# OFFSET INDUSTRIES

## *1st Draft: Desktop aquatic ecology impact assessment for the proposed Hector-Shongweni power line and substation deloyment*

30 June 2017

DRAFT - DESKTOP AQUATIC ECOLOGY

OFFSET INDUSTRIES

clean up your act

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# EXECUTIVE SUMMARY

The proposed project entails the construction of the Shongweni 2 X 500 MVA 400/132kV substation, ±40KM Hector - Shongweni 400kV Powerline and associated infrastructures. It will traverse various farms within the jurisdiction of Ethekwini Metropolitan within the KwaZulu Natal Province, South Africa.

A fly over was conducted on the 23th of May 2017. With the data collected during this exercise as well as avaliable desktop information this desktop aquatic ecology report was compiled. The proposed corridors encounter 2 quaternary catchments and 2 Sub Quaternary Reaches on route.

From the desktop impact assessment it was determined that on average the proposed project poses medium to low risks of erosion, sedimentation and pollution to the aquatic environments it encounters. If no mitigation measures are put in place there is a potentially high risk of impact from alien invasive plant species encroaching on cleared land. The majority of the risks are associated with the construction of the substations. Here, site selection is crucial and it is recommended that any site selected remain at least 60m away from the nearest watercourse measured from the outside edge of the riparian zone.

Shongweni Site G shoud be removed from the site selection process, it is located directly on a stream that supplies the Wekeweke River which is a FEPA river with a largely natural present ecological state. All corridor routes are potentially feasible provided no infrastructure is constructed in aquatic habitats (including riparian areas) and avoides crossing over the Wekeweke River.

The project, if it complies with all recommended mitigation measures, does not pose undue risk the to the aquatic environments it encounters.

However, once the final routes and substation positions have been selected it is recommended that any associated aquatic environments be subject to additional field studies to provide site specific mitigation measures.

# DECLARATION

I **Brett Reimers,** declare that –

- I act as the independent aquatic ecologist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the NEMA Act, regulations and all other applicable legislation;
- As a registered member of the South African Council for Natural Scientific Professions in terms of the Natural Scientific Professions Act, 2003 (Act No. 27 of 2003), I will undertake my professional duties in accordance with the Code of Conduct of the Council;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this report are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading

information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B-(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

**Signature of the specialist:**

**Date:**

| | |
|---|---|
| **Specialist:** | Brett Reimers |
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Abreviations used within report

| | |
|---|---|
| AIP | Alien Invasive Plants |
| DWS | Department of Water and Sanitation |
| km | Kilometre |
| kV | Kilo volt |
| MVA | Mega volt amp |
| NEMA | National Environmental Management Plan |
| NFEPA | National Freshwater priority Area |
| SOC | State owned company |
| SQR | Sub Quaternary Reach |
| WWTW | Waste water treatment works |

# 1. Introduction

## 1.1. Project description

The proposed project entails the construction of the Shongweni 2 X 500 MVA 400/132kV substation, ±40KM Hector - Shongweni 400kV Powerline and associated infrastructures.

The eThekwini Electricity Network has four 275kV Transmission in-feeds from Georgedale, Hector, Illovo and Avon substations.

- Avon Substation supplies Ottawa and Durban North Substations;
- Georgedale and Hector Substations supply Klaarwater Substation; and
- Ilovo Substation Substations supplies Durban South and Lotus Park Substations.

The load forecast shows load demand doubling in the geographical area supplied by Ottawa and Durban North Substations in the next 20 years. The area supplied by Klaarwater is expected to grow by 20% and the area supplied by Durban South and Lotus Park Substations is expected to grow by 30% over the same period. Consequently, Eskom has proposed to construct the Shongweni substation and the Hector-Shongweni 400kV powerline in order to cater for future electricity needs.

LEGAL REQUIREMENTS FOR BASIC ASSESSMENT

The proposed development triggers activities under Government Notice R984 (Listing Notice 2) Activity 9 of the 2014 EIA Regulations. In accordance with the requirements of the NEMA, Eskom Holdings SOC Limited requires approval from the Competent Authority i.e. Department of Environmental Affairs in order to undertake the proposed project.

LOCALITY

The proposed project will traverse various farms within the jurisdiction of EThekwini Metropolitan Municipality, Wards 4 and 103 in the Kwazulu Natal Province, South Africa (Figure 1).

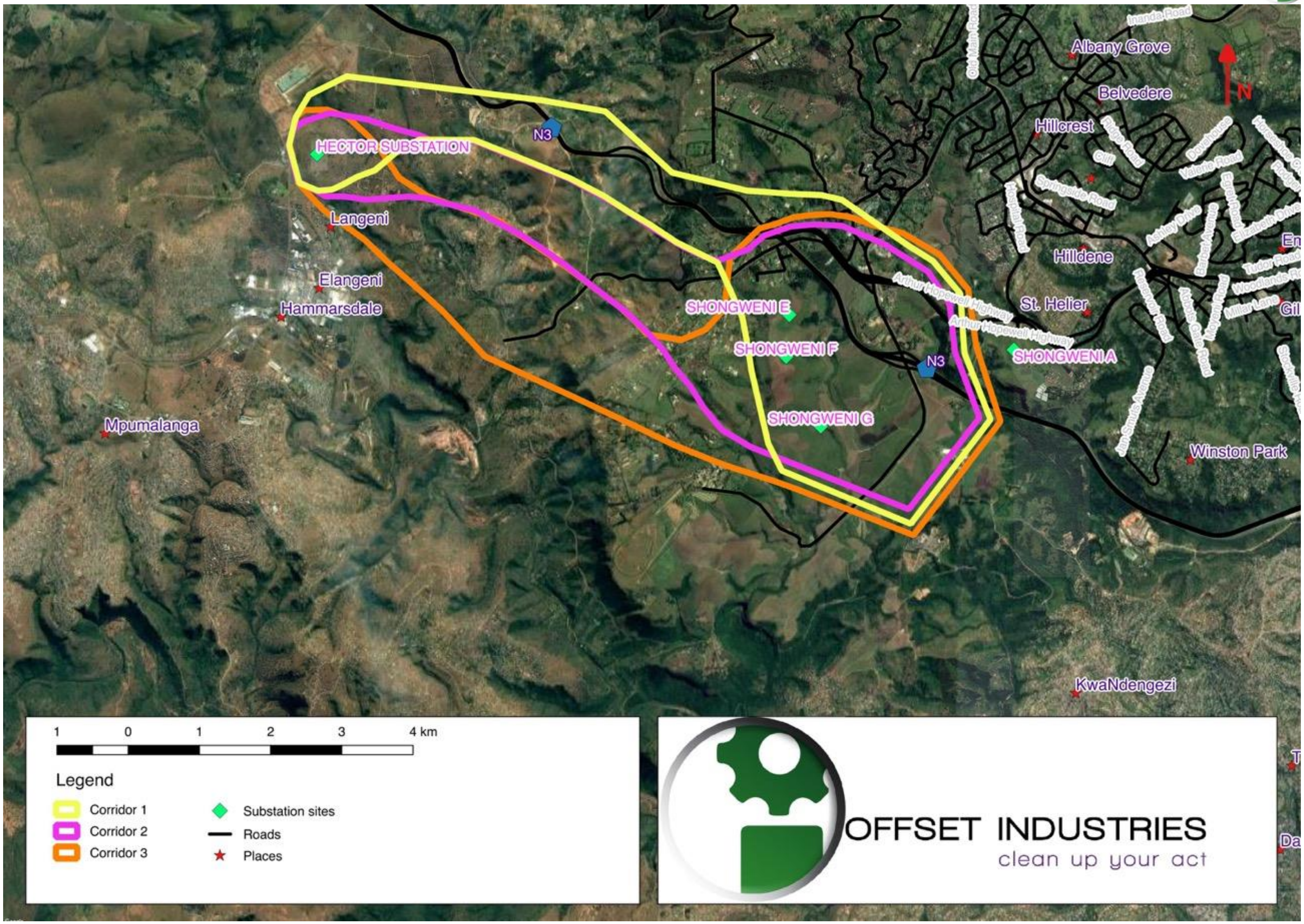


*Figure 1: Locality*

## 1.2. Desktop information

### 1.2.1. Quaternary data

The site falls over multiple quaternary catchments, these are again presented below in Figure 2. the corridors pass through three different primary ecoregions, these are:

- The North Eastern Coastal Belt; and
- The South eastern Uplands

The corridor and proposed substations sites are associated with 2 quaternary catchments (U60C and U60F). The three corridors encounter 2 sub-quaternary reaches these are:

- U60C-04613, the Wekeweke River, and
- U60F-04597 the Mhlatuzana River (Figure 3).

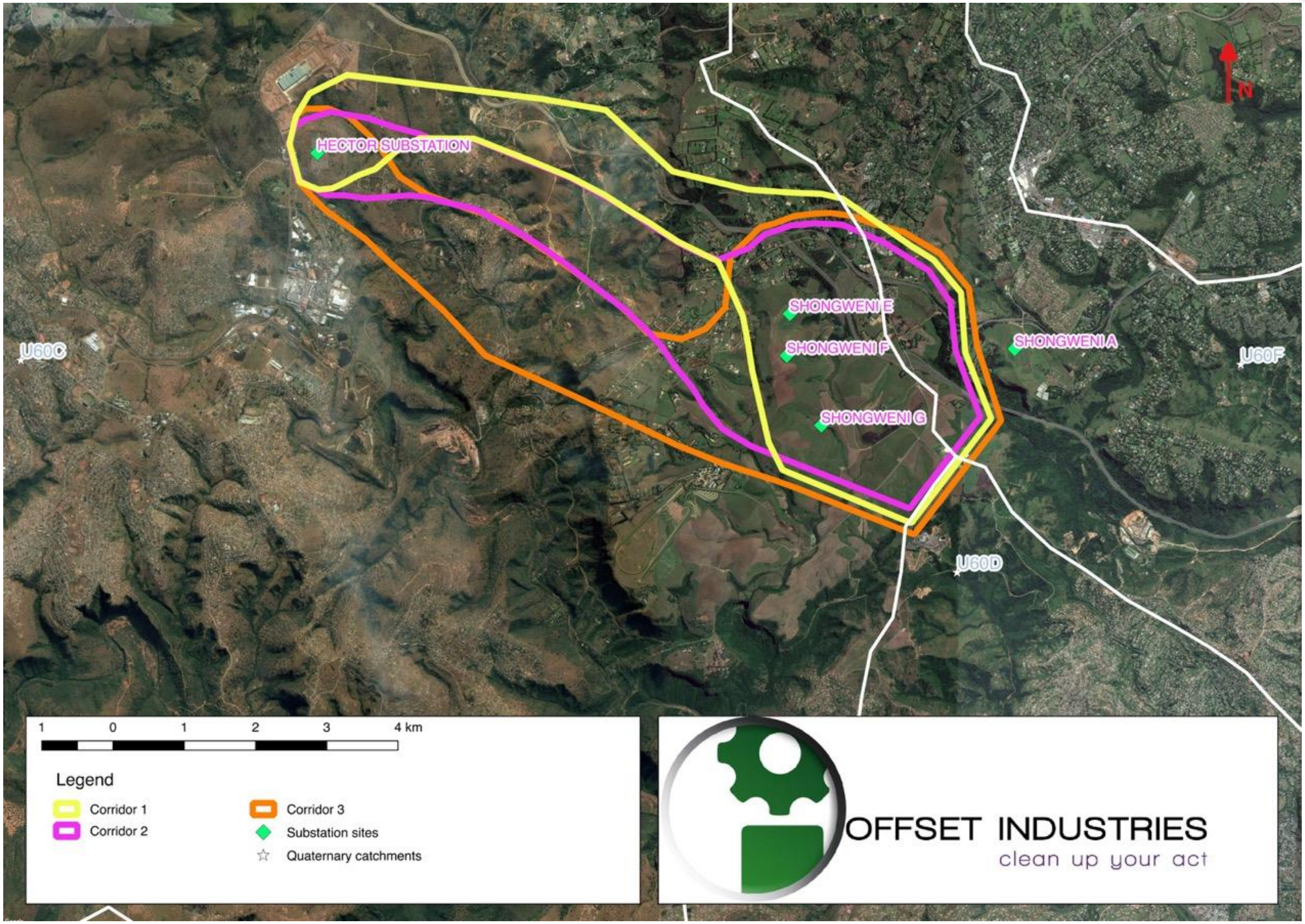


*Figure 2: Quaternary catchment map for all three corridors*

### 1.2.2. NFEPA

The National Freshwater Ecosystem Priority Areas (NFEPA) is a project that was developed to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and support for the sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs (Driver et al 2011).

The corridors areas encounter multiple rivers one of which is a FEPA rivers, these are illustrated below in Figure 3.

FEPA rivers are ecosystems that have strategic importance with regard to water supply or aquatic ecosystem support. Functions include fish recruitment support migration as well as biodiversity management. These rivers are subject to greater scrutinty and developments in close proximity to them need to impliment extra measures to ensure that the present ecological status of these rivers is not deminished by their presence.

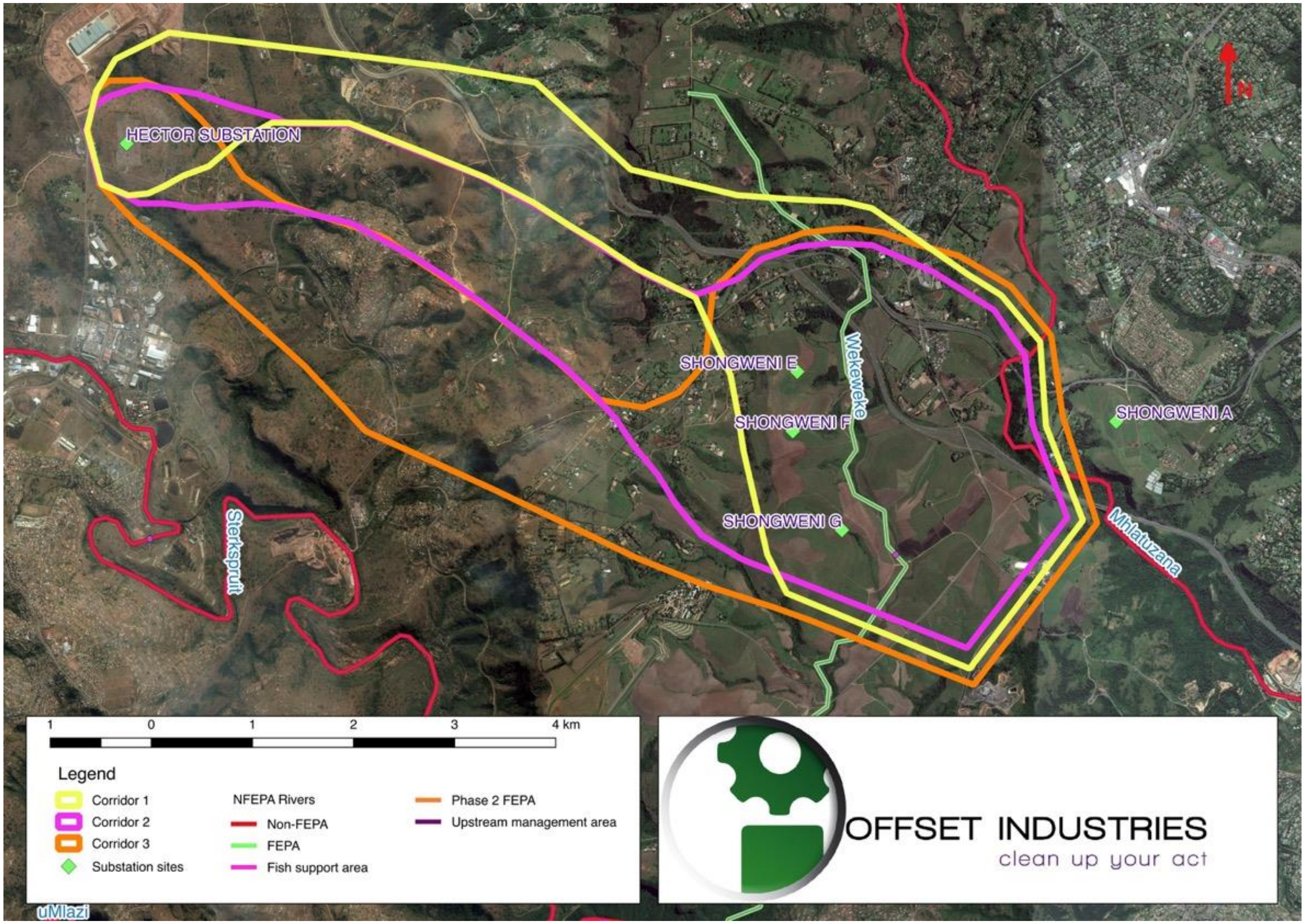


*Figure 3: FEPA rivers associated with the proposed corridors*

All three corridors  potentially cross over the Wekeweke River and border on the Mhlatuzana River.

## 2. Scope of work and limitations

### 2.1. Scope of Work

The scope of work for the desktop aquatic ecology impact assessment investigating the proposed route options between the established Hector substation and the proposed new Shongweni substation are:

A desktop assessment of the aquatic ecology associated with the proposed project will be focused on the sub-quaternary reaches (SQRs) associated with the powerline corridors, and will include the following:

- A description of the Present Ecological Status (PES).
- A description of the Ecological Important (EI) and Ecological Sensitivity (ES) of the reach.
- An expected macroinvertebrate assemblage.
- An expected fish species assemblage.
- A desktop based risk assessment for the proposed project, for the uMngeni River crossing. Mitigation measures will be prescribed for identified risks.

### 2.2. Limitations

The following limitations apply to this report:

- This is a desktop assessment no site visits were conducted,
- All information was sourced from online resources and information presented may be out of date and therefore inaccurate,
- The proposed corridors are as wide as 3 kms with the longest being over 10km it is not possible to cover an area of this extent in exhaustative detail.
- Impact scores are based on desktop information and may be inaccurate when compared to field investigations.
- Site Shongweni A was initially proposed but has been withdrawn by the client as it was deemed unsuitable.
    - Only sites E, F and G are considered within this report.

# 3. Methodology

## 3.1. Desktop assessment methodology

As this is a desktop assessment, no field investigations were carried out. All information was sourced from internet resources such as the NFEPA Atlas project and the Department of water and Sanitations, Desktop Present Ecological Status Assessments (Driver *et al*. 2011; Department of Water and Sanitation 2014). A flyover was undertaken on the 23$^{th}$ of May 2017. Data from the flyover is largely photographic and was used in conjunction with Google Earth Pro ™ imagery to assess the landscape and rivers within the proposed corridors.

## 3.2. Assessment of Impact Significance

Significance scoring both assesses and predicts the significance of environmental impacts through evaluation of the following factors; probability of the impact; duration of the impact; extent of the impact; and magnitude of the impact. The significance of environmental impacts is then assessed considering any proposed mitigations. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required[1]. Each of the above impact factors have been used to assess each potential impact using ranking scales.

Unknown parameters are given the highest score (5) as significance scoring follows the Precautionary Principle. The Precautionary Principle is outlined in Box 1.

> *'When the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.'*

*Box 1: The precautionary principle*

[1] Impact scores given "with mitigation" assume that the mitigation measures recommended in this assessment are implemented correctly and rehabilitation of the site is undertaken. Failure to implement mitigation measures during and after construction will keep the impact at an unacceptably high level.

Table 1: Significance scoring used for each potential impact

| Probability | Duration |
|---|---|
| 1 - very improbable<br>2 - improbable<br>3 - probable<br>4 - highly probable<br>5 - definite | 1 - very short duration (0-1years)<br>2-short duration (2-5 years)<br>3 - medium term (5-15 years)<br>4 - long term (>15 years)<br>5 - permanent/unknown |
| **Extent** | **Magnitude** |
| 1 - limited to the site<br>2 - limited to the local area<br>3 - limited to the region<br>4 - national<br>5 - international | 2 – minor<br>4 – low<br>6 – moderate<br>8 – high<br>10 – very high |

The following formula was used to calculate impact significance:

*Impact Significance: (Magnitude + Duration + Extent) x Probability*

The formula gives a maximum value of 100 points which are translated into 1 of 3 impact significance categories; Low, Moderate and High as per Table 2.

*Table 2: Impact significance ratings*

| Significance Points | Significance Rating |
|---|---|
| 0–30 points | Low environmental significance |
| 31–59 points | Moderate environmental significance |
| 60–100 points | High environmental significance |

The impact assessment is discussed in more detail in **Section 5.**

## 4. Results and discussion

Desktop data from the Department of water and Sanitation is presented below in

Table 3. certain catchments have more information avaliable than others and impacts within the catchments may vary in detail. there are six classes within the River Eco-status and Monitoring Programme (REMP). These are:

| | | | |
|---|---|---|---|
| Class A- Natural | (blue) | Class D- Largely modified | (orange) |
| ClassB- Largely natural | (green) | Class E- Seriously modified and | (red) |
| Class C-Moderately modified | (yellow) | Class F- Critically modified | (black) |

*Table 3: Summary of desktop information*

| Quaternary catchment | U60C | U60F |
|---|---|---|
| **SQR** | U60C-04613 | U60F-04597- |
| **River Name** | Wekeweke | Mhlatuzana |
| **EI** | High | High |
| **ES** | Very High | Very High |
| **PES** | Largely Natural | Largely Modified |
| **Impacts** | Sugar cane and Instream dams within the catchment | WWTWs discharge (Hillcrest) and other lower down the river, sugarcane, AIP in riparian zone, residential, industrial development, township, PPC quarry, estuary channelised |
| **Additional notes** | Shongweni site G,F and E Are closely associated with this SQR. | None |

## 4.1. Expected fish species

The table below (Table 4) gives an indication of the expected fish species within the SQRs associated with the proposed project. The fish are recorded in the table below with abbreviations. A key to the table is provided in Appendix A.

*Table 4: Fish within the associated the two SQRs*

| SQR code | Fish code |
|---|---|
| U60C-04613 | AAEN AMOS ANAT BGUR BNAT BPAL BVIV CGAR OMOS PPHI TREN TSPA |
| U60F-04597- | AAEN ABER AMOS ANAT BGUR BNAT BPAL BVIV CGAR GAES GCAL GGIU MARG MBRA MCAP MCEP MFAL MFLU OMOS PPHI RDEW TREN TSPA |

## 4.2. Current land use

The images below attempt to capture some of the land use within the proposed corridors.

*Figure 4: Large areas of land have been transformed for sugar farming, roads (N3) as well as upmarket and low income housing.*

From the above image, large scale land use change has occurred along large areas of the proposed corridor routes. Sugarcane farming appears to be the largest contributor to this change. However, other farming practises such as horse rearing and subsistence farming is also taking place. Large areas have been transformed for housing and sand mining (Figure 5) is also ongoing within the catchments. herdsmen graze their cattle in the grasslands and water them in the rivers potentially creating increased erosion and bank trampling risks for the aquatic environment (Figure 6).

Fire has been used to harvest sugar cane, this practise removes the wind buffer of the plant and reduces soil anchoring which allows for increased erosion from wind and rain. Replanting of sugarcane leaves soil exposed to the elements and allows for increased wind and water erosion as well as raises the risk of alien invasive plants.

*Figure 5: sand mining*

*Figure 6: Informal housing and subsistence farming*

Farm dams interrupt river and wetland flows altering channels and preventing the migration of aquatic species (predominantly fish, however some invertebrates also migrate). Dams also tend to accumulate toxins from the surrounding environment, such as pesticides and herbicides. Deeper dams can stagnate resulting in the creation of anoxic waters (Figure 7).

*Figure 7: Farm dams are constructed to support agriculture but can prevent the migration of aquatic species.*

The large majority of land has been transformed and alien invasive species have been allowed to colonise large areas (Figure 8).

*Figure 8: Large scale land transformation and alien invasive species encroachment*

# 5. Impact assessment

## 5.1. Construction Phase

During the construction phase, moderate to large scale earth moving will be required during excavations for the foundations of infrastructure such as pylons. Ground may become hardened via compaction effects from heavy vehicles, this compaction will enhance runoff, leading to an increased risk of erosion downslope.

Site clearing will remove vegetation and expose sediments to wind and waters erosive effects. Eroded sediments will be transported downslope and deposited within the aquatic environment. Increased sedimentation can alter available habitat availability and thereby alter the species compositions within rivers.

Vegetation clearing also poses the risk of allowing invasive plant species to colonise the corridors or substation site. These fast-growing weedy species out compete many native plants and can rapidly colonise an area if no management actions are put in place during the construction phase. Table 5 below details the impact assessment for the sites assessed, during the construction phase.

*Table 5: Construction phase impacts*

| | Probability | | Duration | | Extent | | Magnitude | | Significance scoring without mitigation | Significance scoring with mitigation |
|---|---|---|---|---|---|---|---|---|---|---|
| | Without | With | Without | With | Without | With | Without | With | | |
| 1) Impacts associated with soil erosion, sedimentation | | | | | | | | | | |
| Site E | 4 | 1 | 2 | 1 | 2 | 1 | 6 | 4 | 40(Moderate) | 6 (Low) |
| Site F | 4 | 1 | 2 | 1 | 2 | 1 | 6 | 4 | 40(Moderate) | 6 (Low) |
| Site G | 4 | 3 | 2 | 1 | 2 | 1 | 8 | 6 | 48(Moderate) | 24 (Low) |
| 2) Impacts associated with Pollution | | | | | | | | | | |
| Site E | 3 | 1 | 3 | 2 | 2 | 1 | 6 | 4 | 33 (Moderate) | 7 (Low) |
| Site F | 3 | 1 | 3 | 2 | 2 | 1 | 6 | 4 | 33 (Moderate) | 7 (Low) |
| Site G | 3 | 1 | 3 | 2 | 2 | 1 | 6 | 4 | 33 (Moderate) | 7 (Low) |
| 3) Impacts associated alien vegetation | | | | | | | | | | |
| Site E | 3 | 2 | 5 | 2 | 3 | 2 | 6 | 4 | 56 (High) | 16 (Low) |
| Site F | 3 | 2 | 5 | 2 | 3 | 2 | 6 | 4 | 56 (High) | 16 (Low) |
| Site G | 3 | 2 | 5 | 2 | 3 | 2 | 6 | 4 | 56 (High) | 16 (Low) |

From Table 5, all impacts associated with the proposed substations can be lowered from high (alien invasive plants) or moderate significance to low significance if the correct mitigation is put in place. The Shongweni site G was seen to have a higher risk profile as it is more closely associated with an NFEPA river system (Wekeweke River).

The importance of alien invasive plant control cannot be over stressed. With the correct management plan the colonization and spread of alien invasive plants can be greatly reduced. Alternatively, not putting measures in place can result in the transformation of the sites and further spread of seeds via water transport within the rivers.

#### 6.2.1 Mitigation

All site camps must be kept at least 60 m outside of aquatic ecosystems. This distance is to be measured from the outside edge of the riparian zone. No washing of vehicles or personal is permitted within any river. Soils stock piles, concrete and building rubble must be kept at least 60m away from any river.

No vehicles or machinery are to be permitted within the aquatic environment. Maintenance roads may also not enter aquatic ecosystems.

Storm water controls within the substation facility are essential, a storm water management plan must be compiled to prevent the threat of high rainfall events leading to erosion and the deposition of sediments within aquatic ecosystems.

Water must not be abstracted from any river for any irrigation, construction or rehabilitation purposes unless a water use license has been granted allowing the specific activity.

Rehabilitation of the disturbed sediments needs to be conducted in a timely manner and the indigenous vegetation planted should be monitored and maintained to prevent die off and alien invasive plant encroachment.

It is recommended that an in conjunction with an alien invasive plant management specialist that a control and eradication plan be compiled and implemented for the powerline routes.

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If cables need to be placed over aquatic ecosystems the footprint of the exercise must be minimized as much as possible. Where possible, to avoid compaction within soft sediment areas hand stringing should be considered.

*Alien Invasive Vegetation*

- An alien invasive management plan must be compiled for the alien invasive plant species on site and implemented during construction phase and followed up on and monitored as part of the operational phase.
- Protocols should be developed to prevent workers transporting alien invasive seeds from infested areas to as yet un-impacted locations
- If additional studies identify the presence of alien invasive aquatic faunal species these should be added to the invasive species control plan.

### 5.2. Operational Phase

The operational phase of the project poses lower levels of risk to the aquatic environment. Monitoring and maintenance of the powerlines is likely to be sporadic. However, when maintenance is required vehicular movement within riparian zones should be prohibited to prevent damaging vegetation, leading to erosion and reduce the likelihood of river bank collapse.

Table 6 below details the risk assessment for the impacts posed during the operational phase.

Operational risks tend to be higher scoring due to the time frames involved. While construction impacts occur over a limited time they tend to be more significant in terms of impact to the system, the constructed system can be operational over decades; usually the risk profile is lower once the infrastructure has been placed and the surrounding systems have settled.

*Table 6: Operational phase impacts*

| | Probability | | Duration | | Extent | | Magnitude | | Significance scoring without mitigation | Significance scoring with mitigation |
|---|---|---|---|---|---|---|---|---|---|---|
| | Without | With | Without | With | Without | With | Without | With | | |
| 4) Impacts associated with soil erosion, sedimentation | | | | | | | | | | |
| Site E | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 2 | 16 (Low) | 4 (low) |
| Site F | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 2 | 16 (Low) | 4 (low) |
| Site G | 3 | 2 | 2 | 1 | 2 | 1 | 4 | 2 | 24 (Low) | 8 (low) |
| 5) Impacts associated with Pollution | | | | | | | | | | |
| Site E | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 2 | 16 (Low) | 4 (low) |
| Site F | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 2 | 16 (Low) | 4 (low) |
| Site G | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 2 | 16 (Low) | 4 (low) |
| 6) Impacts associated alien vegetation | | | | | | | | | | |
| Site E | 4 | 2 | 5 | 2 | 2 | 1 | 8 | 4 | 60 (High) | 14 (low) |
| Site F | 4 | 2 | 5 | 2 | 2 | 1 | 8 | 4 | 60 (High) | 14 (low) |
| Site G | 4 | 2 | 5 | 2 | 2 | 1 | 8 | 4 | 60 (High) | 14 (low) |

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High and low impacts can be lowered further in all cases if appropriate mitigation measures are put in place. High impacts are again associated with alien vegetation, which if allowed to take hold can self-propagate and expand significantly by using the rivers as transportation for seeds. It is recommended that the alien invasive plant control begin along the river banks and work outwards up the catchment.

#### 6.3.1 Mitigation

Maintenance vehicles are to be prohibited from driving within the riparian zone and must be constrained to established support roads at all times. No vehicles should be allowed within any river system. If significant work needs to be carried out within an aquatic ecosystem a risk assessment should be conducted with input from an aquatic ecologist.

Erosion monitoring at the bases of the pylons and at the substations must be carried out in order to identify issues early and implement remedial measures to reduce environmental degradation.

*Alien Invasive Vegetation*

- An alien invasive management plan must be compiled for both construction and operational phases. This must be implemented during construction phase and followed up on and monitored as part of the operational phase.
- If additional studies identify the presence of alien invasive aquatic faunal species these should be added to the invasive species control plan.

## 6. Recommendations

Shongweni Site G is the least preferred site from an aquatic ecology perspective, it is located on a spring and is a direct tributary of the Nfepa River (the Wekeweke River). Site G should be excluded from selection. Site E and F are more suitable and will not require the power lines to cross the Wekeweke River.

Crossing over the Wekeweke River must be avoided.

It is recommended that either remaining site (Sites E and F) chosen for construction of a substation be at least 60 meters away from the nearest aquatic ecosystem, this includes the associated riparian zone. Due to the scale of the

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project it is highly recommended that once a site has been selected and the route confirmed that any aquatic ecosystems still associated with the proposed substations be subject to field investigations to improve the mitigation measures mentioned in this document.

It is recommended that when the final route is selected that the pylon sites potentially associated with rivers be approved by an aquatic ecologist. Pylons may not be constructed in aquatic environments including riparian zones.

All corridors are viable from and aquatic ecology perspective as long as they proceed in the most direct route to the proposed substation site (E and F) and do not attempt to cross the Wekeweke River.

Additional site specific investigations may be required up to and including the following:

- *In situ* water quality assessment;
- Invertebrate assessments including;
  - the South African Scoring System version 5,
  - Macroinvertebrate Assessment Index.
- Habitat assessments;
  - Invertebrate Habitat Assessment System,
  - Intermediate Habitat Integrity Assessment, and
- Vegetation assessments in the form of Vegetation Response Assessment Index (level 3).
- Fish response assessment index

future monitoring should assess the health of the river and provide mitigation and management options for the improvement of the affected system.

## 7. Conclusion

A fly over was conducted on the 23$^{th}$ of May 2017. With the data collected during this exercise and avaliable desktop information this desktop aquatic ecology report was compiled. The proposed corridors encounter 2 quaternary catchments and 2 SQRs on their approximately 50 km route from the Hector Substation to the proposed sites.

From the assessment it was determined that on average the proposed project poses medium to low risks of erosion, sedimentation and pollution to the aquatic environments it encounters. The majority of the risks are associated with the construction of the substations are related to the spread and colonistation of alien invasive vegetation.

It is recommended that any site selected and designed allow for at least a 60m buffer from the nearest watercourse when measured from the outside edge of the riparian zone.

The least prefered site for a substation is Site G and should be excluded from the selection process. this is due to is location on a tributary of the NFEPA river called the Wekeweke River.

The project if it complies with all recommended mitigation measures does not pose undue risk the to the various aquatic environments. However, once the final routes and substation positions have been selected it is recommended that any associated aquatic environments be subject to additional field studies to provide site specific mitigation measures.

## 8. References


Driver A, Nel J, Snaddon K, Murray K, Roux D, Hill L, & Swartz E. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. WRC Report No. 1801/1/11. Pretoria: Water Research Commission.

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Kleynhans CJ. 2007. Module D: Fish Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2) Joint WaterResearch Commission and Department of Water Affairs and Forestry report. WRC Report No.

## Appendix A

Key to fish codes table extracted from Kleynhans 2007.

| ABBREVIATION | SCIENTIFIC NAME | ENGLISH COMMON NAME |
|---|---|---|
| AAEN | *AWAOUS AENEOFUSCUS* (PETERS 1852) | FRESHWATER GOBY (M) |
| ABAR | *AUSTROGLANIS BARNARDI* (SKELTON, 1981) | BARNARD'S ROCK CATFISH |
| ABER | *ACANTHOPAGRUS BERDA* (FORSSKÅL, 1775) | RIVERBREAM (MS) |
| ABIC | *ANGUILLA BICOLOR BICOLOR* MCCLELLAND, 1844 | SHORTFIN EEL |
| ABRE | *ATHERINA BREVICEPS* VALENCIENNES, 1835 | CAPE SILVERSIDE |
| AGIL | *AUSTROGLANIS GILLI* (BARNARD, 1943) | CLANWILLIAM ROCK-CATFISH |
| AJOH | *APLOCHEILICHTHYS JOHNSTONI* (GÜNTHER, 1893) | JOHNSTON'S TOPMINNOW |
| AKAT | *APLOCHEILICHTHYS KATANGAE* (BOULENGER, 1912) | STRIPED TOPMINNOW |
| ALAB | *ANGUILLA BENGALENSIS LABIATA* PETERS, 1852 | AFRICAN MOTTLED EEL |
| AMAR | *ANGUILLA MARMORATA* QUOY & GAIMARD 1824 | GIANT MOTTLED EEL |
| AMOS | *ANGUILLA MOSSAMBICA* PETERS 1852 | LONGFIN EEL |
| AMYA | *APLOCHEILICHTHYS MYAPOSAE* (BOULENGER, 1908) | NATAL TOPMINNOW |
| ANAT | *AMPHILIUS NATALENSIS* BOULENGER, 1917 | NATAL MOUNTAIN CATFISH |
| ASCL | *AUSTROGLANIS SCLATERI* (BOULENGER, 1901) | ROCK-CATFISH |
| AURA | *AMPHILIUS URANOSCOPUS* (PFEFFER, 1889) | STARGAZER (MOUNTAIN CATFISH) |
| BAEN | *LABEOBARBUS AENEUS* (BURCHELL, 1822) | SMALLMOUTH YELLOWFISH |
| BFRI | *BARBUS AFROHAMILTONI* CRASS, 1960 | HAMILTON'S BARB |
| BAMA | *BARBUS AMATOLICUS* SKELTON, 1990 | AMATOLA BARB |
| BAND | *BARBUS ANDREWI* BARNARD, 1937 | WHITEFISH |
| BANN | *BARBUS ANNECTENS* GILCHRIST & THOMPSON, 1917 | BROADSTRIPED BARB |
| BANO | *BARBUS ANOPLUS* WEBER, 1897 | CHUBBYHEAD BARB |

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| | | |
|---|---|---|
| BARG | *BARBUS ARGENTEUS* GÜNTHER, 1868 | ROSEFIN BARB |
| BBIF | *BARBUS BIFRENATUS* FOWLER, 1935 | HYPHEN BARB |
| BBRI | *BARBUS BREVIPINNIS* JUBB, 1966 | SHORTFIN BARB |
| BCAL | *BARBUS CALIDUS* BARNARD, 1938 | CLANWILLIAM REDFIN |
| BCAP | *BARBUS CAPENSIS* SMITH, 1841 | CLANWILLIAM YELLOWFISH |
| BERU | *BARBUS ERUBESCENS* SKELTON, 1974 | TWEE RIVER REDFIN |
| BEUT | *BARBUS EUTAENIA* BOULENGER, 1904 | ORANGEFIN BARB |
| BGUR | *BARBUS GURNEYI* GÜNTHER, 1868 | REDTAIL BARB |
| BHOS | *BARBUS HOSPES* BARNARD, 1938 | NAMAQUA BARB |
| BIMB | *BRYCINUS IMBERI* (PETERS, 1852) | IMBERI |
| BKIM | *LABEOBARBUS KIMBERLEYENSIS* GILCHRIST & THOMPSON, 1913 | LARGEMOUTH YELLOWFISH |
| BLAT | *BRYCINUS LATERALIS* (BOULENGER, 1900) | STRIPED ROBBER |
| BLIN | *BARBUS LINEOMACULATUS* BOULENGER, 1903 | LINE-SPOTTED BARB |
| BMAR | *LABEOBARBUS MAREQUENSIS* SMITH, 1841 | LARGESCALE YELLOWFISH |
| BMAT | *BARBUS MATTOZI* GUIMARAES, 1884 | PAPERMOUTH |
| BMOT | *BARBUS MOTEBENSIS* STEINDACHNER, 1894 | MARICO BARB |
| BNAT | *BARBUS NATALENSIS* CASTELNAU, 1861 | SCALY |
| BNEE | *BARBUS NEEFI* GREENWOOD, 1962 | SIDESPOT BARB |
| BPAL | *BARBUS PALLIDUS* SMITH, 1841 | GOLDIE BARB |
| BPAU | *BARBUS PALUDINOSUS* PETERS, 1852 | STRAIGHTFIN BARB |
| BPOL | *LABEOBARBUS POLYLEPIS* BOULENGER, 1907 | SMALLSCALE YELLOWFISH |
| BRAD | *BARBUS RADIATUS* PETERS, 1853 | BEIRA BARB |
| BSER | *BARBUS SERRA* PETERS, 1864 | SAWFIN |
| BTOP | *BARBUS TOPPINI* BOULENGER, 1916 | |
| BTRE | *BARBUS TREURENSIS* GROENEWALD, 1958 | TREUR RIVER BARB |
| BTRI | *BARBUS TRIMACULATUS* PETERS, 1852 | THREESPOT BARB |
| BUNI | *BARBUS UNITAENIATUS GÜNTHER, 1866* | LONGBEARD BARB |
| BTRV | *BARBUS TREVELYANI* GÜNTHER, 1877 | |
| BVIV | *BARBUS VIVIPARUS* WEBER, 1897 | BOWSTRIPE BARB |
| CANO | *CHILOGLANIS ANOTERUS* CRASS, 1960 | PENNANT TAIL SUCKERMOUTH (OR ROCK CATLET) |

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| CAUR | *CARASSIUS AURATUS* (LINNAEUS, 1758) | GOLDFISH (EX) |
| CBIF | *CHILOGLANIS BIFURCUS* JUBB & LE ROUX, 1969 | INCOMATI SUCKERMOUTH (OR ROCK CATLET) |
| CBRE | *CHETIA BREVIS* JUBB, 1968 | ORANGE-FRINGED LARGEMOUTH |
| CCAR | *CYPRINUS CARPIO* LINNAEUS, 1758 | CARP (EX) |
| CEMA | *CHILOGLANIS EMARGINATUS* JUBB & LE ROUX, 1969 | PONGOLO SUCKERMOUTH (OR ROCK CATLET) |
| CFLA | *CHETIA FLAVIVENTRIS* TREWAVAS, 1961 | CANARY KURPER |
| CGAR | *CLARIAS GARIEPINUS* (BURCHELL, 1822) | SHARPTOOTH CATFISH |
| CIDE | *CTENOPHARYNGODON IDELLA* (VALENCIENNES, 1844) | GRASS CARP (EX) |
| CMUL | *CTENOPOMA MULTISPINE* PETERS, 1844 | MANYSPINED CLIMBING PERCH |
| CPAR | *CHILOGLANIS PARATUS* CRASS, 1960 | SAWFIN SUCKERMOUTH (OR ROCK CATLET) |
| CPRE | *CHILOGLANIS PRETORIAE* VAN DER HORST, 1931 | SHORTSPINE SUCKERMOUTH (OR ROCK CATLET) |
| CSWI | *CHILOGLANIS SWIERSTRAI* VAN DER HORST, 1931 | LOWVELD SUCKERMOUTH (OR ROCK CATLET) |
| CTHE | *CLARIAS THEODORAE* WEBER, 1897 | SNAKE CATFISH |
| GAES | *GILCHRISTELLA AESTUARIA* (GILCHRIST, 1913) | ESTUARINE ROUND-HERRING |
| GAFF | *GAMBUSIA AFFINIS* (BAIRD & GIRARD, 1853) | MOSQUITOFISH (EX) |
| GCAL | *GLOSSOGOBIUS CALLIDUS* SMITH, 1937 | RIVER GOBY (M) |
| GGIU | *GLOSSOGOBIUS GIURIS* (HAMILTON-BUCHANAN, 1822) | TANK GOBY (M) |
| GZEB | *GALAXIAS ZEBRATUS* CASTELNAU, 1861 | CAPE GALAXIAS |
| HANS | *HIPPOPOTAMYRUS ANSORGII* (BOULENGER,1905) | SLENDER STONEBASHER |
| HCAP | *HYPORHAMPHUS CAPENSIS* (THOMINOT, 1886) | CAPE HALFBEAK (MS) |

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| HMOL | *HYPOPHTHALMICHTHYS MOLITRIX* (VALENCIENNES, 1844) | SILVER CARP (EX) |
| HVIT | *HYDROCYNUS VITTATUS* CASTELNAU, 1861 | TIGERFISH |
| KAUR | *KNERIA AURICULATA* (PELLEGRIN, 1905) | SOUTHERN KNERIA |
| LCAP | *LABEO CAPENSIS* (SMITH, 1841) | ORANGE RIVER LABEO |
| LCON | *LABEO CONGORO* PETERS, 1852 | PURPLE LABEO |
| LCYL | *LABEO CYLINDRICUS* PETERS, 1852 | REDEYE LABEO |
| LMAC | *LEPOMIS MACROCHIRUS* RAFINESQUE, 1819 | BLUEGILL SUNFISH (EX) |
| LMCR | *LIZA MACROLEPIS* (SMITH, 1846) | LARGE-SCALE MULLET (MS) |
| LMOL | *LABEO MOLYBDINUS* DU PLESSIS, 1963 | LEADEN LABEO |
| LRIC | *LIZA RICHARDSONII* (SMITH, 1846) | SOUTHERN MULLET (MS) |
| LROS | *LABEO ROSAE* STEINDACHNER, 1894 (*LABEO ALTEVILIS*) | REDNOSE LABEO |
| LRUB | *LABEO RUBROMACULATUS* GILCHRIST & THOMPSON, 1913 | TUGELA LABEO |
| LRUD | *LABEO RUDDI* BOULENGER, 1907 | SILVER LABEO |
| LSEE | *LABEO SEEBERI* GILCHRIST & THOMPSON, 1911 | CLANWILLIAM SANDFISH |
| LUMB | *LABEO UMBRATUS* (SMITH, 1841) | MOGGEL |
| MACU | *MICRALESTES ACUTIDENS*(PETERS, 1852) | SILVER ROBBER |
| MARG | *MONODACTYLUS ARGENTEUS* (LINNAEUS, 1758) | NATAL MOONY (MS) |
| MBRA | *MICROPHIS BRACHYURUS* BLEEKER, 1853 | OPOSSUM PIPEFISH (M) |
| MBRE | *MESOBOLA BREVIANALIS* (BOULENGER, 1908) | RIVER SARDINE |
| MCAP | *MYXUS CAPENSIS* (VALENCIENNES, 1836) | FRESHWATER MULLET (M) |
| MCEP | *MUGIL CEPHALUS* LINNAEUS, 1758 | FLATHEAD MULLET (M) |
| MCYP | *MEGALOPS CYPRINOIDES* (BROUSSONET, 1782) | OXEYE TARPON |
| MDOL | *MICROPTERUS DOLOMIEU* LACEPÈDE, 1802 | SMALLMOUTH BASS (EX) |
| MFAL | *MONODACTYLUS FALCIFORMIS* LACEPÈDE, 1801 | CAPE MOONY (MS) |

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| MFLU | *MICROPHIS FLUVIATILIS* (PETERS, 1852) | FRESHWATER PIPEFISH (M) |
| MMAC | *MARCUSENIUS MACROLEPIDOTUS* (PETERS, 1852) | BULLDOG |
| MPUN | *MICROPTERUS PUNCTULATUS* (RAFINESQUE, 1819) | SPOTTED BASS (EX) |
| MSAL | *MICROPTERUS SALMOIDES* (LACEPÈDE, 1802) | LARGEMOUTH BASS (EX) |
| NORT | *NOTHOBRANCHIUS ORTHONOTUS* (PETERS, 1844) | SPOTTED KILLIFISH |
| NRAC | *NOTHOBRANCHIUS RACHOVII* AHL, 1926 | RAINBOW KILLIFISH |
| OAUR | *OREOCHROMIS AUREUS* (STEINDACHNER, 1864) | ISRAELI TILAPIA (EX) |
| OMAC | *OREOCHROMIS (NYASALAPIA) MACROCHIR* (BOULENGER, 1912) | GREENHEAD TILAPIA |
| OMOS | *OREOCHROMIS MOSSAMBICUS* (PETERS, 1852) | MOZAMBIQUE TILAPIA |
| OMYK | *ONCORHYNCHUS MYKISS* (WALBAUM, 1792) | RAINBOW TROUT (EX) |
| ONIL | *OREOCHROMIS NILOTICUS (LINNAEUS, 1758)* | NILE TILAPIA (EX) |
| OPER | *OPSARIDIUM PERINGUEYI* (GILCHRIST & THOMPSON, 1913) | SOUTHERN BARRED MINNOW |
| OPLA | *OREOCHROMIS PLACIDUS* (TREWAVAS, 1941) | BLACK TILAPIA |
| PAFE | *PSEUDOBARBUS AFER* (PETERS, 1864) | EASTERN CAPE REDFIN |
| PAMP | *PROTOPTERUS AMPHIBIUS* (PETERS, 1844) | EAST COAST LUNGFISH |
| PANN | *PROTOPTERUS ANNECTENS BRIENI* POLL,1961 | LUNGFISH |
| PASP | *PSEUDOBARBUS ASPER* (BOULENGER, 1911) | SMALLSCALE REDFIN |
| PBUG | *PSEUDOBARBUS BURGI* (BOULENGER, 1911) | BERG RIVER REDFIN |
| PBUR | *PSEUDOBARBUS BURCHELLI* SMITH, 1841 | BURCHELL'S REDFIN |
| PCAT | *PETROCEPHALUSWESSELSI* KRAMER & VAN DER BANK, 2000 | SOUTHERN CHURCHILL |
| PFLU | *PERCA FLUVIATILIS* LINNAEUS, 1758 | EUROPEAN PERCH (EX) |

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| PPHI | *PSEUDOCRENILABRUS PHILANDER* (WEBER, 1897) | SOUTHERN MOUTHBROODER |
| PPHL | *PSEUDOBARBUS PHLEGETHON* (BARNARD, 1938) | FIERY REDFIN |
| PQUA | *PSEUDOBARBUS QUATHLAMBAE* (BARNARD, 1938) | DRAKENSBERG MINNOW |
| PRET | *POECILIA RETICULATA*PETERS, 1859 | GUPPY (EX) |
| PTEN | *PSEUDOBARBUS TENUIS* (BARNARD, 1938) | SLENDER REDFIN |
| RDEW | *REDIGOBIUS DEWAALI* (WEBER, 1897) | CHECKED GOBY (M) |
| SBAI | *SANDELIA BAINSII* CASTELNAU, 1861 | EASTERN CAPE ROCKY |
| SCAP | *SANDELIA CAPENSIS* (CUVIER, 1831) | CAPE KURPER |
| SFON | *SALVELINUS FONTINALIS* (MITCHILL, 1815) | BROOK CHARR (EX) |
| SINT | *SCHILBE INTERMEDIUS* RÜPPELL, 1832 | SILVER CATFISH |
| SMER | *SERRANOCHROMIS MERIDIANUS* JUBB, 1967 | LOWVELD LARGEMOUTH |
| SSIB | *SILHOUETTEA SIBAYI* FARQUHARSON, 1970 | SIBAYI GOBY (M) |
| STRU | *SALMO TRUTTA* LINNAEUS, 1758 | BROWN TROUT (EX) |
| SZAM | *SYNODONTIS ZAMBEZENSIS* PETERS, 1852 | BROWN SQUEAKER |
| TREN | *TILAPIA RENDALLI* (BOULENGER, 1896) | REDBREAST TILAPIA |
| TSPA | *TILAPIA SPARRMANII* SMITH, 1840 | BANDED TILAPIA |
| TTIN | *TINCA TINCA* (LINNAEUS, 1758) | TENCH (EX) |
| VNEL | *VARICORHINUS NELSPRUITENSIS* GILCHRIST & THOMPSON, 1911 | INCOMATI CHISELMOUTH |
| XHEL | *XIPHOPHORUS HELLERI* HECKEL, 1848 | SWORDTAIL (EX) |