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AGRICULTURAL IMPACT ASSESSMENT FOR A PROPOSED HYDROPOWER STATION ON THE FARM RIEMVASMAAK ON THE ORANGE RIVER AUGRABIES, NORTHERN CAPE

Report by
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EXECUTIVE SUMMARY

The aim of this study was to identify and assess the potential impacts that the proposed hydropower development may have on agricultural resources and production. The assessment was based on a desktop study of existing soil and agricultural potential data for the study area.

The key findings of this study are:

- The proposed development will have negligible impact on agriculture.
- The predominant reason for this is that the site is on land of extremely limited agricultural potential that is not currently used nor is it likely to be used in future for agriculture, due to shallow soils and aridity constraints.
- The potential on-site agricultural impact of the development is a reduction in the agricultural potential of the land. This can occur through three different mechanisms: loss of agricultural land use; erosion; and loss of topsoil.
- A candidate site for spoil deposition has been identified on Portion 1 of Farm 492. Approximately 100,000 m^3 of spoil is likely to be deposited here. The spoil deposition site will cover approximately 55 ha. No agriculture is currently being undertaken on the proposed site, so impacts of deposition are primarily on vegetation and topography (botanical impacts are assessed in the botanical report prepared for this project). The heap will be contoured to conform with the local topography, and in time will be rehabilitated with indigenous vegetation. The figure of 100,000 m^3 may be further reduced if organisations or individuals can be identified who will use the spoil for road construction, or other suitable purposes.
- No potential upstream or downstream impacts on agriculture are anticipated.
- Because there is negligible agricultural impact, there is no significant difference, from an agricultural impacts perspective, between the different project alternatives. Agricultural impact will therefore not play a role in the choice between alternatives.

INTRODUCTION AND BACKGROUND

RVM 1 Hydro Electric Power (Pty) Ltd wishes to construct a 40 Megawatt (MW) hydropower station on the Orange River on the farms 1/498 and RE/497 with a 132 kV overhead transmission line crossing four farm portions and the Orange River to reach Eskom's Blouputs – Renosterkop 132 kV line. Aurecon South Africa (Pty) Ltd was appointed to undertake the Environmental Impact Assessment and appointed Johann Lanz to undertake a study to identify and assess the potential impacts that the development may have on agricultural resources and production.

Project description

The facility would be a run-of-river hydropower scheme capable of producing a maximum of 40 MW of electricity. The facility would extract water approximately 1.5 km upstream from the Augrabies Falls and return this water to a branch of the Orange River 7.5 km north west (downstream) of the Augrabies Falls. Run-of-river schemes use the natural flow and drop in elevation of a river to produce electricity. A portion of the river's flow is channelled through the hydropower station and through turbines.

A run-of-river hydropower station, like the proposed, consists of the following main components:

- Intake infrastructure (i.e. weir and off-take structure);
- Water conveyance infrastructure (i.e. canal or pipeline);
- Headpond/ forebay;
- Power station intake structure/ penstock;
- Powerhouse; and
- Outlet works/ tailrace.

Ancillary infrastructure includes access roads for use during construction and for maintenance purposes during operation, a transmission line for evacuating the energy produced by the hydropower station, a switchroom and transformer yard. Additionally an offsite spoil site has been identified for storage of spoil material.

Infrastructure that would be constructed on 1/498 includes:

- The powerhouse and electrical infrastructure;
- The headpond (forebay);
- A section of the pipeline;
- A section of the underground transmission line; and
- The tailrace.

The following ancillary infrastructure would be constructed on RE/497:

- Access road;
- A section of the underground transmission line; and
- A section of the pipeline.

As the weir would be constructed in the Orange River, it would be on land belonging to DWS.

Furthermore, the 132 kV overhead transmission line to the Eskom Blouputs – Renosterkop 132 kV line will cross the following farm portions:

- 1/492
- 59/16
- 107/16
- Kakamas South Settlement

Terms of reference

The terms of reference for this study are:

- Provide a focussed and relevant description of all baseline characteristics and conditions of the site being considered, based on all relevant available data, reports and maps;
- Identify relevant legislation and policies to be complied with (where applicable to Agriculture);
- Assess the potential direct and indirect and cumulative impacts on agriculture resulting from the proposed development (including the canal / pipelines, power-house, transmission lines and associated infrastructure e.g. access roads and spoil site) during construction, operation and decommissioning;
- Provide a detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts and enhance positive impacts for each phase of the project, where required;
- Comment on the potential upstream (water “pushing up” as a result of weir) and downstream impacts (evaporation losses).

APPROACH TO STUDY

Methodology for assessing soils and agricultural potential

The assessment was a desktop study based on existing soil and agricultural potential data for the study area. The source of this data was the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the study area was also used. Furthermore the soil scientist applied his knowledge and previous experience of agricultural conditions in the area. No field-based ground-truthing was undertaken as it was not considered necessary under the conditions of this study.

Methodology for determining impact significance

All potential impacts were assessed and rated in terms of criteria used uniformly for all the specialist studies done as part of this EIA.

ASSUMPTIONS AND LIMITATIONS OF STUDY

Data on the spatial distribution of soil types is dependent on the resolution of sampling points. Investigations for different purposes will use different resolutions. These will record the degree of soil variation that occurs, at different levels of accuracy. The accuracy level of the land type data used in this study is considered completely adequate for achieving this study's aims. A more detailed investigation is not considered likely to have added anything significant for determining the impact of the development on agricultural resources and productivity, and the use of only existing land type data is therefore not seen as a limitation.

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific constraints, uncertainties and gaps in knowledge for this Agricultural study.

BASELINE DESCRIPTION OF THE AFFECTED ENVIRONMENT

Climate and water availability

One of the most important climate parameters for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. It is classified into 6 categories across the country. The proposed project falls within the worst category 6, which is labelled as a very severe limitation to agriculture.

Rainfall for the site is given as 131 mm per annum with a standard deviation of 58 mm according to the South African Rain Atlas (Water Research Commission, undated). The average monthly distribution of rainfall is shown in Table 1.

Table 1. Average monthly rainfall for the site (28° 35' S 20° 21' E) in mm (Water Research Commission, undated)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Tot**
16	22	27	20	9	4	2	2	3	6	8	11	**131**

Given the severe moisture constraints, cultivation is only possible with irrigation. Irrigation mainly occurs within the alluvial soils of the river flood plain, but in certain places so called *buite gronde,* beyond the flood plain, is irrigated where soil conditions allow. The proposed development (except

for the connecting transmission line to Eskom infrastructure) is located within the area of *buite gronde.*

Terrain and soils

The proposed site runs north of the Augrabies Gorge on largely flat land (average slope approximately 1%) before joining a tributary gorge. A satellite image showing the development layout on the site is shown in Figure 1.

The underlying geology is metamorphic rocks of the Namaqualand Metamorphic Complex, with unconsolidated, sandy, superficial deposits of Tertiary to Recent age.

The land type classification is a nationwide survey that groups areas of similar soil and terrain conditions into different land types. There are three land types across the area of the development, but the actual development is almost entirely on one of the land types, Ag2. Soils across this land type are shallow, red, sandy soils on underlying rock and are classified as Hutton, Mispah and Glenrosa soil forms according to the South African soil classification system. The connecting transmission line traverses soils of the Ia1 land type. These are deep alluvial soils of the Dundee and Oakleaf soil forms. The third land type which occurs across the gorge areas is overwhelmingly surface rock outcrops. A summary detailing soil data for the three land types is provided in Table A1.

Table A1. Land type data for site.

Land type	**Land capability class**	**Soil series (forms)**	**Depth (cm)**	**Clay % A horizon**	**Clay % B horizon**	**Depth limiting layer**	**% of land type**
Ag2	7	Hutton	10-30	4-13	6-15	so, db, R	30
		Mispah	5-15	5-12		R	18
		Glenrosa	10-30	3-13		so	10
		Hutton	10-30	10-20	15-25	so, db, R	9
		Hutton	45-120	3-13	3-15	so, db, R	7
		Rock outcrop	0			R	7
Ia1	7	Dundee	>120	6-20	10-35		50
		Oakleaf	>120	6-15	15-35		20
		Streambed					20
Ic3	8	Rock outcrop	0			R	80
		Hutton	30-60	2-4	3-6	R	10

Land capability classes: 7 - non-arable, low potential grazing land; 8 - non-utilisable wilderness
Depth limiting layers: R = hard rock; so = partially weathered rock; db = dorbank hardpan.

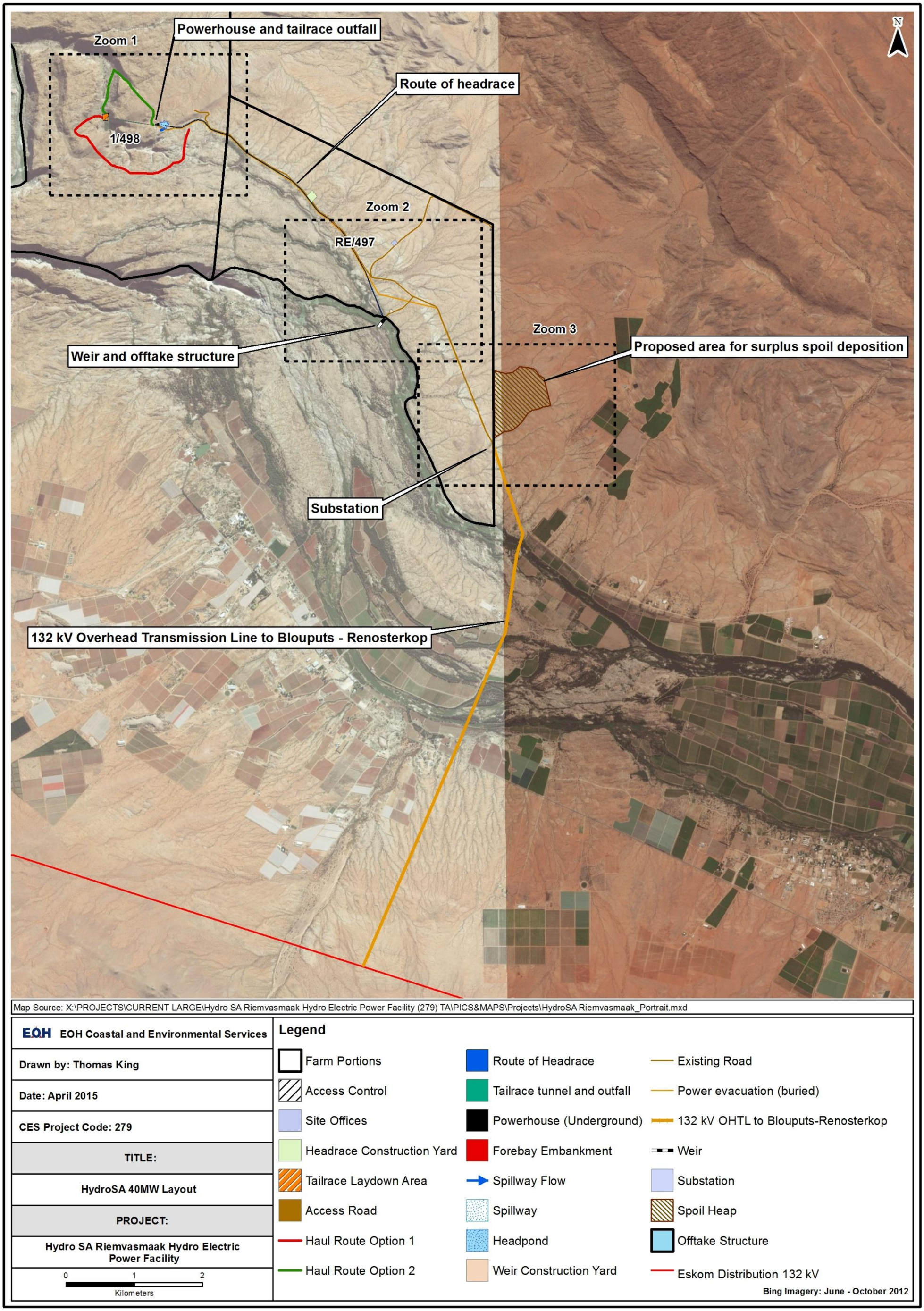

Figure 1. *Layout of the proposed development.*

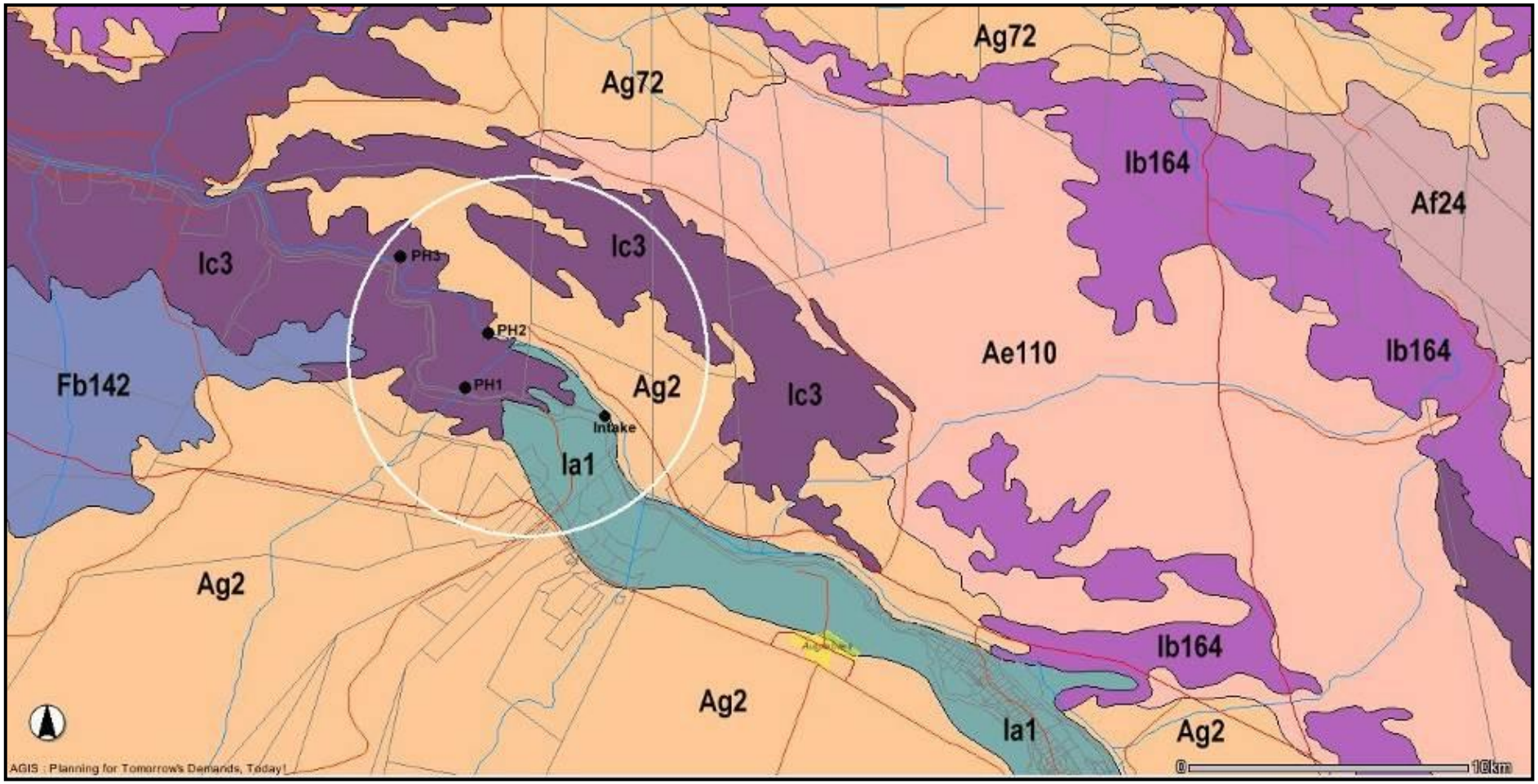

Figure 2: Land type classification in the project area. The powerhouse (PH3) is located on land type Ic3, the route of headrace on Ag2, weir and offtake structure on Ia1, the substation on Ag2 and the overhead transmission line on Ag2 except where it crosses the Orange river (Ia1).

Land capability and agricultural potential

Land capability is the combination of soil suitability and climate factors. Most of the site has a land capability classification, on the 8 category scale, of: Class 7 - non-arable, low potential grazing land. The rocky gorge areas are classified as Class 8 - non-utilisable wilderness.

The land has a low to moderate water erosion hazard (class 5). The soils are susceptible to wind erosion due to their sandy texture.

The shallow soils and the aridity constraints mean that agricultural land use) is restricted to low intensity grazing only. This is because the entire site, excluding the haul road options which are in land capability class VIII (8), are in land capability class VII (7) – non-arable, suitable only for grazing. The natural grazing capacity is low. It varies with distance from the river from 18 to as low as 60 hectares per large stock unit.

Land use and agricultural development

There is absolutely no agricultural development or agricultural land use within the main footprint of the proposed development. The 132 kV overhead transmission line will not cross any irrigated land. The spoil heap will be located on land not used for agriculture.

IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The components of the project that can impact on agricultural resources and productivity are:

- Occupation of the site by the footprint of the facility
- Construction activities that disturb the soil profile and vegetation
- Change in river level and river flow due to weir and water extraction.

The potential on-site agricultural impact of the development is a reduction in the agricultural potential of the land. This can occur through three different identified mechanisms, listed below.

1. Loss of potential agricultural land use due to direct occupation (the footprint) by all facility infrastructure.
2. Erosion due to alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal and the establishment of hard standing areas and roads.
3. Loss of topsoil due to poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance and spoil disposal.

The significance of this impact is negligible, predominantly because the proposed site is on land of extremely limited agricultural potential that is not used nor is likely to be used for agriculture. The impact is assessed in table format in Table 2 below.

The 132 kV overhead transmission line does not cross any irrigated land.

The construction of the weir will raise upstream water levels. Backwater calculations in a numerical simulation of the multiple river channels indicates that increased water levels extend for a distance of about 3 km upstream of the weir. This is known as the limit of influence of the weir. It is downstream of any cultivated areas adjacent to or between the active river channels, and indicates that the weir will not adversely affect irrigation or drainage infrastructure in these areas.

The portion of the river that is bypassed by the project is entirely unsuited to any agriculture (this section of the river traverses a deep gorge) and there is therefore no agricultural impact arising from this.

A summary of the significance of potential impacts on agricultural potential is provided in **Table 2**.

Assessment of impacts

Table 2. Assessment of the impact of reduction in agricultural potential for all phases of the development (construction, operation, decommissioning) and for all alternatives.

Impact	**Extent**	**Magnitude**	**Duration**	**Sig without mitigation**	**Sig with mitigation**	**Probability**	**Rever-sibility**
Reduction in agricultural potential	Site specific	Very Low	Long term	Very Low	Very Low	Probable	Reversible

Mitigation measures

For impact of overhead power line pylons :

Landowners of 1/492, 59/16, 107/16, and Kakamas South Settlement should be consulted for their input into the best placement of pylons. Place all pylons off irrigation land, or if not possible, place between or at the edges of existing land units so as to have minimal disturbance of irrigation land.

For the impact of loss of topsoil:

1. Strip and stockpile topsoil from all areas where soil will be disturbed, or covered by spoils.
2. After cessation of disturbance, re-spread topsoil over the surface, and stabilise the re-spread topsoil against erosion.

ENVIRONMENTAL MANAGEMENT PROGRAMME

Impact: Loss of topsoil

OBJECTIVE: Ensure effective topsoil covering to conserve soil fertility on all disturbed areas.

Project components	All construction activities that disturb the soil below surface, such as levelling, excavations etc.
Potential Impact	Lack of topsoil, resulting in decrease in soil fertility.
Activity / risk source	All construction activities that disturb the soil below surface, such as excavations etc.
Mitigation: Target / Objective	Ensure effective topsoil covering on all disturbed areas.

Mitigation: Action / control	**Responsibility**	**Timeframe**
If an activity will mechanically disturb the soil layer below the surface in any way, then the upper 10-30 cm of topsoil (depending on the specific topsoil depth at the site of disturbance) should first be stripped from the entire disturbed surface and stockpiled for re-spreading during rehabilitation.	Construction managers / Environmental Control Officer (ECO)	Duration of the construction phase
The stockpiled topsoil must be evenly spread over the entire disturbed surface.	Construction managers / ECO	During rehabilitation after construction / operation.

Performance Indicator	That no disturbed areas are left without an effective covering of topsoil, and potential for re-vegetation, after rehabilitation.
Monitoring	Establish an effective record keeping system for each area where soil is disturbed for construction purposes. These records should be included in environmental performance reports, and should include all the records below. Record the GPS coordinates of each area.

	Record the date of topsoil stripping. Record the GPS coordinates of where the topsoil is stockpiled. Record the date of cessation of construction (or operational) activities at the particular site. Photograph the area on cessation of construction activities. Record date and depth of re-spreading of topsoil. Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

REFERENCES

Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Water Research Commission. Undated. South African Rain Atlas available at http://134.76.173.220/rainfall/index.html.