SECTION 21(C) AND (I) WATER USE AUTHORISATION APPLICATION

FOR THE

HARRISMITH MUNIC-42ND HILL 11KV POWERLINE PROJECT, SITUATED IN HARRISMITH, FREE STATE PROVINCE

JULY 2015

Prepared by:

JEFFARES & GREEN (PTY) LTD

PO Box 1109

Sunninghill

2157

Telephone: 011 231 2200

Email: jgijhb@jgi.co.za

Project director: Cecilia Canahai

Form 4.3.1

VERIFICATION PAGE

Rev 13

TITLE : Section 21(c) and (i) water use authorisation application for the Harrismith Munic-42nd Hill Powerline Project, Situated In Harrismith, Free State Province

JGI NO. :	**DATE :**	**REPORT STATUS :**
3887/001	07/07/2015	Final

CARRIED OUT BY :

Jeffares & Green (Pty) Ltd. Johannesburg
P O Box 1109
Sunninghill
2157
Tel (011) 231 2200
Fax (011) 807 1607
Email jgijhb@jgi.co.za

COMMISSIONED BY :

Eskom Distribution Free State Operating Unit
Eskom Centre
120 Henry Street
P O Box 356
Bloemfontein
9300
Tel : 051 404 2287
Fax : 086 604 5709
Email mahlatse.moeng@eskom.co.za

AUTHOR :

Mrs K Peramaul

CLIENT CONTACT PERSON :

Ms Mahlatse Moeng

SYNOPSIS :

Water Use License Application for the Harrismith Munic-42nd Hill 11kV Powerline Project, Situated In Harrismith, Free State Province.

KEY WORDS :

Water Use License Application, Eskom

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certification under certificate number 90906882

Verification	Capacity	Name	Signature	Date
By Author	Environmental Scientist	Kirthi Peramaul		07/07/2015
Checked by	Snr Environmental Scientist	Sonja van der Merwe		07/07/2015
Authorised by	Technical Director	Cecilia Canahai		07/07/2015

SECTION 21(C) AND (I) WATER USE AUTHORISATION APPLICATION FOR THE HARRISMITH MUNIC-42ND HILL 11KV POWERLINE PROJECT, SITUATED IN HARRISMITH, FREE STATE PROVINCE

TABLE OF CONTENTS

EXECUTIVE SUMMARY

It is the intention of Eskom Distribution, Free State Operating Unit to change the alignment of the existing Harrismith-Munic – 42nd Hill 11kV powerlines where these lines exit the existing Harrismith-Munic Substation. The realignment of these lines is required as part of the refurbishment of the Substation. The Harrismith-Munic Substation is situated to the west of the Town of Harrismith, in the Free State Province, on the Remaining Extent of the Farm Harrismith 131. Currently, the existing Harrismith-Munic – 42nd Hill 11kV lines are fed from two 11kV feeders known as 1HMF and 2HMF and exits the substation from one 11kV feeder breaker which is situated in the North Western corner of the substation. Approximately 332m of these existing Harrismith Munic – 42nd Hill 11kV lines will be dismantled.

As part of the refurbishment of the Substation, new feeder breakers and breaker bays will be installed, so each of the 1HMF and 2HMF feeders will be supplied and controlled by its own breaker. The new feeder bays will be situated along the northern boundary of the substation site. The new section of lines will be approximately 350m in length and will run from the substation site to where it will tie into the existing Harrismith-Munic – 42nd Hill 11kV powerlines.

Eskom consulted The Department of Water and Sanitation (DWS) (*formerly known as the Department of Water Affairs*) regarding another project which involves the construction of the new Harrismith-Munic – Letsatsi 11kV Powerlines due to the presence of wetlands in the study area. The DWS provided Eskom with recommendations and the processes to be followed regarding the Water Use Authorisation. The Harrismith-Munic 42nd Hill 11kV powerline project is within close proximity of the Harrismith-Munic – Letsatsi 11kV Powerlines, as both lines exit the Harrismith Munic substation. Hence Eskom took the initiative to follow the Water Use Authorisation process for the Harrismith-Munic 42nd Hill 11kV powerline project due the presence of wetlands in the study area.

The study area is located to the west of the Town of Harrismith, in the Free State Province, at coordinates 28°16’ 35.98”S; 29°06’ 36.53”E. The main river within the study area is the Wilge River. This section of the Wilge River falls within the Upper Vaal Water Management Area (WMA). The Wilge River in particular and the associated sub-quaternary catchments has been identified as a River FEPA (Freshwater Ecosystem Priority Area). According to the National Biodiversity Assessment (NBA) the study area also falls within a terrestrial environment which is considered to be endangered.

According to the Wetland Assessment undertaken by Dr Martin Ferreira the following features are situated within the study area:

- Stormwater channels, which formed to the North West of the Substation, between the substation and the N5. These channels formed as a result of runoff from the N5;
- An artificial wetland, which formed as a result of the stormwater channels and the continuous stormwater runoff from the N5. The artificial wetland has formed next to the Harrismith-Munic substation. The existing section of the Harrismith-Munic – 42nd Hill powerlines to be realigned traverses this artificial wetland, and the new lines will also traverse this artificial wetland;
- A Floodplain Wetland, which is associated with the Wilge River, which is the most important wetland type identified during the study. The proposed realignment of the existing powerlines will be constructed within a 500m radius of the delineated edge of this Floodplain Wetland.

The proposed realignment of the powerlines will not have a direct impact on the water quality of the Floodplain Wetland, but could have a downstream impact, as construction activities may cause pollution of the downstream environment. However, this impact is expected to be low to very low, with the implementation of suitable mitigation measures.

The project may also have an impact on the study area in the form of a potential change in hydrology, geomorphology and vegetation. The risk of any impact occurring is low to very low, as powerlines and a substation already exist within the study area. Mitigation measures have been provided in this Water Use License Technical report, as obtained from the Wetland Assessment Report compiled by Dr Martin Ferreira. These mitigation measures should be applied to avoid any negative impacts on the receiving environment.

This Water Use License Technical Report is compiled as part of the Water Use License Application Process for the realignment of the Harrismith-Munic – 42nd Hill powerlines. Jeffares & Green (Pty) Ltd are undertaking all processes required for obtaining a Water Use License in terms of Section 21(c) and (i) of the National Water Act (Act 36 of 1998). However, as this project is situated within an artificial wetland area, it is foreseen that the proposed project will have a negligible impact on the 500m buffer of the floodplain wetland as well as a low to very low impact on the downstream wetland areas, a General Authorisation may be appropriate.

Jeffares & Green (Pty) Ltd are aware that wetland areas are excluded from the General Authorisations as published in the Government Gazette of 18 December 2009, Gazette No 32805. In terms of this document, any activities that may have a potential to impact a wetland in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) are excluded. However, Jeffares & Green (Pty) Ltd requests that DWS consider a possible General Authorisation (GA), due to the nature of the project, and the low impacts as explained above.

1 INTRODUCTION

It is the intention of Eskom Distributions, Free State Operating Unit to change the alignment of the existing Harrismith-Munic – 42nd Hill 11kV powerlines, where these lines exit the existing Harrismith-Munic Substation. The realignment of these lines are required as part of the refurbishment of the Substation. The Harrismith-Munic Substation is situated to the west of the Town of Harrismith, in the Free State Province, on the Remaining Extent of the Farm Harrismith 131. Currently, the existing Harrismith-Munic – 42nd Hill 11kV lines are fed from two 11kV feeders known as 1HMF and 2HMF and exit the substation from one 11kV feeder breaker which is situated in the North Western corner of the substation. Approximately 332m of these existing Harrismith-Munic – 42nd Hill 11kV lines will be dismantled.

As part of the refurbishment of the Substation, new feeder breakers and breaker bays will be installed, so each of the 1HMF and 2HMF feeders will be supplied and controlled by its own breaker. The new feeder bays will be situated along the northern boundary of the substation site. The new section of lines will be approximately 350m in length and will run from the substation site to where it will tie into the existing Harrismith-Munic – 42nd Hill 11kV powerlines. Refer to Figure 1 below.

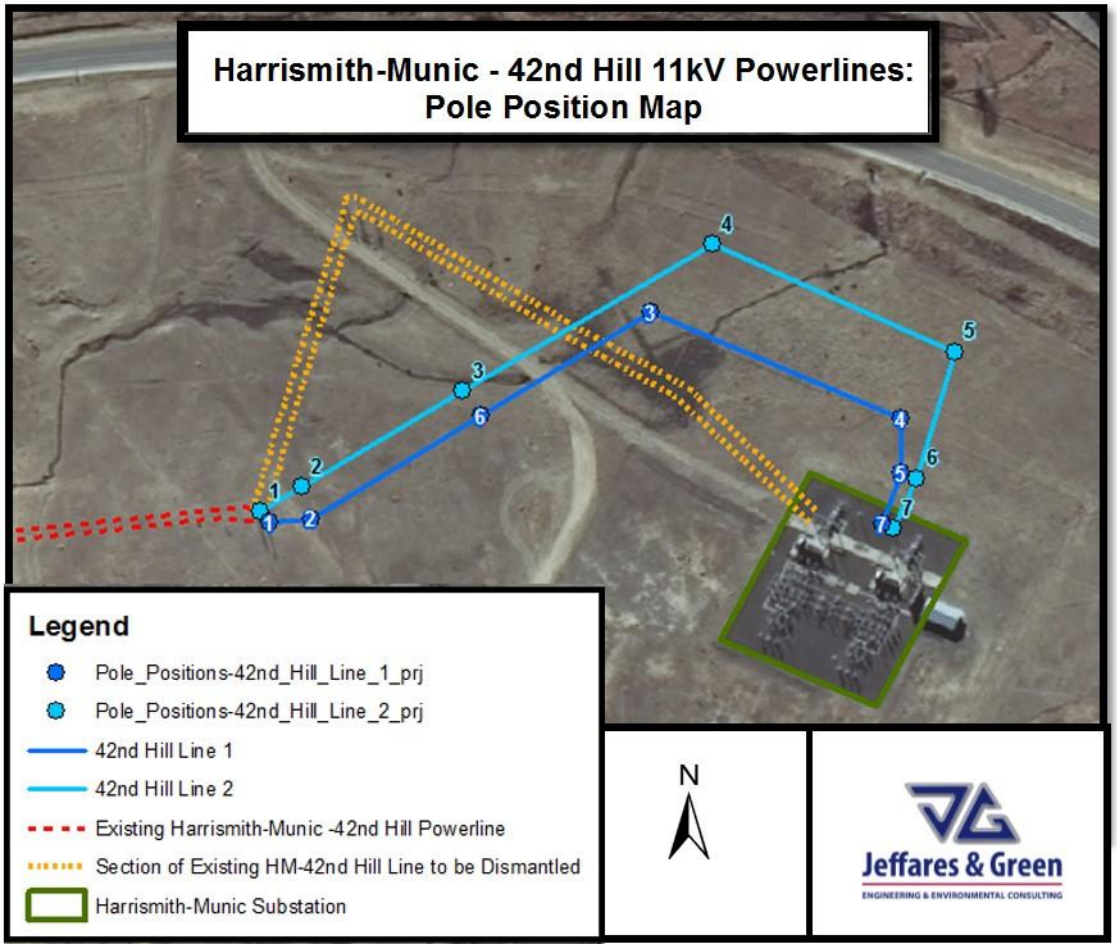

Figure 1: Harrismith-Munic – 42nd Hill 11kV Powerlines Map

1.1 PROJECT NEED AND DESIRABILITY

The existing Harrismith-Munic Substation has currently only one circuit breaker which feeds a double circuit (1HMF & 2HMF), as explained in Section 1 above. Should a fault occur at either one of these feeders, both feeders will not be operational. When such a fault occurs both feeders need to be inspected before closing the breaker. The inspections of both the feeders are time consuming and therefore the power outage time is prolonged. This contributes to the poor performance of the Bethlehem field service area. In addition, the circuit breaker is situated inside the Municipality's Substation (The Maluti-a Phofung Local Municipality). The Municipality has full access to operate this breaker, while Eskom employees are working on the line, which poses a safety risk to the Eskom employees. In order to solve these issues, each of the HM feeders must have its own breaker. The proposed construction of the Harrismith-Munic 42nd Hill 11kV powerlines will therefore improve safety to Eskom employees and the public. It will also improve the performance of the Bethlehem service area, which in turn will ensure an improved quality of electricity supply to customers.

1.2 AUTHORITY LIAISON

Eskom consulted The Department of Water and Sanitation (DWS) (*formerly known as the Department of Water Affairs*) regarding another project which involves the construction of the new Harrismith-Munic – Letsatsi 11kV Powerlines due to the presence of wetlands in the study area. The DWS provided Eskom with recommendations and the processes to be followed regarding the Water Use Authorisation. The Harrismith-Munic 42nd Hill 11kV powerline project is within close proximity of the Harrismith-Munic – Letsatsi 11kV Powerlines, as both lines exit the Harrismith Munic substation. Hence Eskom took the initiative to follow the Water Use Authorisation process for the Harrismith-Munic 42nd Hill 11kV powerline project due the presence of wetlands in the study area.

Jeffares & Green (Pty) Ltd are undertaking all processes required for obtaining a Water Use License in terms of Section 21(c) and (i) of the National Water Act (Act 36 of 1998). However, as this project is situated within an artificial wetland area, and as this project will have a negligible impact on the 500m buffer of the floodplain and as it will have a low to very low impact on the downstream wetland areas, a General Authorisation may therefore be appropriate.

Jeffares & Green (Pty) Ltd are aware that wetland areas are excluded from the General Authorisations as published in the Government Gazette of 18 December 2009, Gazette No 32805. In terms of this document any activityies that may have a potential to impact a wetland in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) are excluded. However, Jeffares & Green (Pty) Ltd requests that DWS consider a possible General Authorisation (GA), due to the nature of the project and the low impacts as explained above.

2 DETAILS OF THE APPLICANT

The details of the project applicant are provided in the table below:

Project applicant:	Eskom Distribution, Free State Operating Unit		
Contact person:	Mrs Mahlatse Moeng		
Physical address:	Eskom Centre, 120 Henry Street, Bloemfontein		
Postal address:	P O Box 356, Bloemfontein		
Postal code:	9300	Cell:	
Telephone:	051 404 2287	Fax:	086 604 5709
E-mail:	mahlatse.moeng@eskom.co.za		

3 PROJECT ENVIRONMENTAL ASSESSMENT PRACTITIONER

Jeffares & Green (Pty) Ltd were appointed by Eskom Distribution, Free State Operating Unit, as the Independent Environmental Assessment Practitioner to undertake the Water Use Authorisation process for this project.

Jeffares & Green is a specialist consultancy offering services in the following sectors; environmental impact and environmental management, geotechnical engineering, geohydrology, waste management and various engineering sectors (roads, structures, municipal, etc.).

In September 2000, Jeffares & Green obtained the international quality management certification, ISO 9001, for all of its services. Our accreditation company is DEKRA.

It should be noted that Jeffares & Green (Pty) Ltd are currently also undertaking another Water Use Authorisation Process for Eskom. This other project involves the proposed construction of the Harrismith-Munic - Letsatsi 11kV powerlines, which will run from the Harrismith-Munic Substation to a new transformer bay to be situated approximately 3.6km North West of the Substation.

A combined Public Participation Process was undertaken for these two projects, and combined specialist assessments were undertaken for these projects, but separate Water Use License Applications Forms and Technical Reports are compiled, as Eskom required separate authorisation for these projects. Details of the combined specialist studies undertaken are provided below:

- A Floodline Assessment undertaken by Mr Phillip Hull from Jeffares & Green (Pty) Ltd ; and
- A Wetland Assessment undertaken by Dr Martin Ferreira from Jeffares & Green (Pty) Ltd

The Specialist reports are attached to Appendix F of this Technical report. The specialist reports include the findings and recommendations for both the Harrismith-Munic - Letsatsi 11kV powerlines and for the Harrismith-Munic – 42nd Hill powerlines.

3.1 Project Team

The J&G project team included the following parties. CV's of the project team members are attached to Appendix C.

Name	Position in Firm	Qualification	Years' Experience	Role in Project
Mrs Cecilia Canahai	Technical Director	Pr Sci Nat, MSc (Eng Geology), BSc (Eng Geology)	24 Years	Project Manager and Reviewer.
Mrs Sonja van der Merwe	Snr Environmental Scientist	BA (Hons) Geography and Environmental Management	9 Years	Environmental Assessment Practitioner and Project Leader.
Dr Martin Ferreira	Aquatic Scientist	PhD. Aquatic health	6 Years	Aquatic Specialist undertaking the Aquatic Assessment and WULA Technical Report compilation assistance.
Miss Anelile Gibixego	Graduate Aquatic Scientist	BSc Biological Sciences	5 Years	Aquatic Specialist undertaking the Aquatic Assessment.
Mrs Kirthi Peramaul	Environmental Scientist	BSc (Hons) Environmental Science	8 Years	Environmental Scientist, compilation of the WULA Technical Report

4 PROJECT LOCATION

The existing Harrismith-Munic Substation is situated south of the N5 National Route in Harrismith, on the Farm Harrismith 131, at the following coordinates:

Latitude:	28°17'00.27"S
Longitude:	29°07'31.03"E

As mentioned previously, the existing Harrismith-Munic – 42nd Hill 11kV lines are fed from two 11kV feeders known as 1HMF and 2HMF and exit the substation from one 11kV feeder breaker, which is situated in the North Western corner of the substation. Approximately 332m of the existing Harrismith-Munic – 42nd Hill 11kV lines will be dismantled.

As part of the refurbishment of the Substation, new feeder breakers and breaker bays will be installed, so each of the 1HMF and 2HMF feeders will be supplied and controlled by its own breaker. The new feeder bays will be situated along the northern boundary of the substation site. The new section of lines will be approximately 350m in length and will run from the substation site to where it will tie into the existing Harrismith-Munic – 42nd Hill 11kV powerlines. The new section of the lines will be situated on the Remaining Extent of the Farm Harrismith 131. Please refer to Figure 2: Project Locality Map.

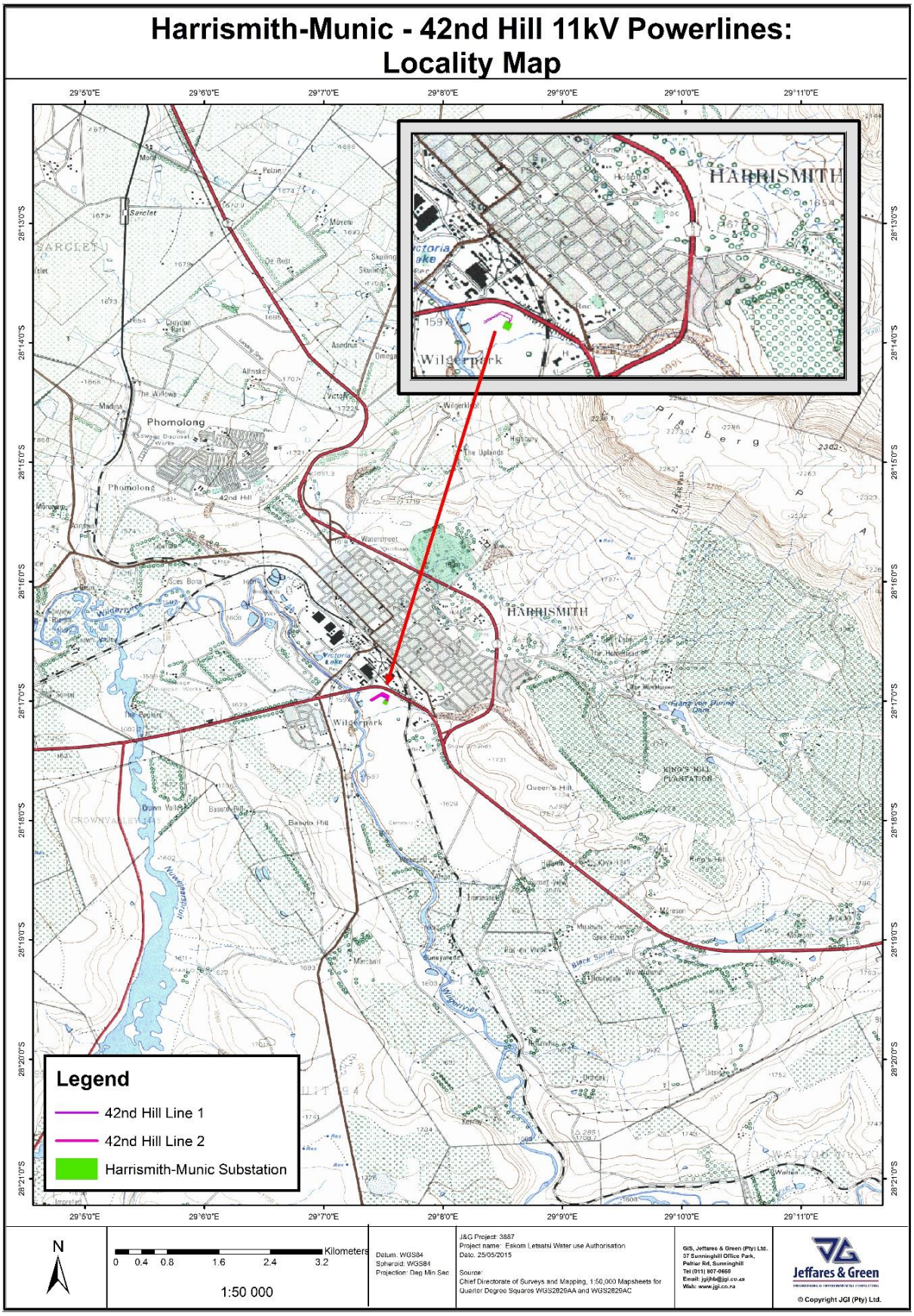

Figure 2: Project Locality Map

Harrismith-Munic - 42nd Hill 11kV Powerlines: Pole Position Map

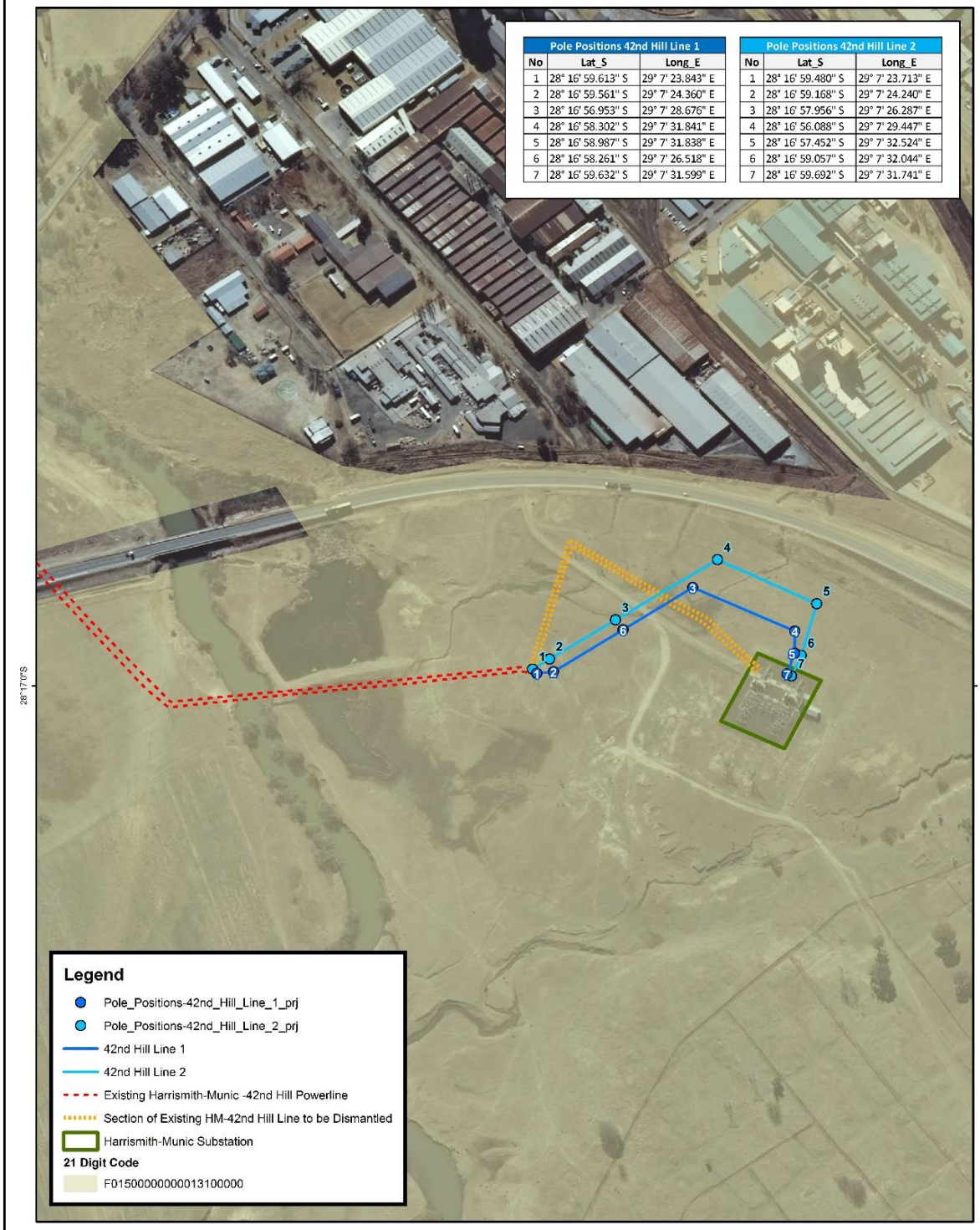

Figure 3: Route and Pole Position Map

5 LANDOWNER AND EXISTING LAND USE OF DEVELOPMENT SITES

The existing substation and the sections of the existing Harrismith-Munic – 42nd Hill 11kV powerlines to be dismantled and realigned are situated on the Remaining extent of the Farm Harrismith 131. This Farm portion is owned by the Maluti a Phofung Local Municipality. Eskom did not register a servitude for the realignment of the powerlines on the affected property, but they have obtained a Way-leave from the Local Municipality. A signed Way-leave from the Municipality to grant Eskom Holdings Limited an eternal right to distribute electricity over this farm portion, under certain conditions, is attached to Appendix H of this Report.

6 LEGISLATIVE REVIEW

6.1 National Water Act

Section 21 of the National Water Act (Act 36 of 1998) defines a list of activities which requires a Water Use Authorisation. Listed activities in terms of Section 21 include the following:

- 21(a) taking water from a water resource;
- 21(b) storing water;
- 21(c) impeding or diverting the flow of water in a watercourse;
- 21(d) engaging in a stream flow reduction activity contemplated in Section 36 of the Act;
- 21(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
- 21(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- 21(g) disposing of waste in a manner which may detrimentally impact on a water resource;
- 21(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- 21(i) altering the bed, banks, course or characteristics of a watercourse;
- 21(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- 21(k) using water for recreational purposes.

The proposed project will require a Water Use Authorization related to activities (c) and (i).

6.2 GENERAL AUTHORISATIONS FOR SECTION 21 (c) and (i) OF 18 DECEMBER 2009 (GAZETTE NO: 32805)

Jeffares & Green (Pty) Ltd are undertaking all processes required for obtaining a Water Use License in terms of Section 21(c) and (i) of the National Water Act (Act 36 of 1998). However, as this project is situated within an artificial wetland area, and as this project will have a negligible impact on the 500m buffer of the floodplain and as it will have a low to very low impact on the downstream wetland areas, a General Authorisation may be appropriate.

Jeffares & Green (Pty) Ltd are aware that wetland areas are excluded from the General Authorisations as published in the Government Gazette of 18 December 2009, Gazette No

32805. In terms of this document any activities that may have a potential to impact a wetland in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) are excluded. However, Jeffares & Green (Pty) Ltd requests that DWS consider a possible General Authorisation (GA), due to the nature of the project and the low impacts, as explained above.

6.3 National Environmental Management Act

New Environmental Impact Assessment (EIA) Regulations were promulgated in December 2014 in terms of Section 24(5) and Section 44 of the National Environmental Management Act (NEMA) (Act 107 of 1998) and consists of the following three (3) Regulations:

- Regulation 982 provide details on the processes and procedures to be followed when undertaking an Environmental Authorisation process;
- Listing Notice 1 (Regulation 983) define activities which will trigger the need for a Basic Assessment process;
- Listing Notice 2 (Regulation 984) define activities which trigger an Environmental Impact Assessment (EIA) process. If activities from both R 983 and R 984 are triggered, then an EIA process will be required.
- Listing Notice 3 (Regulations 985) define certain additional listed activities for which a Basic Assessment process would be required within identified geographical areas.

The above regulations were reviewed to determine whether the proposed project will trigger any of the above listed activities, and if so, what Environmental Authorisation Process would be required. The following activities which could form part of the proposed project were identified:

Listing Notice	Activity	Description
R983 / Listing Notice 1	12	The development of- xii. infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; - excluding- (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves.
R983 / Listing Notice 1	19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- i. a watercourse;

Listing Notice	Activity	Description
		but excluding where such infilling, depositing , dredging, excavation, removal or moving (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.

Eskom confirmed in writing that the realignment of the two (2) Harrismith–Munic - 42nd Hill 11kV powerlines will not trigger these listed activities as the thresholds will not be met. This project therefore does not require an Environmental Authorisation Process. Refer to Appendix H for the written confirmation from Eskom.

7 AUTHORISATION AND LICENSING PROCESSES

7.1 Water Use Authorisation Process

For the purpose of the current study, the National Water Act (Act36 of 1998) definition for wetlands was used to identify wetland environments. According to this definition, wetlands are “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface or the land is periodically covered with shallow water, and which land, in normal circumstances, supports or would support vegetation typically adapted to life in saturated soil”.

Section 21 of the National Water Act (Act 36 of 1998) defines a list of activities which require a Water Use Authorisation. The proposed project will require a Water Use Authorization related to activities (c) and (i).

Section 21(c) of the National Water Act refers to the impeding or diversion of the flow of water in a watercourse. ‘Impeding the flow' means that there will be either a temporary or permanent obstruction or hindrance to the flow of water in a watercourse, by a structure built either fully or partially in or across a watercourse. 'Diverting the flow' refers to the erection of a temporary or permanent structure, causing the flow of water to be rerouted.

Section 21(i) of the National Water Act refers to altering the bed, banks, course or characteristics of a watercourse. This means any change affecting the resource quality of a watercourse.

Where construction will take place within the areas Regulated by the DWS which includes all Riparian Areas, all areas within the 1:100 year Floodline of Rivers and Streams and all areas within a 500m radius of the delineated edge of a wetland, a Water Use Authorisation is required. Hence, an Application needs to be made to the DWS to obtain a Water Use Authorisation.

A Water Use Authorisation in terms of Section 21(c) and (i) of the National Water Act (Act 36 of 1998) would be required for this project, as the project is situated within the 500m buffer area of the delineated edge of the Floodplain Wetland.

7.2 Specialist Studies

The following specialist studies were undertaken by suitably qualified specialists:

- A Floodline Assessment undertaken by Mr Phillip Hull from Jeffares & Green (Pty) Ltd ; and
- A Wetland Assessment undertaken by Dr Martin Ferreira from Jeffares & Green (Pty) Ltd

It should be noted that Jeffares & Green (Pty) Ltd are currently also undertaking another Water Use Authorisation Process for Eskom. This other project involves the proposed construction of the Harrismith-Munic - Letsatsi 11kV powerlines which will run from the Harrismith-Munic Substation to a new transformer bay to be situated approximately 3.6km North West of the Substation.

A combined Public Participation Process was undertaken for these two projects, and combined specialist assessments were undertaken for these projects, but separate Water Use License Applications Forms and Technical Reports are compiled, as Eskom required separate authorisations for these projects.

The Specialist Reports are attached to Appendix F of this Technical Report. The Specialist Reports include the findings and recommendations for both the Harrismith-Munic - Letsatsi 11kV powerlines and for the Harrismith-Munic – 42nd Hill powerlines.

8 DESCRIPTION OF WATER USE

8.1 Water Resource Description

The study area currently falls within the Upper Vaal Water Management Area (WMA) (DWAF, 2004). It has been proposed in the National Water Resource Strategy version 2 (DWA, 2013) that the current 19 WMAs areas be consolidated into 9 WMAs. The study area will then form part of a larger WMA known as the Vaal WMA. The Vaal River system is within the economic heartland of the country and supplies the water resource needs of 60% of the national economy and serves 20 million people (DWA, 2013). The water resources in this WMA are limited and must be secured (DWA, 2013).

The Upper Vaal WMA is a pivotal WMA in the country and includes the transfer of large quantities of water into and out of the area (DWAF, 2004). The northern part of the WMA is characterised by extensive urbanisation, mining and industrial activity, while the remainder of the WMA is characterised by livestock farming and rain fed cultivation. Water resources in the area are highly developed and regulated due to the high level of urbanisation in the WMA and its pivotal role as a water transfer point. Only marginal potential for further development remains in the WMA. Climate over the WMA is fairly uniform, and the average rainfall varies between 600 mm and 800 mm per year. Groundwater is mainly used for stock watering and rural domestic needs but a substantial quantity of water is also abstracted from dolomitic aquifers for urban use (DWAF, 2004).

Table 1: Main characteristics of quaternary catchment C81E in which the study area is located.

Quaternary Catchment	C81 E
Catchment size	590.7 km^2

Mean Annual Precipitation	657.56
Mean Annual Surface Runoff	48.8
Vegetation	Eastern Free State Sandy Grassland
Desktop Ecological Importance and Sensitive*	Moderate
Desktop Present Ecological State*	C (Moderately Modified)

The study area falls within the Highveld ecoregion and the Highveld geomorphic province (Partridge et al., 2010). The Highveld is an extensive grassland region occupying the eastern interior plateau at elevations ranging from ~1200 to 1800 m. Most of the Province is drained by the tributaries and main stem of the Vaal River. The study area falls within a region north of the Vaal River. The older pre-Karoo landscape to the north of the Vaal River has greater relief as a result of slight incision of the superimposed drainage. For example, near Middelburg and Heidelberg many of the rivers follow pre-Karoo lines (e.g., the Blesbokspruit); a major exception is the Suikerbosrand River that flows across a once buried ridge (King, 1967). Much of the Province is, however, gently undulating and is dominated by the late Cretaceous African erosion surface, which remains intact on many of the broad interfluves (Partridge & Maud, 1987). The dominant drainage direction is westerly, partly because of the influence of the pre-Karoo topography, and partly because of warping along the Griqualand–Transvaal axis, whose activity was largely contemporaneous with uplift of the Ciskei–Swaziland axis (Partridge & Maud, 1987).

8.2 Conservation Status

The study area falls within a freshwater protected area (FEPA) (**Error! Reference source not found.**). The Wilge River in particular and the associated sub-quaternary catchments have been identified as River FEPA's. River FEPA's achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.

The National Freshwater Ecosystem Protected Areas (NFEPA) was completed during early 2011 and the goal of the project was to determine strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. This does not mean that the rivers cannot be used for human needs, but that the rivers should be supported by good planning, decision-making and management so that human use does not impact on the river ecosystem condition. The project outputs are in the form of numerous maps indicating various different categories that each has different management implications. These categories include river FEPA's and associated sub-quaternary catchments, wetland FEPA's, wetland clusters, Fish Support Areas and associated sub-quaternary catchments, fish sanctuaries, phase 2 FEPA's and associated sub-quaternary catchments and Upstream Management Areas (Driver et al., 2011). Although wetlands have been identified within the study area through the NFEPA project, none of these are considered to be Wetland FEPAs.

According to the Free State Department of Economic Development, Tourism, Environmental Affairs and Small Business (2012) the study area does fall within a terrestrial environment which is considered to be endangered. This is largely due to the fact that the study area is dominated by the Eastern Free State Sandy Grassland (Figure 5). The conservation target

for the vegetation type is 24%. Around 2% is statutorily conserved in the Qwaqwa and Golden Gate Highlands National Parks, as well as in the Sterkfontein Dam Nature Reserve. Almost half of the vegetation type has already been transformed for cultivation (maize), building of dams (e.g. Sterkfontein, Loch Athlone, Saulspoort).

Cirsium vulgare and *Cosmos bipinnatus* are forming spectacular displays along road verges and on old fields, *Hypochaeris radicata, Plantago virginica, Tagetes minuta, Verbena bonariensis, V. brasiliensis, Richardia brasiliensis, Guilleminea densa* and others are frequent alien invaders and diminish the agricultural and biodiversity value of these grasslands.

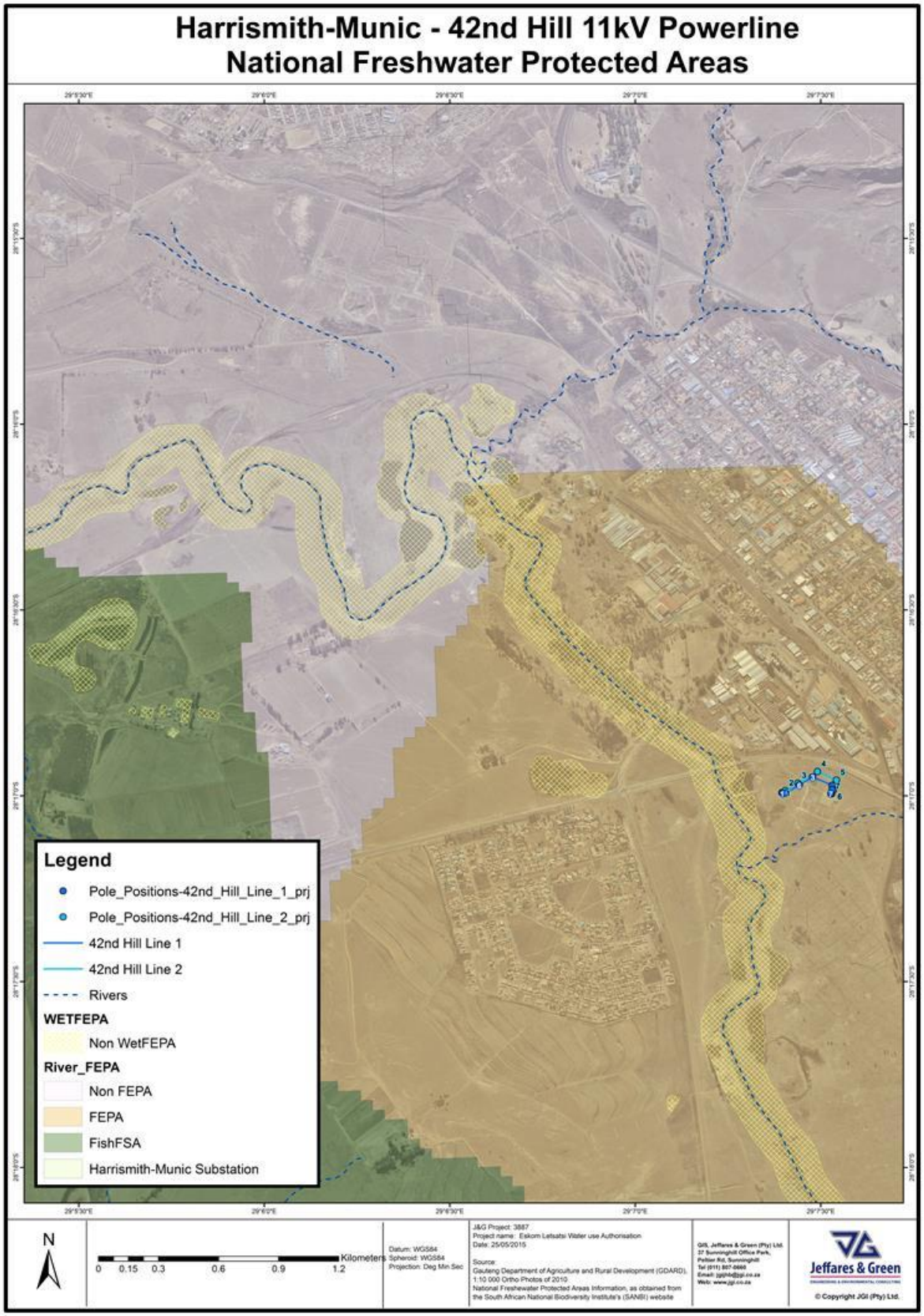

Figure 4: Map of the study area showing the extent of the project and the National Freshwater Protected Areas information

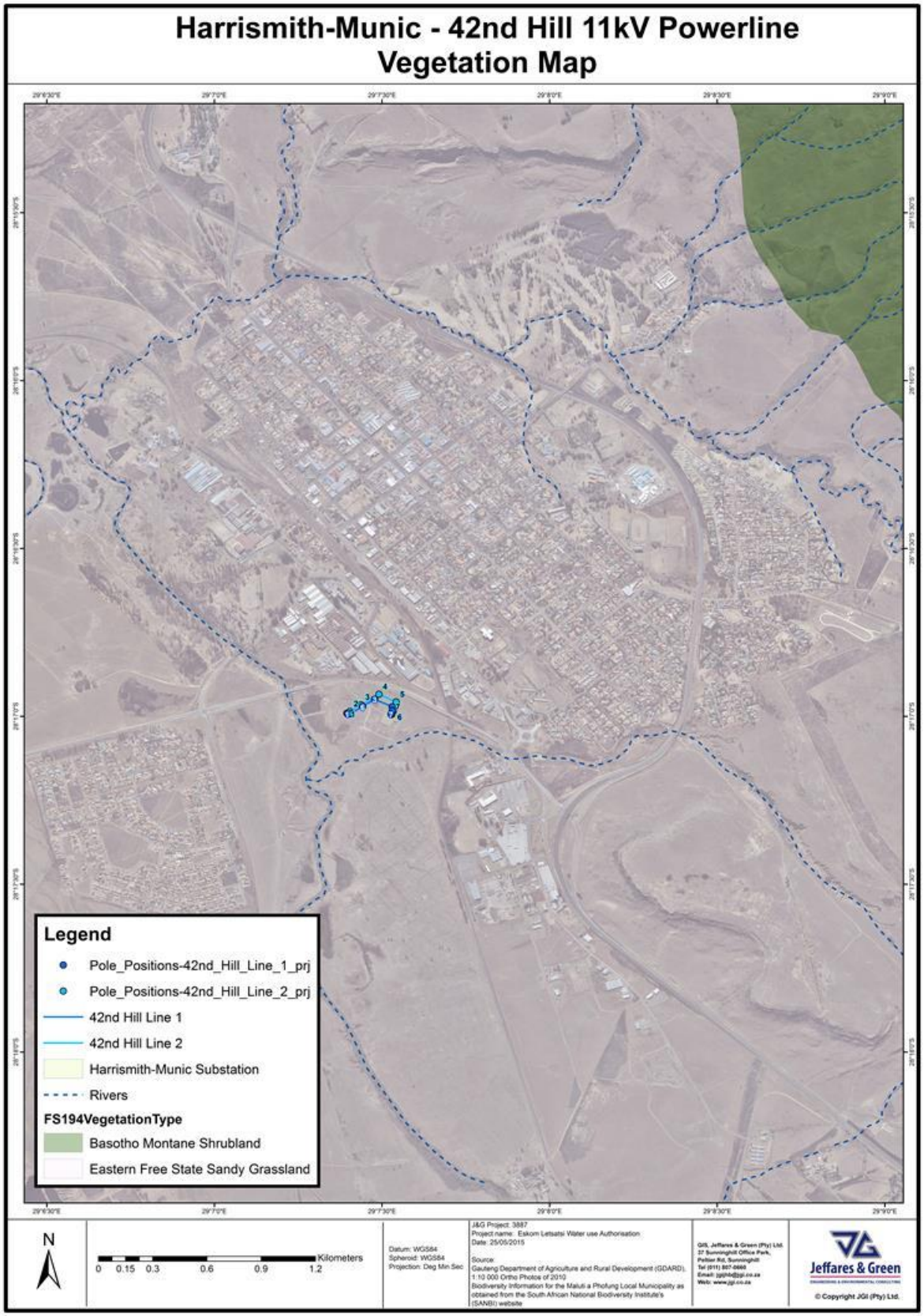

Figure 5: Map of the study area showing the extent of the project and the National Freshwater Protected Areas information

8.3 Wetlands

According to the Wetland Assessment undertaken by Dr. Martin Ferreira, two wetland types were identified in the study area. A copy of the Wetland Assessment Report is attached to Appendix F of this Water Use License Technical Report. The following wetland types were identified during the field survey:

- One (1) artificial wetland, and
- One (1) floodplain wetland.

The proposed powerlines will cross stormwater channels and an artificial wetland that has formed as a result of the stormwater channels. The artificial wetland is, however, connected to the larger floodplain identified during the study, via a channel. The floodplain wetland is the largest wetland associated with the proposed activity, the floodplain will be the only hydrogeomorphic unit (HGM) affected by the proposed activity. Please refer to Figures 11 & 12 which show the wetlands observed during the field survey, and the extent of the wetlands identified and the extent of the project. The Wetlands observed during the field survey are explained in detail below.

8.4 Artificial Wetland

An artificial wetland has formed north of the Harrismith - Munic substation. This wetland appears to have formed as a result of the accumulation of stormwater draining from the N5. Several channels were observed draining into the wetland and permanent water was also present. Although artificial, the wetland that has formed appears to play an important role in attenuating stormwater and slowing the movement of water entering the floodplain. Several channels have, however formed downstream of the wetland and the stormwater outlet, channelizing water and causing erosion of the landscape around the substation.

Figure 6: Soils observed within the artificial wetlands showing clear signs of wetness

Figure 7: The channels forming as a result of stormwater from the N5

8.5 Floodplain

The floodplain wetland is characterized by floodplain pans that have formed and which are depended on the overspill from the Wilge River as a source of water. The floodplain pans are located approximately 120m North West of the point where realignment of the powerlines will be.

Downstream of the study area, the floodplain wetland is characterized by numerous oxbow lakes that are also depended on the overspill from the Wilge River as a source of water. These lakes are situated approximately 2 m from the existing Harrismith-Munic Substation.

Cladium mariscus, Cyperus longus, Cyperus congestus, Cyperus Eragrostis, Schoeneplectus, Cyperus fastigiatus, *Phragmites,* Juncus effesus, *Juncus rigidus, Paspulum dilatatum* and *Persicaria lapathifolia* were found throughout the wetter areas within the floodplain wetland. The temporary wet areas were dominated by *Eragrostis curvula*, *Eragrostis plana, Cirsium vulgare, Stoepe vulgaris, Themeda trianda, Asclepias physocarpa*, *Berkheya* sp, *Verbena bonariensis, Datura stramonium, Bidens pilosa*, *Cirsium vulgare*, , *Helichrysum sp.*

Along the banks of the Wilge River *Eucalyptus* sp, *Salix babylonica* and *Salix fragilis* dominated, with *Quercus robur* and G*leditsia triacanthos* also present in lower abundances.

In the very wet areas such as the floodplain pans, Kroonstad and Katspruit soils dominated while the more temporary wet areas were dominated by Avalon and Westleigh soil forms. The realignment of the Harrismith–Munic - 42nd Hill 11kV powerlines is proposed to be located within the 500m buffer of the floodplain wetland.

Figure 8: A section of the Wilge River

	
Figure 9: Sample collected in the floodplain wetland with an orthic A topsoil with an E horizon indicating clear signs of wetness.	**Figure 10: Soil sample collected in the floodplain wetland with an orthic G Horizon indicating clear signs of wetness.**

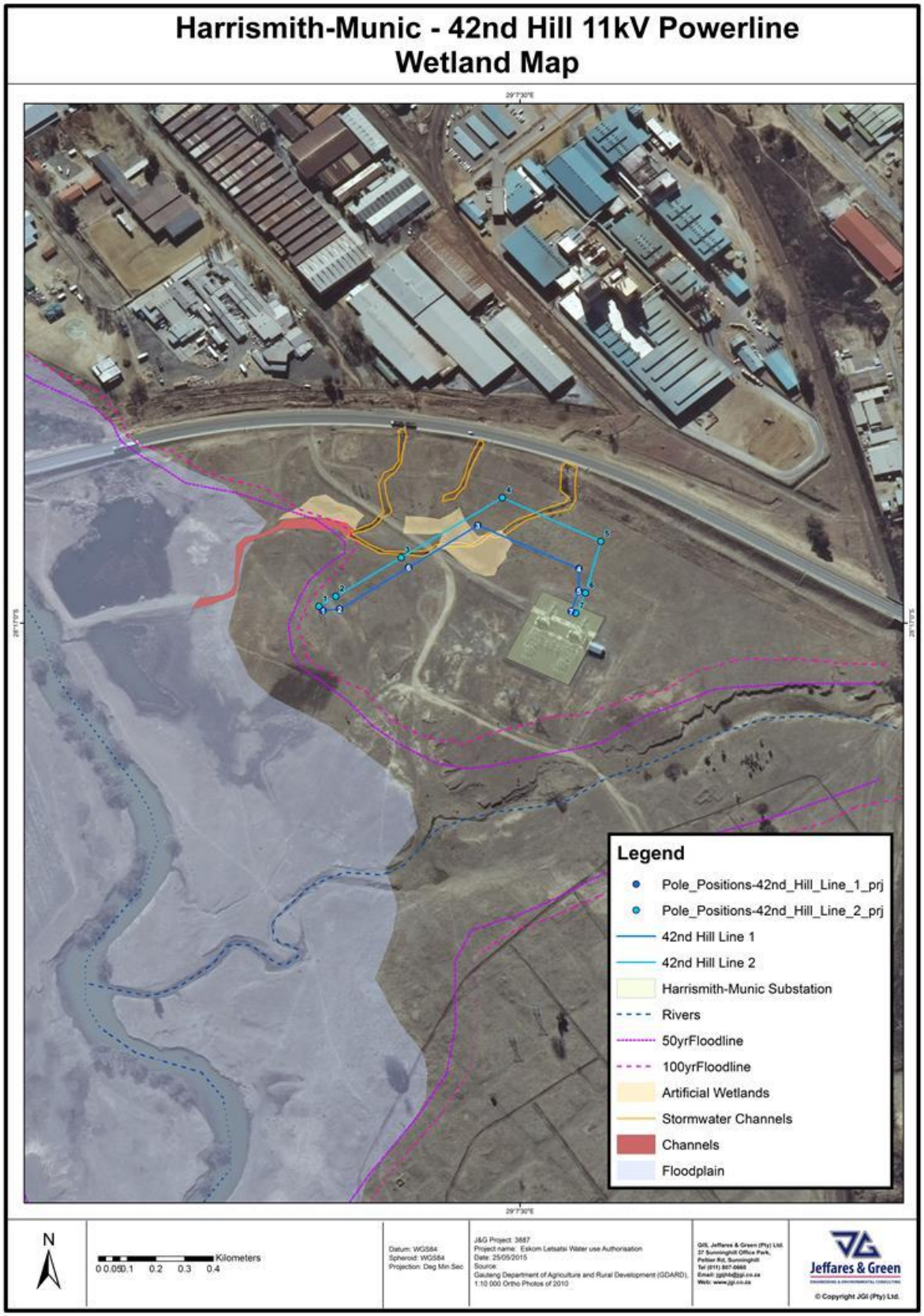

Figure 11: Map indicating the various wetland types observed during the field survey

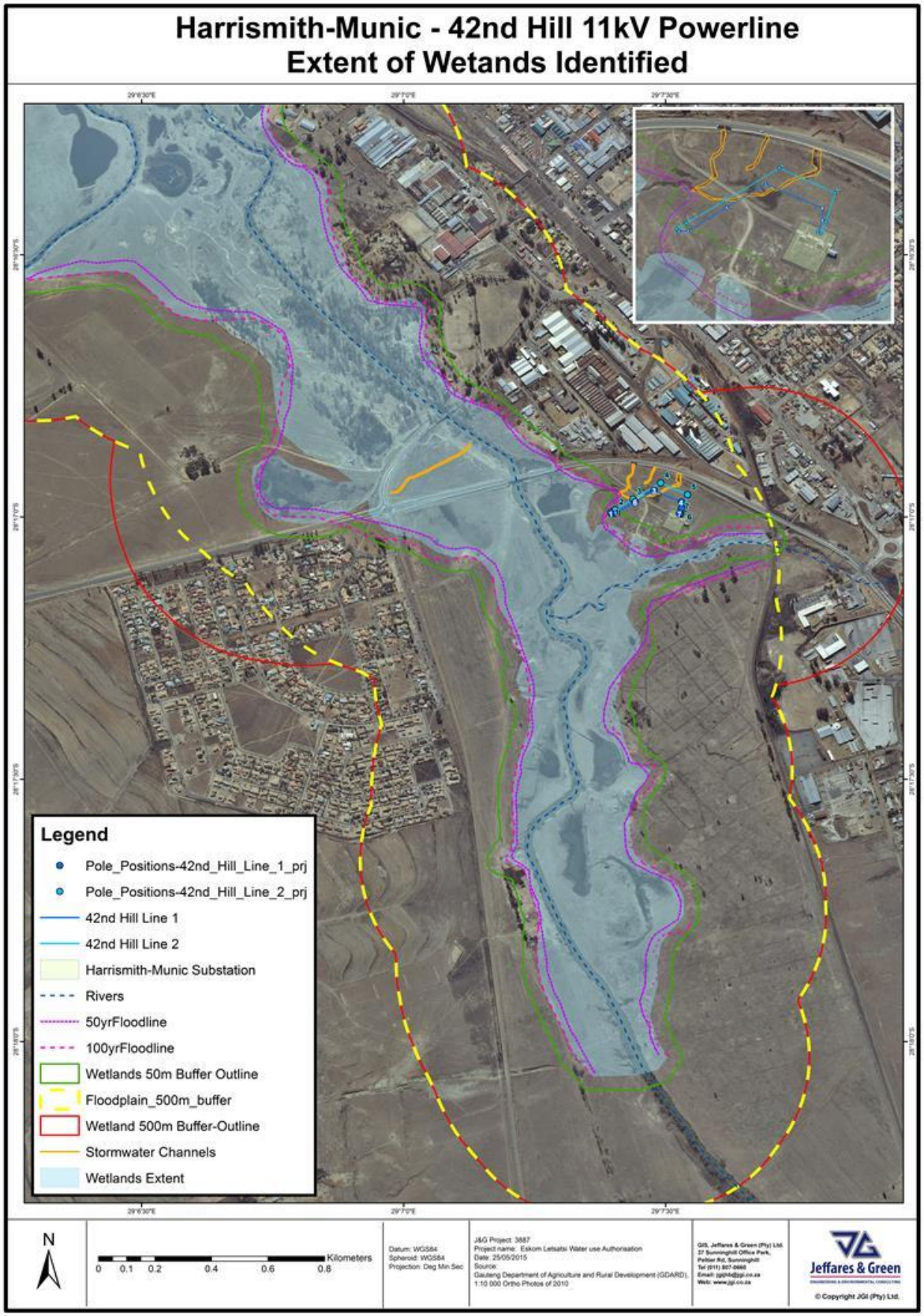

Figure 12: Map showing the extent of the wetlands identified and the extent of the project.

8.6 Water Use Motivation

As mentioned previously, the existing Harrismith-Munic Substation currently only has one circuit breaker which feeds a double circuit (1HMF & 2HMF), as explained in Section 1 of this Report. Should a fault occur at either one of these feeders, none of the feeders will be operational. When such a fault occurs both feeders needs to be inspected before closing the breaker. The inspections of both the feeders are time consuming and therefore the power outage time is prolonged. This contributes to the poor performance of the Bethlehem field service area. In addition, the circuit breaker is situated inside the Municipality's Substation (The Maluti-a Phofung Local Municipality). The Municipality has full access to operate this breaker, while Eskom employees are working on the line, which poses a safety risk to the Eskom employees. In order to solve these issues, each of the HM feeders must have its own breaker. The proposed construction of the Harrismith-Munic 42nd Hill 11kV powerlines will therefore improve safety to Eskom employees and the public. It will also improve the performance of the Bethlehem service area, which in turn will ensure an improved quality of electricity supply to customers.

According to the Wetland Assessment undertaken by Dr Martin Ferreira the following features are situated within the study area:

- Stormwater channels which formed to the North West of the Substation between the substation and the N5. These channels formed as a result of runoff form the N5. The existing section of the Harrismith-Munic – 42nd Hill powerlines to be realigned traverses some of these stormwater channels, and the new lines will also traverse some of these channels;
- An Artificial Wetland which formed as a result of the stormwater channels and the continuous stormwater runoff from the N5, and has formed next to the Harrismith-Munic substation. The existing section of the Harrismith-Munic – 42nd Hill powerlines to be realigned traverses all this Artificial Wetland, and the new lines will also traverse this Artificial Wetland; and
- A Floodplain Wetland associated with the Wilge River, which is the most important wetland type identified during the study. The proposed realignment of the existing powerlines will be constructed within a 500m radius of the delineated edge of this Floodplain Wetland.

The artificial wetland is connected to the larger floodplain identified during the study via a channel. Due to the fact that the wetland directly impacted on is artificial, the current Present Ecological State (PES) of the artificial wetland associated with the Harrismith-Munic – 42nd Hill powerlines could not be determined as the WET-Health and WET-EcoServices tools were not developed for assessing artificial wetlands. The proposed powerlines are to be constructed within a 500m radius of the delineated edge of the Floodplain wetland. However the proposed realignment of the powerlines will not have a direct impact on the water quality of the Floodplain Wetland, but could have a downstream impact as construction activities may cause pollution of the downstream environment. The project may also have an impact on the study area in the form of a potential change in hydrology, geomorphology and vegetation. The risk of any impact occurring is low to very low, as powerlines and a substation already exist within the study area. Mitigation measures have been provided in this Water Use License Technical report, as obtained from the Wetland Assessment Report compiled by Dr Martin Ferreira. These mitigation measures should be applied to avoid any negative impact on the receiving environment.

8.7 Project Phase Description

8.7.1.1 Construction phase

The route will be accessed via existing roads and tracks where possible. The excavations for the new powerlines route will be done by an auger drill. Only where site conditions require, new structures and stay excavations this will be done by hand. The wooden poles will be lifted and mounted using a truck mounted crane. As per the recommendation provided in the Wetland Assessment undertaken by Dr Martin Ferreira, It is recommended that powerlines are erected using a pilot cable for stringing purposes. This will avoid additional movement of heavy vehicles. A copy of Eskom's Construction Method statement for the Harrismith–Munic-42nd Hill 11kV lines is attached to Appendix F of this report. A summary of the method statement for the planting and compaction of poles is provide below

The following Eskom Procedures will be followed for the pole planting and pole compaction:

- *Eskom's Procedure for Conventional stay planting and compaction, pole planting and compaction, and Rock Anchor installation and testing DSP 34-1657).*

The excavation depth for a standard wooden pole (11m in height), is 1.8 meters (m) deep. The first 500mm (0.5m) of the excavation will have a diameter of 1.2m (1,200mm). The remaining 1.3m of the excavation will have a diameter of 600mm. A diagram (Figure 13) is provided below to illustrate the excavation dimensions.

The lower portion of the excavation (1.3m deep section) will be back filled with a select soil that is a Type 2 soil (refer to explanation below) or better. This backfilled section will be compacted in 150mm layers with a hand compacter weighing not less than 12kg. he lower portion of the excavation for wooden poles is generally not backfilled with concrete, as poles easily becomes rotten under such conditions. Where site conditions are poor, a concrete ring will be placed around the lower excavated sections. The upper section of the excavation (500mm deep section) will be backfilled with an imported soil that is moistened and thoroughly mixed with two (2) pockets of 50kg Portland cement.

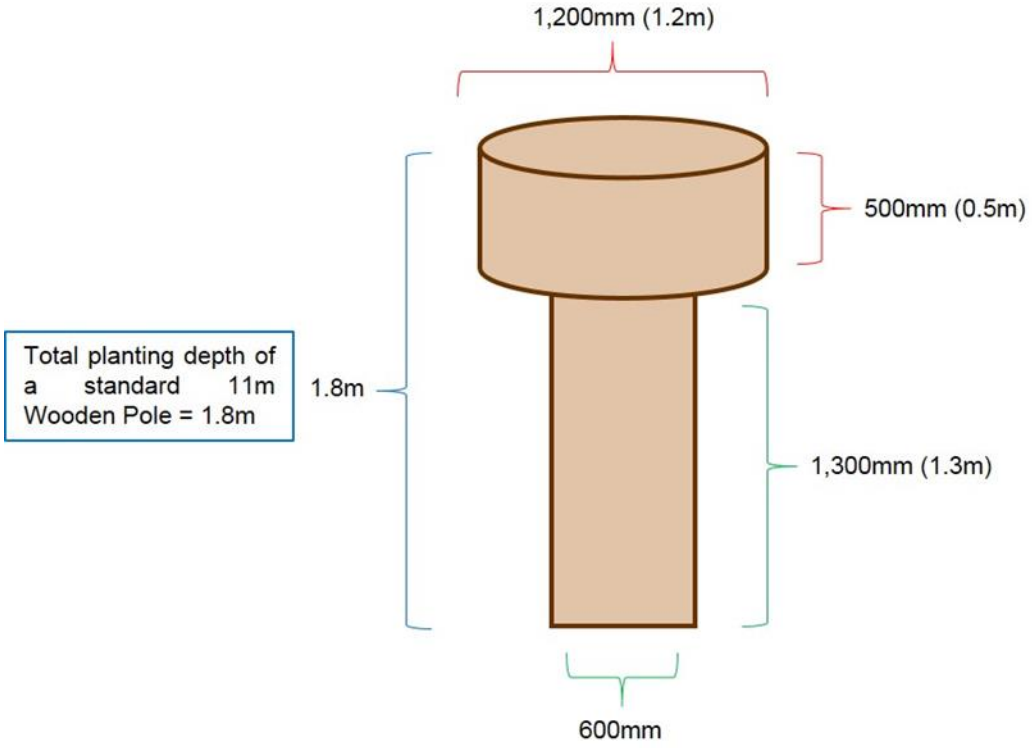

Figure 13: Cross Section View of Planting Wooden Poles

Table2: Compaction methods for different soil types

Soil Type	Method
1. Type 1 and 2 soils (stiff cohesive soils or medium dense cohesion less soils)	After the poles have been planted to the required depth, the soil used for backfilling will be slightly moistened such that if the soil is held in the hand and squeezed it shall stay compacted after opening the hand. This ensures the moisture content is correct therefore enduring best possible compaction.
2. Type 3 and 4 soils (non clay)	Excavated non clay soil will be slightly moistened such that if held in the hand and squeezed it stays compact after opening the hand
3. Type 3 and 4 (Clay/Turf Type Soils)	If the soil removed from the hole is clay, an import soil will be used to backfill the hole which will either be a type 2 soil or a G5 road material.
4. Water logged holes (type 3 and 4 soils)	Should the hole be water logged, the water will be removed before the soil is replaced an import soil shall be used to backfill the hole either with type 2 soil or G5 road material.

The following recommendations as provided in the Wetland Assessment undertaken by Dr Martin Ferreira, will be adhered to during the construction phase:

- Cement must be mixed in a demarcated area and not in wetlands or buffer zones. Any mixing of cement must be undertaken on an impervious surface;
- Movement of contractors and vehicles within wetlands and riparian areas should be minimised to avoid compaction of sediment and water pollution. Vehicles should also be serviced on a regular basis to avoid leaks and spills;
- If soil is used that has been brought in from external sources it should not be stockpiled within the wetland area. The use of soil from outside the wetland should be kept to a minimum.

8.8 Project Description

The project includes the realignment of a section of the two (2) Harrismith-Munic - 42Hill 11kV powerlines over a distance of approximately 350 metres (m). Maximum span lengths between poles can be 90-100m for an 11kV hare line. Each of the realignment sections will consist of six (6) poles. Bird friendly wooden pole structures will be used. Both lines will exit the Harrismith-Munic substation from a new feeder bay and busbar to be situated along the northern boundary of the substation and will run in a northern direction for approximately 60m where after the lines will turn to run in a north western direction for approximately 103m. The lines will then turn in a south western direction for approximately 160m until they tie up with the existing Harrismith-Munic – 42nd Hill 11kV powerlines. As per the Wetland

Assessment undertaken for the Harrismith-Munic – 42nd Hill 11kV powerlines, the powerlines will cross stormwater channels and an artificial wetland.

8.8.1.1 Access Roads

Existing roads will be used for access to the construction areas, and no other access roads or deviations will be made across wet areas by any person or vehicle. Vehicle activity and movement will be limited to the existing roads and servitude area. Footprint damage will be kept to a minimum and vegetation clearance will be limited purely to the servitude route and done where necessary. Vegetation will be removed in sections, as construction is taking place, and should not be removed throughout the extent of the construction area.

8.8.1.2 Excavation and stockpiling of soils in water logged areas, riparian habitats and buffer zones:

According to Eskom's Construction Method Statement, all excavated soils that are stockpiled will be adequately bunded by suitable materials around the entire circumference of the stockpile as an erosion control measure from wind, water and animals. Topsoil will be stockpiled separately from the subsoil. When reinstating or backfilling the soil the sub-soil layer will be backfilled first followed by the topsoil layer. Soils from separate areas will be kept separate and where backfilling is necessary the soil will be returned to the area from where it was taken. Any construction material e.g. unearthed poles will not be left lying in wetland areas when there is no work being done. Where possible, material lying in the wetlands will be kept to a minimum. Storage of materials will be away from wetland areas.

8.9 Rehabilitation Phase

The following activities will be undertaken during the rehabilitation of relevant parts of the site after completion of all construction activities, namely:

- All temporary stockpile areas, litter and rubble to be removed on completion of construction; and
- Where the removal of alien species may have left soil exposed, appropriate wetland/endemic plants should be established. Areas where vegetation has been removed during the construction phase will be re-vegetated.

8.10 Operational phase

During the operational phase maintenance on the powerlines and vegetation monitoring and management will be undertaken within the servitude area. Maintenance on the powerlines will be conducted in accordance to Eskom's Guideline for the routine inspection and consequential maintenance of high, medium and low voltage powerlines (DISAGABF5). The guidelines are attached to Appendix H of this report. Mitigation measures as per Section 11.11 of this report will be considered when undertaking maintenance activities.

8.11 Decommissioning

The proposed powerlines will be permanent structures and it is not envisioned that these structures will be decommissioned in the near future. Should these lines ever be

decommissioned, a Wetland Rehabilitation Plan should be compiled by a suitably qualified specialist, and should be submitted to the Department of Water and Sanitation for review and approval.

8.12 Technique to be used to undertake the water use

Refer to Section 8.7.1.1.

8.13 Safety issues in terms of public, livestock and properties

The property on which the new powerlines will be routed is owned by the Maluti a Phofung Local Municipality. The study area is situated adjacent to the N5. The land use in the area predominantly comprises of vacant grassland. The construction of a housing development is currently underway; the housing development is situated in a South Easterly direction from the study area. A commercial/industrial area is situated North West of the study area. The following safety measures would be put in place to protect the safety of the public, livestock (if applicable) and other properties:

- Hazardous material and chemicals would not be kept or handled within wetland and riparian areas. Hazardous substances will be kept in a demarcated area on an impervious surface. Any spillages from hazardous material would be cleaned immediately and transported to a landfill site that accepts hazardous material;
- All potential hazardous or polluting materials will be stored within the fenced off materials area, as far away from oncoming traffic and from drainage inlets;and
- Vehicle operators would be suitably licensed and have had appropriate environmental and safety induction, are aware of specific site procedures, and are well rested and cognisant when operating heavy or unsafe vehicles / machinery.

8.14 Timing and duration of the various development phases

The duration of the construction phase is expected to be approximately one (1) month.

8.15 Design drawing(s) of any structures to be built

Design drawings and specification of the poles to be used in the proposed construction are attached to Appendix D of this report.

8.16 Proximity of the development to the floodline

A Floodline Delineation study was undertaken by Mr Phillip Hull from Jeffares & Green (Pty) Ltd for a section of the Wilge River, which is located on the outskirts of Harrismith in the Free State Province. The Report compiled by Mr Hull is attached to Appendix F of this Technical Report. The peak discharge values calculated for the Wilge River, Nuwejaarspruit River and two additional unnamed tributaries in the vicinity of the floodline study area, were used to hydraulically simulate the 1:50 and 1:100 year return period floodlines. The hydraulic modelling was undertaken using the HEC-RAS hydraulic model. This model provided flood high water levels and flow velocities associated with the calculated peak discharge values. The resultant floodlines where plotted using the Geographic Information System (GIS) and HEC-geoRAS. The results indicated that the 1:50 and 1:100 year floodlines are extensive, ranging from 400 m wide to 1 250 m wide. These flood events are, however, associated

with relatively low flow velocities (less than 1 m/s) and low Froude numbers (less than 0.2). Froude Number is a dimensionless value that describes different flow regimes of open channel flow. This is largely due to the flat nature of the Wilge River in the vicinity of the proposed powerlines. The plotted floodlines indicate that the proposed Harrismith-Munic - 42nd Hill powerlines will be located outside of the delineated floodline. Please refer to Figure 14, which depicts the 1:50 and 1:100 Year Floodline Delineation Results.

8.17 The effect of the project on the floodlines and flood management

According to the Wetland Assessment conducted by Dr Martin Ferreira, the proposed realignment of the powerlines will cross stormwater channels and an artificial wetland that has formed as a result of the stormwater channels. In addition, the study area borders onto a Floodplain Wetland associated within the Wilge River. The proposed realignment of powerlines will occur within 500m of the delineated edge of this wetland. The proposed realignment of the powerlines will be situated outside of the delineated floodline. Due to the fact that the proposed project is the realignment of an existing powerline, the impact of the project on the floodline and flood management is not considered significant.

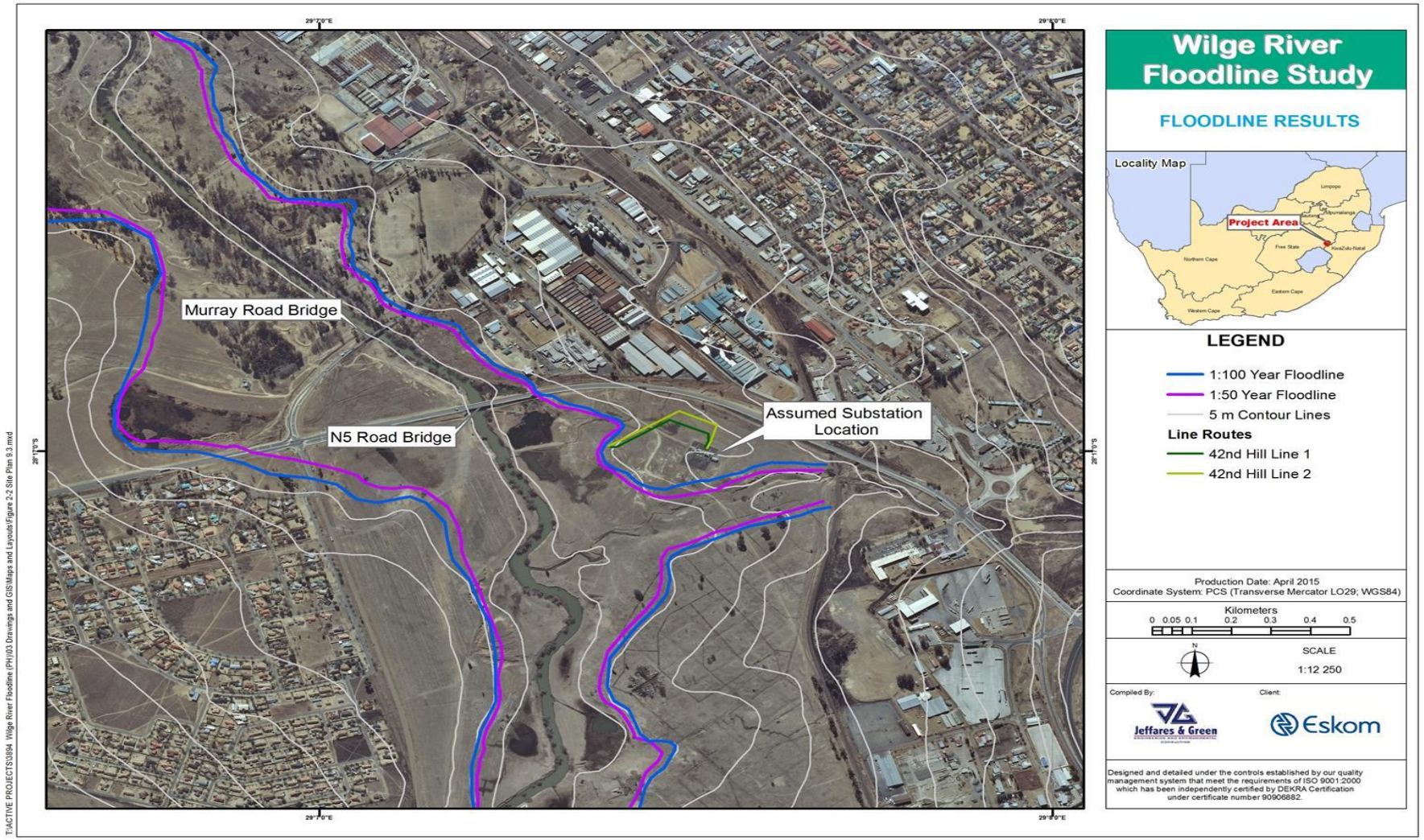

Figure 14: 1:50 and 1:100 Year Floodline Delineation Results

8.18 Stormwater management

The realignment of the Harrismith–Munic – 42nd Hill 11kV powerlines will not have an effect on stormwater, as the powerline is elevated and the poles don't have a footprint over the length of the line. The Harrismith–Munic Substation already exists and therefore no concrete foundations will be constructed.

8.19 Effect on water quality and water flow

According to the Wetland Assessment conducted by Dr Martin Ferreira, changes to the water quality could result in changes to the ecosystem structure and function as well as a potential loss in biodiversity. Water quality pollution often leads to modification of the species composition where sensitive species are lost and organisms tolerant to environmental changes dominate the community structure.

The proposed realignment of the powerlines will not have a direct impact on the Floodplain wetland but could have a downstream impact as construction activities may cause pollution of the downstream environment, for example, any spills of hazardous substances, vehicle oils or grease leakages could be carried to the downstream environment. Inappropriate storage of hazardous substances used during construction can either lead to them being washed into the wetland or can filter into the groundwater, indirectly affecting the water quality of the wetlands identified within the study area.

An increase in flow velocity in the floodplain wetland and the artificial wetland will lead to erosion and long term hydrological changes. The wetlands that were observed during the field survey already showed signs of erosion. This is largely due to poor catchment management. The proposed project includes the realignment of two of the Harrismith-Munic – 42nd Hill powerlines. Each powerline will consist of seven (7) poles each. Therefore a total of fourteen (14) poles will be planted. The footprint of the proposed projected was calculated using the following Area formula:

$$A = \pi r^2$$

$$A = (3.14)(0.6)^2$$

$$A = 1.13m^2$$

The footprint of one (1) pole was calculated to be 1.13m^2. The footprint of all fourteen (14) poles was calculated as 1.13m^2 x 14 =15.82m^2. Therefore the footprint of the proposed two 11kV powerlines is approximately 15.82m^2. Since the project includes the realignment of existing powerlines and the footprint of the project is relatively small, the impact on water quality and water flow is considered very low.

8.20 Effect on migration of biota

The proposed realignment of the powerlines will not have a direct impact on the Floodplain Wetland but could have a downstream impact as construction activities may cause pollution of the downstream environment of the floodplain wetland. The proposed project will not have an impact on the Wilge River and therefore the effect on the migration of biota in the Wilge River is not applicable.

8.21 Erosion protection, stabilisation and rehabilitation measures

Erosion was observed near the Harrismith-Munic substation. The area south of the substation is also severely eroded with large exposed areas. This exposed areas will also contribute to sediment loads within the Wilge River. The Floodplain Wetland already shows signs of erosion as observed during the field survey. This is largely due to poor catchment management. Since erosion is already evident in the Floodplain Wetland and near the Harrismith-Munic substation, the proposed realignment of the powerline will have a low to very low impact on the geomorphology of the study area. The following mitigation measures will however be implemented:

- Erosion protection must be used in all areas where erosion may occur. Selected areas may require rehabilitation and stabilisation prior to construction.

8.22 Materials to be used to perform the water use

Bird friendly wooden poles (11meters in height) will be used. The poles will be backfilled with a soil/cement mixture. If poor soil conditions are present import soil will be used. The soil/cement mixture includes import soil (if necessary) that is moistened and thoroughly mixed with two (2) pockets of 50kg Portland cement. Hare conductors will be used for the construction of the powerlines. However, according to recommendations in the Wetland Assessment report, if soil is used that has been brought in from external sources it should not be stockpiled within the wetland area and the use of soil from outside the wetland should be kept at a minimum.

9 ENVIRONMENTAL ATTRIBUTES

9.1 Environmental Description

All environmental attributes related to the water resource is discussed in detail below. Please refer to Sections 9.2 to 9.10 below.

9.2 Water quality

In terms of the *Overview of Water Resources Availability and Utilisation, Upper Vaal Water Management Area*, compiled by the Department of Water Affairs in 2003, the surface water within the Upper Vaal Water Management Area is of good quality, particularly in streams situated in the north-western parts which receives flow from the dolomitic aquifers in the region. However, the large quantities of urban, mining and industrial effluent, together with urban stormwater, have a major impact on the water quality of some tributaries in the North Western part of the water management area (e.g. Waterval, Blesbokspruit, Natalspruit, Klip) and particularly on the Vaal River downstream of the Vaal Dam (DWAF,2003). Changes to the water quality could result in changes to the ecosystem structure and function as well as a potential loss in biodiversity. Water quality pollution often leads to modification of the species composition where sensitive species are lost and organisms tolerant to environmental changes dominate the community structure.

Any spills of hazardous substances, vehicle oils or grease leakages will be carried to the downstream environment. These pollutants can have a negative impact on the downstream environment as they can react with other compounds in the water to form different pollutants,

thus changing the quality of aquatic life. Inappropriate storage of hazardous substances used during construction can either lead to them being washed into the wetlands or can filter into the groundwater, indirectly affecting the water quality of the wetlands identified on site.

9.3 Fauna

Apart from birds no other faunal species were observed during the site visit undertaken by the wetland specialist. However should any faunal species be encountered, the following measures to ensure minimal impact as documented in Eskom's construction method statement will be implemented. The construction method statement is attached to Appendix H of this report.

- Any animal in the wetland area will be left undisturbed as much as possible;
- All excavated soils that are stockpiled will be adequately bunded by suitable materials around the entire circumference of the stockpile as an erosion control measure from wind, water and animals; and
- The footprint area of construction should be limited to what is absolutely essential to avoid excessive damage/disturbance.

All mitigation measures indicated in the Wetland Assessment undertaken by Dr Martin Ferreira will be applied to avoid any negative impact on the receiving environment.

9.4 Flora

Wetland vegetation plays an important role in providing various direct and indirect services and thus an important component to consider in wetland health. Some vegetation in the study area has been lost through hardened surfaces and infrastructure as a substation and powerlines already exists. The larger catchment remains mostly untransformed with few crops. This will lead to reduced surface roughness, which will lead to additional geomorphological and hydrological impacts. There is a risk of increased abundances of exotic shrubs due to the disturbance of topsoil. Vegetation will be removed during the construction phase, and further loss of vegetation could occur as a result of indirect impacts from changes in the hydrology and geomorphological changes. According to the Wetland Assessment undertaken by Dr Martin Ferreira the seasonal and permanently wet areas were dominated by *Persicaria lapathifolia, Cyperus congestus, Cyperus longus, Juncus effesus*, and *Papalum dilatatum*. The temporary wetted areas and boundaries of the wetland were dominated by *Eragrostis curvula, Eragrostis plana, Asclepias physocarpa*, *Berkheya* sp. and *Verbena bonariensis.*

9.5 Hydrology

The hydrology refers to the movement and the distribution of water within the Floodplain Wetland and the Artificial Wetland. The hydrology has already been altered since powerlines and a substation already exist in the study area. The powerlines will be situated in the vicinity of an artificial wetland, and a floodplain wetland. Although artificial, the wetland that has formed appears to play an important role in attenuating stormwater and slowing the movement of water entering the floodplain. Several channels have, however formed downstream of the artificial wetland and the stormwater outlet, channelizing water and causing erosion of the landscape surrounding the substation.

9.6 Wetlands

Please refer to Section 8.3 of this report, for a description of the wetlands identified during the Wetland Assessment undertaken by Dr Martin Ferreira.

The proposed realignment of the powerlines will not have a direct impact on the water quality of the Floodplain Wetland but could have a downstream impact as construction activities may cause pollution of the downstream environment. However, this impact is expected to be low to very low, with the implementation of mitigation measures. The project will also have an impact on the study area in the form of a potential change in hydrology, geomorphology and vegetation. The risk of any impact occurring is low to very low, as powerlines and a substation already exist within the study area. Mitigation measures have been provided in this Water Use License Technical report, as obtained from the Wetland Assessment Report compiled by Dr Martin Ferreira. These mitigation measures should be applied to avoid any negative impact on the receiving environment.

9.7 Geology and Soils

According to Mucina and Rutherford, (2006), the area is characterized by mudstones, sandstones and shale of the Beaufort Group (Tarsastad Formation in the South and Adelaide Formation in the North). Glenrosa, Bonheim, Avalon and Mayo soil forms dominate the outcrops and slightly elevated areas while Sepane, Arcadia and Rensburg soil forms are typical for moist bottomlands. The Wetland Assessment undertaken by Dr Martin Ferreira identified several channels draining into the wetland and permanent water was also present. The 42nd Hill line crosses these channels. As a result, the soil indicated clear signs of wetness with numerous red-orange mottles observed in the upper 10 cm and an extensive grey matrix.

The geomorphology (soils) will be altered during the construction phase. Soils will be compacted due to the movement of contractors, and will also be excavated for pole construction purposes. Where site conditions allow the pilot cables used for stringing purposes will be pulled along the line route with a 4x4 tractor, van or similar suitable vehicle otherwise it will be hand pulled by hand as the use of heavy vehicles within the wetland areas could potentially cause further compaction of wetland soils.

Soils will be compacted due to the movement of contractors, as well as removed for the placement of the poles. Soils excavated and stockpiled during the construction phase which is not used for backfilling or rehabilitation purposes should be removed from site, as these soil stockpiles may wash down during rainfall events, potentially increasing the availability of soils within the wetland area. Imported soils will also be used during the construction process. These soils could potentially alter sediment structures within the wetland and could also be more susceptible to erosion.

9.8 Topography

The study area is characterised by flat to slightly undulating and undulating terrain with streams and rivers that drain the foothills of the Drakensberg. The N5 road is situated adjacent to the study area. The N5 road cutting has caused the accumulation of storm water draining from the N5 road, causing the formation of several stormwater channels. According to the Wetland Assessment undertaken by Dr Martin Ferreira, very few hardened surfaces were observed during the field survey. In addition very little infilling, gullies and exposed soil

were observed in the study area in general. Due to few changes in land use, the surface roughness also appear to be largely natural.

9.9 Aesthetics

The study area is situated adjacent to the N5. The land use in the area predominantly comprises of vacant grassland. The Harrismith-Munic substation and the existing Harrismith –Munic – 42nd Hill line forms part of the study area. The construction of a housing development is currently underway, the housing development is situated in a South Easterly direction from the study area. A commercial/industrial area is situated North West of the study area. During construction, the removal of vegetation, construction equipment, stockpiles and activities undertaken during the construction phase may have a negative visual impact on the adjacent residential area. No visual impact will occur during the operational phase of the project, as maintenance activities undertaken include the inspection of the powerlines.

9.10 Land Use and Infrastructure

The study area is situated adjacent to the N5. The land use in the area predominantly comprises of vacant grassland. The construction of a housing development is currently underway, the housing development is situated in a South Easterly direction from the study area. A commercial/industrial area is situated North West of the study area. The proposed project includes the realignment of the powerline and the refurbishment of the Substation, new feeder breakers and breaker bays will be installed. This will improve the current electricity supply of the area. Therefore the proposed project will have a positive impact on the land use and infrastructure of the study area.

9.11 Socio-economic components

9.11.1.1 Employment Status of Household Head

The proposed project is located within the Maluti a Phofung Local Municipality. The project will fall within the jurisdiction of Ward 6 of the Maluti a Phofung Local Municipality. The 2011 Census data as obtained from the Stats SA Website (http://interactive.statssa.gov.za/superweb/login.do) was used to obtain the following information. According to the 2011 census survey the following population numbers were documented:

Table 3: Population figures

Geographical Area	Total Population
Free State Province	2,745,590
Maluti a Phofung Local Municipality	335,784
Ward 6	12,089

The Maluti a Phofung Local Municipality had a total population of 335,784 people during the time of the 2011 census survey. A total population of 12,089 people were recorded for Ward

6. A total of 34.07% of persons in Ward 6 were employed in 2011, and a total of 3.07% were unemployed in 2011. A breakdown of the employment status for Ward 6 is provided below. The graph below depicts a comparison between the Free State province, the Maluti a Phofung Local Municipality and Ward 6 of the Maluti a Phofung Local Municipality.

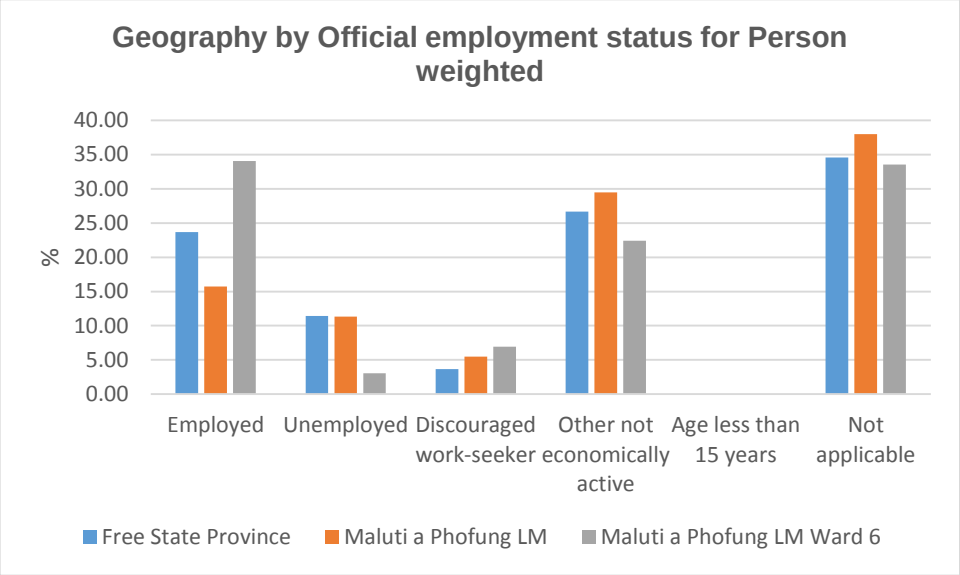

Figure 15: Official Employment status

9.12 Income Status

A breakdown of the individual monthly income for the total population of the, Free State province, the Local Municipality and Ward 6, as recorded during the 2011 census survey is provided below:

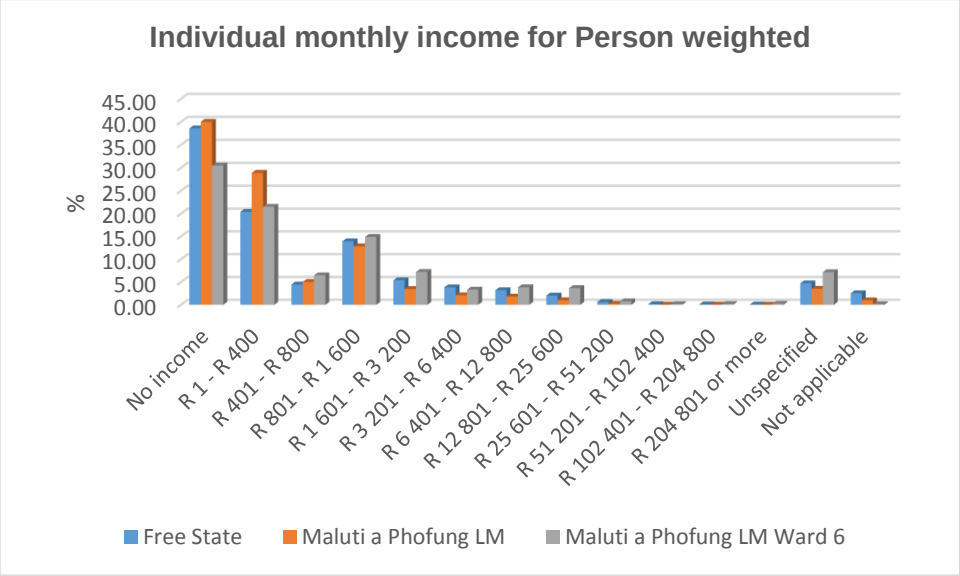

Figure 16 Individual Monthly Income

9.13 Education Level

A breakdown of the education level for the total population of the Free State Province, the Local Municipality, as well as Ward 6, as recorded during the 2011 census survey is provided below. In Ward 6 a total of 983 individuals (14.94 %) have completed Grade 12/Std 10, and 406 individuals (6.17 %) have no schooling.

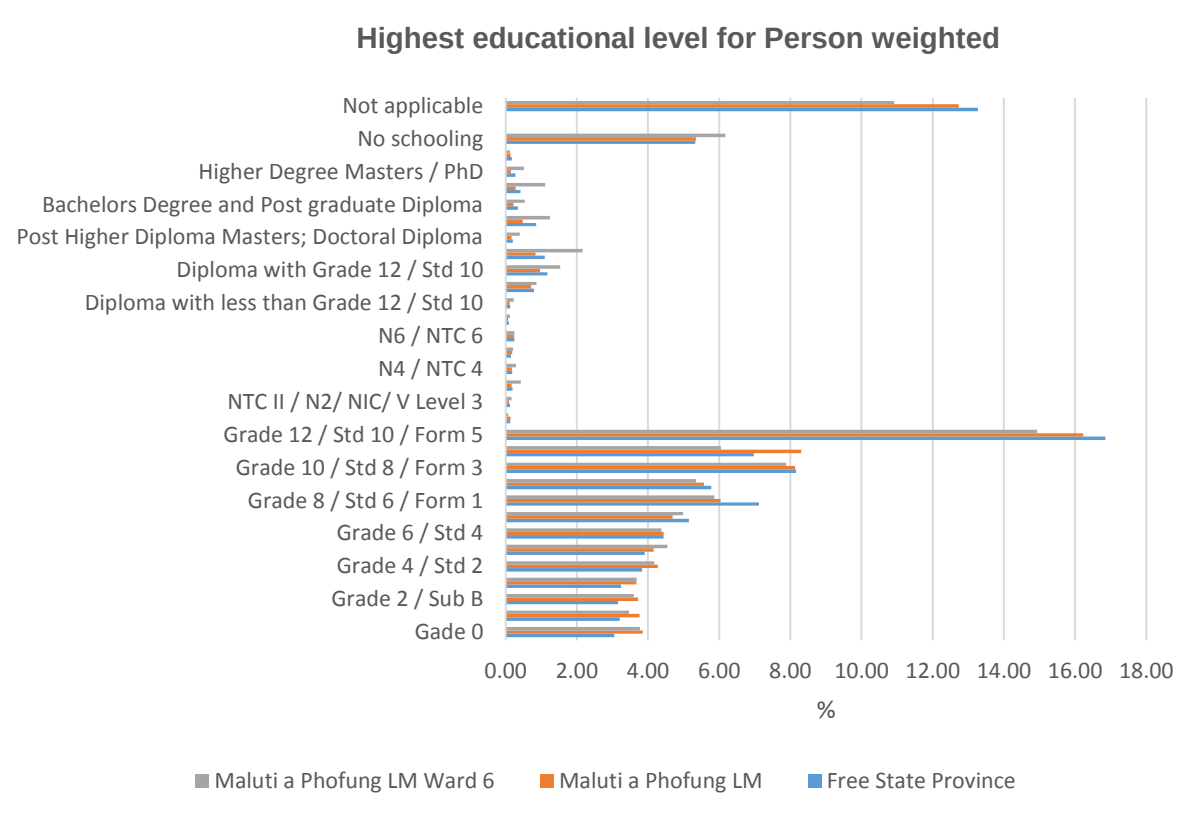

Figure 17: Education Level

9.14 Energy or Fuel for Lighting

In terms of the 2011 Census data, as obtained from the Statistics South Africa Superwed site, only 74.04% of the total population within ward 6 use electricity for lighting up their households. The table below provides a breakdown of the energy or fuel for lighting as recorded during the 2011 census survey.

Energy or fuel for lighting for Household weighted			
Energy Source	**Free State Province**	**Maluti a Phofung LM**	**Maluti a Phofung LM Ward 6**
Electricity	98.92%	89.04%	74.04%
Gas	0.02%	0.11%	0.59%
Paraffin	0.23%	1.07%	0.89%
Candles (not a valid option)	0.80%	9.41%	21.92%
Solar	0.02%	0.19%	2.27%
None	0.01%	0.19%	0.30%

9.15 Energy or fuel for cooking

In terms of the 2011 Census data, as obtained from the Statistics South Africa Superwed site, only 65.45% of the total population within Ward 6 use electricity for cooking. The table below provides a breakdown of the energy or fuel for cooking as recorded during the 2011 census survey.

Energy or fuel for cooking for Household weighted			
Energy Source	**Free State Province**	**Maluti a Phofung LM**	**Maluti a Phofung LM Ward 6**
Electricity	84.49%	81.04%	65.45%
Gas	2.90%	3.23%	7.65%
Paraffin	7.63%	8.73%	3.41%
Wood	3.40%	4.41%	20.14%
Coal	0.80%	1.79%	1.92%
Animal dung	0.38%	0.49%	1.18%
Solar	0.14%	0.11%	0.25%
Other	0.08%	0.02%	0.00%
None	0.19%	0.19%	0.00%

9.16 Importance of Environmental Attributes

Table: 4: Importance of environmental attributes related to the Floodplain Wetland and the Artificial Wetland

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
Water Quality	Low sensitivity	No activity should be undertaken on site that affects the wetlands without authorization in terms of Section 21 of the National Water Act, (Act 36 of 1998	There will be no impact on the public as the Water Quality is already impacted on.	Changes in the hydrology during the construction and operational phases may influence the water resource downstream but mitigation measures may reduce the impact	Any spills of hazardous substances, vehicle oils or grease leakages will be carried to the downstream environment. These pollutants can have a negative impact on the downstream environment as they can react with other compounds in the water to form different pollutants, thus changing the quality of aquatic life. Inappropriate storage of hazardous substances used during construction can either lead to them being washed into the wetlands or can filter into the groundwater, indirectly affecting the water quality of the wetlands identified on site. The potential impacts are all of a very low risk to the receiving environment. The potential impacts can be easily mitigated.
Fauna	Low sensitivity	Not applicable	There are no sensitive species of concern in the area that are of public importance.	There are no sensitive species of concern in the area that are of public importance.	Apart from birds no other faunal species were observed during the site visit undertaken by the wetland specialist. However

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
					should any faunal species be encountered, the following measures to ensure minimal impact as documented in Eskom's construction method statement will be implemented. The construction method statement is attached to Appendix H of this report. • Any animal in the wetland area will be left undisturbed as much as possible; • All excavated soils that are stockpiled will be adequately bunded by suitable materials around the entire circumference of the stockpile as an erosion control measure from wind, water and animals; and • The footprint area of construction should be limited to what is absolutely essential to avoid excessive damage/disturbance.

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
Flora	Low sensitivity	Not Applicable.	Not Applicable.	Not Applicable.	Some vegetation in the study area has been lost through hardened surfaces and infrastructure as a substation and powerlines already exists. The larger catchment remains mostly untransformed with few crops. This will lead to reduced surface roughness, which will lead to additional geomorphological and hydrological impacts. There is a risk of increased abundances of exotic shrubs due to the disturbance of topsoil. Vegetation will be removed during the construction phase, and further loss of vegetation could occur as a result of indirect impacts from changes in the hydrology and geomorphological changes. According to the Wetland Assessment undertaken by Dr Martin Ferrieira the seasonal and permanently wet areas were dominated by *Persicaria lapathifolia, Cyperus congestus, Cyperus longus, Juncus effesus*, and *Papalum dilatatum*. The temporary wetted areas and boundaries of the

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
					wetland were dominated by *Eragrostis curvula, Eragrostis plana, Asclepias physocarpa*, *Berkheya* sp. and *Verbena bonariensis.* The potential impacts are all of low to very low risk to the receiving environment. The potential impacts can be easily mitigated.
Hydrology	Low sensitivity	Not applicable.	The hydrology of these wetlands have been altered	The hydrology of these wetlands have been altered	The hydrology refers to the movement and the distribution of water within these systems. The hydrology has already been altered since powerlines and a substation already exist in the study area. The powerlines will be situated in the vicinity of an artificial wetland, and a floodplain wetland. Although artificial, the wetland that has formed appears to play an important role in attenuating stormwater and slowing the movement of water entering the floodplain. Several channels have, however formed downstream of the artificial wetland and the stormwater outlet, channelizing water and causing erosion of the landscape

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
					around the substation
Wetlands	Low sensitivity	No activity should be undertaken on site that affects the wetlands without authorization in terms of Section 21 of the National Water Act, (Act 36 of 1998)	Functional wetlands perform vital functions at very little financial cost so it is in the publics' interest to improve the state of the wetlands.	The alteration of wetland hydrology can impact on wetlands to perform certain ecosystems services such as streamflow regulation, water quality enhancement and sediment trapping.	The proposed realignment of the powerlines will not have a direct impact on the water quality of the Floodplain wetland but could have a downstream impact as construction activities may cause pollution of the downstream environment. However, this impact is expected to be low to very low, with the implementation of mitigation measures. The project will also have an impact on the study area in the form of a potential change in hydrology, geomorphology and vegetation. The risk of any impact occurring is low to very low, as powerlines and a substation already exist within the study area. Mitigation measures have been provided in this Water Use License Technical report, as obtained from the Wetland Assessment Report compiled by Dr Martin Ferreira. These mitigation measures should be applied to

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
					avoid any negative impact on the receiving environment.
Geology and Soils	According to Mucina and Rutherford, (2006), the area is characterized by mudstones, sandstones and shale of the Beaufort Group (Tarsastad Formation in the South and Adelaide Formation in the North). Glenrosa, Bonheim, Avalon and Mayo soil forms dominate the outcrops and slightly elevated areas while Sepane, Arcadia and Rensburg soil forms are typical for moist bottomlands. The Wetland Assessment undertaken by Dr Martin Ferreira identified several channels draining into the wetland and permanent water was also present. The 42nd Hill line crosses	Not applicable.	Not applicable.	If construction takes place during the wet season, the soils will be flushed into the valley bottom wetland	The geomorphology (soils) will be altered during the construction phase. Soils will be compacted due to the movement of contractors, as well as removed for the placement of the poles. If construction takes place during the wet season, the soils will be flushed into the valley bottom wetland. Mitigation measures as discussed in the Wetland Assessment report undertaken by Dr Martin Ferreira will be applied in order to avoid negative impacts on the receiving environment.

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
	these channels. As a result, the soil indicated clear signs of wetness with numerous red-orange mottles observed in the upper 10 cm and an extensive grey matrix.				
Topography	The study area is characterised by flat to slightly undulating and undulating terrain with streams and rivers that drain the foothills of the Drakensberg. The N5 road is situated adjacent to the study area. The N5 road cutting has caused the accumulation of storm water draining from the N5 road, causing the formation of several stormwater channels. According to the Wetland Assessment undertaken by Dr Martin Ferreira, very few hardened surfaces were	Not applicable.	Changes in the topography will not impact on the public.	Not applicable.	Not Applicable

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
	observed during the field survey. In addition very little infilling, gullies and exposed soil were observed in the study area in general. Due to few changes in land use, the surface roughness also appear to be largely natural.				
Aesthetic	Low sensitivity	Not applicable	An existing powerline will be realigned in close proximity to an already existing substation. Due to the existing infrastructure in the study area which is an existing visual impact, the visual impact during the construction and operational phases will therefore be very low.	The aesthetics of the area will not impact the water resource.	An existing powerline will be realigned in close proximity to an already existing substation. Due to the existing infrastructure in the study area which is an existing visual impact, the visual impact during the construction and operational phases will therefore be very low.
Infrastructure	Low Sensitivity The realignment of the proposed powerline will improve the current infrastructure in the area.	Not applicable.	The construction of the new feeder bays will improve safety to Eskom employees and the public. It will also improve the performance of the Bethlehem service	The realignment of the powerlines may have a negative impact on the water resource but the implementation of mitigation measures may reduce the	The construction of the new feeder bays will improve safety to Eskom employees and the public. It will also improve the performance of the Bethlehem service area which in turn will ensure an improved quality of

Environmental Attribute	**Sensitivity** (resilience, how readily it is affected by a particular stressor)	**Legal importance** (e.g. protected status)	**Public** (i.e. interested and affected parties) importance	**Influence to water resource**	**Professional judgement**
			area which in turn will ensure an improved quality of electricity supply to customers.	impacts.	electricity supply to customers.
Socio-economic components	Low Sensitivity	Not applicable.	The construction of the new feeder bays will have a positive impact on the local community as the consistent and reliable supply of electricity to the 42nd Hill community. Electricity is essential as it is used in everyone's daily lives, without a reliable electricity the community would have to resort to other forms of energy that are less efficient	Development in the area may improve the socio-economic situation in the area which may indirectly improve the condition of the water resource.	The positive socio-economic impacts that the construction of the new feeder bays will have, outweighs the possible negative impacts on the water resource

10 ASSESSMENT OF ALTERNATIVES

It is the intention of Eskom Distributions, Free State Operating Unit to change the alignment of the existing Harrismith-Munic – 42nd Hill 11kV powerlines, where these lines exit the existing Harrismith-Munic Substation. The realignment of these lines are required as part of the refurbishment of the Substation. The Harrismith-Munic Substation is situated to the west of the Town of Harrismith, in the Free State Province, on the Remaining Extent of the Farm Harrismith 131. Currently, the existing Harrismith-Munic – 42nd Hill 11kV lines are fed from two 11kV feeders known as 1HMF and 2HMF and exit the substation from one 11kV feeder breaker which is situated in the North Western corner of the substation. Approximately 332m of these existing Harrismith-Munic – 42nd Hill 11kV lines will be dismantled. As part of the refurbishment of the Substation, new feeder breakers and breaker bays will be installed, so each of the 1HMF and 2HMF feeders will be supplied and controlled by its own breaker. The new feeder bays will be situated along the northern boundary of the substation site. The new section of lines will be approximately 350m in length and will run from the substation site to where it will tie into the existing Harrismith-Munic – 42nd Hill 11kV powerlines. Therefore, no alternatives have been assessed, as the proposed project involves the realignment of the existing Harrismith–Munic - 42nd Hill 11kV powerlines.

11 IMPACT ASSESSMENT AND MANAGEMENT

The Environmental Impact Assessment Regulations, 2014, promulgated in terms of Section 24(5) of the National Environmental Management Act (Act 107 of 1998) prescribes requirements to be adhered to when undertaking impact assessments. Requirements for undertaking impact assessments for Basic Assessments and full Environmental Impact Assessments are outlined in the regulations R983, R984 and R985 of the above mentioned act.

In terms of these Regulations, the following should be considered when undertaking an impact assessment:

- A description and assessment of the significance of any environmental impacts, including –
  a) Cumulative impacts, that may occur as a result of the undertaking of the activity during project life cycle;
  b) Nature of the impact;
  c) Extent and Duration of Impact;
  d) The Probability of Impact Occurring;
  e) The degree to which the impact can be reversed;
  f) The degree to which the impact may cause irreplaceable loss of resources; and
  g) The degree to which the impact can be mitigated.

In terms of the above legislated requirements a standard impact assessment methodology was compiled. In order to compile the impact assessment methodology a review of existing impact assessment methodologies utilised by consultants in the field was undertaken. Furthermore, the following document as compiled by the former Department of

Environmental Affairs and Tourism (DEAT) was utilised during the compilation for the impact assessment methodology:

- *DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria*.

A description of the method for assessing the above criteria as well as the method for determining impact risks are provided in Sections 11.1 to 11.7 below.

11.1 Cumulative Impacts

Cumulative impacts can occur over different temporal and spatial scales by interacting, combining and compounding so that the overall effect often exceeds the simple sum of the previous effects. The spatial scale can be local, regional or global, whilst the frequency or temporal scale includes past, present and future impacts on a specific environment or region.

Cumulative effects can simply be defined as the total impact that a series of developments, either present, past or future, will have on the environment within a specific region over a particular period of time.

Potential cumulative impacts on all elements of the receiving environment are addressed for all project phases (pre-construction, construction, operational and decommissioning), before and after implementation of mitigation measures.

11.2 Significance/Magnitude/Nature of Impacts

The significance or magnitude of an impact refers to the importance of an impact. When rating the extent of an impact, it is important to also rate the significance of an impact in order to determine the actual importance of an impact. For example, the size of an area affected by atmospheric pollution may be extremely large, but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be High or Very High, but if it is dilute it would be Very Low or Low.

The significance of impacts has been grouped into five classes, as outlined in the **Table** 5 below:

Table 5: Description of the different classes of significance

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more

RATING		DESCRIPTION
		difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

11.3 Extent of Impacts

The extent or spatial scale of an impact refers to whether an impact will occur at a local, regional, or global scale. The extent of impacts has been grouped into five classes, as outlined in the **Table** 6 below.

Table 6: Description of the different classes for the extent of the proposed project/development

RATING		DESCRIPTION
5	Global/National	The impact could/will occur on a national or global scale.
4	Regional/Provincial	The impact could/will occur at a Regional/Provincial Level
3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the Boundary of the study site
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the development footprint.

11.4 Duration of Impacts and Degree to which impacts can be reversed

The duration or temporal scale of an impact refers to actual impact timeframe, i.e. how long will impacts to the environment last. The reversibility of impacts is directly linked to the duration of impacts. For e.g. permanent impacts are irreversible impacts, whereas, incidental impacts are immediately reversible. The duration and reversibility of impacts has been grouped into five classes, as outlined in the **Table** 7 below.

Table 7: Description of the different classes of reversibility of a particular impact

RATING		DESCRIPTION	REVERSIBILITY
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.	Immediately reversible
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.	Quickly reversible
3	Medium term	The environmental impact identified will operate for the duration of life of the project.	Reversible over time
4	Long term	The environmental impact identified will operate beyond the life of the project.	Reversible over the long term
5	Permanent	The environmental impact will be permanent.	Irreversible, impact is permanent

11.5 Probability of Impact Occurring

The probability of an impact refers to the likelihood of an impact occurring. The probability of impacts has been grouped into five classes, as outlined in the **Table** 8 below.

Table 8: Description of the different classes of probability of a given impact

RATING	DESCRIPTION
1	Practically impossible that impact will occur
2	Unlikely that impact will occur
3	Impact could occur
4	Very Likely that impact will occur
5	Impact will occur or has already occurred

11.6 Degree to which the impact may cause irreplaceable loss of resources (Intensity or Severity of an Impact)

The degrees to which an impact may cause irreplaceable loss of resources are determined based on the outcome of the impact risk assessment. High risk impacts in sensitive areas are more likely to result in irreplaceable loss of resources compared to low risk impacts.

Table 9: Description of the different classes of intensity/severity of an impact

RATING	DESCRIPTION
High	Disturbance or pristine areas that have important conservation value. Destruction of rare or endangered species.
Medium	Disturbance of areas that have potential conservation value or rare of use as resources. Complete change in species occurrence or variety.
Low	Disturbance of degraded areas, which have little conservation value. Minor change is species occurrence or variety.

11.7 The degree to which the impact can be mitigated

The degree to which an impact can be mitigated are determined by comparing the impact risk class prior to implementation of mitigation measures to the impact risk class after implementation of mitigation measures. If for e.g. an impact risk class can be reduced from a high to very low, then it is likely that there is a high potential that an impact can be mitigated.

Table 10: Description of the different degrees to which an impact can be mitigated

RATING	DESCRIPTION
High	High Potential to mitigate negative impacts to the level of insignificant effects.
Medium	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.
Low	Little or no mechanism to mitigate negative impacts.

11.8 Degree of Certainty

As it is not possible to be 100% certain of all facts, a standard “degree of certainty” has been incorporated into this Impact Assessment Methodology to indicate the degree of the EAP’s certainty regarding impact ratings.

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard “degree of certainty” scale will be used as outlined in the Table below. When very detailed specialist studies are available or have been undertaken as part of a project, impacts can be more accurately determined.

Table 11: Description of the different classes of certainty

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an

RATING	DESCRIPTION
	impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.
Don't know	The consultant cannot, or is unwilling, to make an assessment given available information.

11.9 Quantitative Description of Impacts

In order to describe impacts in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 have been used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and duration scale as described below:

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Duration})}{3} \text{ X } \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

Impact	Significance	Spatial Scale	Duration Scale	Probability	Risk Rating
Impact to air quality - For e.g. construction vehicles travelling on areas where vegetation has been cleared could result in dust impact.	Low	Local	Medium-Term	Could Happen	1.6
	2	3	3	3	

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to 5 classes as described in the table below.

Impact Risk Classes:

Rating	Impact Class	Description
0.1-1.0	1	Very Low

1.1-2.0	2	Low
2.1-3.0	3	Moderate
3.1-4.0	4	High
4.1-5.0	5	Very High

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact..

11.10 Impact Assessment Tables

Table 12: Summary of impacts related to the pre-construction and construction of the powerline

	Impact Description	Impact Ratings Before Mitigation					Impact Ratings After Mitigation					Degree of Mitigation
		S	E	D	P	Risk	S	E	D	P	Risk	
Change in hydrology	• Increase in hardened surfaces through soil compaction	2	1	2	3	Very Low	2	1	2	3	Very Low	Medium
	• Decrease in surface roughness	2	1	2	3	Very Low	2	1	1	3	Very Low	Medium
Change in geomorphology	• Increased deposition	2	1	2	4	Low	2	1	2	3	Very Low	Medium
	• Change in soil permeability	2	1	2	4	Low	2	1	2	3	Very Low	Medium
	• Wetland soil removal and compaction	2	1	2	4	Low	2	1	2	3	Very Low	Medium
	• Increase in exposed areas due to vegetation stripping	2	1	2	4	Low	2	1	2	3	Very Low	Medium
	• Formation of erosion gullies	2	1	2	4	Low	2	1	2	3		Medium
Change in vegetation	• Loss of vegetation through removal	2	1	3	4	Low	2	1	1	3	Very Low	High
	• Increase in exotic vegetation	2	1	2	4	Low	2	1	2	3	Very Low	High
	• Loss of vegetation through hydrological and geomorphological changes	2	1	2	4	Low	2	1	2	3	Very Low	High
Change in Water Quality	• Pollution due to spills and leaks	2	1	1	3	Very Low	2	1	2	3	Very Low	Medium

11.11 Mitigation Measures

The potential impact on the wetlands can be alleviated by applying certain mitigation measures. The functioning of any wetland is not depended on a single component, and

changes to one aspect (such as hydrology) may ultimately cause changes in another (such as vegetation). The powerline will cross stormwater channels and an artificial wetland that has formed as a result of the stormwater channels. As the wetland is artificial in nature, accepted wetland assessment and delineation methodologies are not applicable. The artificial wetland is, however, connected to the larger floodplain identified during the study via a channel. The mitigation measures indicated in this section below will thus be applicable to this artificial wetland if potential impacts on the floodplain is to be avoided or minimised. The mitigation measures include the following approaches:

- Hazardous material and chemicals should not be kept or handled within wetland and riparian areas. Hazardous substances must be kept in a demarcated area on an impervious surface. Any spillages from hazardous material should be cleaned immediately and transported to a landfill site that accepts hazardous material.
- Cement and other material must be mixed in a demarcated area and not in wetlands or its associated buffer zones. Any mixing of cement must be undertaken on an impervious surface.
- Movement of contractors and vehicles within wetland and riparian areas should be minimised to avoid compaction of sediment and water pollution. Vehicles should also be serviced on a regular basis to avoid leaks and spills.
- It is recommended that powerlines are erected using a pilot cable for stringing purposes. This will avoid additional movement of heavy vehicles.
- Solid waste should be removed on a regular basis and chemical toilets should be provided and should be serviced on a regular basis.
- Any contractor's camps should not be placed near any wetlands.
- Topsoil and excavated soil must not be placed within the wetland or riparian areas. The soil that is excavated from these wetlands should not be used for construction, but rather for any rehabilitation processes.
- If soil is used that has been brought in from external sources it should not be stockpiled within the wetland area. The use of soil from outside the wetland should be kept to a minimum.
- The removal of vegetation must be kept to a minimum where possible. The time that soil is exposed must be limited and re-vegetation or another covering method must be applied during the construction and post construction phase.
- Vegetation must be removed in sections, as construction is taking place, and should not be removed throughout the extent of the construction area.
- Re-vegetation must be completed using the appropriate wetland/endemic plants. Where possible, the vegetation must be removed intact to ensure that it can be planted again during rehabilitation.
- Where vegetation is removed, the compaction of wetland soils must be minimised to avoid an increase in surface runoff speeds.
- The establishment of exotic plants must be avoided.
- The management (cutting) of vegetation should be kept to a minimum as this could influence the ability of the floodplain to retain floods and remove sediment.
- Where possible, the area where construction will take place should be demarcated. Demarcation of the construction areas will ensure that only the required area is cleared of vegetation.
- Erosion protection must be used in all areas where erosion may occur. Selected areas may require rehabilitation and stabilisation prior to construction.

- Erosion may be correlated with flow regulation and connectivity therefore must be maintained within these systems.
- Suitable indicators must be identified and monitored by a qualified wetlands specialist to ensure that the impacts are minimised and corrected timeously.

11.12 Monitoring

In order to ensure that continuous monitoring is undertaken and the risk of negative impacts on the sensitive areas within the study area is reduced, Eskom will ensure that there is an internal Environmental Control Officer (ECO) on site throughout the construction phase. In addition the following monitoring is proposed for the project:

- The Wetland Monitoring Programme (WMP) which was compiled as part of the Water Use Authorisation process should be updated prior to the commencement of construction activities to include all general and specific recommendations provided in the Water Use License. The WMP is included in Section 4.8 of the Supplementary Report which is attached to Appendix G of this Water Use Licence Technical Report. Copies of the Environmental Control Officer's (ECO) Report will only be submitted to DWS should any non-compliance within the DWS Regulated area occur or should any non-compliance in terms of the Water Use License occur, or if otherwise specified in the General Authorisation (Please refer to Section 8.6 of this technical report regarding a possible GA).
- A photographic record must be kept as follows and submitted with reports:
    - Dated photographs of all the sites to be impacted before construction commences.
    - Dated photographs of all the sites during construction on a monthly basis.
    - Dated photographs of all the sites after completion of construction and rehabilitation.

12 SECTION 27 OF THE NATIONAL WATER ACT

12.1 (27(a)) Existing Lawful water uses;

The proposed project does not fall under an existing lawful use. The project involves the realignment of sections of the two (2) existing Harrismith-Munic - 42nd Hill powerlines.

12.2 (27(b)) The need to redress the results of past racial and gender discrimination;

Eskom is a level 4 B-BEEE company. The B-BBEE certificate is attached to Appendix H of this report. The construction of the new feeder bays will have a positive impact on the local community as the proposed project will ensure the consistent and reliable supply of electricity to the 42nd Hill community. At this early stage of the project Eskom Distribution Free State operating unit could not guarantee job opportunities to the local community as the construction activities will be outsourced to an independent contractor.

12.3 (27(c)) Efficient and beneficial use of water in public interest

Eskom proposed the realignment of the Harrismith – Munic - 42nd Hill 11kV powerlines, in order to improve electricity supply to customers. The existing Harrismith-Munic Substation currently only has one circuit breaker which feeds a double circuit (1HMF & 2HMF). Should a fault occur at either one of these feeders, both feeders will not be operational. When such a fault occurs both feeders need to be inspected before closing the breaker. The inspection of both the feeders is time consuming and therefore the power outage time is prolonged. This contributes to the poor performance of the Bethlehem field service area. In addition, the circuit breaker is situated inside the Municipality's Substation (The Maluti-a Phofung Local Municipality). The Municipality has full access to operate this breaker, while Eskom employees are working on the line, which poses a safety risk to the Eskom employees. As part of the refurbishment of the Substation, new feeder breakers and breaker bays will be installed, so each of the 1HMF and 2HMF feeders will be supplied and controlled by its own breaker. The new feeder bays will be situated along the northern boundary of the substation site. The new section of lines will be approximately 350m in length and will run from the substation site to where it will tie into the existing Harrismith-Munic – 42nd Hill 11kV powerlines. The proposed realignment of the Harrismith-Munic - 42nd Hill 11kV powerlines will therefore improve safety to Eskom employees and the public. It will also improve the performance of the Bethlehem service area which in turn will ensure an improved quality of electricity supply to customers.

12.4 (27(d)i) Socio-economic impact of water use if authorised

As mentioned previously, the construction of new feeder bays will have a positive impact on the local community as the consistent and reliable supply of electricity to the 42nd Hill community Electricity is essential as it is used in everyone's daily lives, without a reliable electricity the community would have to resort to other forms of energy that are less efficient.

12.5 (27(d) ii) Socio-economic impact of failure to authorise water use

Without the construction of the new feeder bays, reliable and consistent electricity supply to the 42nd Hill community will not be provided. This will have a negative effect on the provision of essential services to the community. The safety risk of Eskom employees will also remain high, as the circuit breaker is situated inside the Municipality's substation (The Maluti-a Phofung Local Municipality) and the Municipality has full access to operate this breaker, while Eskom employees are working on the line, hence, as part of the substation refurbishment, new feeder breakers and breaker bays need to be added for each of the 42nd Hill 11kV lines.

12.6 (27(e)) Catchment management strategy

There is no Catchment Management Strategy (CMS) available for this WMA at this stage.

12.7 (27(f))The likely effect of the water use on the water resource and on other water users

Changes to the water quality could result in changes to the ecosystem structure and function as well as a potential loss in biodiversity. Water quality pollution often leads to modification of the species composition where sensitive species are lost and organisms tolerant to them being washed into the wetlands or can filter into the groundwater, indirectly affecting the

water quality of the wetlands identified in the study area. According to the Wetland Assessment undertaken by Dr Martin Ferreira, the proposed realignment of the powerlines are to be constructed within a 500m radius of the delineated edge of the Floodplain wetland. The proposed realignment of the powerlines will not have a direct impact on the water quality of the Floodplain Wetland but could have a downstream impact as construction activities may cause pollution of the downstream environment. However, this impact is expected to be low to very low, with the implementation of mitigation measures. The project may also have an impact on the study area in the form of a potential change in hydrology, geomorphology and vegetation. The risk of any impact occurring is low to very low, as powerlines and a substation already exist within the study area. Mitigation measures have been provided in this Water Use License Technical report, as obtained from the Wetland Assessment Report compiled by Dr Martin Ferreira. These mitigation measures should be applied to avoid any negative impact on the receiving environment.

12.8 (27(h)) Investments already made by water user in respect of the proposed water use

Jeffares and Green Engineering and Environmental Consultants (J&G) have been appointed by Eskom Free State Operating Unit to undertake the Water Use Licence Application process and Specialist Studies for the project. The following Specialist Studies were undertaken:

- A Floodline Assessment undertaken by Mr Phillip Hull from Jeffares & Green (Pty) Ltd; and
- A Wetland Assessment undertaken by Dr Martin Ferreira from Jeffares & Green (Pty) Ltd

12.9 (27(i))Strategic importance of the water use to be authorised.

As mentioned in Section 12.3 above it is imperative that the water use be authorised as it will ensure the consistent and reliable supply of electricity and minimise the safety risk that Eskom employees are currently subjected to.

12.10 (27(k)) Probable duration for which water use is to be authorised

The proposed realignment of existing powerlines will be a permanent structure. The major impacts will occur during the construction phase which is estimated to last for one (1) month.

13 PUBLIC CONSULTATION PROCESS

The property on which a sections of the existing Harrismith – Munic - 42nd Hill 11kV powerlines will be realigned is owned by the Maluti a Phofung Local Municipality. Eskom did not register a servitude for the realignment of the powerlines on this affected properties / servitudes, but they have obtained a Way-leave from the various entities. Since Eskom has already obtained a Way-Leave, the Municipality was consulted by Eskom prior to the appointment of Jeffares & Green (Pty) Ltd. Jeffares & Green (Pty) Ltd made contact with the DWS Gauteng Regional Office on the 2nd of June 2015 regarding their requirements for the undertaking of a Public Participation Process for this project, as the affected landowner already issued a Way-Leave to Eskom for the realignment of the powerlines. The DWS

responded on the 4th of June 2015 indicating that a newspaper advertisement should be placed in a local newspaper for the broader public to be informed of the details of the project.

A combined Public Participation Process was undertaken for both the construction of the Harrismith-Munic – Letsatsi 11kV powerlines and the realignment of the Harrismith-Munic – 42Hill 11kV powerlines. Jeffares & Green (Pty) Ltd placed an advertisement in the Harrismith Free State Express newspaper. The advertisement appeared in the newspaper on the 17th of June 2015. The newspaper is distributed every Wednesday to the following towns, Bethlehem, Clarens, Ficksburg, Harrismith, Kestell, Ladybrand, Phuthaditjhaba, Reitz, Senekal and the Lesotho Border Posts. A copy of the newspaper tear sheet is attached to Appendix H of this report. Key stakeholders were identified and formal written notices were sent to these stakeholders on the 6th of July 2015. All written notices are attached to Appendix H of this Technical report. All Interested and Affected Parties have been given till the 12th of August 2015 to provide their comments on the proposed project. Please refer to Table 13 below for a summary of the comments received and responses provided to date. Jeffares & Green (Pty) Ltd will add an addendum to this Technical Report, should any further comments be received from Interested and Affected Parties. Please refer to Table 14 below for a list of key stakeholders that were identified during the public participation process.

Table 13: Issues and Response Report

Issues and Response Report		
Name	**Comment Made**	**Response Provided**
Miss Ntando Mbhata 051 410 4805 Free State Heritage Resources Authority (FSHRA)	Acknowledged the receipt of the Notification of the Proposed realignment of the Harrismith-Munic – 42nd Hill 11kV powerlines. Miss Mbhata Indicated that the Department awaits the Heritage Impact Assessment and WULA Technical Report.	Jeffares & Green (Pty) Ltd thanked Miss Mbhata for her response and indicated that the request will be forwarded to Eskom Distributions, Free State Operating Unit.
Ms Isabel Potgieter 058 623 0860 N3 Toll Concession	Acknowledged the receipt of the Notification of the Proposed realignment of the Harrismith-Munic – 42nd Hill 11kV powerlines. Miss Potgieter Forwarded the notification to other stakeholders she thought may have an interest in the project. Miss Potgieter also advised that an advertisement could be placed in the Harrismith Chronicle Newspaper.	Jeffares &Green (Pty) Ltd thanked Ms Potgieter for her response and mentioned that a newspaper advertisement had already been placed in the Express Eastern Free State, which was published on the 17th of June 2015.

Table 14: Key Stakeholder Database

KEY STAKEHOLDER DATABASE						
Authority/Organ of State/Affiliation	**Contact person (Title, Name and Surname)**	**Tel No**	**Fax No**	**e-mail**	**Postal address**	**Physical address**
The Free State Department of Tourism, Economic Development and Environmental Affairs	Grace Mkhosana	051 400 4817 051 400 4929		mkhosana@detea.fs.gov.za	Private Bag X 0801 Bloemfontein 9307	Bojananala Building 33 Markgraff Street Bloemfontein
Maluti a Phofung Local Municipality	Mr Steve Nhlapo Manager: Environmental and Solid Waste Management	058 718 3727/23	086 537 8932	stevovo@map.fs.gov.za	Private Bag X805, Witsieshoek 9870	Cnr Moremoholo & Motloung Streets, Setsing Complex, Phuthaditjhaba
Thabo Mofutsanyane District Municipality	Department: Environmental management and care	(058) 718 1036	(058) 718 1034	swartpg.tm@gmail.com	Private Bag X10, Witsieshoek 9870	Old Parliament Building, 1 Mampoi Street, Phuthaditjhaba.
Free State Heritage Resources Authority (FSHRA)	Heritage Coordinator Miss Ntando Mbhata	051 410 4805		mbatha.npz@sacr.fs.gov.za	Private Bag X20606, Bloemfontein, 9300	Department of Sport Arts, Culture and Recreation Office 307 Business Partners Building Cnr Henry Street & East Burger Street Bloemfontein
Councillor ward 6-Maulti a Phofung Local Municipality	Councillor May Tsotetsi	073 354 8396		maytsotetsi@rocketmail.com		

KEY STAKEHOLDER DATABASE						
Authority/Organ of State/Affiliation	**Contact person (Title, Name and Surname)**	**Tel No**	**Fax No**	**e-mail**	**Postal address**	**Physical address**
Councillor ward 22-Maulti a Phofung Local Municipality	Councillor Temello Thebe	083 9022 1082		councilorthebe@webmail.co.za		
N3 Toll Concession	Isabel Potgieter	058 623 0860	0866084763	isabelp@n3tc.co.za	P O Box 1052 Harrismith 9880	Bergview Complex Warden Street Harrismith

14 CONCLUSION

According to the Wetland Assessment undertaken by Dr Martin Ferreira the following features are situated within the study area:

- Stormwater channels, which formed to the North West of the Substation, between the substation and the N5. These channels formed as a result of runoff form the N5;
- An artificial wetland, which formed as a result of the stormwater channels and the continuous stormwater runoff from the N5. The artificial wetland has formed next to the Harrismith-Munic substation. The existing section of the Harrismith-Munic – 42nd Hill powerlines to be realigned traverses this artificial wetland, and the new lines will also traverse this artificial wetland;
- A Floodplain Wetland, associated with the Wilge River, which is the most important wetland type identified during the study. The proposed realignment of the existing powerlines will be constructed within a 500m radius of the delineated edge of this Floodplain Wetland.

The proposed realignment of the powerlines will not have a direct impact on the water quality of the Floodplain Wetland but could have a downstream impact as construction activities may cause pollution of the downstream environment. However, this impact is expected to be low to very low, with the implementation of mitigation measures. The project may also have an impact on the study area in the form of a potential change in hydrology, geomorphology and vegetation. The risk of any impact occurring is low to very low, as powerlines and a substation already exist within the study area. Mitigation measures have been provided in this Water Use License Technical report, as obtained from the Wetland Assessment Report compiled by Dr Martin Ferreira. These mitigation measures should be applied to avoid any negative impact on the receiving environment.

This Water Use License Technical Report is compiled as part of the Water Use License Application Process for the realignment of the Harrismith-Munic – 42nd Hill powerlines. Jeffares & Green (Pty) Ltd are undertaking all processes required for obtaining a Water Use License in terms of Section 21(c) and (i) of the National Water Act (Act 36 of 1998). However, as this project is situated within an artificial wetland area, and as this project will have a negligible impact on the 500m buffer of the floodplain and as it will have a low to very low impact on the downstream wetland areas, a General Authorisation may be appropriate.

Jeffares & Green (Pty) Ltd are aware that wetland areas are excluded from the General Authorisations as published in the Government Gazette of 18 December 2009, Gazette No 32805. In terms of this document, any activities that may have a potential to impact a wetland in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998) are excluded. However, Jeffares & Green (Pty) Ltd requests the DWS to consider a possible General Authorisation (GA) due to the nature of the project and impacts as explained above.

15 REFERENCES

Archibold, O.W., C. Acton, and E.A. Ripley. 2000. Effect of site preparation on soil properties and vegetation cover, and the growth and survival of white spruce (*Picea glauca*) seedlings in Saskatchewan. Forest Ecology and Management. 131:127–141

Canadian Association of Petroleum Producers (CAPP), Canadian Energy Pipeline Association (CEPA) and Canadian Gas Association (ACGA). (2005). Pipeline Associated Watercourse Crossings. Prepared by TERA Environmental Consultants and Salmo Consulting Inc. Calgary, AB.

Clemens, D. (2010). Environmental Guideline 2010/01 - Erosion and Sediment Control Guidelines for Land Disturbing Activities. Environment Bay of Plenty and Ridley Dunphy Environmental Limited.

Department of Water Affairs and Forestry, South Africa. 2004. Upper Vaal Water Management Area: Internal Strategic Perspective. Prepared by PDNA, WRP Consulting Engineers (Pty) Ltd, WMB and Kwezi-V3 on behalf of the Directorate: National Water Resource Planning. DWAF Report No P WMA 08/000/00/0304.Department of Water Affairs

(DWA), (2013). National Water Resource Strategy Version 2. DWA Pretoria.

Driver A, Nel JL, Snaddon K, Murray K, Roux DJ, Hill L, Swartz ER, Manuel J and Funke N (2011). Implementation Manual for Freshwater Ecosystem Priority Areas. WRC Report No. 1801/1/11, 119 pp

Kotze, D., Ellery, W., Rountree, M., Grenfell, M. Marneweck, G., Nxele, I., Breen, C., Dini, J., Bachelor, A. & Sieben, E. (2008). WET-RehabPlan. Guidelines for planning wetland rehabilitation in South Africa.

Lof, M., Dey, D.C., Navarro, R.M. & Jacobs, D.F. (2012). Mechanical site preparation for forest restoration. *New Forests*. 43: 825–848.

Minnesota Local Road Research Board (LRRB), Minnesota Department of Transportation (Mn/DOT) and Federal Highway Administration (FHWA) (2003). Erosion Control Handbook for Local Roads. Manual Number 2003/08.

NGH Environmental. (2007). Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park. Parks and Wildlife Division, Department of Environment and Climate Change NSW.

Walling D.E and Moorehead, P.W (1987). Spatial and Temporal Variation of the Particle-Size Characteristics of Fluvial Suspended Sediment. *Geografiska Annaler Series A, Physical Geography*. Vol. 69 (1) pp 47-59. *In:* Ferreira, M. (2010). *The Development of Methods to Assess the Ecological Integrity of Perennial Pans.* Philosophiae Doctor. University of Johannesburg

APPENDIX A: WATER USE LICENSE APPLICATION FORMS

APPENDIX B: MAPS

APPENDIX C: TEAM CV

APPENDIX D: DESIGN DRAWINGS

APPENDIX E: DWA LIAISON

APPENDIX F: SPECIALIST STUDIES

APPENDIX G: SUPPLEMENTARY REPORT

APPENDIX H: OTHER