report for the WULA water-related issues. The collection, arrangement, and integration of comments and I&APs concerns referred to were mainly for the associated EIA completed. Subcategory 2.3.3. performed poorly because no water use-related key impacts on I&APs were identified in supporting specialist studies, public participation report, and were not integrated into the consolidated WULA technical report. Category 2.6. on the specialist studies conducted omitted the impacts of climate change on the development and vice versa. The impacts of wastewater on the watercourses were also not considered due to the absence of the required IWWMP.
- Review area 3: Subcategory 3.1.3. on WULA specialist studies performed poorly in identifying alternatives for unexpectedly severe adverse impacts or events on watercourses, and the comparison of alternatives did not take place in their entirety, under subcategory 3.1.4. Subcategory 3.2.5. indicated that supporting specialists did not make efforts to mitigate emergencies related to watercourses. There was no commitment to the mitigation measures in the reports from the developer's side, under subcategory 3.3.1.
- Review area 4: The result for subcategory 4.2.3. indicated that the consolidated WULA technical report was not presented as an integrated whole due to the absence of an IWWMP, public participation reports, and references to water use forms.
- Subcategory 4.4.2 results indicate that the reports lacked non-executive summaries that must cater to the authorities and the public, to understand and make informed decisions regarding the applications.

4.5. Strengths of WULA technical report quality

Based on the evaluation results, the following strengths of WULA technical report quality were determined:

- Review area 1: All the relevant water uses were listed in the WULA technical reports. All the WULA technical reports and supporting specialist reports provided an adequate master layout map that depicts the development site and activities in relation to the

watercourses. Good explanations of the existing land uses on proposed sites were included in the WULA technical reports.

- Review area 2: All the required specialist impact assessments were conducted to provide potential significant impacts on watercourses.
- Review area 4: Concise sections on the purpose and scope of the WULA technical report were provided in support of communicating the assessment results. Clear opinions as to whether the activities should or should not be authorized were provided by the EAPs and specialists.

4.6. Chapter summary

This chapter addressed research objective 1, which was to adapt and discuss the outcomes of adapting a Lee and Colley Review Package, how it was informed, and how it enabled the evaluation of WULA technical reports. The relevant water-related and impact assessment legislation, DWS WULA guidelines, and best practices identified in similar previous studies were applied to adapt the subcategories of an existing Lee and Colley Review Package to create the ALCRP that could be used for Objective 2.

The ALCRP was used to evaluate WULA technical reports submitted to obtain WULs for eight solar power plant cases in the Free State province. According to the evaluation results, which are related to research objective 2, the performance of the WULA technical reports was satisfactory (51%), as it was found to be 49% unsatisfactory (Figure 11). Amongst the four review areas that were used as evaluation criteria, review areas 1 and 2 were indicated to be the better performing review areas. Review area 3 performed average (satisfactory = 45%, unsatisfactory = 45%), and review area 4 performed the poorest (satisfactory = 40%, unsatisfactory= 59%). The reports proved noteworthy gaps in identifying and assessing alternatives and mitigation measures due to the omission of supporting documents (IWWMP and public participation report) and information from the scoping process. Contrary to many similar previous studies and international trends, the communication of report results and structuring of the reports show the poorest performance. The evaluation results show that the reports are better in describing the project, the local environment, and baseline conditions, together with identifying and evaluating key potential impacts.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This research aimed to evaluate the quality of WULA technical reports for solar power plants in the Free State province. A case study approach was adopted and implemented, in which eight cases (WULA technical reports) were sampled and evaluated against an ALCRP. This ALCRP was informed by South African legislation, best practice guidelines, and the outcomes of similar previous studies. The following subsections briefly explain how the three research objectives were met, summarise key research findings, and present evaluation results. Lastly, recommendations to improve the quality of WULA technical reports will be discussed.

5.2. Conclusions

Objective 1 of the research was met through the development of an adapted report quality review package that is suitable to review the quality of WULA technical reports for solar power plants in the Free State province. The ALCRP for this research was completed based on the framework of a report quality review package that was designed to evaluate EIA reports for projects that might potentially impact wetlands (Retief, *et al*., 2008). The subcategories in its review areas have been adapted to suit the report quality of WULA technical reports and can be applied to solar power plants in the Free State province. These adapted subcategories were informed by South African legal requirements, best practice guidelines, and results from similar previous studies (Lee, *et al*., 1999). The ALCRP has four review areas, eighteen categories, and five hundred and fifty-four sub-categories.

Objective 2 was achieved through the evaluation of WULA technical reports for solar power plants in the Free State province of which results were analysed to present the quality of these reports. The evaluation results were categorised as satisfactory (A-C) and unsatisfactory (D-F). The final report quality rating was found to be satisfactory, with the most satisfactorily performing review areas being review area 1 (description of the development, local environment, and baseline conditions) and review area 2 (identification and evaluation of key impacts). The poorer performing review areas are 3 (alternatives and mitigation) and review area 4 (communication of results).

The last research objective is met by making recommendations to improve the quality of the WULA technical reports. Detailed recommendations are proposed below to close noteworthy gaps that were detected in the subcategories during this report quality review study.

5.3. Recommendations

The following section is outlining how objective 3 of this research was achieved through providing recommendations to improve the quality of WULA technical reports.

5.3.1. Recommendations related to the research objectives

The relevant authorities and the I&APs depend on the content of impact assessment reports to make good decisions in authorising impacts from proposed developments and concurrently aid the applicant to mitigate potential impacts (Alberts, *et al*., 2022a; Bond, *et al*., 2016; Sandham & Pretorius, 2008; Scheepers, *et al*., 2019). In achieving research objective 3 (to make recommendations to improve the quality of the WULA technical reports), the following recommendations are proposed:

- **Completeness of documents:** In support of the above-mentioned purpose of report quality, It is recommended that final designs of proposed developments be made available to EAPs and specialists for them to have a clear and holistic understanding of the proposed development in its entirety, be obtained by the specialists to improve the scoping of all potential impacts that can arise from development activities, raw materials and processes. This will enable EAPs to compile WULA technical reports in a manner that better protects water resources from proposed development impacts (Matlala, 2025; Moolman, *et al*., 2025; Myburg, 2018; RSA, 1998b; Swanepoel, *et al*., 2016; Wentzel, *et al*., 2023). It is imperative to include all the necessary documents, such as BBBEE certificates and water use forms or their references, as part of the WULA technical report to avoid difficulties for DWS officials in processing applications efficiently (Alberts, *et al*., 2022b; Moolman, *et al*., 2025; Myburg, 2018).
- **Project life cycle:** All project phases (planning, design, construction, rehabilitation, decommissioning) and their activities, raw material, equipment, materials, and all other project dynamics should be considered in the scoping and impact assessment to constitute a concise WULA technical report (Retief, *et al*., 2008). The comprehensive scoping of project activities will cascade down into the key impact identification, mitigation, and monitoring measures of the report (Moolman, *et al*., 2025).
- **Legal review:** It is recommended that EAPs and specialists conduct a thorough legal review and consider all relevant legislation attached to the proposed activities and proposed site. All relevant supporting specialist studies should be conducted for the appropriate NWA Section 21 water uses, e.g., an IWWMP to support Section 21(g) in the

prevention of pollution and a public participation report to substantiate the application or decision-making.

- **Waste-related impacts:** The required DWS Risk Assessment Matrix for assessment, which determines the level of development impact, and all other supporting specialist reports should include waste-related impacts and impacts on I&APs (Moolman, *et al*., 2025; Sandham & Pretorius, 2008). This will allow the WULA technical report to provide decision-makers a comprehensive reflection of potential impacts and mitigation measures, and the applicant with information on all potential impacts to manage and budget for.
- **Inclusivity of reports:** The WULA technical reports are drafted as an integrated report consisting of all the recommendations and mitigations from the different supporting specialist reports, including IWWMP, public participation report, wetland impact assessment report, and DWS risk assessment matrix (DWS, 2007a; Moolman, *et al*., 2025; Wentzel, *et al*., 2023).
- **Emergencies:** It is recommended that climate change effects, emergencies, and impacts from adverse unforeseen events be considered in the specialist impact assessments for a more proactive approach against pollution and degradation of watercourses that can arise from emergencies (Hallatt *et al*., 2015; Matlala, 2023; NWA, 2008b; VOCMA, 2024).
- **Alternatives:** Specialists should consider all possible alternatives for comparison in the WULA technical report to reach the most environmentally sound option related to watercourses and public interest (DEA, 2014; Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023).
- **Mitigation measures:** Specialists and EAPs should refrain from generic mitigation measures and include site-specific monitoring programmes in their reports to avoid inadequate and ineffective mitigation (Matlala, 2025; Moolman, *et al*., 2025).
- **Report summaries and conclusions:** non-technical summaries and conclusions, especially after long chapters, should consist of information regarding impacts on all environmental aspects, including waste and public interest on waste impacts, fauna, avi-fauna impacts, and impacts on public-related interests (De Jager, 2022; Moolman, *et al*., 2025; Wentzel, *et al*., 2023).

5.3.2. Areas for future research

It was established in this research that the common water uses applied for by solar power plant developers was the NWA Section 21 (a) which is for the abstraction of water from water resource such as a borehole, (c) to impede or divert the natural flow of water, (g) to disposing of waste in manner that can pollute a water resource and (i) altering the bed, banks or characteristics of a watercourse. The identification of key impacts and impact significance rating, inform the amount and substance of information on which authorities base their WUL decisions. Therefore, it is recommended that future research should be focused on the impact identification and significance rating in WULA specialist documents such as groundwater study reports and the wetland impact assessment reports. The aim of such future research is to improve the outcome of such specialist reports in the furtherance of improving WUL decisions.

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ANNEXURE A: JUSTIFIED ADAPTED LEE AND COLLEY REVIEW PACKAGE FOR WATER USE LICENCE APPLICATION TECHNICAL REPORTS

Review Area 1 DESCRIPTION OF THE DEVELOPMENT, LOCAL ENVIRONMENT AND BASELINE CONDITIONS								
	1.1. DESCRIPTION OF THE DEVELOPMENT	***A***	***B***	***C***	***D***	***E***	***F***	***NA***
1.1.1.	Purpose and objectives of development The need, desirability and the National Water Act Section 27 motivation of the development (Moolman, *et al*., 2023; RSA, 1998b). Regional and national importance of the development (DWS, 2007b). (DEA, 2014: Section 2(b), Appendix 3)							
1.1.2.	Design and size of proposed development A plan which locates the proposed development at an appropriate scale. Linear activities: Description and coordinates of the approved coordinates. Area: Coordinates of the area within which the activity is proposed (DWS, 2017). Sufficient description of the proposed activity to inform the determination of all water uses (Moolman, *et al*., 2023). Are all required supplementary forms indicated in the water use forms marked off in the water use forms, correctly filled in, signed, and included in the application? (DWS, 2007b: Appendix A). Section 3(1)(h)(i), Full description of the processes involved in the development within the approved site as contemplated in the accepted scoping report, including: (i) details of the development footprint alternatives considered (DEA, 2014: Appendix 3). (De Jager, 2022; Hallat, *et al*., 2015; Scheepers, *et al*., 2019)							
1.1.3.	Physical footprint development within receiving environment							

	Section 28. (I) A licence contemplated in this chapter must specify— (b) the property or area in respect of which it is issued (RSA, 1998b). Location of the proposed activity and site description (DWS, 2017). Section 3(1)(l)(ii)(ii), a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers (DEA, 2014: Appendix 3). (De Jager, 2022; Hallat, *et al*., 2015; Scheepers, *et al*., 2019)							
1.1.4.	Nature and expected rate of construction activities in the proposed development S27(k) the probable duration of any undertaking and which a water use is to be authorised (RSA, 1998b). Section 2. Conceptualisation of activity 2.1. Description of activity 2.2. Extent of activity 2.3. Key activity related processes and products 2.4. Activity life description 2.5. Activity infrastructure description (DWS, 2017). Section 3(d)(i)(ii)(iii)(d), a description of the scope of the proposed activity, including— (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development (DEA, 2014: Appendix 3). Description of the activity, site and location of the development (De Jager, 2022). Nature of production processes and expected rate of production (Scheepers, *et al*., 2019).							
1.1.5.	Nature and quantity of raw materials needed during different development phases							

	Nature of the business, production volumes, turnover, development cost and development schedule (Ngeleza, 2023; DWS, 2007b). Section 3(d)(ii), Description of the scope of the proposed activity, (ii) a description of the associated structures and infrastructure related to the development (DEA 2014: Appendix 3). Nature of production processes and expected rate of production (Scheepers, *et al*., 2019).							
1.1.6.	Identification of the applicant Section 13(1)(f)(i)(ii), Disclose to the proponent or applicant, all material information in the possession of the EAP that reasonably has or may have the potential of influencing (DEA, 2014). DW755 requires the following supporting information of the applicant: • Certified copy of the identity document; • Certified copy of business registration certificate; • Title deeds and/or permission to occupy; • Certified copy of letter of authority; • Proof of water use licencing fee payment; • Certified copy of BBBEE certificate (DWS, 2017). Risk Assessment Matrix (RAM) must be carried out by a registered SACNASP registered practitioner (DWS, 2023).							
1.1.7.	Details of EAP who prepared the WULA technical report Section 3(1)(a)(i)(ii) Details of the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae (DEA, 2014: Appendix 3; De Jager, 2022). The skills and competencies of the EAP is relevant to the water related field of study (Moolman, *et al*., 2023). Knowledge gaps of the EAP (DWS, 2017). Professional body registration details (DWS, 2025b).							

	RAM completed by SACNASP registered specialist (DWS, 2023). Section 26 (1)(f) requiring qualifications for and registration of persons authorised to design, construct, install, operate and maintain any waterwork in order to protect the public and to safeguard human life and property (RSA, 1998b).							
1.1.8	Declaration of independence by the EAP Impact Assessment reports completed by an independent consultant (DWS, 2023). A declaration of interest by the EAP or specialist, which EAP or specialist meets all the requirements contemplated in regulation 13 (NEMA: EIA regs Section 16(1)(b)(iii); Department of Water and Sanitation, 2025b). Section 3(1)(s)(i)(ii)(iii)(iv)(v), An undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties (DEA, 2014: Appendix 3). Declaration of independence (Hallat, *et al*., 2015).							
1.1.9.	Are the all the relevant water uses listed in the report? Applicable Section 21 Water Uses (DWAF, 2007; DWS, 2017; DWS, 2025b; Moolman, *et al*., 2023; RSA, 1998b) This section should briefly describe the: • Water uses that need to be licensed • Affected water resources •Volumes in terms of taking water, dewatering, discharging and storage volumes							

	•Water quality requirements (DWAF, 2007). Section 2(a), Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context; (DEA, 2014: Appendix 3).							
GRADE – REVIEW AREA 1.1								
COMMENTS – REVIEW AREA 1.1.								
1.2. SITE DESCRIPTION: On site land requirements of development and duration of each land use		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
1.2.1	Locality map depicting the development site and activities Section 28(1) A licence contemplated in this chapter must specify: (b) the property or area in respect of which it is issued (RSA, 1998b) Section 3(1)(h)(iv)(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects (DEA, 2014: Appendix 3).			.				
1.2.2	Description of existing land uses on proposed site Detail scale maps showing land uses, Spatial Development Frameworks (SDF), plans denoting the corridor for linear activities and for areas, photographs (DWS, 2017; Hallat, *et al*., 2015; Moolman, *et al*., 2023; Swanepoel, *et al*., 2019).							
1.2.3	Duration of the development phases Description of lifespan of all activities on the proposed site (De Jager, 2022; DWS, 2017) All proposed development activities and their schedules (DWS, 2007b) Section 27(k) the probable duration of any undertaking and which a water use is to be authorised (RSA, 1998b).							

1.2.4	Key related activity, processes, products and infrastructure The nature of the business, production volumes, turnover, development cost (DWS, 2007b). Section 3(1)(h)(iv)(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report (DEA, 2014: Appendix 3). Description of the project and alternatives (Hallat, *et al*., 2015).							
1.2.5	Land development permits and licences required for the development to continue e.g. land and services servitude agreements, land use change approvals, Community Resolutions Existing lawful water uses on the properties applicable to the WULA (DWS, 2007b). Authorisation documents referencing the supporting documents (DWS, 2007b). Section 39(1), Activity on land owned by a person other than proponent (1). If the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an EA in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land (DEA, 2014: Appendix 4).							
1.2.6	Method statements of activities affecting watercourses How the development and associated infrastructure will be constructed within water resource regulated areas without compromising the water resources (DWS, 2025b).							
PRELIMINARY GRADE – REVIEW AREA 1.2								
COMMENTS – REVIEW AREA 1.2.								
1.3. WASTES: Estimated types and quantities of wastes which might be produced and proposed disposal routes to the environment described.		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
1.3.1	Estimated types and quantities of wastes and rate of production							

	Quantities of waste, key water uses and waste streams, waste volumes, waste quality analysis, disposal by evaporation, disposal to waste disposal site (DWS, 2017). Section 26(1)(h) prescribing waste standards which specify the quantity, quality and temperature of waste which may be discharged or deposited into or allowed to enter a water resource (RSA, 1998b). NEM: WA Section 30 Contents of industry waste management plans (RSA, 2008). Section 26(1)(j) requiring that waste discharged or deposited into or allowed to enter a water resource be monitored and analysed and prescribing methods for such monitoring and analysis (RSA, 1998b).							
1.3.2	Proposed handling/treatment, disposal and disposal routes to the water resource NEM: WA Part 5 Section 21, 22, 23, 24, 25 Storage, collection and transportation of waste (RSA, 2008).							
1.3.3	Integrated water and wastewater management report content IWWMP report content requirements (DWS, 2017).							
1.3.4	Requirements of waste permits Waste management activity (NEM: WA) Waste related authorisations (DWS, 2017). Section 20 (b) Waste management activities in respect of which a waste management licence is required in accordance with NEMA:WA (RSA, 2008).							
PRELIMINARY GRADE – REVIEW AREA 1.3								
COMMENTS – REVIEW AREA 1.3.								
1.4. ENVIRONMENT DESCRIPTION: Area and location likely to be affected by development proposal		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
1.4.1	Description of the overall environment							

	Location of basin/catchment, geographical aspects of the environment, biophysical description of environment, socio/cultural characteristics, current cumulative impacts (De Jager, 2022). Section 3(l)(ii), “a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers” (DEA, 2014).							
1.4.2	Indication of likely area to be affected by development Giving baseline details of the environment (De Jager, 2022; DWS, 2017; Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Section 2 (e), “identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment” (DEA, 2014: Appendix 3).							
1.4.3	Maps, plans and photographs Section 3(j)(i), an assessment of each identified potentially significant impact and risk, including: (i) cumulative impacts (DEA, 2014: Appendix 3). Master layout plan indicating activities in relation to delineated watercourses (DWS, 2023). Area likely to be affected (map) (De Jager, 2022). Maps, plans and photographs (Hallat, *et al*., 2015; Swanepoel, *et al*., 2019). Was a plan which locates the proposed activity or activities with associated water uses applied for at an appropriate scale provided? (Moolman, *et al*., 2023).							
1.4.4	Indication of key environmental sensitive areas/elements in the area The risk-based approach allows for the identification of areas of risk and impact mitigation in these areas and achieves focused and effective pollution-source management actions (DWS, 2007).							

	5.1 Characteristics of affected environment (Swanepoel, *et al*., 2019). Important components of affected environment (methods and uncertainties) (De Jager, 2022). Section 2(g)(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (DEA, 2014: Appendix 2)							
PRELIMINARY GRADE – REVIEW AREA 1.4								
COMMENTS – REVIEW AREA 1.4.								
1.5 BASELINE CONDITIONS: Description of effected environment as it is currently and as it could be expected to develop if project were not to proceed.		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
1.5.1	Identification and description of important components of the affected environment A description of the receiving environment, including the biophysical, social and economic components (e.g. air and water quality, demographics, literacy levels, economic activities) (DEAT, 2002a). On-site and surrounding environment and other up-stream and down-stream waters, properties, health and safety of the general public and resource quality (DWS, 2023). Section 16 (1)(b)(v)(1), An application for an environmental authorisation must: (b) when submitted in terms of regulation 19 or 21, be accompanied by: (v) the report generated by the national web based environmental screening tool, once this tool is operational (DEA, 2014). 1.3. The outcome of the site sensitivity verification must be recorded in the form of a report that confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure; the change in vegetation cover or status etc.; is submitted together with the relevant assessment report							

	prepared in accordance with the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) (DEA, 2004; DEA, 2014; DEA, 2020). A description of the receiving environment, including the biophysical, social and economic components (e.g. air and water quality, demographics, literacy levels, economic activities (DEA, 2014). Interaction and effect of project on environment (De Jager, 2022). Was a description of the location of the activity provided? (Moolman, *et al*., 2023). Present Environmental Situation (DWS, 2017). Applicable specialist inputs: (Hydrology, Aquatic, Wetland) • Hydrology & flow of resource • Present Ecological State (PES) of water resource • Ecosystem goods and services • Socio-economic benefits • Ecological Importance and Sensitivity (EIS) of water resource • Habitat integrity • Resource Management Class & Recommended Ecological Category • Current state of the Ecological Reserve (DWS, 2017).							
1.5.2	Existing data sources searched and utilized Site inspection and pre-application meeting outcome (DWS, 2017). Section 16 (1)(b)(v)(1), An application for an environmental authorisation must— (b) when submitted in terms of regulation 19 or 21, be accompanied by— (v) the report generated by the national web based environmental screening tool, once this tool is operational (DEA, 2014). 1.3. The outcome of the site sensitivity verification must be recorded in the form of a report that confirms or disputes the current use of the land and the environmental sensitivity as							

	identified by the screening tool, such as new developments or infrastructure; the change in vegetation cover or status etc; is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) (DEA, 2004; DEA, 2014; DEA, 2020) 1.2. The site sensitivity verification must be undertaken through the use of: a desktop analysis, using satellite imagery; (b) a preliminary on-site inspection; and (c) any other available and relevant information. (Site sensitivity verification requirement, it where a specialist assessment is required but no specific assessment protocol has been prescribed (DEA, 2020). Spatial Development Frameworks (SDF) Catchment Management Strategies RSA surface water reserve determination map (De Jager, 2022). Chapter 3 Ecological Reserve is enshrined in South African legislation as part of the NWA. (RSA, 1998b).							
1.5.3	Local land use plans, policies consulted, and other data collected to determine baseline conditions Water services providers e.g. municipalities strategic plans, Water User Associations e.g. irrigation boards, Subterranean Water Control Boards, Water Boards for Stock Watering, Settlement Boards, Water Conservation Boards (DWS, 2017). Agriculture Business Plan (DWS, 2017). Screening process should take into consideration the alignment of the proposal with existing policies and plans, the scale of the proposed development, the intensity of potential impacts and the significance of potential impacts (DEAT, 2002a). 1.3. The outcome of the site sensitivity verification must be recorded in the form of a report that confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure; the change in vegetation cover or status etc. (c) is submitted together with the relevant assessment report							

	prepared in accordance with the requirements of the Environmental Impact Assessment Regulations1 (EIA Regulations) (DEA, 2020).							
PRELIMINARY GRADE – REVIEW AREA 1.5								
COMMENTS – REVIEW AREA 1.5.								
SUMMARY OF PRELIMINARY GRADES – REVIEW AREA 1		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
1.1	***DESCRIPTION OF THE DEVELOPMENT***							
1.2	***SITE DESCRIPTION***							
1.3	***WASTES***							
1.4	***ENVIRONMENT DESCRIPTION***							
1.5	***BASELINE CONDITIONS***							
FINAL GRADE REVIEW AREA 1								

Review Area 2 **IDENTIFICATION AND EVALUATION OF KEY IMPACTS**								
2.1 DEFINITION OF IMPACTS: Potential impacts of development on the environment		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
2.1.1.	Scoping of all possible project impacts (negative and positive) on the water resources Describing different relevant water uses and their impacts on water resources (DWS, 2025b). Determine the risk class of impacts on watercourse characteristics with the DWS risk assessment template (DWS, 2023; SANS, 2019). Identify and predict potential impacts (DEAT, 2002b). “(c) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptance” (DEA, 2014: Appendix 6).							

	Section 2(f) identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity (DEA, 2014: Appendix 3).							
2.1.2	Identify and describe interaction of water resource impacts from different WULA technical reports Identify water uses that can trigger other water uses such as Section 21(d) (DWS, 2017). Describe the different water uses and the watercourses and the effects of the proposed development in watercourses with supporting technical reports (DWS, 2017). Link the specialist studies and identify impacts on ecological processes (Hallat, *et al*., 2015). Indirect or cumulative impacts (Swanepoel, *et al*., 2019). Section 3(1)(i)(i), (c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment (DEA, 2014: Appendix 3).							
GRADE – REVIEW AREA 2.1								
COMMENTS – REVIEW AREA 2.1.								
2.2. IDENTIFICATION OF IMPACTS: Criteria used for identification of all significant impacts		A	B	C	D	E	F	NA
2.2.1	Impact identification methodology (DWS, 2025b) The required tools to determine impact risk significance must be used: A practical field procedure for delineation of wetlands and riparian area.							

	The risk matrix spreadsheet and information regarding the method to determine risk in the DWS 2015 publication: Section 21(c) and (i) water use risk assessment protocol. Guideline on assessment of activities/developments affecting wetlands. Guideline for the determination of buffer zones for rivers, wetlands and estuaries (DWS, 2023). Has the site inspection been undertaken and water uses, information requirements, including the need for public participation been determined within the prescribed timeframes? (Moolman, *et al*., 2023). Assessment approach and methodology (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*, 2023) "(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used" (DEA, 2014: Appendix 6). An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include— (h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks (DEA, 2014: Appendix 3; DWS, 2025b).							
GRADE – REVIEW AREA 2.2								
COMMENTS – REVIEW AREA 2.2.								
2.3. Public participation: Key impacts should be identified, and main investigation cantered on these		***A***	***B***	***C***	***D***	***E***	***F***	***NA***

2.3.1	Genuine attempt to contact public and special interest groups to appraise them of project Brief description of the: 1. Notification 2. Public consultation process that was followed 3. The comments and objections received 4. Description of how each objection or class of objection was dealt with (DWS, 2007b) “Public participation process must be conducted in the Water Use Licence Application (WULA) process” (Moolman, *et al*., 2023). Section 41(4)(a) “the applicant to give notice in newspapers and other media— (i) describing the licence applied for; (ii) stating that written objections may be lodged against the application before a specified date, which must be not less than 60 days after the last publication of the notice; (iii) giving an address where written objections must be lodged; and (iv) containing such other particulars as the responsible authority may require; (b) to take such other steps as it may direct to bring the application to the attention of relevant organs of state, interested persons and the general public; and (c) to satisfy the responsible authority and interests of any other persons having an interest in the land will not be adversely affected” (RSA, 1998b). ” Consulted all I&APs” (DWS, 2017). A description of the notification to I&APs and the public participation process (PPP), and the comments and objections received, as well as a description of how each objection or class of objection was dealt with (DWS, 2007b). (iii) “a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them” (DEA, 2014: Appendix 3).							
2.3.2	Collect, arrange and integrate comments and concerns of I&APs							

	Section 41(4) (a) the applicant to give notice in newspapers and other media— (ii) stating that written objections may be lodged against the application before a specified date, which must be not less than 60 days after the last publication of the notice (RSA, 1998b) The opinion of rural and peri-urban communities secure minimum raw water access as basic human need (Van Koppen & Schreiner, 2014) Section 27(1)(b) The opinions of previously disadvantaged groups and of women have been collected (RSA, 1998b) Public participation report: 19. (1) The applicant must compile and submit a public participation report to the responsible authority containing the following — (a) written comments or objections of interested and affected parties. (b) records of meetings; and (c) register of interested and affected parties as contemplated in regulation 18. (2) Where a person is desirous but unable to access written comments as contemplated in sub-regulation (1) due to — (a) illiteracy; or (b) disability, reasonable alternative methods of recording comments must be provided for. (DWS, 2017) Section 3(1)(s)(ii) “an undertaking under oath or affirmation by the EAP in relation to— (ii) the inclusion of comments and inputs from stakeholders and I&APs” (DEA, 2014: Appendix 3).							
2.3.3	Key impacts on I&APs identified and integrated into the WULA technical report Section 27(4) states that I&APs should not be adversely affected by the development (RSA, 1998b). Public participation report:							

	19. (1) The applicant must compile and submit a public participation report to the responsible authority containing the following — (a) written comments or objections of interested and affected parties. (b) records of meetings; and (c) register of interested and affected parties as contemplated in regulation 18. (2) Where a person is desirous but unable to access written comments as contemplated in sub-regulation (1) due to — (a) illiteracy; or (b) disability, reasonable alternative methods of recording comments must be provided for. (DWS, 2017) Key Interested and Affected Party (I&APs) input into the WULA process (Swanepoel, *et al*., 2019). Appendix 3, Section 3(1)(i)(i) "Identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including— (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process" (DEA, 2014: Appendix 3).							
GRADE – REVIEW AREA 2.3								
COMMENTS – REVIEW AREA 2.3.								
2.4. PREDICTION OF IMPACT MAGNITUDE: Likely impacts on water resources and society. Impacts should be described in exact terms where possible		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
2.4.1	Data used to estimate magnitude of main impacts and gaps in data clearly indicated "(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used" (DEA, 2014: Appendix 6)							

	Assessment approach and methodology (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Appendix A: Risk Assessment Matrix risk determination in terms of likelihood and magnitude (DWS, 2023; SANS, 2019). Using the Ecological Status and Present Ecological Importance and Sensitivity to determine the risk to watercourse as receptor (DWS, 2023). Swanepoel, et al. (2019) ALCRP requires the following: “9.3 Linkages to other specialist studies 9.4 Criteria used to assess impacts 9.5 Impacts on ecological processes 9.6 Indirect or cumulative impacts linkages from identification to evaluation” (Swanepoel, *et al*., 2019). “The following generic criteria, which have been drawn from the published literature and South African practice, can be used to describe magnitude and significance of impacts in a systematic manner. The criteria are: • Extent or spatial scale of the impact. • Intensity or severity of the impact. • Duration of the impact. • Mitigatory potential. • Acceptability. • Degree of certainty. • Status of the impact. • Legal requirements” (DEAT, 2002c). Section 2(1)(h) (ii-iv) (h) “a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:—							

	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks" (DEA, 2014: Appendix 3) Section 3(1)(i)(i), "positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects" (DEA, 2014: Appendix 3).							
2.4.2	Methods predicting impact magnitude on water resources and society clearly described "Was significance (risk) determined in accordance with a justified criteria and methodology?" (Moolman, *et al*., 2023). Section 2(1)(h) (ii-iv) (h) "a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including— (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks" (DEA, 2014: Appendix 3).							
2.4.3	Express predictions of impact in measurable quantities with confidence limits "The following generic criteria, which have been drawn from the published literature and South African practice, can be used to describe magnitude and significance of impacts in a systematic manner. The criteria are: • Extent or spatial scale of the impact. • Intensity or severity of the impact. • Duration of the impact. • Mitigatory potential. • Acceptability. • Degree of certainty. • Status of the impact. • Legal requirements" (DEAT, 2002c).							

	Section 3(1)(j)(i-vii) (j) “an assessment of each identified potentially significant impact and risk, including— (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated” (DEA, 2014: Appendix 3).							
GRADE – REVIEW AREA 2.4								
COMMENTS – REVIEW AREA 2.4.								
2.5. ASSESSMENT OF IMPACT SIGNIFICANCE: Estimation of expected significance of impacts for society		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
2.5.1.	Assessment of Impacts Determine the significance of identified impacts (Moolman, *et al*., 2023). “9.8 Explicitness of consequences 9.9 Irreversibility and irreplaceability of impacts 9.10 Assessment in terms of desired state 9.11 Identification of beneficiaries” (Swanepoel, *et al*., 2019) Assess the significance of the impacts against the natural state of the water resource characteristics with an established criterion (DEA, 2004b). Analysis and characterisation of the water use activities (DWS, 2017). Chapter 1: “interpretation and purpose of regulations, significant impact means an impact that may have an effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence” (DEA, 2014).							
2.5.2.	Impact significance determination and rating on affected ecological processes and I&APs “9.7 Linkages from identification to evaluation							

	9.8 Explicitness of consequences 9.9 Irreversibility and irreplaceability of impacts 9.10 Assessment in terms of desired state 9.11 Identification of beneficiaries" (Swanepoel, *et al*., 2019). The following generic criteria, which have been drawn from the published literature and South African practice, can be used to describe magnitude and significance of impacts in a systematic manner. The criteria are: • Extent or spatial scale of the impact. • Intensity or severity of the impact. • Duration of the impact. • Mitigatory potential. • Acceptability. • Degree of certainty. • Status of the impact. • Legal requirements (DEAT, 2002c). There is no single method for determining significant environmental aspects, however, the method and criteria used should provide consistent results. The organization sets the criteria for determining its significant environmental aspects. Environmental criteria are the primary and minimum criteria for assessing environmental aspects. Criteria can relate to the environmental aspect (e.g. type, size, frequency) or the environmental impact (e.g. scale, severity, duration, exposure) (SANS, 2015). Section 3(1)(h)(vii) "positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects" (DEA, 2014: Appendix 3).							
2.5.3.	Consideration for mitigation of ecological and social impacts Do proposed mitigation measures coincide with the significance of the impacts on the water resource? (Moolman, *et al*., 2023).							

	Adherence to the Broad-based Black Economic Empowerment Guideline for Section 27 evaluation (DWS, 2007b). Section 3(1)(h)(vii), “positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects” (DEA, 2014: Appendix 3).							
2.5.4.	Significance of impacts in terms of national and international quality standards IAIA best practice guideline. ISO14001:2015 standard. The following generic criteria, which have been drawn from the published literature and South African practice, can be used to describe magnitude and significance of impacts in a systematic manner. The criteria are: • Extent or spatial scale of the impact. • Intensity or severity of the impact. • Duration of the impact. • Mitigatory potential. • Acceptability. • Degree of certainty. • Status of the impact. Legal requirements (DEAT, 2002c). “The required tools to determine impact risk significance must be used: •A practical field procedure for delineation of wetlands and riparian area •The risk matrix spreadsheet and information regarding the method to determine risk in the DWS 2015 publication: Section 21(c) and (i) water use risk assessment protocol. •Guideline on assessment of activities/developments affecting wetlands. •Guideline for the determination of buffer zones for rivers, wetlands and estuaries” (DWS, 2023).							
2.5.5.	Justify the method of impact significance rating.							

	IAIA best practice guidelines. PES and EIS. DWS Risk Assessment Matrix (RAM) criteria.							
GRADE – REVIEW AREA 2.5								
COMMENTS – REVIEW AREA 2.5								
2.6 SPECIALIST ASSESSMENT IMPACTS: Estimation of expected significance of impacts on focus areas		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
2.6.1	Identify sources of and impacts of climate change A catchment management strategy must take into account: (d) climate (National Water Act, 36 of 1998). The climatic conditions vary considerably from west to east across the WMA and effects of climate change could have impact on the water resources in the catchment (VOCMA, 2024). Were the characteristics of affected environment (geology, climate, topography, soils, etc.) discussed? (Matlala, 2023). Section 2(1)(h) (ii-iv), a plan of study for undertaking the environmental impact assessment (EIA) process must consider: (ii) a description of the aspects to be assessed as part of the EIA process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists (DEA, 2014: Appendix 3).							
2.6.2.	Identify water use impacts on stream flow reduction Stream flow reduction activity business plans (DWS, 2017).							

	Section 2(1)(h) (ii-iv), a plan of study for undertaking the environmental impact assessment (EIA) process must consider: (ii) a description of the aspects to be assessed as part of the EIA process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists (DEA, 2014: Appendix 3).							
2.6.3	Identify water use impacts on underground water Geohydrological report (DWS, 2017). Mine closure and rehabilitation plan (DWS, 2017). Section 2(1)(h) (ii-iv), a plan of study for undertaking the environmental impact assessment (EIA) process must consider: (ii) a description of the aspects to be assessed as part of the EIA process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists (DEA, 2014: Appendix 3).							
2.6.4	Identify water use impacts on watercourses as defined by the National water act 36 of 1998 Wetland delineation report (DWS, 2017). Impacts on watercourse characteristics (riparian habitat, biota, water quality, natural flow regime) (DWS, 2017; DWS, 2023). Section 2(1)(h) (ii-iv), a plan of study for undertaking the environmental impact assessment (EIA) process must consider: (ii) a description of the aspects to be assessed as part of the EIA process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists (DEA, 2014: Appendix 3).							
2.6.5.	Identify water use impacts of civil design Minimum civil design requirements (DWS, 2017).							

	Section 2(1)(h) (ii-iv), a plan of study for undertaking the environmental impact assessment (EIA) process must consider: (ii) a description of the aspects to be assessed as part of the EIA process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists (DEA, 2014: Appendix 3).							
2.6.6	Identify water use impacts on ecological processes "9.5. Impacts on ecological processes 9.6. Indirect or cumulative impacts" (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*, 2023). Section 2(1)(h) (ii-iv), a plan of study for undertaking the environmental impact assessment (EIA) process must consider: (ii) a description of the aspects to be assessed as part of the EIA process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists (DEA, 2014: Appendix 3).							
2.6.7.	Identify water use impacts on agriculture Agriculture business plan agricultural water use (DWS, 2017). Section 2(1)(h) (ii-iv), "a plan of study for undertaking the environmental impact assessment process to be undertaken, including— (ii) a description of the aspects to be assessed as part of the environmental impact assessment process; (iii) aspects to be assessed by specialists; (iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists" (DEA, 2014: Appendix 3).							
2.6.8.	Identify impacts of wastewater on watercourses Disposal of treated mining or industry wastewater with an Integrated Water and Wastewater Management Plan (IWWMP) (DWS, 2017).							
SUMMARY OF PRELIMINARY GRADES – REVIEW AREA 2		***A***	***B***	***C***	***D***	***E***	***F***	***NA***

2.1	***DEFINITION OF IMPACTS***							
2.2	***IDENTIFICATION OF IMPACTS***							
2.3	***PUBLIC PARTICIPATION***							
2.4	***PREDICTION OF IMPACT MAGNITUDE***							
2.5	***ASSESSMENT OF IMPACT SIGNIFICANCE***							
2.6	***SPECIALIST ASSESSMENT IMPACTS***							
FINAL GRADE REVIEW AREA 2								
Review Area 3 **ALTERNATIVES AND MITIGATION**								
3.1. ALTERNATIVES: Feasible alternatives should be considered		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
3.1.1	Consideration/description of alternative sites "Section 2(c), The proposed location of the development footprint must be based on an impact and risk assessment process which includes cumulative impacts and a ranking process of all footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment" (DEA, 2014: Appendix A). "6.1. Inclusion of reasonable alternatives" (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Alternatives that will address the hierarchy of impacts, starting with the exclusion of watercourses (DWS, 2017). The aim of the specialist study phase is to provide information on the positive and negative impacts associated with the project alternatives (DEAT, 2002c).							
3.1.2	Consideration/description of alternative processes, technology designs, layout and operating conditions Alternatives that will address the hierarchy of impacts, especially the exclusion of watercourses (DWS, 2017). Chapter 1 (1) "alternatives, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which							

	may include alternatives to the— (a) property on which or location where the activity is proposed to be undertaken; (b) type of activity to be undertaken; (c) design or layout of the activity; (d) technology to be used in the activity; or (e) operational aspects of the activity; and includes the option of not implementing the activity" (DEA, 2014).							
3.1.3	Alternatives identified for unexpectedly severe adverse impacts or events Alternatives that will address the hierarchy of impacts, especially the exclusion of watercourses (DWS, 2017). Section 2(c), The proposed location of the development footprint must be based on an impact and risk assessment process which includes cumulative impacts and a ranking process of all footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment (DEA, 2014: Appendix A).							
3.1.4	Comparative assessment of all alternatives identified "6.2. Comparison of alternatives 6.3. Identification of best environmental option" (Hallatt *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Alternatives that will address the hierarchy of impacts, starting with the exclusion of watercourses (DWS, 2017). Section 2(c), identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment (DEA, 2014: Appendix 3).							
GRADE – REVIEW AREA 3.1								
COMMENTS – REVIEW AREA 3.1								
3.2 SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES: All significant adverse impacts should be considered for mitigation.		***A***	***B***	***C***	***D***	***E***	***F***	***NA***

3.2.1	Consider mitigation of all significant adverse impacts in WULA required technical reports, construction monitoring programmes and rehabilitation programmes. “10.1 Summary of key management actions 10.2 Mitigation of positive and negative impacts 10.3 Precautionary principle 10.4 Viability and practicability of mitigation” (Hallatt, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Section 21(c) and (i) water uses should not affect on-site and surrounding environment, other up and down stream water users, property, health and safety of public and resource quality (DWS, 2023). The risk-based approach provides for identifying risk areas and their related mitigation measures for focused pollution-source management (DWS, 2007b). Section 1(n), An environmental impact assessment report (EIA) must include— (n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment (DEA, 2014: Appendix 3).							
3.2.2	Mitigation measures considered should include alternatives, administrative mitigation, engineering mitigation, resource mitigation, construction mitigation. Were proposed mitigation measures proportional to the significance of the impacts on the water resource? (Moolman, *et al*., 2023). “3.2.1. Mitigation of all significant adverse impacts considered 3.2.2. Mitigation measures proposed to prevent or offset adverse impacts 3.2.3. Mitigation measures clearly defined 3.2.4. Anticipated effectiveness of proposed mitigation” (De Jager, 2022). “Management actions that could enhance the condition of the environment (i.e. potential positive impacts of the proposed project) should be identified. If no mitigation is considered feasible, this must be stated and the reasons provided. The rating both with and without mitigation or enhancement actions should be recorded. Quantifiable standards (performance criteria) for reviewing or tracking							

	the effectiveness of the proposed mitigation action should be provided where appropriate" (DEAT, 2002c). For each positive impact, determine whether it can be further enhanced, and for identified negative impacts, determine how it can be mitigated. Section 2, (e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to— (i) identify and motivate a preferred site, activity and technology alternative; (ii) identify suisee Table measures to avoid, manage or mitigate identified impacts; and (iii) identify residual risks that need to be managed and monitored (DEA, 2014: Appendix 1). Where relevant, mitigation actions should consider enhancement options, soft engineering solutions or using the construction and operation methods or processes to reduce environmental effects (DEAT, 2002c). Avoidance: Mitigation by not carrying out the proposed action or parts of the proposed action. For example, if the only area available for a regional airport happens to be an area of extensive wetlands that would be filled in by construction of the airport, avoidance of the action would be the only reasonable way to protect those wetlands. Minimization: Mitigation by scaling down the magnitude of a project, reorienting the layout of the project or employing technology that reduces the factors generating the undesirable environmental impact. Rectification: Mitigation through the restoration of environments affected by the action. For example, areas cleared for the installation of pipelines or power lines can be rehabilitated and then replanted with native vegetation. Reduction: Mitigation by taking maintenance steps during the course of the action. For example, storm water management systems can be designed to trap sediments from developed areas. Compensation: Mitigation through the creation, enhancement or acquisition of environments similar to those affected by an action. This step should only be considered after all steps above have been completed. As a last resort, donation							

	of land or money for a regional programme of habitat creation or enhancement should be considered. (DEAT, 2002c).							
3.2.3	Extent of effectiveness of mitigation when implemented Monitoring and reporting conditions of the General Authorisation (GA) and/or the water use licence (DWS, 2023). 3.2.4. Anticipated effectiveness of proposed mitigation (De Jager, 2022). Quantifiable standards (performance criteria) for reviewing or tracking the effectiveness of the proposed mitigation action should be provided where appropriate (DEAT, 2002c). Section 3(1)(e), an indication of the ability of the EMPr, and the closure plan in the case of a closure activity to— (i) sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis; (ii) sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility in the case of a closure activity; and (iii) ensure compliance with the provisions of environmental authorisation, EMPr, and the closure plan in the case of a closure activity (DEA, 2014: Appendix 7).							
3.2.4	Indication of residual impacts that cannot be mitigated The remaining risk should be subject to ongoing monitoring, review and further treatment where possible (SANS, 2019). Ensure the establishment of additional monitoring plans as required by the Risk Matrix (DWS, 2023). If no mitigation is considered feasible, this must be stated and reasons provided (DEAT, 2002c). Section 3(1)(h), An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include— (h) a full description of the							

	process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (viii) the possible mitigation measures that could be applied and level of residual risk (DEA, 2014: Appendix 3).							
3.2.5	Inclusion of Environmental emergency response plans Pollution mitigation for emergency alterations. Monitoring plan for emergency structures. Water course protection plan for emergency alterations (DWS, 2023). Emergency measures in Environmental Impact Plans, Rehabilitation plan, Stormwater Management Plan, Risk Assessment (DWS, 2023). Section (1)(f)(i), An EMPr must comply with Section 24N of the Act and include—(f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to—(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation (DEA, 2014: Appendix 4).							
GRADE – REVIEW AREA 3.2								
COMMENTS – REVIEW AREA 3.2								
3.3. COMMITMENT TO MITIGATION		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
3.3.1	Developer must clearly commit to mitigation measures Security by applicant 30. (1) A responsible authority may, if it is necessary for the protection of the water resource or property, require the applicant to give security in respect of any obligation or potential obligation arising from a licence to be issued under this Act. (2) The security referred to in subsection (1) may include any of the following: (i) A letter of credit from a bank; (ii) a surety or a bank guarantee; (iii) a bond; (iv) an insurance policy; or (v) any other appropriate form of security (RSA, 1998b). 14. (1) The applicant who is required to provide a security in respect of a particular water use licence application must complete and submit to the responsible authority Annexure E.							

	(2) The security is to specify coverage of individual items as well as the operation of the whole system. (3) The security shall be valid for a period of at least 5 years after water use licence activities have lapsed (DWS, 2017). Appendix E: Security and Guarantee (DWS, 2017). Section (1)(d), a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development (DEA, 2014: Appendix 4)							
3.3.2	Monitoring arrangements should be proposed in each technical report Scheduled monitoring baseline water quality 1 month before construction. Construction water quality testing according to parameters given in GA 4167 of 2023. Monitoring programme available. Scheduled Environmental Audits by suitably qualified person (DWS, 2023). 11.2. Viability and practicability monitoring (Hallatt, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Monitoring programme for each specialist input: (Hydrology, Aquatic, Wetland) • Hydrology & flow of resource • Present Ecological State (PES) of water resource • Ecosystem goods and services • Socio-economic benefits • Ecological Importance and Sensitivity (EIS) of water resource • Habitat integrity • Resource Management Class & Recommended Ecological Category • Current state of the Ecological Reserve (DWS, 2017). Section (1)(g), (h), the method of monitoring the implementation of the impact management actions contemplated in paragraph (f); (h) the frequency of							

	monitoring the implementation of the impact management actions contemplated in paragraph (f) (DEA, 2014: Appendix 4).							
3.3.3	Inclusion of Proposed Rehabilitation programme to remedy/mitigate adverse impacts on the water resource quality. The rehabilitation is regarded as a means of protection of a watercourse from degradation (RSA, 1998b). 3.3.3 Financial provisions for rehabilitation/closure (De Jager, 2022). Environmental Impact management and Rehabilitation Plan (DWS, 2023). Section (1)(d)(4)(iv) rehabilitation of the environment after construction and in the case of a closure activity, closure (DEA, 2014: Appendix 4).							
GRADE – REVIEW AREA 3.3								
COMMENTS – REVIEW AREA 3.3								
SUMMARY OF PRELIMINARY GRADES – REVIEW AREA 3		A	B	C	D	E	F	NA
3.1	FEASIBLE ALTERNATIVES							
3.2	SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES							
3.3	COMMITMENT TO MITIGATION							
FINAL GRADE REVIEW AREA 3								
Review Area 4 COMMUNICATION OF RESULTS								
4.1. LAYOUT OF THE REPORT		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
4.1.1	Purpose and scope of the WULA technical report (De Jager, 2022; Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023)							

	Introduction with project description and aims of the Water Use Licence Application (WULA) (De Jager, 2022).							
4.1.2	Structure of the information (De Jager, 2022; Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023). Is information logically arranged in sections and clearly identified in an index or see Table of contents? (Moolman, *et al*., 2023) Has superfluous information (i.e. information not needed for the decisions) been avoided? (Moolman, *et al*., 2023)							
4.1.3	Adequacy of conclusions (De Jager, 2022; Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023) Has information and analysis been offered to support all conclusions drawn? (Moolman, *et al*., 2023)							
4.1.4	Reference of external sources (De Jager, 2022; Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023) When information from external sources has been introduced, has a full reference to the source been included? (Moolman, *et al*., 2023) The application forms must be accompanied by a brief application report, a map, the appropriate supporting documents, and the licence application fee (DWS, 2007b).							
PRELIMINARY GRADE – REVIEW AREA 4.1								
COMMENTS – REVIEW AREA 4.1								
4.2. PRESENTATION: Information should be accessible to the non-specialist		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
4.2.1	Comprehensible presentation of information (avoiding obscure language) (De Jager, 2022) Has information and analysis been offered to support all conclusions drawn? (Moolman, *et al*., 2023)							

	Was the description of the proposed activity sufficient to inform the determination of all water uses? (Moolman, *et al*., 2023)							
4.2.2	Technical terms, acronyms, initials defined (De Jager, 2022) Has information and analysis been presented so as to be comprehensible to the non-specialist, using maps, see Tables and graphical material as appropriate?							
4.2.3	Presentation of the report as an integrated whole (De Jager, 2022) Did the report include all relevant DW forms, all the determined water uses, all technical assessments, S27 motivation statement and a description of the location of the activity provided? (Moolman, *et al*., 2023) 3.8 Summary impact assessment see Table 3.9 Potential implications of findings (Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023) Appendix 3: 3(q), a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation (DEA, 2014: Appendix 3).							
PRELIMINARY GRADE – REVIEW AREA 4.2								
COMMENTS – REVIEW AREA 4.2								
4.3. EMPHASIS: Information should be represented without bias		***A***	***B***	***C***	***D***	***E***	***F***	***NA***

4.3.1	Prominence and emphasis to potentially severe impacts Was the information provided sufficient to justify the identification of key water-related issues (scoping)? (Moolman, *et al*., 2023) Were key impacts of the activities on water resources determined? (Moolman, *et al*., 2023) (i) a description of any assumptions made and any uncertainties or gaps in knowledge (DEAT, 2002c). (j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities (DEAT, 2002c).							
4.3.2	Statement must be unbiased (De Jager, 2022) 3.6 Justification of opinions or statements (Hallat, *et al*., 2015; Swanepoel, *et al*., 2019; Wentzel, *et al*., 2023).							
4.3.3	Opinion as to whether the activity should/should not be authorized Has information and analysis been offered to support all conclusions drawn? (Moolman, *et al*., 2023) Opinion as to whether development should/ should not be authorised (De Jager, 2022)							
PRELIMINARY GRADE – REVIEW AREA 4.3								
COMMENTS – REVIEW AREA 4.3								
4.4. NON-TECHNICAL SUMMARY: Clearly written non-technical summary of main findings		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
4.4.1	Non-technical summary of main findings and conclusions							

	Does the EIA contain a brief but concise non-technical summary that clearly explains the project and the environment, the main issues and mitigation measures to be undertaken, and any remaining or residual impacts? Production of a non-technical executive summary (the executive summary should be a summary with actions).							
4.4.2	Summary must cover all main issues Does the summary include a brief explanation of the overall approach to the assessment? Does the summary provide an indication of the confidence which can be placed in the results? 3(q) A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation. (DEA, 2014, Appendix 3).							
PRELIMINARY GRADE – REVIEW AREA 4.4								
SUMMARY OF PRELIMINARY GRADES – REVIEW AREA 4		***A***	***B***	***C***	***D***	***E***	***F***	***NA***
4.1	***LAYOUT OF THE REPORT***							
4.2	***PRESENTATION***							
4.3	***EMPHASIS***							
4.4	***NON-TECHNICAL SUMMARY***							
FINAL GRADE REVIEW AREA 4								

ANNEXURE B: COLLATION SHEET

List of reports	A	B	C	D	E	F	G	H
Report year	2022	2024	2023	2025	2024	2023	2025	2022
Review Area 1: Description of the development, local environment and baseline conditions								
1.1. DESCRIPTION OF THE DEVELOPMENT	D	A	A	C	B	A	D	A
1.2. SITE DESCRIPTION	E	D	C	B	A	B	D	A
1.3. WASTES	F	C	F	F	F	F	F	C
1.4. ENVIRONMENT DESCRIPTION	D	B	C	C	A	B	D	A
1.5 BASELINE CONDITIONS	D	A	D	C	B	A	E	B
Review Area 2: Identification and evaluation of key impacts								
2.1 DEFINITION OF IMPACTS	D	A	D	B	C	C	C	B
2.2. IDENTIFICATION OF IMPACTS	E	C	E	C	A	A	C	C
2.3. PUBLIC PARTICIPATION	D	E	D	E	F	C	F	C
2.4. PREDICTION OF IMPACT MAGNITUDE	D	E	C	D	C	C	D	D
2.5. ASSESSMENT OF IMPACT SIGNIFICANCE	D	D	D	E	C	B	D	D
2.6 SPECIALIST ASSESSMENT IMPACTS	D	B	A	C	F	A	F	D
Review Area 3: Alternatives and mitigation								
3.1. ALTERNATIVES	C	F	F	F	F	B	F	F
3.2 SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES	F	C	D	D	D	C	C	C
3.3 COMMITMENT TO MITIGATION	F	D	D	C	D	D	E	E

Review Area 4: Communication of results								
4.1. LAYOUT OF THE REPORT	D	D	D	B	C	D	D	D
4.2. PRESENTATION	D	D	D	D	D	D	D	D
4.3. EMPHASIS	B	C	C	C	C	C	C	C
4.4. NON-TECHNICAL SUMMARY	E	D	D	D	E	E	E	E

ANNEXURE C: COMPARISON OF REPORT QUALITY EVALUATION RESULTS FROM THE CURRENT AND PREVIOUS STUDIES

	Current study	*Previously evaluated report quality*				
		Retief, et al., 2008 (4 reports)	***De Jager, 2022 (7 cases)***	***Moolman, et al., 2025 (8 technical reports)1***	***Wentzel, et al., 2023 (16 report)2***	***Matlala, 2023 (15 reports)3***
Review Area 1: DESCRIPTION OF THE DEVELOPMENT, LOCAL ENVIRONMENT AND BASELINE CONDITIONS	A=31%, B=14%, C=19%, D=15%, E=11%, F=9%, NA=0%	A=23%, B=30%, C=13%, D=6%, E=4%, F=12%, NA=12%	A=46%, B=35%, C=12%, D=2%, E=1%, F= 3%, NA= 1%	A=78%, B=17%, C=6%	A=10%, B=15%, C=20%, D=21%, E=20%, F=14%, NA=0%	A=81%, B=7.25%, C=2.5%, D=3%, E=1%, F=15%, NA= 4%

[1] The review areas were group to suit the review areas of the current study. Review area 1 (documentation, technical information, water uses, description of the environment, description of activity, socio-economic considerations), Review area 2 (key impacts and significance, scoping substance, significance substance), Review area 3 (public participation, mitigation substance, public participation substance). Rating description A=Good, B=Average, C=Poor. Rating (number of ratings ÷ numbers of sub-categoriesX100).

[2] The review areas were grouped to suit the current study. Review area 1 (expertise and professional conduct, adequacy and sufficiency of information, description of project, description of baseline environment). Review area 2 (Prediction and assessment of impacts). Review area 3 (considering alternatives, stakeholder consultation, monitoring). Review area 4 (clarity of report). Number of sub-categories reviewed (number of reports x review areas in group). Rating (number of ratings ÷ number of sub-categories reviewed x 100).

[3] The review areas were grouped to suit the current study. Review area 1 (specialist expertise, adequacy of report information, legislative framework, baseline site description). Review area 2 (methodology, impact assessment discussion). Review area 3 (study area buffer). Review area 4 (report introduction, result discussion, conclusions and recommendations, references). Ratings (Averaged the score percentages of the grouped review areas).

	Current study	Previously evaluated report quality				
		Retief, et al., 2008 (4 reports)	*De Jager, 2022 (7 cases)*	*Moolman, et al., 2025 (8 technical reports)1*	*Wentzel, et al., 2023 (16 report)2*	*Matlala, 2023 (15 reports)3*
Review Area 2: IDENTIFICATION AND EVALUATION OF KEY IMPACTS	A=14%, B=9%, C=24%, D=30%, E=9%, F=11%, NA=9%	A=14%, B=35%, C=22%, D=9%, E=10%, F=9%, NA=1%	A=31%, B=36%, C=24%, D=5%, E=2%, F=0%, NA=0%	A=63%, B=31%, C=6%	A=0%, B=19%, C=38%, D=38%, E=5%, F=0%, NA=0%	A=75%, B=4.5%, C=3%, D=2.5%, E=2%, F=12%, NA=1%
Review Area 3: ALTERNATIVES AND MITIGATION	A=5%, B=13%, C=26%, D=20%, E=14%, F=28% NA=0%	A=13%, B=41%, C=28%, E=3%, F=3%, NA=12%	A=25%, B=33%%, C=24%, D=1%, E=0%, F=0%, NA=17%	A=75%, B=18%, C=7%	A=2%, B=16%, C=8%, D=13%, E=13%, F=48%, NA=0%	A=60%, B=10%, C=3%, D=4%, E=0%, F=23%, NA=0%
Review Area 4: COMMUNICATION OF RESULTS	A=5%, B=13%, C=26%, D=35%, E=21%, F=21%, NA=0%	A=14%, B=64%, C=18%, D=4%	A=55%, B=31%, C=8%, D=1%, E=0%, F=1%, NA=4%	NA	A=31%, B=38%, C=25%, D=0%, E=6%, F=0%, NA=0%	A=90.5%, B=2.25%, C=4.25%, D=15, E=0%, F= 2.75%, NA=0%
Overall performances (Average the rating percentages =average (sum of ratings))	A=14%, B=12%, C=24%, D=25%, E=14%, F=17%, NA=2%	A=16%, B=43%, C=20%, D=5%, E=6%, F=8%, NA=6%	A=39%, B=34%, C=17%, D=2%, E=1%, F=1%, NA=6%	A=72%, B=22%, C=6%	A=11%, B=22%, C=23%, D=18%, E=11%, F=16%	A=76.5%, B=6%, C=3%, D=6%, E=1%, F=13%, NA=1.25

(Own creation, 2025. Based on De Jager, 2022; Matlala, 2023; Moolman, *et al*., 2025; Retief, *et al*., 2008; Wentzel, *et al.,*2023)