PROPOSED ESKOM BATTERY STORAGE DEVELOPMENT, WESTERN CAPE.

WORCESTER GROUP: HEX SUBSTATION

ECOLOGICAL SURVEY STATEMENT

Prepared for:

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DECLARATION

PROJECT: PROPOSED ESKOM BATTERY STORAGE PROJECT: WORCESTER GROUP: HEX SS, WC. Ecological Statement.

This report has been prepared according to the requirements of the Environmental Impact Assessments Regulations (GNR 982) in Government Gazette 38282 of 4 December 2014. We (the undersigned) declare the findings of this report free from influence or prejudice.

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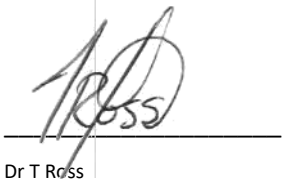

Date: 20 January 2019

Dr T Ross

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1.1. Background

ESKOM has proposed a development that will see the establishment of on-site battery storage of power at various substations throughout the Western Cape Province. The proposed Battery Energy Storage Systems (BESS) will consists of an electrolyte (varying from zinc-bromide, vanadium, lithium ion and other lead-acid containing substances) and will be filled on site during the construction period. The substances will be kept in the electrolyte for a short period. This report details the findings of the Hex Substation, which forms part of the Worcester group.

The proposed development site lies adjacent to the existing Hex Substation and therefore requires an expansion of the actual substation footprint area. This will require the removal of all vegetation within the footprint, landscaping and importing of aggregate to line the ground to abate fire hazards. The impact footprint will therefore be completely transformed, with little to no mitigation measures being appropriate to reduce the ecological impact within the infrastructure footprint. It is, however, a relatively small footprint area. The proposed site is an open area that is currently disused but which has been subject to historical and ongoing ecological impacts that all have led to transformation of the natural habitat features, including soils, vegetation and general habitat. Historical infrastructure development has directly impacted the site and is regarded as one of the most prominent drivers of ecological change. These include a railway line and formal roads that border the site. The site is embedded within an urbanised setting, with the land use being predominantly industrial and commercial sectors. These factors have led to the relative ecological isolation of the site. Landscaping and dumping of surplus building materials, rubble and urban refuse are pressures that are further regarded as drivers of ecological transformation. Although some indigenous flora does occur at the site, it is regarded as having limited ecological value. The locality of the site is presented in Figure 1.

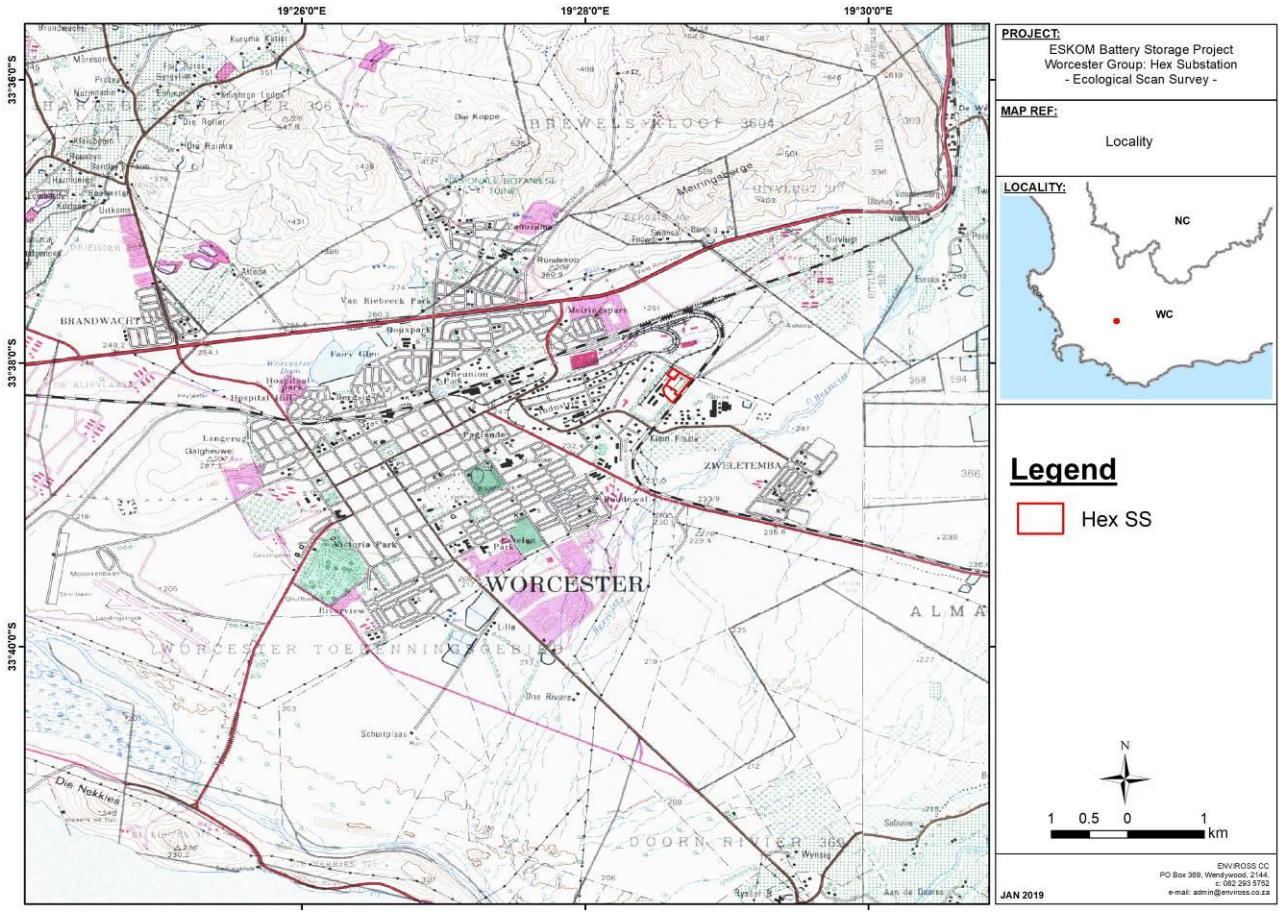

Figure 1: Locality of the proposed development site.

1.2. Scope of Work

EnviRoss CC was requested to undertake a brief field survey to evaluate the ecological integrity of the site and to offer a professional opinion on the ecological impacts associated with the development of the site. There is limited ecological value offered by the features present at the site and therefore a brief ecological statement was thought adequate to supplement the environmental authorisation process. The field survey was undertaken during January 2019.

2. ASSUMPTIONS & LIMITATIONS

The conclusions to overall perceived impacts have been based on a desktop survey that was reiterated by ground-truthing through a brief field survey of the proposed development site. Even though every effort was undertaken to identify ecologically sensitive habitats, the presence of RDL and protected species and

other pertinent ecological issues relating to the project, the limited time spent on site (limited to a single field survey) necessitated certain assumptions regarding the potential presence or absence of species to be made. These assumptions were largely based on the professional judgement that is supported by similar field experience within similar areas of the specialist.

3. DESCRIPTION OF THE SURVEY SITE

3.1. Ecological processes

The proposed development site has an association with Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) according to the Western Cape Conservation Plan (C-Plan, 2017). These associations are presented in Figure 2.

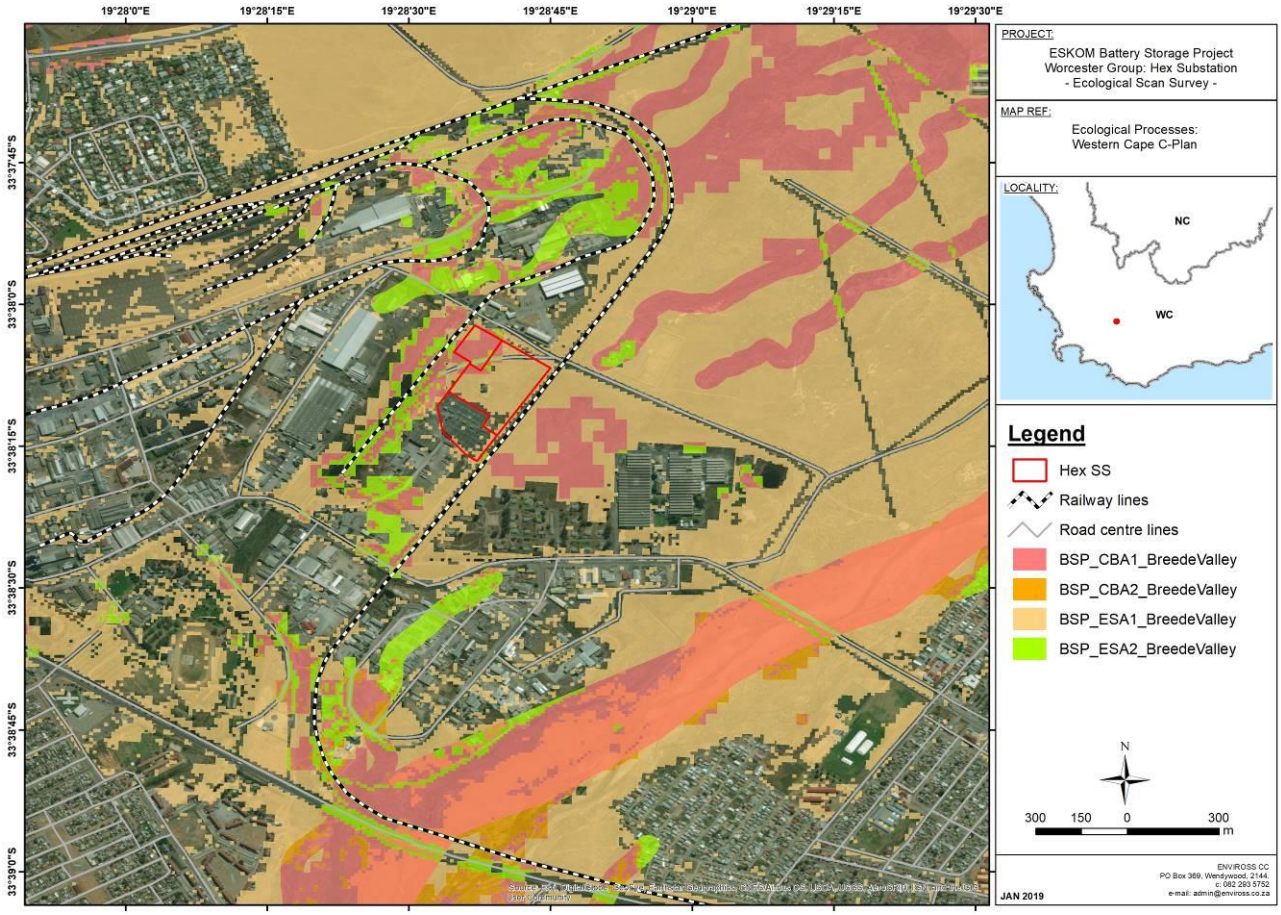

Figure 2: The association that the proposed development site has with areas designated as ecologically significant according to the Western Cape C-Plan (2017).

From this it can be seen that the proposed development site falls within an area designated as a CBA1 and also includes an area designated as ESA1. Areas that have retained natural vegetation that are embedded within a floral unit of conservational significance are generally categorised as CBA1, as they have the potential to support representation of the vegetation units as well as provide potential habitat for Rd Listed floral species. The areas designated as ESA1 represent natural areas that have suffered a degree of transformation but are considered to provide valuable buffer zones to CBA areas or are those areas that perform specific ecological functions (regardless of ecological condition), such as linear habitat units such as riparian and wetland zones. The site has been subject to a significant amount of transformation and therefore limited natural habitat has remained. Indigenous flora does occur at the site, but vegetation structures don't represent primary vegetation features.

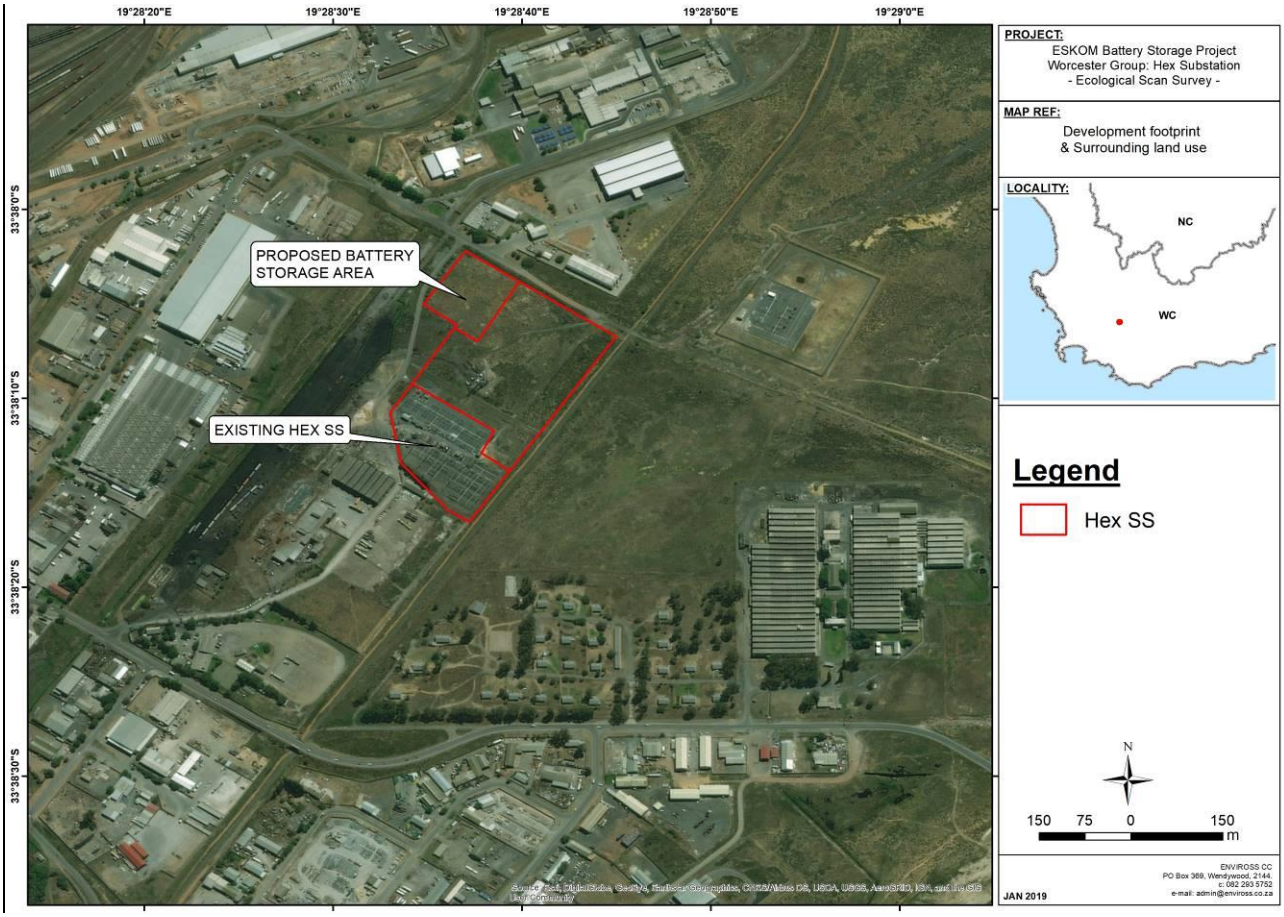

Figure 3: The proposed development footprint and surrounding land use.

Being embedded within the industrial and commercial sector, and lying adjacent to the existing substation, has resulted in the site suffering from ecological isolation (Figure 3). Pressures emanating from the surrounding land use, and historical and ongoing degradation factors associated with the site have resulted

in an ecologically transformed area, which is regarded as having limited ecological value. Landscaping, dumping of refuse and rubble as well as persistent impacts from historical infrastructure development have all had deleterious impacts on the overall ecological integrity of the site (as shown in Figure 4). No wetland and/or other surface water ecosystems are associated with the site. The proposed development site is also topographically flat and therefore the development of the site will lead to a low risk of erosion and therefore a low risk of impacting any nearby wetland or aquatic features.

Figure 4: Various views of the proposed development footprint area.

3.2. Vegetation unit

The proposed development area falls within the Fynbos Biome, with the major vegetation unit being Breede Alluvium Renosterveld. This vegetation type is considered to be conservationally *Endangered* due to a high level of transformation and limited formal conservation of the unit. Although some floral species that typify the vegetation unit are present at the site, structure of the floral community indicates

transformation of the unit, which is mostly through pressures and drivers emanating from the local land use.

3.3. Floral species assessment

Indigenous floral species do occur at the site, but in a floral community structure that was not representative of the diagnostic characteristics of the vegetation unit. Exotic vegetation was also noted to occur at the site. Dominant species noted during the field survey included *Aspalathus spinosa, Athanasia trifurcata* and *Stoebe plumosa*. Pioneering grass species, being indicative of recent historical and ongoing disturbances, were noted, with *Cynodon dactylon* being most dominant. *Pentaschistis airoides* also occurred at the site.

The development of the site would not pose a threat to floral conservation within the area.

3.4. Faunal features

No mammalian species were noted within the site. A variety of bird species were noted, but were limited to those that opportunistically were utilising the site for foraging purposes. Species were limited to generalist and adaptable species. No herpetofaunal species were noted during the survey. Invertebrate species noted included only generalist species that are found in a variety of habitat types and are considered to be common throughout their geographical distribution range.

The development of the site would not pose a threat to faunal conservation within the area. This is reiterated by the site being ecologically isolated.

4. SIGNIFICANCE RATINGS OF PERCEIVED ENVIRONMENTAL IMPACTS

The potential impacts pertaining to a development of this nature have been identified that could be deleterious to the overall long term ecological functionality and integrity of the proposed development area have been shown to be readily managed to within acceptable limits by the implementation of realistic and achievable mitigation measures. It should be noted, however, that the successful implementation of the mitigation measures and the long-term impacts on the overall ecological integrity at the development

site can only be possible with the sincere efforts of the management and construction teams associated with the project.

The ratings are calculated for the scenarios of both before and after the implementation of mitigation measures (Table 1 and Table 2). This was done in order to show how the degree of impacts can be reduced by careful planning and the following of relatively simple mitigation measures. The methodologies and ratings system are provided in Appendix A.

Table 1: The significance ratings both before and after implementation of mitigation measures of the main potential ecological impacts perceived to be associated to the proposed development activities pertaining to the construction phase.

PRE-CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
Clearing of vegetation to accommodate infrastructure and services	<u>Direct Impact:</u>	Existing	1	4	1	1	6.0 - MOD	Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; The footprint of the proposed development should be limited to the areas that already suffer transformation; Rehabilitation of the areas that are impacted by the development outside of the ultimate infrastructure footprint will aid in abating the ecological impacts.	The construction footprint area has already suffered significant ecological transformation. Limited significant impacts are thought to occur.
	Vegetation stripping of the infrastructure footprint will be necessary to allow for the establishment of; infrastructure; This will have limited significance to the due to the site having already been historically subject to impacting features.	Cumulative	3	4	2	1	9.0 - MOD		Cumulative loss of the vegetation unit to accommodate infrastructure development is relatively high.
		Residual	1	4	1	1	6.0 - MOD		Insignificant residual impacts will remain as the site already suffers ecological transformation and degradation, but the site will establish infrastructure within an area that had natural features before.
Loss of RDL floral species during site clearing.	<u>Direct Impact:</u>	Existing	1	4	1	0.1	0.6 - LOW	The occurrence of RDL floral species is highly unlikely due to the transformation of the associated habitat throughout the site.	Loss of RDL floral species at the local scale from the proposed development activities is considered insignificant following historical transforming land use.
	Site clearing will remove all vegetation to accommodate the infrastructure development. RDL or otherwise sensitive floral species may be included when vegetation is stripped, suffering loss of individuals; This is highly unlikely due to the transformed nature of the footprint area and therefore thought insignificant to the project.	Cumulative	2	4	2	0.5	3.0 - MOD		Cumulative loss of RDL flora is relatively high. Cumulative losses are the very reason why species become threatened.
		Residual	1	4	1	0.1	0.6 - LOW		Residual impacts to RDL flora are minimal due to the site being located adjacent to existing industrial infrastructure.
Loss and/or displacement of sensitive faunal species.	<u>Direct Impact:</u>	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); Unlikely to occur due to the transformed state of the proposed construction footprint	Thought to be insignificant due to the largescale transformation of the habitat throughout the survey area.
	Site disturbances and vegetation (habitat) loss may lead to the loss of faunal species that are sensitive to	Cumulative	2	4	2	0.5	0.8 - LOW		Displacement of sensitive faunal species due to habitat destruction eventually leads to loss of those species.

PRE-CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
	disturbances. Again, the transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.	Residual	1	4	1	0.1	0.6 - LOW	and immediate surrounding areas.	Insignificant residual impacts will remain as the site already suffers ecological transformation and degradation, but the site will establish infrastructure within an area that had natural features before.
Destruction of nesting and/or roosting habitat for faunal species.	<u>Direct Impact:</u>	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	Thought to be insignificant due to the largescale transformation of the habitat at the site.
	Site clearing will remove all vegetation to accommodate the infrastructure development; The transformed nature of the footprint area assumes that only highly adaptable and generalist species would inhabit the site and therefore thought insignificant to the project.	Cumulative	2	4	2	0.5	4.0 - MOD		Destruction of nesting habitat displaces the affected species eventually leads to loss of those species.
		Residual	1	4	1	0.1	0.6 - LOW		Insignificant residual impacts will remain, but the site will establish infrastructure within an area that had natural features before.
Destruction of ground-dwelling and/or sedentary fauna.	<u>Direct Impact:</u>	Existing	1	4	1	0.1	0.6 - LOW	Limit the footprint to only areas necessary for the construction process; Utilise single access roads only; Avoid indiscriminate destruction of habitat.	Thought to be insignificant due to the transformation of the habitat at the site.
	Site clearing will remove all vegetation and habitat to accommodate the infrastructure development. Ground-dwelling fauna (e.g. Mygalomorph spiders) or ground-nesting birds may be included when vegetation is stripped, suffering loss of individuals; Thought to have a low probability, however, due to the already-transformed nature of the proposed development site.	Cumulative	2	4	2	0.5	4.0 - MOD		Loss of habitat is the leading cause of species decline in general.
		Residual	1	4	1	0.1	0.6 - LOW		Insignificant residual impacts will remain, but the site will establish infrastructure within an area that had natural features before.
Destruction of sensitive habitat.	<u>Direct Impact:</u>	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); Unlikely to occur due to the transformed	Thought to be insignificant due to the largescale transformation of the habitat at the site.
		Cumulative	3	4	2	0.5	4.5 - MOD		Cumulative loss of sensitive habitat is relatively high within the region.

PRE-CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
	Association that the site has with CBAs and ESAs indicates that sensitive habitat units occur at the site. The proposed development site has already suffered ecological and physical transformation and therefore this is thought to be an insignificant impact.	Residual	1	4	1	0.1	0.6 - LOW	state of the proposed construction footprint and immediate surrounding areas.	Insignificant residual impacts will remain, but the site will establish infrastructure within an area that had natural features before.
Disturbance features that alter the vegetation structures	<u>Indirect Impact:</u>	Existing	1	4	1	0.1	0.6 - LOW	Indiscriminate habitat destruction to be avoided and the proposed development should remain as localised as possible (including support areas and services); Unlikely to occur due to the transformed state of the proposed construction footprint and immediate surrounding areas.	Exotic vegetation could invade the area following disturbance impacts. This will require active management. True for the maintained perimeter areas that will be continually maintained to avert fire risk. Continued maintenance means that this impact is easily mitigated.
	Disturbances of soils will lead to altered state of vegetation structures. This will often lead to bush encroachment or establishment of exotic invasive species; The infrastructure footprint will be permanently stripped of vegetation and maintained as such. A perimeter area will also be maintained to avert fire risks.	Cumulative	3	4	2	0.5	4.5 - MOD		Cumulative loss of primary vegetation features is relatively high within the region and therefore should be avoided.
		Residual	1	4	2	0.1	0.7 - LOW		Insignificant residual impacts will remain as it is an impact that is readily mitigated for.
Habitat fragmentation resulting from infrastructure development.	<u>Direct Impact:</u>	Existing	1	3	1	0.1	0.5 - LOW	The habitat is already highly fragmented due to surrounding infrastructure development. The significance of this impact due to the proposed development is therefore insignificant.	Habitat fragmentation is thought to be an insignificant impact due to the close proximity to existing features that already disrupts the connectivity of the habitat units.
	The proposed development site is embedded within an industrial area and therefore already suffers relatively	Cumulative	3	4	2	0.5	4.5 - MOD		Habitat fragmentation is relatively high within the region and is a leading cause of habitat destruction.

PRE-CONSTRUCTION PHASE									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
	ecological isolation. An open area occurs to the southeast, but access is hindered by a railway line. This is therefore not thought to be a significant ecological impact emanating from the proposed development.	Residual	1	2	1	0.1	0.4 - LOW		Insignificant residual impacts will remain.
Soil erosion	<u>Direct Impact:</u>	Existing	1	1	1	0.1	0.3 - LOW	Topsoil stockpiles should be protected from erosion.	Soil erosion should not be a significant impacting feature due to the relatively flat topography of the site.
	Soil erosion will take affect any unprotected soils that have suffered disturbances, including unprotected stockpiles of stored topsoil. Soil stripping, soil compaction and vegetation removal will increase rates of erosion and entry of sediment into the general environment and surrounding watercourses; The site is relatively flat, so there will be limited risk of erosion. Stockpiled soils will, however, be at risk of dispersal.	Cumulative	2	2	2	0.5	3.0 - MOD		Soil erosion is of national concern and is one of the leading causes of ecological degradation.
		Residual	1	1	1	0.1	0.3 - LOW		Insignificant residual impacts will remain if managed appropriately.

Table 2: The significance ratings both before and after implementation of mitigation measures of the main potential ecological impacts perceived to be associated to the proposed development activities pertaining to the operations and management phase.

OPERATIONS PHASE									
Activity	**Nature of Impact**	**Impact type**	**Extent**	**Duration**	**Potential Intensity**	**Likeli-hood**	**Rating**	**Mitigation***	**Interpretation**
Storing and utilisation of dangerous chemicals.	Direct & Indirect Impact:	Existing	1	2	4	0.2	1.4 - LOW	Storage of chemicals to be limited to appropriate and secure facilities on site and access limited to authorised personnel only; Storage in secure containers to ensure/limit the potential for the occurrence of leakages; Storage area to be bunded with an appropriate volume capacity to protect from environmental contamination should accidental leakages occur; Transferal of chemicals to batteries should be done according to best practice guidelines to limit spillage; Should spillage occur, the ECO must be informed immediately, and a clean-up operation immediately commenced. Contaminated soils must be cleared and removed for disposal at a registered waste site capable of disposal of the chemicals.	The storage facilities as well as the management and utilisation thereof will be strictly controlled and therefore significant accidental spillages, although possible, are thought to be improbable.
	Spillages of dangerous chemicals from inadequate and unprotected storage facilities and/or spillages during routine operations will contaminate soils and lead to chemicals (heavy metals) becoming bio-available to enter into the food chain; Chemical leachates could contaminate groundwater and/or be transported to surface water ecosystems via surface water runoff.	Cumulative	3	3	2	0.75	6.0 - MOD		Cumulative habitat degradation through soil and water contamination from pollutants, especially heavy metals elements, is a leading cause of ecological degradation in industrial areas.
		Residual	1	1	1	0.2	0.6 - LOW		Insignificant residual impacts will remain if adequate clean-up operations are immediately implemented should spillages occur.
Vegetation transformation for areas that are routinely maintained.	Indirect Impact:	Existing	1	3	1	0.1	0.5 - LOW	The peripheral area of the substation will be routinely maintained to avert the fire risks and therefore any emergent exotic vegetation can be simultaneously managed.	This will have a limited impact to the site.
	Routine disturbances of vegetation will result in transformation of the structures, with an expected increase in abundance of pioneering species; The relatively small spatial scale tends to render this impact insignificant.	Cumulative	2	3	2	0.5	3.5 - MOD		Cumulative vegetation transformation through invasion of exotic vegetation is a nationwide concern,
		Residual	1	2	1	0.1	0.4 - LOW		Little to no residual impacts should remain if managed appropriately.

4.1. Pre-Construction & Construction Phase

The pre-construction and construction phases of the proposed development activities will include the site preparation for the storage area, which will include the complete stripping of vegetation, landscaping, compaction of soils and preparation of the ground with a fire retardant inert substance (most likely to be concrete, stone paving or crushed stone (such as crushed dolerite). This will have the inevitable impacts of loss of habitat and loss of vegetation, which will influence the biodiversity within the area. The significance of this impact will vary according to the present ecological state of the site, the conservation status of the vegetation type and whether the vegetation present at the site can be considered to be representative of primary vegetation structure, the scale of the site to be cleared, the use of heavy earthmoving equipment that may require to impact an area larger than the ultimate development footprint (site offices, equipment and mateirals storage yards, access roads) and whether the site has an association with other sensitive ecological features such as surface water ecosystems. The significance is also determined by what impacting features can be mitigated for and how successful those mitigation measures are expected to be in the long term. By keeping the footprint of the impacts reduced to a minimum by only allowing heavy machinery to operate on designated access roadways and by avoiding the indiscriminate destruction of habitat within areas adjacent to the actual construction areas, the ecological impacts can be greatly reduced. This is especially pertinent for activities that are to take place adjacent to the wetland areas and associated conservation buffer zones (if applicable).

4.1.1. Red Data Listed biodiversity impacts

No RDL species were noted to occur at the site during the field survey and, due to the close proximity to existing infrastructure that results in the site suffering relative ecological isolation, no RDL faunal or floral species are thought to occur within the impact footprint area. This impact is therefore regarded as being insignificant.

4.1.2. Floral community structures

The disturbance of soils and vegetation enhances the growth of opportunistic pioneering species. These species can be indigenous, but are most often exotic in origin that grow rapidly, colonising an area through aggressive encroachment and will out-compete the indigenous counterparts in most cases. The proposed

development footprint has already been subject to historical disturbances and therefore the floral community structures have already been altered.

4.1.3. Faunal community structures

The construction phase of a development of this nature requires the use of heavy machinery, earthmoving equipment and large teams of construction crews who are very often accommodated in construction camps (although this is unlikely for this particular development). This means that disturbance features typically increase. This could lead to displacement of sensitive species, especially ground-dwelling and ground-nesting species. Direct impacts to habitat will also lead to destruction of suitable nesting and foraging areas. This is thought to be of minor significance to the project though as the proposed development footprint area is located directly adjacent to existing industrial infrastructure. The proposed development activities are therefore seen to be of minor ecological significance.

4.1.4. Soil features

Soil erosion emanating from disturbed areas and soil stockpiles could smother surrounding habitat and silts could reach aquatic and wetland systems (if applicable). This will displace faunal biota from those areas that are transformed through this impact. This feature can be easily mitigated. It is, however, regarded as being highly unlikely that soils and silts would be transported to any surface water ecosystems due to the distance of the proposed development area from the nearest wetland units and the site is considered to be topographically flat. It is, however, prudent to manage soil erosion throughout all phases of the proposed development activities as a general means of maintaining ecological health.

4.2. Management/Operations Phase

The operations phase of the proposed development refers to the everyday activities and those impacts that are thought to perpetuate. The proposed activities will store chemicals associated with battery storage that are deleterious to the environment without proper storage and handling. Impacts will be the result of accidental spillages, inadequate storage facilities (such as not being bunded) and poor handling by badly-informed operators and technicians. Again, these impacts can be mitigated for to abate negative ecological

impacts, but the likelihood of an impact occurring will be largely up to the operators and technicians and their attitudes toward safe practice.

4.2.1. Chemical spillages

The management of dangerous chemicals that are utilised and stored on site is regarded as the most pertinent mitigation point to minimise the risk of environmental contamination. Chemicals must be stored in a designated and approved storage area where access is limited to qualified and approved personnel only. This storage area must be bunded with a volume capable of containing spillages from accidental spillages, or leaking containers, or any other foreseeable accidental spillage scenarios. Maintenance of batteries and chemical handling must be done by appropriately trained personnel only. Any accidental spillages must be immediately cleaned, contaminated soils removed and disposed of at a registered disposal site that is capable of processing such chemicals. The severity of the impact associated with spillages will depend on the scale, the runoff potential, the response time between the spill event and the clean-up operations and the success rate of the clean-up operations. Emergency procedures to deal with spillages must be written up in the EMPr and all applicable personnel must be familiar with the procedures.

4.2.2. Other perpetuating impacts

Management of soil erosion as well as exotic vegetation will also be important to the management/operations phase and should be monitored for routinely. Any emerging concerns must be dealt with immediately. Stormwater runoff must also be monitored for as this is often a source of emerging erosion. The site is regarded as being topographically flat and therefore this is not thought to be a significant concern.

5. CONCLUSIONS & RECOMMENDATIONS

Following a brief evaluation of the ecological processes associated with the proposed battery storage area that lies adjacent to the existing Hex Substation, the following conclusions were drawn:

- Limited ecological value has been retained by the proposed development site;
- The actual development footprint already has suffered ecological transformation due to the typical pressures and drivers of ecological change associated with the site being located within an

industrial and commercial area. These include dumping of rubble and domestic refuse, soil pollution, landscaping, etc;

- The site is regarded as being ecologically isolated due to the surrounding land use;
- No dependency of RDL fauna or flora is relevant to the site;
- No surface water ecosystems are applicable to the site;
- Disturbances of the site, typical of the construction phase of a development of this nature, will not lead to undue erosion due to the site being topographically flat;
- The development of the site would pose limited significance to the conservation of biodiversity within the area;
- The impacts that have been identified following this survey are shown to range from low to moderate. Moderate impacts can be successfully mitigated to lower the overall impacts;
- The storage of dangerous chemicals must be within approved and secure storage areas and the usage thereof must be limited to trained and authorised personnel. Spillages must be cleared up and disposed of immediately to avoid passive leaching within the soils;
- It is recommended that the impact footprint remain as localised as possible to minimise the impact footprint and that supporting services (storage yards, etc) be sited within areas already established;
- It is recommended that the developer undertake a clean-up operation to remove the dumped rubble and other discarded materials from the vegetated areas, as well as managing any alien vegetation associated with the site. This will aid in improving a degree of ecological functionality of the site and allow for the support of a level of biodiversity.

APPENDIX A – IMPACT RATING SIGNIFICANCE METHODOLOGIES & CALCULATIONS.

A1. Impact Assessment Methodology

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria, as discussed below.

A2. Nature of the impact

Each impact should be described in terms of the features and qualities of the impact. A detailed description of the impact will allow for contextualisation of the assessment.

A3. Extent of the impact

Extent intends to assess the footprint of the impact. The larger the footprint, the higher the impact rating will be. The table below provides the descriptors and criteria for assessment.

Table 3: Criteria for the assessment of the extent of the impact.

Extent Descriptor	Definition	Rating
Site	Impact footprint remains within the boundary of the site.	1
Local	Impact footprint extends beyond the boundary of the site to the adjacent surrounding areas.	2
Regional	Impact footprint includes the greater surrounds and may include an entire municipal or provincial jurisdiction.	3
National	The scale of the impact is applicable to the Republic of South Africa.	4
Global	The impact has global implications	5

A4. Duration of the impact

The duration of the impact is the period of time that the impact will manifest on the receiving environment. Importantly, the concept of reversibility is reflected in the duration rating. The longer the impact endures, the less likely it is to be reversible. See Table 4for the criteria for rating duration of impacts.

Table 4: Criteria for the rating of the duration of an impact.

Duration Descriptor	Definition	Rating
Construction / Decommissioning phase only	The impact endures for only as long as the construction or the decommissioning period of the project activity. This implies that the impact is fully reversible.	1
Short term	The impact continues to manifest for a period of between 3 and 5 years beyond construction or decommissioning. The impact is still reversible.	2
Medium term	The impact continues between 6 and 15 years beyond the construction or decommissioning phase. The impact is still reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 15 years beyond construction or decommissioning. The impact is only reversible with considerable effort in implementation of rigorous mitigation actions.	4
Permanent	The impact will continue indefinitely and is not reversible.	5

A5. Potential intensity of the impact

The concept of the potential intensity of an impact is the acknowledgement at the outset of the project of the potential significance of the impact on the receiving environment. For example, SO_2 emissions have the potential to result in significant adverse human health effects, and this potential intensity must be accommodated within the significance rating. The importance of the potential intensity must be emphasised within the rating methodology to indicate that, for an adverse impact to human health, even a limited extent and duration will still yield a significant impact.

Within potential intensity, the concept of irreplaceable loss is taken into account. Irreplaceable loss may relate to losses of entire faunal or floral species at an extent greater than regional, or the permanent loss of significant environmental resources. Potential intensity provides a measure for comparing significance across different specialist assessments. This is possible by aligning specialist ratings with the potential intensity rating provided here. This allows for better integration of specialist studies into the environmental impact assessment. See Table 5 and Table 6 below.

Table 5: Criteria for impact rating of potential intensity of a negative impact.

Potential Intensity Descriptor	Definition of negative impact	Rating
High	Significant impact to human health linked to mortality/loss of a species/endemic habitat.	16
Moderate-High	Significant impact to faunal or floral populations/loss of livelihoods/individual economic loss.	8
Moderate	Reduction in environmental quality/loss of habitat/loss of heritage/loss of welfare amenity	4

Potential Intensity Descriptor	Definition of negative impact	Rating
Moderate-Low	Nuisance impact	2
Low	Negative change with no associated consequences.	1

Table 6: Criteria for the impact rating of potential intensity of a positive impact.

Potential Intensity Descriptor	Definition of positive impact	Rating
Moderate-High	Net improvement in human welfare	8
Moderate	Improved environmental quality/improved individual livelihoods.	4
Moderate-Low	Economic development	2
Low	Positive change with no other consequences.	1

It must be noted that there is no HIGH rating for positive impacts under potential intensity, as it must be understood that no positive spinoff of an activity can possibly raise a similar significance rating to a negative impact that affects human health or causes the irreplaceable loss of a species.

A6. Likelihood of the impact

This is the likelihood of the impact potential intensity manifesting. This is not the likelihood of the activity occurring. If an impact is unlikely to manifest then the likelihood rating will reduce the overall significance. Table 7 provides the rating methodology for likelihood.

The rating for likelihood is provided in fractions in order to provide an indication of percentage probability, although it is noted that mathematical connotation cannot be implied to numbers utilised for ratings.

Table 7: Criteria for the rating of the likelihood of the impact occurring

Likelihood Descriptor	Definition	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1
Unlikely	The possibility of the impact occurring is low with a less than 10% chance of occurring. The impact has not occurred before.	0.2
Probable	The impact has a 10% to 40% chance of occurring. Only likely to happen once in every 3 years or more.	0.5
Highly Probable	It is most likely that the impact will occur and there is a 41% to 75% chance of occurrence.	0.75
Definite	More than a 75% chance of occurrence. The impact will occur regularly.	1

A7. Cumulative Impacts

Cumulative impact are reflected in the in the potential intensity of the rating system. In order to assess any impact on the environment, cumulative impacts must be considered in order to determine an accurate significance. Impacts cannot be assessed in isolation. An integrated approach requires that cumulative impacts be included in the assessment of individual impacts.

The nature of the impact should be described in such a way as to detail the potential cumulative impact of the activity.

A8. Significance Assessment

The significance assessment assigns numbers to rate impacts in order to provide a more quantitative description of impacts for purposes of decision making. Significance is an expression of the risk of damage to the environment, should the proposed activity be authorised.

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, which takes cognisance of extent, duration, potential intensity and likelihood.

Impact Significance = (extent + duration + potential intensity) x likelihood

Table 8 provides the resulting significance rating of the impact as defined by the equation as above.

Table 8: Significance rating formulas.

Score	Rating	Implications for Decision-making
< 3	Low	Project can be authorised with low risk of environmental degradation
3 - 9	Moderate	Project can be authorised but with conditions and routine inspections. Mitigation measures must be implemented.
10 - 20	High	Project can be authorised but with strict conditions and high levels of compliance and enforcement. Monitoring and mitigation are essential.
21 - 26	Fatally Flawed	Project cannot be authorised