TURN180
ENVIRONMENTAL CONSULTANTS

REGISTRATION NUMBER: 2018/110720/07

FINAL ENVIRONMENTAL IMPACT ASSESSMENT

REPORT:

FOR THE CLEARANCE OF VEGETATION AND CULTIVATION OF CROPS ON PORTION 1 OF THE FARM HARRISDALE 226 (KILMOREY), BARKLY WEST DISTRICT, NORTHERN CAPE.

Ref. no. NC/EIA/03/FB/DIK/BAR1/2019

SEPTEMBER 2019

Report prepared by:

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Applicant:

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Site Information:

Farm / Erf Name	: Harrisdale
Farm Number	: 226
Farm Portion	: 1
21 Digit Surveyors Code	: C00700000000022600001
District	: Barkly West
District Municipality	: Francis Baard District Municipality
Local Municipality	: Dikgatlong Local Municipality
Site coordinates (Centre of site)	: - 28.492473° S and 24.655838° E

EXECUTIVE SUMMARY

Dorata (Pty) Ltd (**"the applicant"**) seeks to apply for an Integrated Water Use License (**"IWUL"**) with the Department of Water and Sanitation (**"DWS"**) in terms of Sections 21(a), (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) (**"NWA**") and Environmental Authorisation (**"EA"**) with the Department of Environment and Nature Conservation (**"DENC"**) in terms of the 2014 EIA Regulations as amended in 2017 (**"EIA Regulations"**) under the National Environmental Management Act, (Act No. 107 of 1998) (**"NEMA"**) for the clearance of more than 20 ha of indigenous vegetation and the cultivation of crops on Portion 1 of the farm Harrisdale 226 (**"Kilmorey"**), Barkly West District, Northern Cape.

The applicant intends to produce Lucerne and Pecan Nuts on Kilmorey. The proposed agricultural development by the applicant seeks to cultivate and irrigate approximately 40 ha of Lucerne and plant 28 ha of Pecan Nut trees on the site. These activities will occur within 100 m of the Vaal River at certain areas and within 100 m of a drainage line located towards the west of the proposed site.

"Wetland vegetation and soil samples were utilised to determine the presence and border of wetlands. The soil samples taken along the banks of the Vaal River are clearly indicative of wetland conditions on a perennial basis. The Vaal River and its banks are clearly defined and easily identifiable. The boundary of the floodplain is not easily identified due to previous transformation by centre-pivot irrigation although the riparian zone is still clearly defined." (van Rensburg, 2019). Refer to the Ecological and Wetland Assessment in **Annexure 5.**

"The soil survey and accompanying analysis of soil properties indicate that the majority of the 68 ha Kilmorey site is suitable for cultivation and irrigation of Lucerne according to the norms and standards provided by the Northern Cape Department of Agriculture. An area occupied by Valsrivier soils are not suitable due to the strong structure and high clay contents of the pedocutanic B horizon. Sodium leaching and salt monitoring should occur frequently." (van Tol, 2019).

Abstraction of 1 104 000 m^3 of water from the Vaal river through means of a submersible pump will be applied for in the IWULA. According to best practices to yield maximum production for Lucerne, 600 000 m^3 are needed per annum, and for Pecan Nuts, 504 000 m^3 of water per annum. The cultivation of the Lucerne and Pecan Nuts will be preceded by the clearance of 68 ha of indigenous vegetation. The area applied for (**"Study area"**) was used for crop production in the past, more than 10 years ago, and the vegetation is classified as a secondary indigenous vegetation (mostly grasses). The irrigation of Lucerne will take place directly from the Vaal River through the means of a central pivot point using an overhead sprinkler system, together with the Pecan Nut trees which will utilize underground drip irrigation methods.

An IWULA will be made to the DWS to abstract a volume of 1 104 000 m^3 water per year from the Vaal River to be used for irrigation purposes. The IWULA will include the following water uses in terms of Section 21 of the NWA:

- Section 21(a): "*Taking water from a water resource*"
- Section 21(c): "*Impeding or diverting the flow of water in a watercourse*"
- Section 21(i): "*Altering the bed, banks, course or characteristics of a watercourse*"

Section 21(c) and (i) will not be an attempt to impede, divert flow and/or alter the watercourse in any way. The NWA requires a Section 21(c) and (i) to be completed when activities take place within 100 m of a watercourse and 500 m from a wetland area. The study area is located within 55 m of the Vaal River which contains a wetland area.

EA will also be applied for with the DENC to authorise activity 25 of GN. R. 325 which reads as follows:

- "The clearance of an area of 20 ha or more of indigenous vegetation".

Alternatives

1. Location alternatives:

There is no feasible location alternative for this project that will be assessed due to the following reasons:

The area chosen for the proposed site is the only part of Kilmorey that can be used as no other land is available. Mining for diamonds on the property in the past also left the land to the east degraded and not suitable for the cultivation of Lucerne which needs moist topsoil to grow effectively. The proposed site has also been used in the past for pivot irrigation before mining took place. After mining ceased the study area was left to revegetate itself. The surrounding properties do not belong to the same landowner and are already taken up by cultivated land. The remaining area surrounding the Lucerne cultivation area will not be left deserted and will be utilized towards the establishment of an orchard of Pecan Nut trees. Thus, no other location for the proposed site exists.

2. Design / Layout alternative:

The site has been cultivated in the past and has all the necessary infrastructure in place. This application simply seeks to continue (with EA) the agricultural activities on the same site before mining took place and left the study area abandoned. Certain aspects of the layout can be changed as the location of the pump in the Vaal River is not fixed. There is, however, a pump house located near the Vaal River which will be used and can be demolished and built on a new location close to the Vaal River. This, however, is very impractical since it will cost time and money to rebuild the pump house and loss of riparian vegetation will take place to make space

for the new building. The pivot point can also be moved but will also be impractical due to the study area being of limited size together with the considerable time and money it will take to implement this change.

The soil analysis and suitability study indicated that the soils on the current layout is sufficient for crop production.

3. Technological alternative:

As far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. Pivot and sprinkler irrigation systems will be used to irrigate the Lucerne crops which require large areas to be feasible. The pivot and sprinkler system are the only way of effectively irrigating such a large area daily. The water will be abstracted from the Vaal River and directly fed to the pivot and the sprinklers, as storing the large amounts of water required daily by Lucerne is not feasible at the proposed site. Dry land farming is not a feasible alternative, due to the area which does not receive sufficient rainfall to support Lucerne. Lucerne needs large amounts of water for optimal production which is around 1 200 mm annually per hectare.

The Pecan Nut trees will also use water directly abstracted from the Vaal river. The preferred method for irrigating Pecan Nut trees makes use of underground wetting processes where irrigation lines are situated underground near the trees to directly wet the area containing the tree roots. This is the most practical method of irrigation for Pecan Nut trees as it optimizes the amount of water taken up by the trees and ensures minimal loss of water through evaporation. Also, heavy-duty rakes, pesticide sprayers and tree shakers are usually used during orchard management and harvesting.

4. No Go alternative:

The "no-go" alternative will be considered throughout the assessment of the proposed project. If the project cannot be authorised, no Lucerne and Pecan Nuts will be produced, which will lead to no creation of new jobs as well as losing an opportunity to boost the economy in the agricultural sector. The site will be left abandoned as is, as there is no other activity beside agriculture, which can take place on the study area. The vegetation on the site will stay the same with mostly grasses dominating the area.

Baseline Assessments

A baseline site assessment was undertaken by Mr. Louis De Villiers to identify and assess any potential impacts associated with establishing the proposed project. This was followed by numerous discussions with specialists and the applicant.

A desktop study was also undertaken to determine sensitive features on the site and in the surrounding environment.

Public Participation

The Public Participation Process (**"PPP"**) was conducted according to the EIA Regulations' minimum requirements.

Comments, responses and proof of notifications sent during the PPP are included in Section 7 of this Scoping Report and **Annexure 3** attached.

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1.1 The Applicant

Applicant:	Dorata (Pty) Ltd
Registration number:	2003/020819/07
Address:	2 Barnard Street Potchefstroom 2531
Telephone:	018 297 2090

1.2 The landowner

Name:	BASFOUR 730 (Pty) Ltd
Address:	2 Barnard Street Potchefstroom 2531
Telephone:	018 297 2090

1.3 The Environmental Assessment Practitioner ("EAP")

Company:	Turn 180 Environmental Consultants
Contact person:	Louis De Villiers (EAP) Morné van Wyk (Assistant EAP)
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The project team:

Project Manager and EAP:	Louis De Villiers
Assistant to EAP:	Morné van Wyk

Specialists:

Ecological and Wetland Assessment:	Mr. Darius Van Rensburg
Heritage and Palaeontological Assessment:	Dr. Lloyd Rossouw
Irrigation Suitability Report	Dr. Johan van Tol

1.4 Property and Site

1.4.1 Property and Site Description

Kilmorey is located in the Barkley West District of the Northern Cape (refer to Figure 1 below and the locality map in **Annexure 2**). The site is zoned as agricultural land and is surrounded by numerous other cultivated areas. A farmhouse is also situated on the Kilmorey property, 1.3 km away from the study area in a North Easterly direction. However, the house is abandoned and partially demolished and inhabitable. There are no major roads close to the proposed site and the proposed site is located approximately 4.6 km North West, from the nearest town, which is Riverton. The site is also located approximately 13.5 km North East from Barkly West.

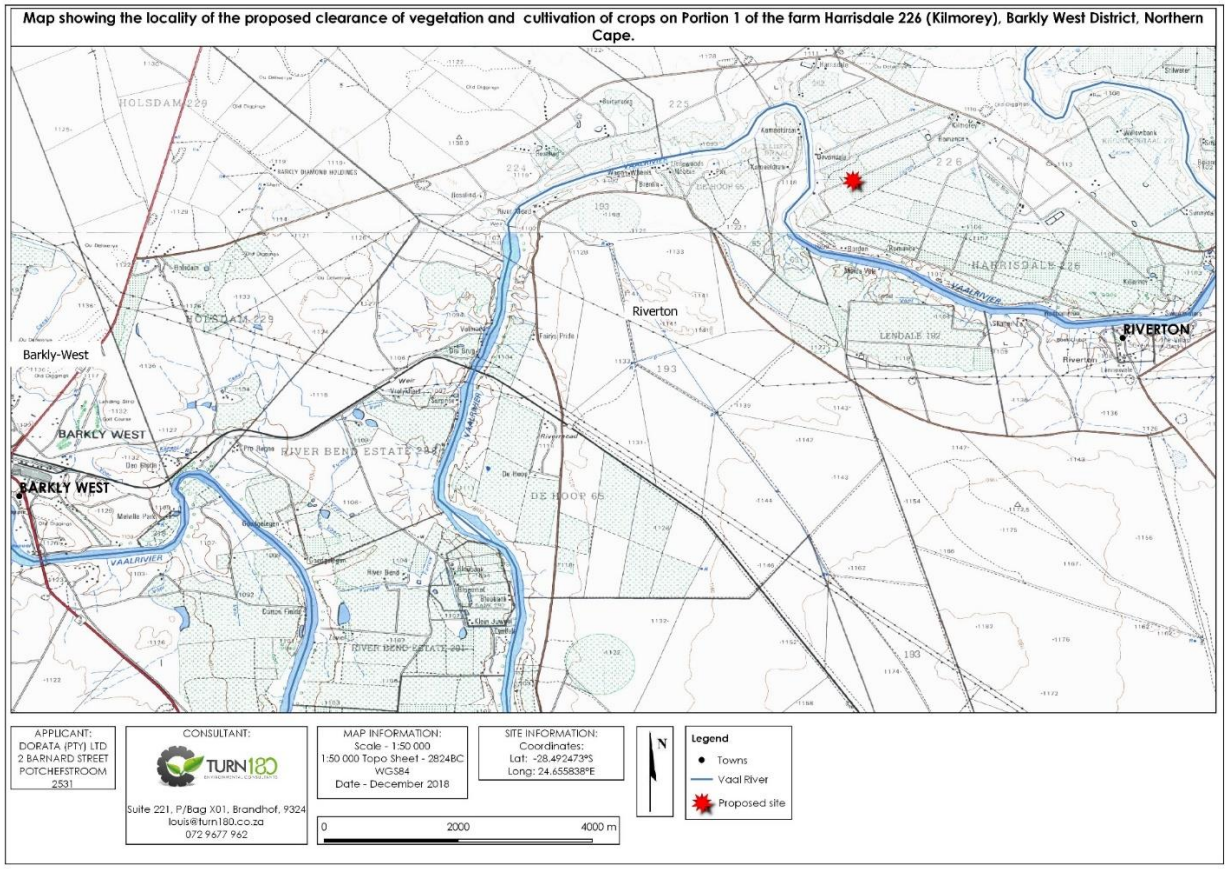

Figure 1: Locality map for the proposed project.

After mining ceased the study area was left abandoned, for at least 10 years, allowing natural vegetation to regrow. The site consists mostly of natural vegetation though it is clear that a crop field including centre-pivot was present in the past. Therefore, the vegetation on the site, although indigenous, must be of secondary establishment. "According to Mucina & Rutherford (2006) the area consists of Kimberley Thornveld (SVk 4). This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004). The vegetation type is not currently subjected to any pronounced transformation pressures. Riparian vegetation associated with the Vaal River consists of Highveld Alluvial Vegetation (Aza 5), also listed as being of Least Concern (LC) but does not form part of the proposed site. Furthermore, the natural vegetation type on the site has been transformed and consequently the conservation value is relatively low" (van Rensburg, 2019). Due to past agricultural and mining activities the study area is no longer in its original pristine conditions together with secondary vegetation which revegetated the abandoned area. As a result, the habitat and species diversity are consequently also very low.

"An Index of Habitat Integrity ("IHI") was conducted along the Vaal River within the study area. The results of the IHI indicated that the Vaal River has an Instream IHI of category C/D: Moderately to Largely Modified and Riparian IHI of category D: Largely Modified. The Ecological Importance and Sensitivity ("EI&S") of the floodplains associated with the Vaal River has been rated as being Moderate: Floodplains that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers." (van Rensburg, 2019). Refer to the Ecological and Wetland Assessment in **Annexure 5**.

"A soil analysis study was conducted for the purpose of obtaining a ploughing certificate. The study concluded that the majority of the site is suitable for the cultivation and irrigation of Lucerne. Only a small area occupied by Valsriver soils are not suitable due to the strong structure and high clay contents of the pedocutanic B horizon. Sodium leaching and salt monitoring should occur frequently." (van Tol, 2019).

"Kilmorey is approximately 116.15 ha in extent and is owned by Basfour 730 (Pty.) Ltd. It is bordered by Portion 13, 16 and 2 of the Farm Harrisdale 226. "The impact significance has been determined and it is clear that the impacts before mitigation will vary from low to moderate with the impact on the Vaal River and increased infestation by exotics being the most notable as moderate impacts." (van Rensburg, 2019).

There are no surface water features located on the study area. However, Kilmorey encompasses a larger area which includes the study area as well as the Vaal River as the western boundary. A drainage line is also located West of the study area, just outside the study area boundary, which when filled with runoff will flow from South to North.

"Notable impacts on the site include the previous clearing of vegetation which has caused significant alteration to the vegetation structure and species composition, soil surface disturbance along the North Eastern portion of the site due to alluvial diamond mining operations and linear trenches/canals associated with these mined areas."(van Rensburg, 2019). Old slimes dams associated with historic mining activities are still present at the North Eastern part of the study area. However, the site has been dormant for more than 10 years.

21 Digit Surveyor General Code for Portion 1:	**C00700000000022600001**

Coordinates of the corners of the site:

Corner	Latitude (S)	Longitude (E)
A	-28.494531°	24.650505°
B	-28.494215°	24.651052°
C	-28.493947°	24.650955°
D	-28.493450°	24.650784°
E	-28.492855°	24.650738°
F	-28.492249°	24.650812°
G	-28.491678°	24.650947°
H	-28.491014°	24.651224°
I	-28.490374°	24.651922°
J	-28.489747°	24.653009°
K	-28.487329°	24.659132°
L	-28.492422°	24.661426°
M	-28.497527°	24.652748°
Centre of Site	-28.492473°	24.655838°

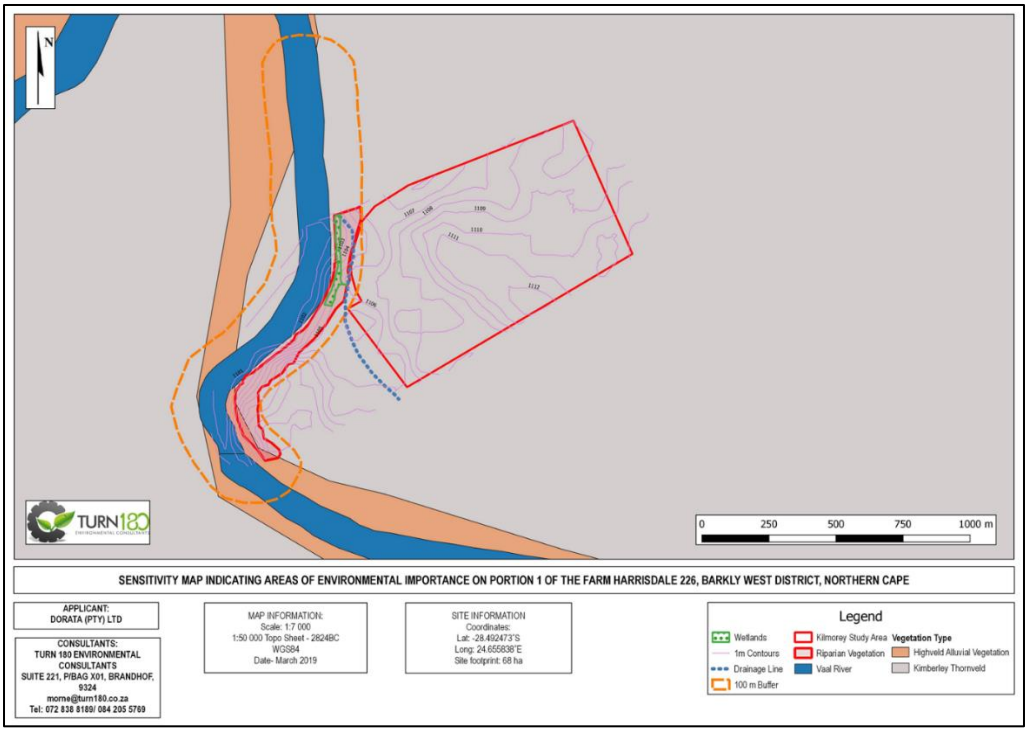

Figure 2: Sensitivity map for the proposed project

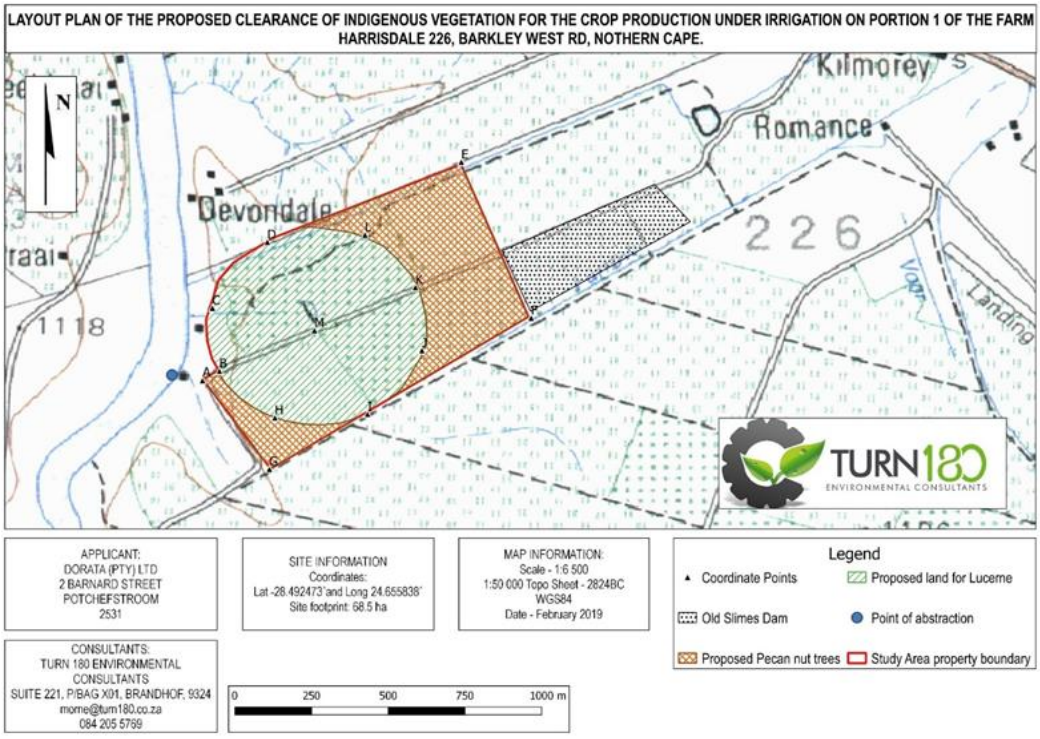

Figure 3: Layout map for the proposed project.

1.4.2. Zoning

The site is zoned as agricultural land and is surrounded by numerous other cultivated areas.

1.4.3. Direction to nearest towns

The proposed site is located approximately 23 km northeast of Barkly West alongside the Vaal River near Riverton.

2 Description of the existing environment

2.1 Geology and soil

The geology of the area consists of Andesitic lavas of the Allanridge Formation and fine-grained sediments of the Karoo Supergroup. The soil consists of deep sandy to loamy soil. The proposed site specifically has geology of sedimentary origin and red-yellow apedal, freely-drained soil with a depth of 450 mm – 750 mm (ENPAT, 2001; Mucina & Rutherford, 2006: 516). "The soils of the study area comprise of Hutton, Bloemdal, Oakleaf and Valsrivier forms. The latter, covering around 20 ha, is deemed unsuitable for irrigation due to a strongly developed structure and high clay contents. The remainder of the soils contain morphological, chemical and physical properties which complies to the Northern Cape Department of Agriculture's irrigation and cultivation requirements and are therefore suitable to highly suitable." (van Tol, 2019). Please refer to the Soil Suitability report in **Annexure 5.**

Soils forms: "The soils of the study area vary considerably. Freely drained, apedal Hutton soils cover 31.3 ha (42%) of the surveyed area. Strongly structured Valsrivier soils occur in the north and north-eastern parts of site, below an old slimes dam (approximately 20 ha). Oakleaf soil forms were observed in the eastern corner of the site as well in the south-western areas adjacent to the river, covering 22.3 ha. A small area of approximately 0.8 ha (1% of the surveyed site) is occupied by Bloemdal soils". (van Tol, 2019).

Soil Depth: "The soils in the studied area are deep, exceeding 3 500 mm in all the observations. The freely drained depth in the Oakleaf and Hutton soils are equal to the total soil depth. For the Valsrivier soils, the freely drained depth is only the thickness of the orthic A horizon. The pedocutanic B horizon is the depth limiting layer. For the Bloemdal soil, the unspecified material with signs of wetness is the depth limiting layer and occur at approximately 1 300 mm. The drainable depth is considered the depth to where drainage can be installed. On the drainable depth is therefore the entire soil depth and exceeds 2 500 mm for the entire site". (van Tol, 2019).

Chemical and soil texture: Based on the chemical analysis, all the soils are suitable for irrigation. "The particle size distribution reveals however that the clay contents of both Valsrivier 1121 and 2122 are above the threshold value of 35% and are therefore not suitable for irrigation. The pH of the soils ranged between 6.12 and 7.32, bordering the guidelines of below 7.5. It is however expected that irrigation with high quality irrigation water will leach some of the base forming cations out of the soil profiles and thereby lower the pH. The electrical conductivity (EC) values are within the expectable norms of > 300 Ohms and < 400 mS/m respectively. The Exchangeable Sodium Percentage (ESP) is relatively high in the Hutton and Oakleaf soils but could be managed to the well-drained nature of these soils. The excess Na should be leached out with the application of gypsum and excess irrigation water. This program should be determined by a qualified soil scientist and must be monitored. The P contents are relatively high and signify a land that has been subjected to cultivation in the past. Imbalances in cations should be addressed prior to establishment of lucerne. The clay content of the Valsrivier soils are very high and exceed the norm of <35% proposed by the Department of Agriculture of the Northern Cape. Clay contents are more than 40% in the orthic A horizon and up to 48% in the pedocutanic B horizon of K11. The clay contents of the remainder of the samples are below 30%. The majority of the samples form part of the Sandy-Clay-Loam texture class". (van Tol, 2019).

2.2 Climate

The area is located in Rain Zone C9B and receives summer and autumn rainfall between 300 mm – 400 mm annually (Figure 4) (Water Resource Council, 2005). The proposed site is also located in Evaporation Zone 9B with a mean annual evaporation (**"MAE"**) between 2 000 – 2 200 mm per annum (Figure 5) (Water Resource Council, 2005).

Due to the low rainfall in the area and the high MAE it is not foreseen that their will be any ponding or excessive infiltration on the surface of the study area. Also note that the proposed study area will be completely covered with Lucerne and Pecan nut trees increasing absorption through roots and decreasing infiltration. Rainfall in this area is usually characterized by single high rainfall events that caused excessive runoff to be generated. Due to the activity being proposed the runoff will be minimized from rainfall by the Lucerne and Pecan nut trees.

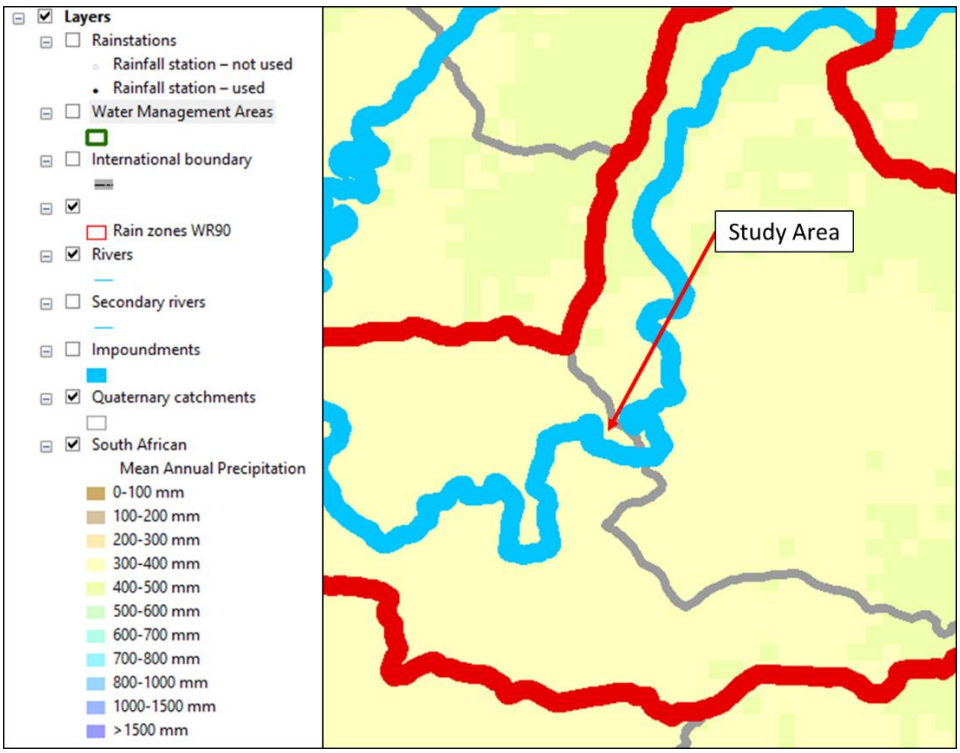

Figure 4: Map indicating the mean annual Precipitation for the study area. (Water Resource Council, 2005).

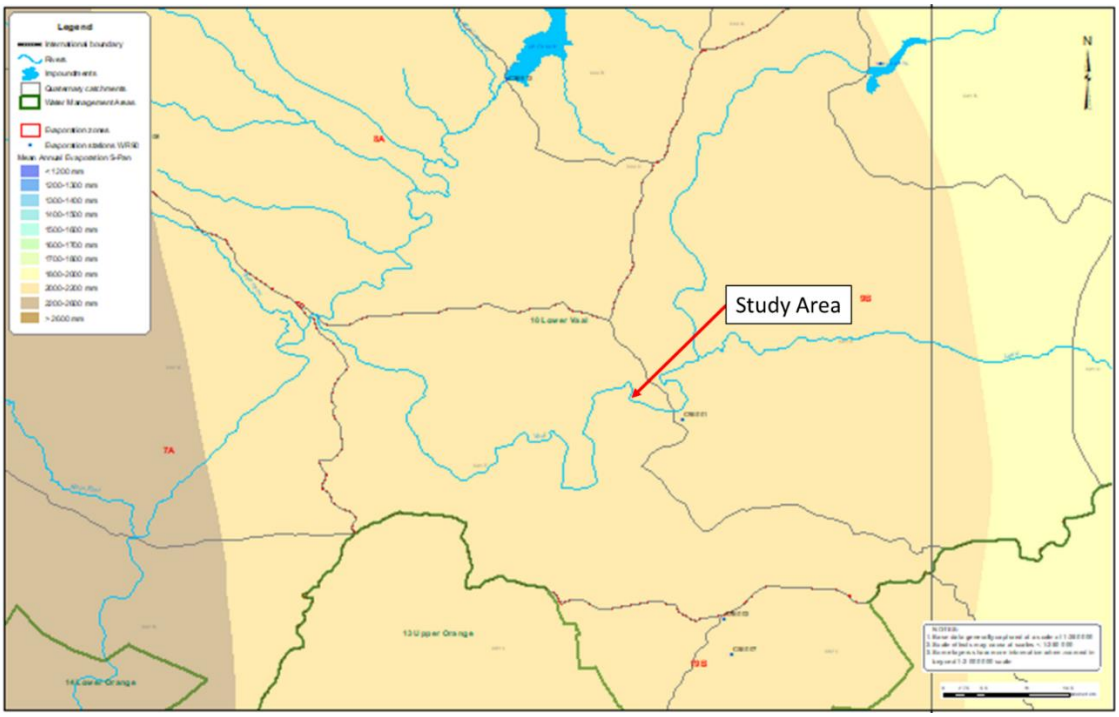

Figure 5: Graph indicating mean annual evaporation for the study area (Water Resource Council, 2005).

2.3 Land Use

The current land use is classified as being vacant and only used for the grazing of cattle. The study area of the Kilmorey site was used in the past (more than 10 years ago) for the pivot irrigation of crops which can still be seen from aerial photos. The entire Kilmorey site was also used for the mining of alluvial diamonds. The mining dumps are situated outside the study area boundaries and will be left as is. This site has been dormant for more than 10 years and the applicant has indicated that they have a desire to start cultivating corps again. Lucerne, of approximately 40 ha, will be cultivated on the previous pivot irrigation area. The remainder of the study area, of approximately 28 ha, will be utilized to plant Pecan nut trees. A soil suitability study was done to indicate if the soils are still up to standard to produce the above-mentioned crops. The site is degraded due to past mining activities and abandoned agricultural activities. The site has secondary vegetation (mostly grasses of different varieties) that established themselves on the area used in the past for pivot irrigation. The riparian vegetation, close to the Vaal River, will not be removed and left as is.

2.4 Vegetation and Animal Life

"According to Mucina & Rutherford (2006) the area consists of Kimberley Thornveld (SVk 4). This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Map 2). The vegetation type is not currently subjected to any pronounced transformation pressures. Riparian vegetation associated with the Vaal River consists of Highveld Alluvial Vegetation (Aza 5), also listed as being of Least Concern (LC) but does not form part of the proposed site." (van Rensburg, 2019).

Vegetation:

"Notable impacts on the site include the previous clearing of vegetation which has caused significant alteration to the vegetation structure and species composition, soil surface disturbance along the north eastern portion of the site due to alluvial diamond mining operations and linear tranches/canals associated with these mined areas. From the survey of the site it is clear that although it is dominated by natural, indigenous vegetation this is of secondary nature and the natural vegetation type on the site has been completely transformed. The vegetation is in a pioneer stage of succession progressing toward a climax condition. As a consequence, the conservation value of the ecology on the site is relatively low. The habitat and species diversity is consequently also very low. Furthermore, being dominated by pioneer species no protected, rare or endangered species could be identified on the site. Such species are often adapted to

specialised habitats in good conditions and it is therefore highly unlikely that such a species would occur on the site." (van Rensburg, 2019).

"As mentioned previously the dominant vegetation structure on the site consists of a dense grass layer. Over the majority of the site the dominant grass species include *Eragrostis lehmanniana, Enneapogon cenchroides, Cynodon dactylon* and *Chloris virgata*. These are all pioneer species commonly found on old crop fields as is the case at the site. They therefore indicate a degraded and transformed grass layer. Scattered clumps of the climax grass, *Schmidtia pappophoroides*, also occur and indicate that the vegetation is still in the process of succession. Scattered shrubs are mostly represented by *Lucium cinerium*, also an indicator of a pioneer vegetation layer. Several exotic weeds including *Datura ferox, Salsola kali* and *Argemone ochroleuca* also indicates a disturbed vegetation layer. The site is located within the Savannah Biome and as such should contain a well-developed grass layer but also with a prominent tree/shrub layer (Map 2). This layer is absent on the site and therefore indicates that the natural vegetation type on the site has been transformed to a large degree. This is most likely due to the historical ploughing for the centre-pivot cultivation. Toward the north east and outside the footprint of the historical centre-pivot the site has been affected by previous mining activities and here the natural vegetation type has also been transformed to a large degree. The grass layer remains similar to that given above although exotic weeds and dwarf shrubs become more prominent. Additional grass species observed in this area included *Eragrostis echinchloidea, Panicum coloratum* and *Aristida congesta*. The dwarf shrub species noted include *Chrysocoma ciliata* and *Pentzia incana*. These are natural to the increased calcrete and gravel content in this portion of the site. Additional exotic weed species in this area and which confirm a degraded vegetation layer include *Tagetes minuta, Verbena bonariensis* and *Schkuhria pinata*. The exotic and highly invasive tree, *Prosopis* glandulosa was also observed as scattered specimens. The pioneer, indigenous shrub, *Laggera decurrens*, also indicates a pioneer vegetation layer still in the process of succession. A small specimen of *Senagalia melifera* was observed and indictive of succession towards a climax and natural vegetation structure. In this portion of the site a series of longitudinal trenches/canals/excavations are also present. These are clearly of artificial excavation and may be associated with previous mining activities. They indicate a higher moisture regime and it is highly likely that they collect surface runoff. The vegetation in these areas are highly transformed as can be expected. Dominant vegetation includes a small sedge, *Cyperus sp.* and herbs including *Selago densiflora, Arctotis arctotoides, Cullen tomentosum* and *Atriplex semibaccatta*. Exotic weeds similar to those species in the surroundings are also common. The exotic tree species, *Tamarix chinensis*, is also common in these excavations and are often found where surface water accumulates. Stands of reeds, *Phragmites australis*, also confirm the accumulation of surface runoff. These

trenches/canals/excavations are however considered as totally artificial and does not represent watercourses or wetlands and also do not perform any significant function, either natural or artificial." (van Rensburg, 2019).

Vaal River Wetland:

The marginal zone

"The marginal zone within the Vaal River as it occurs within the study area is well defined and easily identifiable by the presence of a dense reedbed (*Phragmites australis*) which is inundated on an annual basis. This is also a listed obligate wetland species. The reedbed is so dense that it almost excludes all other vegetation with a few scattered herbs and exotic weeds occurring. These include the indigenous herb, *Arctotis arctotoides,* and exotic weeds, *Xanthium spinosum* and *Bidens bipinnata*. The width of the marginal zone in the study area is relatively narrow and uniform along the stretch adjacent to the site. The section of Vaal River in close proximity to the site has a length of approximately 400 meters and the areas in closest proximity is approximately 60 meters from the marginal zone of the river. These marginal zones also constitute perennial wetland areas. The marginal zone is largely natural although the dominant reedbeds may indicate a high nutrient content caused by agricultural activities or upstream impacts." (van Rensburg, 2019).

The lower zone

"The riparian vegetation in this zone is dominated by a low shrub and grass layer and the absence of larger trees. Low shrubs include *Lycium cinerium, Diospyros lycioides, Asparagus larcinus* and *Lycium hirsutum*. *Enneapogon cenchroides* is the dominant grass in the lower zone with *Setaria verticillata* common under shrubs. The exotic weeds *Bidens bipinnata* and *Salsola kali* is also common. This vegetation structure can also be explained by the flooding of the lower zone. Grasses, sedges and low shrubs are much better adapted to flooding and able to withstand being uprooted to a much better degree. As a result, the marginal and lower zones contain almost no trees whereas the upper zone is dominated by trees. The lower zone is largely natural and the geomorphology intact." (van Rensburg, 2019).

The upper zone

"The tree species are able to attain height and age due to the deep root systems still able to access the higher moisture levels and as flood disturbance in the upper zone is much less the trees are allowed to grow old without being removed by flood damage. The riparian tree species within the upper zone is dominated by *Vachellia karroo* (Sweetthorn), *Ziziphus mucronata* (Buffalo Thorn), *Searsia lancea* (Karree), *Combretum erythrophyllum* (River Bushwillow) and *Diospyros lycioides* (Bluebush) which then also indicate the border of the upper zone. The understorey also contains

a dense but low shrub and climber layer dominated by *Lycium cineriumm, L. hirsutum, Clematis brachiata, Asparagus larcinus* and *Gymnosporia buxiifolia*. The dense shade caused by trees and shrubs cause the establishment of shade loving species including the grass, *Setaria verticillata* and herbs, *Dicliptera leistneri* and *Atriplex semibaccatta*. Exotic weeds are also abundant and include *Bidens bipinnata, Datura ferox, Tagetes minuta, Achyranthes aspera* and *Sphaeralcea bonariensis*. The upper zone is mostly natural and the geomorphology intact though it is clear that some disturbance from adjacent land uses causes disturbance of the vegetation layer." (van Rensburg, 2019).

The floodplain

"The vegetation structure is dominated by a more open grass layer as compared to the upper zone, scattered shrubs and the absence of strictly riparian tree species. Dominant grasses include *Cynodon dactylon, Panicum coloratum, Enneapogon cenchroides, Eragrostis lehmanniana* and *Chloris virgata*. Shrubs and small trees include *Lycium cinerium, Vachellia karroo* and *Ziziphus mucronata*. Exotic weeds are abundant here and include *Bidens bipinnata, Tagetes minuta, Datura ferox, Salsola kali, Argemone ochroleuca* and *Xanthium spinosum*. The exotic tree species, *Tamarix chinensis* and *Melia azedarach* are also scattered. These exotic species also indicate the largely transformed nature of the floodplain." (van Rensburg, 2019).

Animal life: "Tracks and signs of mammals are present on the site but notably diminished from the natural condition. This is probably due to the largely transformed vegetation type on the site and its isolation from larger areas of natural vegetation by surrounding crop fields. Extensive centre-pivot irrigation surrounds the site and has resulted in the clearance of natural vegetation. Mammal species which are rare and endangered are often habitat specific and sensitive to habitat change. It is therefore considered unlikely that such species would occur on the site. Numerous small burrows occur on the site and is most likely those of small rodents. These burrows are most likely those of the Multimammate Mouse (*Mastomys coucha*) and the Striped Mouse (*Rhabdomys pumilio*). According to Avenant (2000) where extensive disturbance of grassland occur these species dominate. It has also been shown that these rodent species can be used as indicators of grassland degradation (Avenant & Cavallini 2007, MacFadyen *et al.* 2012). In light of the transformed and pioneer condition of the grassland on the site this is considered the most likely occupants of the small burrows." (van Rensburg, 2019).

Please refer to the Ecological Assessment in **Annexure 5**.

2.5 Surface Water

There are no surface water features on the study area. However, Kilmorey is bordered by the Vaal River to the West, as well as being preceded by wetlands on the bank of the Vaal River and a single drainage line bordering the study area, flowing from South to North. The Vaal River is located within 55 m of the proposed site.

The wetland conditions associated with the Vaal River can be characterised as a channel wetland system (SANBI 2009): "An open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the hydrodynamic nature of these units. Note that, for purposes of the classification system, channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow (see unchannelled valley-bottom wetland). As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks. An active channel is a channel that is inundated at sufficiently regular intervals to maintain channel form and keep the channel free of established terrestrial vegetation. These channels are typically filled to capacity during bankfull discharge (i.e. during the annual flood, except for intermittent rivers that do not flood annually)." This accurately describes the wetland conditions along the Vaal River. Here the wetland conditions are most prominent along the main channel and decrease in distance from the channel." (van Rensburg, 2019).

"The Vaal River and its associated floodplains are considered a fifth order watercourse. This is also due to the river being a large lowland river. The quaternary catchment of this area is C91E. The largest impact on the site itself is considered historical alluvial diamond mining and centre-pivot irrigation which has had a high impact on the site. Consequently, almost the entire site consists of indigenous vegetation, but which are of secondary establishment and transformed from the natural vegetation type. This will undoubtedly also have an impact on the ecological functioning of the Vaal River. Upstream impacts are also numerous and cause alteration in the functioning of the river. The most prominent impacts are the upstream alluvial diamond mining and construction of containment dams which alter the flooding regime and the functioning and habitat of the river

and its floodplains. An Index of Habitat Integrity (IHI) was conducted along the Vaal River within the study area (Appendix D). The results of the IHI indicated that the Vaal River has an Instream IHI of category C/D: Moderately to Largely Modified and Riparian IHI of category D: Largely Modified. This is largely due to the change in flooding regime and other significant upstream impacts as well as historical alluvial diamond mining within the study area." (van Rensburg, 2019).

Please refer to the Ecological Assessment in **Annexure 5**.

2.6 Groundwater

Since the area is so closely situated to the Vaal River, it is expected that the water level will be close to the surface approximately around 10 meters below ground level (**"mbgl"**). The actual aquifer might be deeper around 20 -30 mbgl and exists as either; (1) an intergranular aquifer consisting of consolidated sands and clays or (2) contact aquifer between sandstones and the prevailing igneous rocks (dyke or sill). Due to the proximity of the aquifer to the Vaal River it can be assumed that these two systems are reliant on each other. The quality of the groundwater is expected to be good to moderate as extensive agriculture takes place in the surrounding environment and is highly likely that nitrate rich fertilizer and pesticides have infiltrated the aquifer causing elevated values of total dissolved solids.

2.7 Air Quality and Noise

The ambient air quality in the region is good due to the lack of heavy industrial complexes. However, the air quality in the area can be negatively impacted on by the areas cleared of vegetation for crop production. The risk of air pollution is especially high during the ploughing of soil and soil laying bare during very windy conditions.

Noise will be generated as a result of agricultural related activities. These will include noise generated from agricultural vehicles such as ploughing and harvesting equipment. Also, noise will be generated from the pump near the Vaal River banks. It must be noted that the area is situated far from any urban areas, between existing agricultural areas, and any noise generated will be small to insignificant and will be noise associated with agricultural activities.

2.8 Cultural Heritage and Archaeology and Palaeontology

It was confirmed by Dr. Rossouw that the site has been severely degraded by previous agricultural activities. "There are no indications of rock engravings, prehistoric or historical structures within the footprint area. The survey revealed no evidence of or Stone Age archaeological sites along the section. Isolated stone tools were recorded on the surface. Uncapped and exposed, these artefacts are most likely out of context, being laterally displaced over time. Two separate grave localities have been recorded but these are not located within in the demarcated development

area." (Rossouw, 2019). According to Rossouw there are no significant archaeological and paleontological features that need protection. Refer to the Phase 1 HIA and PIA in **Annexure 5**.

2.9 Aesthetics

The area surrounding the site is intensely used for crop cultivation and irrigation. Although the Kilmorey site will be transformed from natural area where previous disturbance occurred to crop production it will not have a negative aesthetic impact due to its remote location in relation to large residential areas and/or major roads. Furthermore, the aesthetics of the area along the Vaal River is associated with crop production and irrigation and the Kilmorey site will thus conform to this broader aesthetic.

2.10 Demographics and Regional Socio-economic Structure

The nearest town to the site is Riverton, followed by Barkly West. Barkly West has a population of 8258 (No statistics on Riverton could be found). Of this, 63.3 % is considered to be working age (15-64), while 31 % of the population is young (0-14) and 5.6 % is elderly (65+). The population consists of 41.9 % Black Africans, followed by 47.2 % Coloureds, 9.0 % Whites, 0.5 % Indian/Asian and 1.3 % Other (STATS SA, 2018).

3 Public Participation

3.1 Project initiation

A PPP under the EIA Regulations was undertaken as part of the Scoping Phase, which included the following:

- Placing site notices at the entrance to the site and on the proposed site;
- Placing adverts in the Diamond Field Advertiser (**"DFA"**) and Noord Kaap newspaper;
- a Notification and Background Information Document (**"BID"**) regarding the proposed project was sent to all Identified Interested and Affected Parties (**"I&APs"**). This includes the adjacent landowners and relevant authorities (refer to **Annexure 3**).

A time period of 30 days was allowed for the public to register and / or send their issues and concerns regarding the project to Turn 180 Environmental Consultants Environmental.

3.2 Interested and Affected Parties ("I&AP") / Stakeholders

Adjacent landowners and relevant stakeholders were notified of the Project via written notifications and a BID. The main purpose of this was to inform the potential I&APs of the project and obtain insight into any related issues they may have.

A comments and response register will be made and updated to include all comments received from I&APs. This register will also record the responses from the consultants and how comments are addressed.

3.3 Authorities

The following departments and / or organs of state were consulted during the PPP:

- Department of Agriculture, Land Reform and Rural Development;
- South African Heritage Resource Agency ("**SAHRA**");
- Northern Cape Provincial Heritage Authority;
- Department of Water and Sanitation
- Department of Environment and Nature Conservation
- Dikgatlong Local Municipality (Municipal Manager and Ward Councillor);
- Francis Baard District Municipality.

3.4 List of all I&AP

Table 1: List of all I&AP

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Authorities & Stakeholders				
Ms. Z.M. Bogatsu (Municipal Manager)	Frances Baard District Municipality	Private Bag X6088 Kimberley 8300 51 Drakensberg Ave Carters Glen Kimberley Contact: Fatima Ruiters (Personal Assistant) 053 838 0998 (Tell) fatima.ruiters@fbdm.co.za (E-mail)	BID sent via Email on 28/08/2018. Draft Scoping Report delivered by hand on 18/03/2019. Final Scoping Report couriered on 30/04/2019 Draft EIA report delivered by hand on 08/08/2019	No comments received.
Mr. Kgotso Moeketsi	Dikgatlong Local Municipality	33 Cambell Street Barkly-West	BID sent via Registered post on 29/08/18. Draft Scoping Report delivered via courier on 18/03/2019. Final Scoping Report couriered on 30/04/2019	No comments received.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
(Acting Municipal Manager)		8375 053 531 6500 (Tel)	Draft EIA couriered on 08/08/2019	
Municipal Ward Councillor: Ward 2	Dikgatlong Local Municipality	33 Cambell Street Barkly-West 8375 053 531 6500 (Tel)	BID sent via Registered post on 29/08/18. Draft Scoping Report delivered via courier on 18/03/2019. Final Scoping Report couriered on 30/04/2019 Draft EIA couriered on 08/08/2019	No comments received.
Mr. W. Mothibi (HOD – Agricultural and Rural Development) OR Harm Voster	Department of Agriculture, Land reform and Rural Development (Northern Cape)	053 838 9100 (Tel) Private Bag X5018 Kimberley 8300 162 George Street Kimberlite Building 083 233 7730 (Cell)	BID sent via Registered post on 29/08/18. Draft Scoping Report delivered by hand on 18/03/2019. Final Scoping Report couriered on 30/04/2019 Draft EIA report delivered by hand on 08/08/2019	**Comment:** The Department of Agriculture, Land reform and Rural Development requested that an application should be made for a plough certificate and that a soil analysis should be done. **Response:** The application for a plough certificate will be made by the department after the final decision concerning the EIA

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
				has been made. As per request a soil suitability test was conducted.
Mr. H.M Ndzilili (HOD- Environment and Nature Conservation)	Department of Environment and Nature Conservation (Northern Cape)	Private Bag X6010 Kimberley 8301 90 Long Street Kimberley 8300 053 807 7300 (Tell) 053 807 7328 (Fax)	BID sent via Registered post on 29/08/18. Draft Scoping Report delivered by hand on 18/03/2019. Final Scoping Report delivered by hand on 02/05/2019 Draft EIA report delivered by hand on 08/08/2019	No comments received.
Mr. A. Abrahams (Chief director)	Department of Water affairs – Water Management Area 10	053 830 8803 (Tel) 0082 883 6741 (Cell)	BID sent via Email on 28/08/2018. Draft Scoping Report delivered by hand on 18/03/2019. Final Scoping Report couriered on 30/04/2019	Comments received on the 21/05/2019.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
		0053 831 4534 (Fax) Private Bag X6101 Kimberley 8300 AbrahamsA@dwa.gov.za (E-mail)	Draft EIA report delivered by hand on 08/08/2019	Information on the water use application, environmental legal requirements to be kept to, the disposal of waste measures and pre-application meeting to be held.
Me. Natasha Higgit (Heritage Officer)	South-African Heritage Resource Agency	021 462 4502 (Tel) P.O. Box 4637 Cape Town 8000	BID uploaded on SAHRIS on 28/08/2018. Draft Scoping Report uploaded on SAHRIS on 18/03/2019. Final Scoping Report uploaded on SAHRIS on 30/04/2019 Draft EIA Uploaded on SAHRIS on 15/08/2019	**Comment:** SAHRA commented that a Heritage Impact Assessment must be done as part of the EIA process. They also requested that the Draft and Final Scoping Report be submitted to them. Comments attached in Annexure 3. **Response:** A Heritage Impact Assessment will be included in the EIA report. The Draft and Final Scoping Report was uploaded on SAHRIS.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
				Draft EIA comments attached in Appendix 3
Mr. Andrew Timothy (MEC)	Northern Cape Provincial Heritage Authority	1 Monridge Office Park c/o Kekewich Drive & Memorial Road Kimberley 8300 079 036 9695 (Cell) rtimothy@nbkb.org.za (Email)	BID sent via Email on 28/08/2018. Draft Scoping Report delivered by hand on 18/03/2019. Final Scoping Report couriered on 30/04/2019 Final Draft EIA report delivered by hand on 08/08/2019	No comments received.
Identified Interested and Affected Parties				
Landowner: Basfour 730 (Pty.) Ltd Marius De Villiers	Harrisdale 1/226	082 450 1485 (Cell) divprok@gmail.com (Email)	BID sent via Email on 30/08/2018	No comments received.
Deon Celliers	Harrisdale 16/226	deonc@nugen.co.za (Email) 083 446 2084 (Cell)	BID sent via Email on 28/08/2018	No comments received.

Contact Person	Organisation	Contact detail	Manner of notification	Comments & Response
Louis De Kock	Harrisdale 13/226 Harrisdale 2/226	082 820 3393 (Cell) PO Box 46 Barkly West 8375	BID sent via Registered post on 29/08/18. Registered as I&AP on 25 September 2018. Draft Scoping Report sent via registered mail on 18/03/2019. Final Scoping Report sent via registered post 30/04/2019 Draft EIA couriered on 08/08/2019	**Comment:** He requested to be kept informed throughout the project. **Response:** Mr. De Kock has and will receive all future reports.
Marius Malherbe	Kameeldraai	083 2612 952 (Cell) marius@malupork.com (Email)	BID sent via Email on 29/08/2018	No comments received.

The I&AP list with the manner of notification and comments is also attached in **Annexure 3.**

3.5 Summary of Comments and Responses

3.5.1 Comments and Concerns received from I&AP

- Mr. W. Mothibi (HOD – Agriculture, Land Reform and Rural Developments) requested that an application should be made for a plough certificate and that a soil analysis should be done.
- Me. Natasha Higgit (Heritage Officer – South African Heritage Resource Agency) commented that a Heritage Impact Assessment must be done as part of the EIA process and requested that the Draft and Final Scoping Report be submitted to them.
- Louis de Kock (Harrisdale 226/13 and 2) requested to be kept informed throughout the project.
- No other comments were received.

3.5.2 Feedback on Comments and Concerns from I&AP

- A Soil Suitability Study was done, and a Plough Certificate Application will be submitted and included in this EIA report.
- A Heritage Impact Assessment will be included in the EIA report and that the Draft and Final Scoping Report was uploaded on SAHRIS.
- It was indicated to Mr. de Kock that he will receive all future reports.

4 Motivation for the Proposed Project

The Kilmorey property has undergone numerous changes in the past and was used for various activities. The study area was initially used for the cultivation of crops under pivot irrigation, where after, alluvial diamond mining took place and cultivation of crops ceased. Now, more than 10 years later, the applicant seeks to cultivate the abandoned site and contribute to South Africa's agricultural sector and food supply and to use the land optimally.

The cultivation of crops under irrigation is also more labour intensive and will require people to be employed to assist with planting, harvesting and management on the site. The project will thus contribute to job creation and a contribution to the local economy and equipment (i.e. pump), vehicles, and machinery will be purchased and/or hired locally. It is expected that a minimum of 2 people will be employed full-time to manage and monitor the crops. However, during the planting and harvesting of the crops additional employment will be created on a temporary basis.

The proposed crops that have been selected for cultivation on the site were those of Lucerne and Pecan nut trees.

Lucerne is one of the most important fodder crops grown as an alternative source of forage for animal production, which reduces the erosion from natural foraging. This project will lead to the production of good quality hay that will be sold commercially and that will contribute to the area's economy, as well as food security.

Pecan Nut prices over the years have exponentially increased from R50 in 2004 to R200 in 2016 per kilogram. 90% of all Pecan Nuts produced in South Africa are exported to foreign markets and fetch high prices as demand for them are still increasing. The planting of Pecan Nuts will therefore increase the national export and thus contribute to the economy. It takes around 8 years to make a financial return on the initial investment when starting from a new development.

It is planned that the planting of Lucerne will serve as a cash crop for approximately 8 years funding the development while the Pecan Nut trees reach maturity and start producing nuts and funding the development further. Considering the size of the planned Pecan Nut orchard, at least 10 or more job opportunities for local people will also be established through this project, as processing Pecan Nuts requires large amounts of labour during harvesting, processing and orchard maintenance.

4.1 Legal Requirements

The aim of this section is to provide an overview of the legal framework and administrative requirements applicable to the licensing of the activity to ensure compliance with environmental requirements.

- **NEMA;**

A S&EIR process must be followed in terms of the 2014 EIA Regulations as amended in 2017 and the following activities are being applied for in terms of GN. R. 325 of the 2014 EIA Regulations as amended:

Number and date of the relevant notice	Activity No(s) in terms of the relevant notice	Description of each listed activity
GN. R. 325 7 April 2017	15	"*The clearance of an area of 20 ha or more of indigenous vegetation*"

- **NWA**;

An IWULA will be applied for in terms of the NWA for the following water uses:

Legislation	Water Use	Description of each Water Use
NWA	Section 21(a)	*"Taking of water from a water resource"*
NWA	Section 21(c)	*"Impeding or diverting the flow of water in a watercourse"*
NWA	Section 21(i)	*"Altering the bed, banks, course or characteristics of a watercourse"*

As previously mentioned, Section 21(c) and (i) will not be an attempt to impede, divert flow and/or alter the watercourse in any way. The NWA requires a Section 21 (c) and (i) to be completed when activities take place within 100 m of a watercourse and within 500 m a wetland area. The study area lies within 55 m of the Vaal River which contains a wetland area.

- **NHRA**;

The site has not been given any formal protection by the SAHRA or the Northern Cape Provincial Heritage Authority under the NHRA. A Heritage Impact Assessment ("**HIA**") and Palaeontological Impact Assessment ("**PIA**") has been completed by a specialist to determine the historical value of the site and all findings will be communicated to SAHRA and the Northern Cape Provincial Heritage Authority during the EIA Phase of the project.

4.2 Aspects that were assessed as part of the Environmental Impact Assessment Process.

- The identification of threatened as well as alien plant species on site.
- Identification of any possible watercourses on the site.
- Possible impact on the groundwater resources.
- Identification of any sensitive natural areas on site.
- Identification of any heritage areas or artefacts on site.
- Soil suitability for the proposed crops.

4.3 Who will benefit from this project?

The establishment of a fully functioning farm producing Lucerne and Pecan nuts will benefit society and especially the local residents in the following manner:

- Numerous job opportunities for local people will be created as manual labour in harvesting, planting and maintenance as well as jobs requiring some form of skills utilizing machine for the cultivation process.

- Food prices will be positively affected, as cattle earmarked for meat production, have access to local and a nearby source of feed. This in turn will lower the cost of sourcing feed from other regions, bringing down the cost and lowering the price of meat in the area.
- Pecan nuts produced on the study area can reach high prices in oversees market. This will not only increase South Africa's total export, but also the money gained from exporting can help stimulate the area in expansion and increase production.
- The economy of the area will be positively affected through increased agricultural production which will require machinery, vehicles, fertiliser and seed, which in turn will stimulate the small to medium business sector in supplying those materials.

5 Consideration of Alternatives

The site selected (Study area) is the only site that can be considered as the applicant has no other land adjacent to the area. Also, the site can be moved in either direction due to neighbouring property boundaries as well as tailings dumps to the northeast and the Vaal River to the West.

5.1 Site Alternatives

5.1.1 Preferred Alternative: Harrisdale 226/1

Site Coordinates:

Property description	**Coordinates**	
Harrisdale 226/1	**Latitude**	**Longitude**
	-28.492473°	24.655838°

The proposed property has an extent of 149 ha, while the proposed site has a footprint of 68 ha. The proposed site is located 4.6 km northwest of the edge of the town of Riverton, directly adjacent to the Vaal River.

Positive attributes of the preferred site for the establishment of an agricultural area:

- The proposed site was used in the past to produce crops under pivot irrigation. The client simply desires to continue with agricultural activities more than 10 years after diamond mining was ceased.
- The cultivation of Lucerne will take place on the footprint of the previously used pivot irrigation area. Mostly secondary indigenous vegetation (mostly grasses) that re-established itself in the past 10 years will have to be removed.
- The remaining land of the study area will be utilized through the establishment of Pecan nut tree orchards, leaving no land unused and optimizing production for the specific area.

- The agricultural activities will take place at least 55 m away from the Vaal River leaving the present riparian vegetation in its current condition.
- No drainage lines or wetlands are located on the study area earmarked for agricultural activities.
- The study area falls within the Kimberley Thornveld (SVk4) and listed as being of least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004).
- The neighbouring areas are also currently being used for agricultural activities, which mainly include pivot irrigation with water supplied from the Vaal River.
- No protected, rare or endangered species could be identified during the Ecological Assessment.
- "The site has low archaeological significance and has a rating of Generally Protected C according to the Phase 1 HIA and PIA." (Rossouw, 2019) (refer to **Annexure 5**).

<u>Negative attributes of the preferred site for the establishment of an agricultural area:</u>

- The study area is located close to the Vaal River and the topography also slopes towards the Vaal River. Agricultural activities may contaminate the water from rainfall and runoff with pesticides and nitrates, which may drain into and contaminate the Vaal River.
- The agricultural activities alongside the Vaal River may impact on the aesthetic value of the surrounding area.

Figure 6: Map indicating the locality of the farm Harrisdale 226/1 (preferred site), Barkly West, Northern Cape.

5.1.2 Alternative 2:

As previously mentioned, no alternatives could be brought forth or considered, as this is the only property that the applicant owns and wants to develop. This area is also restricted to all sides by old mining dumps, two neighbouring properties and the Vaal River and thus can't be moved.

5.2 Design/Layout Alternatives

There is no feasible design/layout alternative for this project that will be assessed due to the following reasons:

The applicant desires only to develop the site in question and due to the site being bordered by various landmarks, obstacles and property boundaries, it is the only layout that can be considered if agricultural activities are authorised. Some aspects of the site can be changed which include the pump house and centre of the pivot point. These, however, would be very costly to change and rebuild and would be counterproductive as the infrastructure is already in place for agricultural activities.

5.3 Technological Alternative

As far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. This agricultural project will start a new and will utilize the best possible technologies for the proposed crops. Power efficient pumps and pivot irrigation structures will be used as well as accurate water abstraction meters, to manage and minimize water abstraction to preserve the water source. Underground drip irrigation will be implemented for the Pecan nut trees as to ensure optimal absorption of water through the tree roots as well as minimizing the effect of evaporation and loss of water. New modern machinery will be used to cultivate and harvest the corps to minimize crop losses as well as their dependency on fuel and their potential impact on the environment.

5.4 No Go Alternative

The "no-go" alternative will be considered throughout the assessment of the proposed project. If the project is not authorised, no activities will take place on the property and will stay abandoned. No production of Lucerne or Pecan nuts will be produced, which has the potential to increase employment (skilled and unskilled), stimulate the local economy through the small to medium business sector and increase the overall export of South Africa. The Lucerne will also stimulate local meat production due to the availability of fodder crop for cattle, equating to lower prices for meat.

6 Project description

6.1 Agricultural activities

The development will entail the establishment of an agricultural area. The agricultural development aims to cultivate and harvest Lucerne (40 ha) and Pecan nut trees (28 ha) by utilizing water from the adjacent Vaal River for irrigation. The area selected for this proposed development was Kilmorey with a total area of 155 ha. Only a portion of the Kilmorey site will be utilized for the production of crops to the total area of 68 ha.

The site has been used in the past for the production of crops. There after alluvial mining operation started leaving certain parts of the property unusable due to the presence of rehabilitated tailings dams. After mining ceased, the site was left abandoned for more than 10 years, allowing the vegetation of the area to reclaim the land.

The applicant seeks to continue with agricultural activities as done in the past. This will include the removal of more than 20 ha of secondary indigenous vegetation which established itself for more than 10 years. In the past before mining commenced, the study area was only used for pivot irrigation to the total area of 40 ha. The same pivot area will now be used to cultivate the proposed Lucerne to the same size. The rest of the open area (28 ha) will also be utilized for the establishment of Pecan nut tree orchards. This will ensure that no land is left abandoned or unused, optimizing production and efficiency.

Lucerne

Lucerne is a perennial crop with a productive stand life of 5- 7 years. The first cutting gives an average yield of about 1.5-2 tons/ha and then the yield increases during subsequent cuttings. Average yield ranges between 15 000 kg to 30 000 kg per hectare.

After sowing of the Lucerne seeds the soil must be kept until the Lucerne has emerged. For good production, Lucerne requires about 1 200mm of water a year. Lucerne is cut throughout the growing season and requires about 150mm between cuts, depending on soil and climatic conditions. In winter, there should be a single irrigation just after the last cut and another about six weeks before the start of the new growing season. In total about 600 000m^3 of water will be needed per annum.

It is foreseen that the average yield per hectare of between 15 000 - 30 000 kg for Lucerne will be possible.

Pecan nut trees

Pecan nut trees on the other hand requires a standing period of 3 – 4 years (growing time until production) and 6 - 8 years (15 -20 kg nuts per tree) before harvesting reaches its full potential. Taking into account that an average price per kg of pecan, in South Africa, can reach around R80.00/kg the approximate income generated for a 28 ha pecan orchard is in the vicinity of R 3 000 000/a.

Pecan nut trees require large amounts of water, in the vicinity of 500 L/ per tree/per day. The tree will be planted 10 m apart on a 28 ha space. This yields 2 800 trees needing 500 l of water per day. This brings the total water requirements for the optimal production of pecan nuts to approximately 504 000 m^3 per annum.

It is foreseen that the average yield per hectare of between 42 000 – 56 000 kg for the Pecan nut trees will be achieved.

7 Environmental Impact Assessment

7.1 Assessment Methodology

The main objective of the EIA process will be to assess and quantify the potential impacts that were identified by the project team, specialists and I&AP during the Scoping Phase.

The concept of "significance" is at the core of impact identification, evaluation and decision-making during the EIA process and can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. intensity, duration and likelihood), while impact significance is the value placed on the change by different affected parties (i.e. level of acceptability) (DEAT, 2002).

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence x Overall Likelihood

7.1.1 Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: **Severity/Intensity, Duration and Extent/Spatial Scale**. Each factor is assigned a rating of 1 to 5, as described below.

7.1.1.1 Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects will impact on the biophysical and socio-economic environment.

Table 2: Rating of Severity

Type of criteria	**7.2 Rating**				
	1	**2**	**3**	**4**	**5**
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social / Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable / Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action

Type of criteria	7.2 Rating				
	1	2	3	4	5
Irreversibility	Very low cost to mitigate / High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

7.1.1.2. Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g.

Table 3: Rating of Duration

Rating	Description
1: Low	One month
2: Low-Medium	Between 1 and 3 months (Quarter)
3: Medium	3 months to 1 year
4: Medium-High	1 to 10 years
5: High	More than 10 years

7.1.1.3. Determination of Extent/Spatial Scale

Extent refers to the spatial influence of an impact. It will be: a) limited to the site and its immediate surroundings; b) extending to the surrounding local area, c) regional (will have an impact on the region) c) national (will have an impact on a national scale); or d) or international (impact across international borders).

Table 4: Rating of Extent

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Regional
4: Medium-High	National
5: High	International

7.1.1.4. Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 3.

Table 5: Example of calculating Overall Consequence.

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 3)	3.3

7.1.2. Determination of Likelihood

The determination of likelihood is a combination of **Frequency** and **Probability**. Each factor is assigned a rating of 1 to 5, as described below.

7.1.2.1. Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 6: Rating of Frequency

Rating	Description
1: Low	Once a year or once during operation
2: Low-Medium	Once / more in 6 Months
3: Medium	Once / more a Month
4: Medium-High	Once / more a Week

5: High	Daily

7.1.2.2. Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment.

Table 7: Rating of Probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

7.1.2.3. Determination of Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Table 8: Example of calculating the Overall Likelihood.

Likelihood	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

7.1.3. Determination of Overall Environmental Significance

7.1.3.1. Quantitative description or magnitude of Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 9: Determination of Overall Environmental Significance.

Significance or Risk	Low	Low-Medium	Medium	Medium-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

7.1.3.2. Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision-making process associated with this event, aspect or impact.

Table 10: Description of the Environmental Significance and the related action required.

Significance	**Low**	**Low-Medium**	**Medium**	**Medium-High**	**High**
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to I&AP.	Impact is real and substantial in relation to other impacts. Pose a risk to the I&AP. Unacceptable.	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

7.2. Environmental Impact Assessment

7.2.1 Geology and Soil

The following impacts may occur on the soil as a result of the construction and operational phase of the activity:

- Loss of topsoil during initial land preparation,
- Loss of topsoil during ploughing periods,
- A change in soil characteristics as a result of the disturbance of the soil,
- Contamination of soil due to spillage of petrochemical substances and soil pollution due to overuse of fertilizers, pesticides and herbicides.

1. Loss of topsoil through agricultural activities								
Harrisdale 226/1								
Potential Impact Description:	During the initial stages of vegetation clearance, levelling of site and periodical ploughing of the field, topsoil can be lost through dust fallout as a result of heavy vehicle activity.							
Duration of Impact:	Lifetime of activity (Ploughing of Lucerne will only happen every 3-5-year period)							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	3	2	3	2	1	1,5	4.5
With Mitigation	2	1	1	1,333333333	2	1	1,5	2
Mitigation Measures	Measures that can be implemented to decrease the loss of topsoil through activities include the following features. Heavy vehicles can implement a maximum speed limit of 40 km/h and use existing gravel roads to limit dust being generated. If levelling of the site has to be done, the topsoil needs to be separated and stored away from any erosion effects of wind and dust. This stored topsoil then needs to be reworked into the levelled area before planting of crops commences.							
	Operational Phase							

	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	2	2.33333	2	1	1,5	3.5
With Mitigation	2	1	1	1.3333	2	1	1,5	2
Mitigation Measures	It is advisable that planting of crops commence as soon as possible after the clearance of vegetation has been completed to prevent topsoil from being lost through runoff and windy conditions. Ploughing and reworking of land will only occur between 3 - 5 years and it is recommended that the reworked land not be left empty for long periods as to preserve the topsoil from wind and runoff erosion effects.							
Can the Impact be Reversed	Yes, the impact can be reversed. However, it is highly unlikely that the impact will have a significant effect on topsoil loss with or without mitigation. The reversing of topsoil loss involves the sourcing of topsoil from other areas.							
Will impact cause irreplaceable loss to resource	No, topsoil can be source from various sources at high expense. If mitigation measures are followed correctly it is anticipated that there will be a minimal to insignificant loss of topsoil.							
Cumulative Impacts	If the field are ploughed more than is necessary topsoil can become loosened and lost through wind and rainfall effects as a result of excessive heavy vehicle movement.							

2. Loss of topsoil through erosion as an effect of the natural environment							
Harrisdale 226/1							
Potential Impact Description:	Erosion through the effects of wind and rainfall can severely affect the topsoil through the removal of large quantities of soil over a relatively short period. These natural effects can cause the loss of topsoil if it is not properly stored or if topsoil is still present at the surface, can cause loss through dust fallout or erosion trenches.						
Duration of Impact:	Lifetime of activity (Ploughing of Lucerne will only happen each 3-5-year period)						
	Construction phase						
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	2	2	2,666666667	2	2	2	5.3333

With Mitigation	2	1	1	1,333333333	2	2	2	2,666666667
Mitigation Measures	It is recommended that the clearance of vegetation and levelling of land commences during periods when the wind intensity is low and rainfall events are seldom and rare. During levelling of the field, berms around the proposed crop production area need to be constructed as to prevent runoff from rainfall carrying away topsoil. Any topsoil stored for later use has to be stored at the highest point, at no more than 1.5 m high and should not be stored on steep slopes.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	2	2.333333	2	1	1,5	3.5
With Mitigation	2	1	1	1.333333	2	1	1,5	2
Mitigation Measures	It is advisable that the land earmarked for crop production always be in use as to minimize the loss of topsoil through wind and runoff on bare land. If erosion channels develop as a result of natural effects, these need to be rehabilitated and berms or channels placed in the correct areas as to prevent them from forming again.							
Can the Impact be Reversed	Yes, the impact can be reversed through proper management of topsoil and crop production techniques. Topsoil loss can be largely eliminated through constructing appropriate berms.							
Will impact cause irreplaceable loss to resource	No. If proper crop production techniques are used natural erosion effects won't affect the soil as the crops cement the topsoil together through their roots and prevent loss from windy conditions or runoff from rainfall.							
Cumulative Impacts	If the field are ploughed more than is necessary topsoil can become loosened and lost through wind and rainfall effects such as erosion channels.							

3. Change in soil characteristics as a result of petrochemical spills
Harrisdale 226/1)

Potential Impact Description:	All vehicles have the potential to either leak oil-based fluids or petrochemical substances. During vegetation clearance and levelling of site, construction vehicles may leak hazardous fluids on the surface. During the harvesting of the crops agricultural equipment may leak various hazardous substances on the surface. The impact may cause pollution of the soil.							
Duration of Impact:	Lifetime of activity							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	3	1	2,66667	3	1	2	5.33333
With Mitigation	2	1	1	1,333333333	2	1	1,5	2
Mitigation Measures	When clearance of vegetation and levelling of the area commences, the construction vehicles have to be inspected and maintained in a good working condition. Any stationary vehicles or vehicles that need repairs have to be parked in a designated area that is lined. If the areas are not lined drip trays must be used and regularly cleaned and disposed of in the correct manner. Any soil or area that is contaminated must be cleaned immediately by removing the soil and disposing of the hazardous waste in the correct manner.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	3	1	2,333333333	3	1	2	4,666666667
With Mitigation	1	1	1	1	2	1	1,5	1,5
Mitigation Measures	Before the start of a ploughing or harvesting season, the agricultural vehicles need to be inspected and repaired to acceptable working levels to prevent any spills from occurring. If spills occur the contaminated soils need to be removed and disposed of in the correct manner.							
Can the Impact be Reversed	Yes, the impact can be reversed. However, it is highly unlikely that the impact will have a significant effect on topsoil loss with or without mitigation. The reversing of topsoil loss involves the sourcing of topsoil from areas that have excess soil.							
Will impact cause irreplaceable loss to resource	No. Soils can always be sourced from other sustainable areas and chemically changed to match with the surrounding environment.							
Cumulative Impacts	If the hazardous spills and contaminate soils are not removed and disposed of correctly, numerous spills can alter the soil composition and deem the land unfit for crop production.							

4. Change in soil characteristics as a result of fertilizer and pesticide overuse								
Harrisdale 226/1)								
Potential Impact Description:	Adding excessive fertilizer for the growth of crops can enrich the soil with certain elements and cause the salination of the ground. Overuse of pesticides and herbicides which are either organic or non-organic have a long residual lifetime that they are active in a system. This can cause the enrichment of soil with nitrates and render the soil unfit for crop production.							
Duration of Impact:	Operational phase until Rehabilitation phase							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	5	4	2	3.6666667	4	2	2,5	11
With Mitigation	2	1	2	1.3333333	2	1	1,5	2.5
Mitigation Measures	Analysis of the soil has to be done to determine the chemical constituents and determine whether the soil needs any fertilizer or whether the crops can grow effectively without it. There will be no need for herbicides if regular removal of alien species is removed. To be environmentally friendly, the operation can consider building birdhouses, to establish a very local bird population which feeds of insects and thus eliminate the use for pesticides. If any of the above-mentioned activities are chosen without mitigation, it is recommended that it be done in small quantities.							
Can the Impact be Reversed	Yes, the impact can be reversed by adding or removing certain chemicals from the ground. Also not using pesticides or herbicides for an extended period will cause the chemicals to naturally breakdown and dissipate.							
Will impact cause irreplaceable loss to resource	No. Soils can always be sourced from other sustainable areas and chemically changed to match with the surrounding environment.							
Cumulative Impacts	The only cumulative impact that is foreseen is the constant use of herbicides, fertilizers and pesticides which will concentrate on site if there is no rest period in-between use on the land and no proper management.							

Total Combined Effects				
	Construction		Operational	
Potential Impacts	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
1. Loss of topsoil through agricultural activities	4.5	2	3.5	2
2. Loss of topsoil through erosion as an effect of the natural environment	5.3	2,6	3.5	2
3. Change in soil characteristics as a result of fertilizer and pesticide overuse	none	none	11	1,5
4. Change in soil characteristics as a result of petrochemical spills	5.3	2	5.6	1.5
Grand Average Total:	5.0555	2,22222222	5.6667	1,75
The overall environment significance indicates that the impact on soils and geology will have a low impact. Although the impact seems insignificant special attention should be given to soil and topsoil retention on site as well as the use of chemicals which should be used sparingly.				

Note that the agricultural development will have to first develop and prepare the land and periodic ploughing to prepare the land for sowing. The disturbance of soil will be limited to the study area of the combined 40 ha Lucerne and 28 ha of Pecan nut trees. It is planned for this operation to continue for more than 10 years and thus the soil, with the addition of fertilizers, will remain close to the same condition. The soil profile might be disturbed by the harvesting of Lucerne which has a standing time of 3-5 years after which new seeds have to be sown and the soil will have to be reworked. Unlike the Lucerne, once the Pecan nut trees have been planted the are stationary and no further reworking of the soil needs to take place. During ploughing and the initial ground preparation petroleum products may leak from equipment and contaminate the soils which can negatively affect the environment as well as the crops being grown. It is therefore recommended that regular maintenance of the equipment takes place as well as placing drips trays under parked equipment.

The impacts on soil at the preferred site alternative will achieve a LOW-MEDIUM score of 5 during the construction phase and a LOW-MEDIUM score of 5.6 during the operational phase, without mitigation. The mitigation measure for both phases still achieve a LOW score of 2 and 1.75 respectively. It should be noted that the preferred site has already under numerous changes including past crop production indicating preferred soil conditions for such activities. According to the Ecological Assessment the site consists mostly of natural vegetation, though it is clear that a crop field including centre-pivot was present at some time. Therefore, the vegetation on the site, although indigenous, must be of secondary establishment.

Notable impacts on the site include the previous clearing of vegetation which has caused significant alteration to the vegetation structure and species composition, soil surface disturbance along the north eastern portion of the site due to alluvial diamond mining operations and linear trenches/canals associated with these mined areas.

As mentioned earlier in the report, there is no feasible design/layout alternative because the site has previously been used for crop production and the optimal layout has already, in the past, been chosen. The preferred design/layout alternative will not have any impact on the soil or geology of the site, besides what was mentioned.

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment.

The cumulative impacts on soil may be high at the preferred as there will be a continual addition of fertilizer to the soil, pending a chemical analysis and the needs of the crops. This addition of fertilizers might cause an increase in concentration of certain elements in the soils if the soil isn't managed properly. Furthermore, the area along the Vaal River is known for crop cultivation and irrigation. The addition of the additional 68 ha of crops will have a cumulative impact on the soil. However, due to the scale the cumulative impact on soil will be low.

<u>Proposed mitigation:</u>

- Topsoil will be removed during the construction phase (land preparation and levelling) if necessary, which will either be used in levelling of the ground or be stockpiled appropriately and in such a manner to prevent any loss thereof.
- Topsoil stockpiles must not exceed a height of 1.5 m.
- Soil loss through erosion will be reduced by implementing storm water management practices.

- Equipment and machinery on site will be maintained and drip trays will be used to prevent spillages of petrochemical products which may cause contamination of soil. Any hazardous substances on the site will be stored in a bunded area which consists of an impermeable floor with walls which will have the capacity to contain 110% of the volume of the substance stored therein. This refers to permanent hazardous substances stored. It is however not expected that hazardous substances will be stored permanently.
- Any spills of hazardous substances will be cleaned immediately by disposing of the affected soil as hazardous waste.
- The use of fertilizer, pesticides and herbicides should be minimized by only using these products when it is absolutely necessary. Alternatives such as reworking tillage (organic waste from the fields) in the ground and investigating the construction of bird houses to keep the insect population low. The use of herbicides can be eliminated by regular removal of alien species.

7.2.2 Climate

The following impacts may occur on the climate as a result of the construction and operational phase of the activity:

- There will be no impact on climate for the study area, as the proposed site is small, and the agricultural activities proposed will not impact upon the climate.
- The cumulative impact of numerous agricultural activities along the Vaal River may impact on the microclimate but will also have an insignificant effect on climate on the larger scale as these activities are only limited to a small are alongside the Vaal River.

1. Climate changes								
	Harrisdale 226/1							
Potential Impact Description:	Due to the size and the activities proposed, the agricultural development will not have any effect on the climate							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	No Impact							
With Mitigation	No Impact							
Mitigation Measures	None							

	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	No Impact							
With Mitigation	No Impact							
Mitigation Measures	None							
Can the Impact be Reversed	There will be no need to reverse any impacts as the agricultural activity has no effect on the climate							
Will impact cause irreplaceable loss to resource	There are no impacts on climate							
Cumulative Impacts	There is the possibility that a cumulative effect on the climate can occur. The whole area alongside the Vaal River is populated by agricultural developments and may have a small impact on the climate in the small region adjacent the Vaal River.							

The impact of the agricultural development on the climate will be small to insignificant as no climate changing factors are large or toxic enough to change the climate in the area. Over the 10-year interval the Lucerne will have no effect on the climate, but the Pecan nut trees may provide enough shade to lower the immediate temperature by a few degrees.

There are no preferred technological or design alternatives, except for the activities that are planned and their impact on the environment. This is due to the nature of climate preventative measures were large scale operation affect the climate in a significant manner. This operation is very small and due to it being an agricultural development, will actually improve the ambient air quality and temperatures.

There may be a small cumulative impact on a larger scale including the surrounding agricultural developments. In combination with the surrounding developments the impact will still be seen as insignificant as this may affect the temperatures by a degree.

<u>Proposed mitigation:</u>

- None

7.2.3 Land Use

The following impacts may occur on the land use and characteristics of the land as a result of the construction and operational phase of the activity:

- The potential to use the land for other activities will be lost.

1. Use of land for other activities								
	. Harrisdale 226/1							
Potential Impact Description:	The land was used in the past for crop production under pivot irrigation. After the crop production halted alluvial diamond mining commenced outside the study area but left rehabilitated tailing dumps outside the study area. This area is only ideally suited for agricultural purposes when considering the above-mentioned factors. Currently the land is abandoned and overgrown by indigenous vegetation of secondary establishment.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	1	2	4	1	2,5	5
With Mitigation	2	1	1	1,333333333	4	1	2,5	3,333333333
Mitigation Measures	Effects of land use can be mitigated by only using land that is deemed necessary, levelling and removing vegetation from that areas only.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	5	1	3	5	5	5	15
With Mitigation	2	5	1	2,666666667	4	4	4	10,66666667

Mitigation Measures	An agricultural crop development is mainly reliant on the land for production and thus high intensity land use will be recorded. The intensity of the land use can be mitigated by ploughing every 3- 5 years (which will be the case for Lucerne). Also, activities on the land such as vehicles can be minimized by correct management.
Can the Impact be Reversed	Yes, the impact can be reversed if correct rehabilitation of the land takes place after the agricultural activities have ceased. This will involve returning the site to its original state and encouraging indigenous vegetation to establish themselves on the area.
Will impact cause irreplaceable loss to resource	No. There will be no loss of land.
Cumulative Impacts	Cumulative impacts have already taken place, through neighbouring areas, which also utilize the land for crop production alongside the Vaal River.

Only 68 ha (40 ha Lucerne and 28 ha Pecan nut trees) will be used of the Farm Harrisdale 226/1. This is the only land that is available on the property for the activity of agriculture. No area of the proposed site will be left abandoned and all areas will be utilized for maximum production. The Lucerne will be planted on a previously used area which utilized pivot irrigation and was to the size of 40 ha. The remaining bordering areas to the size of 28 ha will be utilize for the planting of a Pecan Nut Orchard.

The impacts on the land use will be LOW -MEDIUM during the construction phase and MEDIUM-HIGH during the operational phase, without mitigation. The impact on land has a relatively high impact rating as destruction of land and redevelopment thereof is unavoidable. The reasons why the land use impacts are considered MEDIUM-HIGH is because the site will be used for more than 10 years and each year harvesting and ploughing will take place. The impacts can be lowered to a LOW-MEDIUM impact after mitigation has taken effect. These mitigation measures include, using the footprint of the past pivot irrigation area to plant crops, ploughing and planting only once every three years as Lucerne has a standing time of three years and no reworking of the soil once the Pecan nut trees have been planted. The land will be used for nothing else as what was mentioned, and the layout of the Lucerne and Pecan nut trees will stay the same.

As mentioned earlier, there is no feasible design/layout alternative because the whole study area will be utilized and that the applicant has no other land adjacent this property that can be developed.

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. The preferred technological alternative will not have any impact on the land use of the site.

The cumulative impacts on land use may be medium at both alternative sites, because of the adjacent agricultural developments alongside the Vaal River, where the main land use is for crop production.

Proposed mitigation:

- Impacts on land use is unavoidable. However, this land can be used numerous times for the purpose of crop production even after the activities applied for has ceased.
- No major construction will take place except for the initial preparation and levelling of the site and will only commence within the study area.
- The area near adjacent the Vaal River, has riparian vegetation and will be protected and left undisturbed for as long as the activity is in operation.
- Land reworking processes (incl. ploughing, planting and harvesting) will be kept to a minimum to ensure that the land is least disturbed.

7.2.4 Vegetation and Animal Life

The following impacts may occur on the vegetation and animal life as a result of the construction and operational phase of the activity:

- Transformation of the land.
- Loss of natural vegetation although secondary in nature (Kimberly Thornveld).
- The growth and spreading of alien plant species.
- Fires made on the site by employees may result in the loss of vegetation of the surrounding environment.
- Destruction of habitat and loss of animal life.

Refer to the Ecological Assessment attached in **Annexure 5**.

1. Transformation of land								
	Harrisdale 226/1							
Potential Impact Description:	To make room for the new proposed agricultural development, the indigenous vegetation needs to be removed for the planting of crops.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	5	5	1	2.666667	5	2	3,5	12.833333
With Mitigation	4	5	1	3.333333	5	1	3	10
Mitigation Measures	Clearance of vegetation must only occur within the boundaries of the selected site.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	5	1	3	2	1	1,5	4.5
With Mitigation	2	5	1	2,6667	1	1	1	2,666667
Mitigation Measures	During the operational phase most of the indigenous vegetation has been removed and replaced by crops and thus there will be little to no areas or vegetation that will be further affected by land transformation. Mitigation measures will include no activities outside the specified areas and protected areas alongside the Vaal River will be left undisturbed and in pristine condition.							
Can the Impact be Reversed	Yes, the impact can be reversed if correct rehabilitation of the area and indigenous vegetation takes place after the activity has ceased.							
Will impact cause irreplaceable loss to resource	If the activity continues into the far future the indigenous vegetation will be lost indefinitely. If the activity ceases steps need to be taken to encourage indigenous vegetation to establish themselves once again on the site.							

Cumulative Impacts	A cumulative impact of land transformation has already occurred through the development of numerous agricultural areas alongside the Vaal River. This site is very small in comparison to the already developed areas around it and it is not foreseen that the transformation of this area will have a significant effect on the large scale.

2. Loss of natural vegetation of secondary establishment								
	Harrisdale 226/1							
Potential Impact Description:	Indigenous vegetation has established itself on an old irrigation pivot and surrounding area. The site has been abandoned for 10 years giving the vegetation (most grasses) time for re-establishment. This vegetation will be lost with the specified area to clear the land for crop production.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	4	2	2.66667	4	3	3,5	9.33333
With Mitigation	2	4	2	2,66667	4	3	3.5	9.33333
Mitigation Measures	During clearance of vegetation activities should only be limited to the specified area. Endangered or protected species must be identified and relocated.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	5	2	3	3	1	2	6
With Mitigation	1	5	2	2.666667	3	1	2	5,333333333
Mitigation Measures	While the agricultural development is in its operational phase there will not be abundant indigenous vegetation left and any effects on such small areas will be insignificant. However, the riparian vegetation and any endangered/protected species must be left undisturbed or relocated.							

Can the Impact be Reversed	Yes, the impact can be reversed if correct rehabilitation of the area and indigenous vegetation takes place after the activity has ceased.
Will impact cause irreplaceable loss to resource	Yes, the loss to the specific area's vegetation will continue indefinitely until the agricultural activity ceases and correct rehabilitation followed in an attempt to re-establish indigenous vegetation.
Cumulative Impacts	Cumulative impacts concerning the vegetation loss has already commenced alongside the Vaal River with the establishment of large agricultural developments. This area is very small and will not significantly contribute to cumulative impacts on vegetation loss.

3. The growth and spreading of alien plant species								
	Harrisdale 226/1							
Potential Impact Description:	The removal of indigenous vegetation may promote the growth of alien vegetation on bare land. Sowing of seeds for crop production may also introduce alien species amongst the seeds that were sown. A lack of regular removal of alien species can cause them to produce seeds and intestate a large area.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	4	3	3.333333333	4	3	3.5	11.6666667
With Mitigation	3	4	2	3	3	3	3	9
Mitigation Measures	After removal of vegetation and levelling of site has taken place, it is recommended that planting of crops occur as soon as possible. All alien species near or in the vicinity of the planting area must be removed prior to planting.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	4	3	3.33333	4	3	3.5	11.6667

With Mitigation	2	4	2	3	3	3	3	9
Mitigation Measures	Regular removal of alien vegetation during site maintenance and inspection in and around the crop area.							
Can the Impact be Reversed	Yes, the impact can be reverse by regular removal of all alien vegetation on a monthly basis.							
Will impact cause irreplaceable loss to resource	No and will only require regular removal of identified alien species.							
Cumulative Impacts	A cumulative impact can commence if any alien vegetation establishes itself as a result of non-removal of alien species on site or in neighbouring areas.							

4. Destruction of habitat and loss of animal life								
	Harrisdale 226/1							
Potential Impact Description:	The study area will be completely transformed in preparation for the planting of crops. This will include levelling and removal of vegetation during the construction phases. During the operational phase the whole area will be cover with crops with little to no natural environment left. Both the construction and operational phases make no room for possible animal life.							
Duration of Impact:	Lifetime of operation until after rehabilitation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	4	2	2,666666667	3	3	3	8
With Mitigation	2	4	2	2.666666667	3	3	3	8
Mitigation Measures	The destruction of habitat and loss to animal life can be mitigated by only clearing and levelling the specified area, taking caring to stay within the property boundaries. All animals found on site will not be harmed and will need to be relocated.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	4	2	2,666666667	2	2	2	5.333333

With Mitigation	1	4	2	2.333333333	2	2	2	4.666667
Mitigation Measures	During the operational phase, little to no natural vegetation will be present on the specified site and will be completely levelled and covered with crops. This means that the chance of finding animals within the crop areas are highly unlikely. The areas around the specified site will still retain their natural vegetation such as the upper part of the Kilmorey site and the riparian zone close to the Vaal River. As a mitigation measure these areas need to be left undisturbed and in pristine condition with no activities taking place there. This will encourage certain animal life to stay in those areas. As a proactive measure to utilize less pesticides, bird houses can be built around the site which will encourage bird life to occupy them and as a result keep the pest numbers low.							
Can the Impact be Reversed	Yes, the impact can be reverse by correctly rehabilitating the land and ensuring that natural vegetation grows back, which will encourage animals to return.							
Will impact cause irreplaceable loss to resource	No							
Cumulative Impacts	A cumulative impact has already commenced with the development of agricultural areas alongside the Vaal River. These activities have already eliminated most of the indigenous vegetation adjacent the Vaal River, causing most animals species to leave the area. It must be noted that during the Wetland assessment no significant animals were noted and mostly evidence of small rodents was noticed. Due to rodents being in the area snakes and falcons were seen during the soil suitability study.							

Total Combined Effects				
	Construction		**Operational**	
Potential Impacts	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Transformation of land	12.8	10	4.5	2.67
Loss of natural vegetation of secondary establishment	9.3	9.3	6	5.3
The growth and spreading of alien plant species	11.6	9	11.6	9

Destruction of habitat and loss of animal life	8	8	6.9	4.67
Grand Total:	7.5	6.8	6.87	5.4
It is noted that although certain aspects of the impact assessment on animal life and vegetation are rated high, it must be kept in mind that the site is highly transformed and degraded together with indigenous vegetation of secondary establishment and no significant animal life.				

The study area and beyond its borders was already disturbed by agricultural activities followed by alluvial diamond mining (adjacent study area) and left abandoned for just more than 10 years. This lack of activity prompted the vegetation to grow back as well as small animal life to return. It must be noted that the vegetation close to the Vaal River (within 55 m) (riparian) will be left as is and undisturbed. The vegetation, although indigenous, is of secondary nature as the original vegetation was removed by previous activities. Since the whole 68 ha will be utilized for agricultural purposes, the same amount of vegetation will need to be removed. The vegetation is classified as Kimberley Thornveld, which is of least concern, and consists mainly of scrubs and grasses. All care will be given to the maintenance of the Pecan nut Orchard, as the trees need to be planted 10 m away from each other, and the possibility will arise for the invasion of alien vegetation species. These species, if the need arises, will be removed constantly.

The impacts on the vegetation and animal life at the preferred site alternative will be LOW-MEDIUM at a score of 7.5, without mitigation. It should be noted that this site was already extensively used for pivot irrigation crops (Study area) and alluvial diamond mining (outside study area) in the past, thus the site cannot be considered pristine but rather degraded with secondary indigenous vegetation regrowth during the abandonment period. If mitigation is applied the impact can be reduced LOW-MEDIUM score of 6.8. This mitigation will include not disturbing the riparian vegetation alongside the Vaal River and encouraging indigenous vegetation to grow back after the activities have ceased as part of rehabilitation. The proper rehabilitation of vegetation will also encourage the return of various animal species.

It is unlikely that there will be much of an impact on the animal life, as the secondary vegetation (mostly grasses) encourages small rodents to inhabit these areas. Numerous birds of prey were observed alongside snakes (during the soil suitability study), most probably due to the rodent population. These animals will not be significantly impacted on as they can easily find new areas to inhabit near the Vaal River's riparian vegetation.

As mentioned earlier, there is no feasible design/layout alternative because the study area has already been chosen to optimize production and that it was used in the past in the same manner.

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment.

It is possible to assume that there might be a cumulative impact on vegetation, especially alongside the Vaal River, as the adjacent farms used for crop cultivation, can encroach into the riparian vegetation or that crops grown on the developed area can establish themselves between the riparian vegetation.

Proposed mitigation:

- Vegetation will only be cleared within the applied for study area boundary.
- Removal of alien plants must adhere to the Alien and Invasive Species Regulations.
- No hunting will occur of animals that are present.
- No fires will be allowed on site.
- Rehabilitation afterwards may restore disturbed habitats.

7.2.5 Surface Water

The following impacts may occur on the surface water as a result of the construction and operational phase of the activity:

- Surface water resources close to the proposed development may become contaminated as a result of spillages and mismanagement of petrochemical substances and fertilizer on site.
- Water resources may become silted as a result of erosion if storm water management on the proposed site is not implemented and maintained. This impact can occur during construction and operation phases of the project.
- The proposed development may affect the quantity of water draining to the surface water resources due to the increase in vegetation (crops) acting as obstructions for the flow of water.

1. Surface water contamination through petrochemicals and fertilizers

	Harrisdale 226/1							
Potential Impact Description:	Overuse of fertilizers and accidental spills of petrochemical substances may contaminate surface water during rainfall events, irrigation on the crop area as well as runoff which may end up in the Vaal River.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	2	3	3	3	2	2.5	7.5
With Mitigation	2	2	2	2	2	2	2	4
Mitigation Measures	Surface water can be protected from the harmful effects of petrochemicals and overuse of fertilizers. During construction all vehicles must be inspected and maintained regularly, and leaks repaired. Any still standing vehicles must be parked in designated areas as well as using drips trays when under maintenance. The soil chemistry must be monitored regularly to determine the composition of the soils and whether fertilizer will be needed. As a precautionary measure all crop fields must have a berm surrounding them as to sperate clean water from dirty water and preventing contaminated surface water from entering the Vaal River.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	4	2	3	3	2	2.5	7.5
With Mitigation	2	2	2	2	2	2	2	4
Mitigation Measures	No ponding of water on the crop area must be allowed as this will increase the contact time water has with the chemicals, which indicates either poor drainable soils or over irrigation. The surface that falls onto the crop area (possibly contaminated) through irrigation and rainfall may not leave the site and it is recommended that berms be built to stop any runoff from entering the Vaal River or contaminating clean water. During harvesting and ploughing vehicles must be repaired and maintained often to prevent possible leaks and the use of drip trays under still standing equipment is recommended. Any surface water that is contaminate on site must be collected (if possible) and disposed of properly. It is also recommended that fertilizer be used sparingly and only when necessary as a last resort.							

Can the Impact be Reversed	Yes, through natural attenuation these chemicals will balance out over time. The constant repair/maintenance of vehicles and relying less on fertilizer will also speed up recovery of the surface water.
Will impact cause irreplaceable loss to resource	No
Cumulative Impacts	There might be a cumulative impact on the Vaal River as a surface water resource if all the agricultural areas alongside the Vaal River use excessive fertilizer. Although the impact on site will be significant, no large-scale impact can be foreseen.

2. Siltation of surface water resources								
	Harrisdale 226/1							
Potential Impact Description:	If soils are not properly secured by either leaving the land bare of vegetation or not constructing berms, the Vaal River may become filled with silt from agricultural activities. This may lead to a change in flow patterns in the Vaal River as well as resulting in low flow areas.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	3	2,666666667	3	2	2.5	6.67
With Mitigation	2	2	1	1.666666667	2	2	2	3.3
Mitigation Measures	It is recommended that clearance of vegetation and levelling of site commence during periods were no rainfall is expected and wind velocities are low, as to minimize the potential of runoff from the area, picking up silt and distributing it into the Vaal River. Berms will need to be constructed around the crop area as a precaution to lower runoff velocities and stopping silt entering the Vaal River.							

	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	5	3	3.6667	3	2	2.5	9.16
With Mitigation	2	5	2	3	2	2	2	6
Mitigation Measures	It must always be ensured that the crop production area is never bare of crops as a lack thereof causes soils to lose their cohesion and wash away during rainfall events. The construction of additional berms of maintaining the berms in a suitable condition will also decrease the amount of siltation being generated and ending up in the Vaal River.							
Can the Impact be Reversed	Yes, the impact can be reverse by removing the silt from the Vaal River.							
Will impact cause irreplaceable loss to resource	No and not on the scale of this proposed development.							
Cumulative Impacts	Cumulative impacts may include siltation on a large scale were all agricultural developments along the Vaal River contribute to siltation into the Vaal River changing the course and volume of water inside the Vaal River. This proposed development is small compared to the surrounding developments and will have a small and insignificant contribution to siltation, if it does occur.							

3. Obstruction of drainage to the Vaal River	
	Harrisdale 226/1
Potential Impact Description:	During the operational lifetime of the agricultural development the specified area will be cover in crops and surrounded by berms. This "obstruction" may impact upon the volume of water that drains naturally into the Vaal River through means of run-off generated by rainfall and any other surface water using natural drainage lines.
Duration of Impact:	From operational phase until after rehabilitation

	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	5	2	3.33333	3	2	2,5	8.3
With Mitigation	2	5	1	2,66667	3	2	2,5	6.67
Mitigation Measures	Ensure that clean runoff water stays separate from contaminated runoff through means of a berm and that the clean water has an unobstructed drainage line towards the Vaal River. Due to the layout of this proposed development obstruction of flow towards the Vaal River can't be avoided but natural drainage lines within the wetland and riparian zones will be left undisturbed and will allow drainage of clean water towards the Vaal River.							
Can the Impact be Reversed	Yes, after activities have ceased rehabilitation should ensure that water from runoff can flow unobstructed towards the Vaal River.							
Will impact cause irreplaceable loss to resource	No and not on this scale. The amount of water that will be lost to the Vaal River as a result of this development will be small and insignificant.							
Cumulative Impacts	The combined effect of drainage obstruction from all the agricultural developments alongside the Vaal River will have an effect on the volume of water available in the Vaal River. The area where the proposed development is small and will have little to no effect on a larger scale.							

4. Over abstraction of water from surface water resources	
	Harrisdale 226/1
Potential Impact Description:	Over abstraction from the Vaal River will have an effect on the available water volume in the river. This may cause depletion or longer periods of low flow. Over abstraction can also cause less water for downstream users. Over abstraction can also cause flooding of the crop fields.
Duration of Impact:	Operational

	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	5	5	3	4.3	2	2	2	8.67
With Mitigation	2	5	2	3	1	1	1	3
Mitigation Measures	All water abstracted from the Vaal River needs to be metered by using a water volume reader. Irrigation volumes will be closely monitored to determine the optimal water usage for the crops and what volumes of water the soils can retain.							
Can the Impact be Reversed	The impact can be reversed by lowering the abstraction volumes.							
Will impact cause irreplaceable loss to resource	No, the river is replenished yearly upstream and as a result of rainfall.							
Cumulative Impacts	The Vaal River is already being used by numerous agricultural developments for crop irrigation. The proposed development will not have a large or significant effect on the Vaal River as a whole.							

Total Combined Effects				
	Construction		**Operational**	
Potential Impacts	**Without Mitigation**	**With Mitigation**	**Without Mitigation**	**With Mitigation**
1. Surface water contamination through petrochemicals and fertilizers	7.5	4	7.5	4
2.Siltation of surface water resources	6.67	3.3	9.16	6
3. Obstruction of drainage to the Vaal River	none	none	8.3	6.6

4. Over abstraction of water from surface water resources	none	none	8.6	3
Grand Total:	7	3.6	8.4	4.9

The project aims to utilize water from the Vaal River to irrigate the Pecan nut trees as well as the Lucerne field. It was calculated that an average of 1 104 000 m³/a water will be needed for optimal growth for both of the selected crops. Pumping water from the Vaal River might affect the immediate area as well as the surrounding environment. It is therefore proposed that the volume of water pumped from the Vaal River be managed according to wet and dry seasons. These crops require to be watered every day, but the amount of water they received according to the season can vary and don't need the maximum amount of water. It is also proposed that during the dry season or low flow periods, the volume of water abstracted from the Vaal River to be decreased, in consideration for plant and animal life as well as neighbouring water users downstream from the activity. Volume abstraction meters will be placed on the main supply line from the Vaal River as well as meters on the water lines purposed for the Lucerne and Pecan nut trees. Care will also be given to the amount of water that can infiltrate the soil, as to not flood the land with excess water.

The preferred site alternative, with its specific design/layout, will have a LOW- MEDIUM impact on service water with a score of 5.3. There are surface water features, including the Vaal River and drainage line, both located outside the study area. The Vaal River is located approximately 55 m to the West of the study area. However, the topography of the site (gradual west facing slope) may lead to runoff from the site flowing into the Vaal River. This impact can be reduced to LOW with the correct mitigation and management measures which will include building berm and channels which will stop surface runoff from entering the Vaal River. (Please refer to the Storm Water Management Plan **Annexure 5**).

As mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. The preferred technological alternative will not have any impact on surface water.

There may be a high cumulative impact on the surface water features at the preferred alternative, due to the presence other agricultural developments adjacent the Vaal River.

<u>Proposed mitigation:</u>

- Berms will be constructed around the site, especially at the western border, to divert clean water from entering the crop area and drain into the natural drainage lines of the environment.
- Stormwater will not be allowed to drain into the natural drainage lines from the operational area as this area will contain fertilizer.
- All potentially hazardous substances will be stored in a bunded area which can contain 110% of the volume of the substance.
- Spillages of hydrocarbons will be prevented by using drip trays and a clean-up procedure will be implemented to clean any hydrocarbon spills as soon as possible.
- The site will be monitored for any erosion trenches. Trenches will be rectified, and erosion control measures will be implemented.
- Ponding of water on land indicates that the soil is saturated and possibly over irrigated. This effect cannot be allowed to occur.

7.2.6 Groundwater

The following impacts may occur on the groundwater as a result of the construction and operational phase of the activity:

- Contamination as a result of spillages of hazardous substances.
- Incorrect storage of waste products on the site may result in the contamination of the groundwater.
- Although it is not foreseen to occur there will be an impact on the groundwater quantity if groundwater is abstracted for the development.
- The development may induce surface runoff and therefore reduce infiltration. Lower infiltration will lead to lower groundwater recharge.

1. Contamination of the aquifer through hazardous spillages								
	Harrisdale 226/1							
Potential Impact Description:	The majority of hazardous substances will originate from equipment and vehicles used during the construction and operational phases. These hazardous substances can and will infiltrate to the aquifer during high rainfall or successive events if the spillages aren't removed immediately.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	4	2	3.333	3	2	2,5	8.3

With Mitigation	2	2	1	1,667	2	1	1,5	2.5
Mitigation Measures	Before any clearance of vegetation and levelling of site commences, the equipment and vehicles that will be used for the activities must be inspected and repaired were necessary. Any still standing or repair of vehicles must be done in a designated area suited for this activity (preferably lined area) and the use of drips trays under equipment to minimize the potential for contamination. Any spills that do occur on site must be immediately removed alongside the soil and disposed of offsite.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	3	2	2,67	3	2	2,5	6.6
With Mitigation	2	2	1	1,333333333	2	1	1,5	2
Mitigation Measures	The implementation of a correct "in the field work" management plan will reduce the amount of time, equipment and vehicles are exposed to the crop area which in turns reduces the risk of any spillages occurring. Any spillages that occur from equipment during activities in the field must be removed as soon as possible and disposed of offsite.							
Can the Impact be Reversed	Yes, the impact can be reversed by limiting the number of spillages and immediate clean-up of any hazardous substances. Any contamination to the aquifer itself as a result of hazardous substances infiltrating into the water can be remedied by natural attenuation if the aquifer isn't contaminated any further.							
Will impact cause irreplaceable loss to resource	No as the aquifer has a constant influx of new water and over a period of time will cleanse itself of the pollutants present.							
Cumulative Impacts	A cumulative impact from this proposed area can occur in conjunction with neighbouring agricultural developments, but the area proposed is very small and its contribution will be insignificantly small.							

2. Induced surface runoff causing lower infiltration to the aquifer as a result of the development	
	Harrisdale 226/1

Potential Impact Description:	During the construction phase when vegetation and levelling of the area already commenced the land will be bare. Any water as a result of rainfall or water used during the construction phase on the area, will obtain high flow velocities as there are no natural obstacles (vegetation) slowing down the flow of water. This high flow velocities don't allow water to seep into the ground and eventually reach the aquifer and rather forms channels which flow to the lowest point.
Duration of Impact:	Construction phase

	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	2	2,333333333	2	1	1,5	3,5
With Mitigation	2	1	1	1,333333333	1	1	1	1,333333333

Mitigation Measures	It is recommended that construction activities related to the development of the land commence during period when no rainfall is expected. As soon as the field is levelled crop need to be planted to slow runoff velocities and help increase infiltration. It is also recommended that the vehicle footprint on the levelled site be as small as possible as to avoid compacting the ground which also limits the infiltration potential of water.
Can the Impact be Reversed	Yes, through proper storm water management and re-vegetation of the developed land.
Will impact cause irreplaceable loss to resource	No
Cumulative Impacts	No cumulative impacts can be foreseen as the whole area surrounding the site has good land cover.

3. Contamination of the aquifer through overuse of pesticides, herbicides and fertilizers	
	Harrisdale 226/1

Potential Impact Description:	The overuse of fertilizers, herbicides and pesticides can cause an imbalance in the chemicals present in the ground. The excess chemicals can be absorbed by any form of water thorough rainfall or irrigation and as a result the absorbed chemicals infiltrated into the aquifer contaminating the water with nitrates, phosphates and sulphates.
Duration of Impact:	Operational phase until after rehabilitation

	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	3	2	3	3	2	2,5	7,5
With Mitigation	2	2	1	1,666666667	1	1	1	1,666666667

Mitigation Measures	It is recommended that the use of pesticides, herbicides and fertilizers be minimized and alternatives to the products be found which are more environmentally friendlier.
Can the Impact be Reversed	Yes, the impact can be reversed by using less of the above-mentioned products, finding alternatives and allowing the aquifer to recover through natural attenuation
Will impact cause irreplaceable loss to resource	No as new water enters the aquifer daily and through this process slowly cleanses itself if there are no new influxes of contaminates.
Cumulative Impacts	The impact is already small, but a combined impact by all the neighbouring farms including the proposed development can contaminate the aquifer as a whole lowering its quality of water.

4. Increased infiltration and contamination through ponding as a result of over irrigation.	
	Harrisdale 226/1
Potential Impact Description:	Over irrigation of the crop fields can saturated the soils at a point where the soils cannot absorb any more water. The excess water cannot infiltrate and manifests itself as ponds along the surface. Over a short period (couple days) the water in the saturated soils drain into the aquifer, additionally absorbing the water that is now ponding on the surface. The water that was ponding had a long time to absorb chemicals and other constituents while interact with the surface. This water will become contaminated and eventually reach the aquifer and polluting its waters.

Duration of Impact:	Operational phase until after rehabilitation							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	4	3	3	3.3	2	2	2	6.6
With Mitigation	2	2	2	2	1	1	1	2
Mitigation Measures								
Can the Impact be Reversed	Yes, the impact can be reversed through only irrigating to the needs of the crops and what volume the soils can drain.							
Will impact cause irreplaceable loss to resource	No							
Cumulative Impacts	No cumulative impacts are foreseen on site or surrounding areas, as ponding of excessive water washes away precious topsoil and damages crops.							

Total Combined Effects				
	Construction		Operational	
Potential Impacts	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
1.Contamination of the aquifer through hazardous spillages	8.3	2.5	6.67	2.5
2. Induced surface runoff causing lower infiltration to the aquifer as a result of the development	3,5	1,33333333	none	none

3. Contamination of the aquifer through overuse of pesticides, herbicides and fertilizers	none	none	7,5	1,666666667
4. Increased infiltration and contamination through ponding as a result of over irrigation.	none	none	6.67	2
Grand Total:	5,9	1,9	6,9	2

Due to the proposed area situated so close to the Vaal River, it is expected that the groundwater will be close to the surface. No boreholes are on site and thus no groundwater abstraction will take place for the irrigation of crops. The only concern is what impact the new agricultural development will have on the quality of the groundwater. The groundwater in the area might possibly be affected by the new development due to the water table being so close to the surface. Factors such as surface pollution or the use of excessive fertilizer can seep into the groundwater during irrigation or rainfall events. It is thus of great importance that no water ponds in low lying areas and that no excessive fertilizer is used. The groundwater might be affected for the period (more than 10 years) when the agricultural activity is ongoing. The main factor is considering the nitrate and phosphate contamination of the groundwater which will eventually seep into the Vaal River. This factor will only be limited to the just outside the study area and will have a low probability of occurring (only during high rainfall events or excessive irrigation). Equipment leaking fluids and petroleum-based products can also negatively affect the groundwater and it is recommended that equipment be serviced regularly to prevent such spills. If spills occur the contaminated soil must be removed as soon as possible and disposed of in the correct manner.

The impacts on the groundwater at the preferred site alternative will be LOW-MEDIUM with a score of 5.5, without mitigation. The groundwater of the area consists of minor aquifers with good water quality. The aquifers at the site most likely has an approximate depth of 10 mbgl due to the proximity to the Vaal River. Due to the nature of the proposed development (crops and trees) recharge may take place at a slower rate. Although recharge is retarded in this area fertilizer and other crop chemical may still infiltrate into the shallow aquifer during rainfall events or irrigation and cause the

contamination of the aquifer with chemical such as nitrates and phosphates (Refer to the Stormwater Management Plan and Erosion Management Plan). With mitigation, this impact can be reduced to LOW with a score of 1.6 which will include the minimal use of fertilizers.

As mentioned earlier, there is no feasible design/layout alternative because the study area chosen for the project is already perfect for the activities planned. The preferred design/layout alternative will not have any impact on groundwater

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. The preferred technological alternative will not have any impact on groundwater.

There may be a high cumulative impact on the groundwater due to the presence of the adjacent agricultural developments, which also may be using fertilizers and abstracting water from the aquifer.

Proposed mitigation:

- Hazardous substances will be stored inside a bunded area with an impermeable surface which has the capacity to store more than 110% of the volume of the substance.
- Spillages of hydrocarbons will be prevented by using drip trays and a clean-up procedure will be implemented to clean any hydrocarbon spills as soon as possible.
- No water will be abstracted from groundwater for use in irrigation.
- The use of fertilizers will be minimized.

7.2.7 Air Quality and Noise

The following impacts may occur on the air quality and noise levels as a result of the construction and operational phase of the activity:

- During the construction/operational phases there may be an impact on the air quality as a result of dust emissions due to construction activities and movement of vehicles during ploughing and harvesting. It should be noted that ploughing will not take place very year as these crops have a standing life of 3 -5 years.

- Harvesting will take place each year and noise will be generated from this activity through vehicles and equipment. It should be noted that the noise will not have a significant impact as this area is very remote and no urban areas are situated close to it.

1. Dust generation through agricultural activities								
	Harrisdale 226/1							
Potential Impact Description:	Stripping the land of vegetation and the process of levelling can significantly increase the amount of dust being generated through wind. Vehicles that move over loose and uncover land as well as initial ploughing with also kick up dust. Generated dust can decrease the quality of air on site and surrounding areas.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	2	2,333333333	3	1	1,5	4.6
With Mitigation	2	2	1	1,666666667	2	1	1	1,6
Mitigation Measures	It is recommended that planting of crops on the bare levelled land commence as soon as the land is ready for planting. The time it takes to prepare the land must also be kept to a minimum as to decrease the effect of wind on dust generation. No unnecessary movement of vehicles on the bare land as well as limited speed of these vehicles will decrease dust generation. Clearance of vegetation and levelling of the area must take place during periods of low wind velocities.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	2	2	2.3	3	1	2	4.6
With Mitigation	2	1	2	1.6	2	1	1.5	2.5

Mitigation Measures	During the operational phase the whole area will be covered in crops. The only time dust will be generated is during annual harvesting and occasional ploughing (between 3 - 5 years). It is recommended that these activities occur as fast as possible to limit the time vehicles are in the field which leads to less dust being generated. It is also recommended that no land is left empty for extended periods of time to limit dust being generated through wind.
Can the Impact be Reversed	Yes, by covering open land with crops and limiting vehicle activities on those areas.
Will impact cause irreplaceable loss to resource	No
Cumulative Impacts	A cumulative impact can occur is this area as well as neighbouring areas plough and harvest at the same time and during windy conditions, which will create a dust cloud.

2. Noise generation through agricultural activities								
	Harrisdale 226/1							
Potential Impact Description:	Noise will be generated by the following activities: (1) Pumping water from the Vaal River, (2) construction noise during clearance of vegetation and levelling of site and (3) operational noise through harvesting and ploughing equipment. These sources of noise generation may potential cause animal life to leave the area as well as complaints by neighbours.							
Duration of Impact:	Lifetime of operation							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	3	2	2,67	3	1	2	5.3

With Mitigation	2	2	2	2	2	1	1,5	3
Mitigation Measures	All construction and removal of vegetation will take place within normal working hours. All equipment and vehicles must be inspected beforehand to determine is excess noise are generated from them and the problem corrected.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	5	2	3.3	3	1	2	6.6
With Mitigation	2	5	2	3	2	1	1.5	4.5
Mitigation Measures	Harvesting and ploughing activities should not take longer as necessary to limit the amount of noise being generated over a period of time. If any static equipment (such as the pump) generates noise, measures should be investigated to insulate the noise.							
Can the Impact be Reversed	Yes, by ceasing activities that generate the noise							
Will impact cause irreplaceable loss to resource	No							
Cumulative Impacts	No cumulative impacts are foreseen as the site is very small and activities generating noise will be limited (lack of numerous vehicles on site). The site is also situated far for any urban areas and the activities generating noise are in line with the that of the neighbouring agricultural developments.							

Total Combined Effects		
	Construction	**Operational**

Potential Impacts	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
1. Dust generation through agricultural activities	3,5	1,333333	3	1
2. Noise generation through agricultural activities	4,66667	2,5	3	2,333333333
Grand Total:	5	2.75	5.67	3.5

Since this development will be of an agricultural nature, no significant impact will be experienced to the air quality and noise levels. The air quality might affect the surrounding area during the initial preparation of the land and during harvesting/planting season with dust being kicked put by machinery. The noise will also not be of significant impact as the activity is only limited to the study area. The equipment generating noise will be that of the harvesting and planting machinery and will only be for a limited time once the operation of harvesting and planting has been finished. The air quality is expected to be in a good condition as the surrounding area also consists of mainly crop production. The noise and air quality can be improved by not working during windy conditions and using new equipment only when necessary.

The site alternatives will have a LOW-MEDIUM impact score of 5. This low score is due to the nature of agricultural developments which only impact on air quality and noise when ploughing of the land takes place. The air quality will be impacted on slightly as a result of dust be generated during ploughing and noise be generated from the equipment used to do so. It must also be mentioned that the small impacts will not be noticed regularly as the study area is far outside urban areas and the activity of ploughing will happen less than twice every 3 years. The impact will stay LOW with a score of 2.75 with the correct mitigation and management measures.

As mentioned earlier, there is no feasible design/layout alternative because the study area chosen for the project is already perfect for the activities planned. The preferred design/layout alternative will not have any impact on air quality and noise generated.

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. The preferred technological alternative will not have any impact on air quality and noise.

There may be a cumulative impact on the air quality at the site and surrounding areas due to the land in the area strictly being use for crop production. This concentration of agricultural developments can lead to a cumulative effect in climate, either positive or negative.

Proposed mitigation:

- It is recommended to limit the amount of ploughing that takes place according to the crop cycles.
- Regular maintenance of the equipment should also keep the noise generate by machinery to a minimum.

7.2.8 Archaeological, Palaeontological and Cultural Resources

The following impacts may occur on the archaeological, palaeontological and cultural resources as a result of the construction and operational phase of the activity:

- There may be accidental unearthing, damage and/or loss of heritage and/or palaeontological resources as a result of construction or operational activities. It should be noted that this is not expected to happen, as no heritage and/or palaeontological resources of significant value were observed.

1. Loss of culturally significant resources								
	Harrisdale 226/1							
Potential Impact Description:	Although no significant cultural resources were found during the Heritage Impact Assessment, it's entirely possible that significant unearthing can still be found at site. The artefacts may be destroyed by workings or activities on site and it is important to immediately identify them and take correct action.							
Duration of Impact:	Lifetime of project							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	5	2	2	3	2	1	1.5	4.5
With Mitigation	3	2	1	2	2	1	1.5	3

Mitigation Measures	The highest change of unearthing culturally significant resources will be during the clearance of vegetation and levelling of the site. If any artefacts are unearthed as specialist must be contacted immediately for his assessment and SAHRA must be notified.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	5	2	2	3	2	2	1.5	4.5
With Mitigation	3	2	1	2	2	1	1.5	3
Mitigation Measures	Once the operational phase is in progress no major land activities will take place except for harvesting and occasional ploughing. This limits the possibility of finding any significant artefacts. Working inside the specified boundaries and limiting the amount of land activities taking place can preserve culturally significant resources from being damaged through unearthing. As with the construction phase, if any important resources are uncovered, a specialist must be informed immediately and SAHRA must be notified.							
Can the Impact be Reversed	No. Once the artefact has been unearthed or damaged it cannot be replaced.							
Will impact cause irreplaceable loss to resource	No. The site has been identified as having insignificant cultural resources and the activities planned for the area have little to no change of unearthing any significant artefacts.							
Cumulative Impacts	There are no cumulative impacts.							

The HIA indicated no significant or culturally important features. Since this operation plan to cultivate crops for more than 10 years and its location close to the Vaal River, significant finds might be uncovered during the operational phase of this project. If any such culturally important finds are made on the site, a Heritage and Palaeontology Specialist will be consulted and SAHRA will be informed.

The impact of the preferred site alternative will be LOW at a score of 2, as no archaeological material or indications of rock art, prehistoric structures or historical buildings were observed during the Phase 1 HIA and PIA. It was also found that the area does not have any palaeontological significance (Refer to the HIA and PIA in **Annexure 5**). The impact at the alternative 1 site will be LOW with mitigation at the same score of 1.3. No heritage artefacts or sites were observed during the site visit and the chances of this occurring is unlikely. However, uncertainties do exist.

As mentioned earlier, there is no feasible design/layout alternative because the study area chosen for the project is already perfect for the activities planned. The preferred design/layout alternative will not have any impact on the archaeological, palaeontological and cultural resources

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. The preferred technological alternative will not have any impact on the archaeological, palaeontological and cultural resources.

It is not expected that there will be any cumulative impacts.

Proposed mitigation:

- No excavation will take place.
- If any archaeological objects or palaeontological remains are found, work will stop immediately and SAHRA will be notified.

7.2.9 Aesthetics

The following impacts may occur on the aesthetics as a result of the construction and operational phase of the activity:

- The proposed site is already degraded with previous activities including agriculture and alluvial diamond mining.
- The riparian vegetation is still in good condition and may be affected, but all effort will be made to stay away and not impact upon this area.

1. Impact on Aesthetics								
	Harrisdale 226/1							
Potential Impact Description:	The activity may lower overall value of the aesthetics for the site.							
Duration of Impact:	Lifetime of operation.							
	Construction phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	5	1	2,666666667	1	1	1	2,666666667

With Mitigation	1	5	1	2,333333333	1	1	1	2,333333333
Mitigation Measures	Before clearance of vegetation and levelling of site commences, it must be understood that no activities may take place in the riparian zone or outside the specified areas to preserve what will be left of the natural environment.							
	Operational Phase							
	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	1	1	1,333333333	1	1	1	1,333333333
With Mitigation	1	1	1	1	1	1	1	1
Mitigation Measures	All agricultural activities must occur within the specified boundaries of the site and the vegetation outside these boundaries must be left intact.							
Can the Impact be Reversed	Yes, through correct rehabilitation of land and vegetation.							
Will impact cause irreplaceable loss to resource	No as aesthetic value can be increased through correct rehabilitation							
Cumulative Impacts	The whole is alongside the Vaal River is developed with agricultural areas and the combination of this proposed development will only add to the decrease in aesthetic value, although the effect is small to insignificant.							

The aesthetic value of the study area and surrounding area will change slightly as the site is not that large to have a significant impact. The site is also surrounded by numerous agricultural developments along the Vaal River. The natural riparian vegetation will be left undisturbed adding to the aesthetics of the surrounding area.

The site will have a small negative visual impact on the surrounding environment during construction and operation. The aesthetic impact will be LOW at a score of 2.6, as the preferred alternative is located adjacent the Vaal River. This rating after mitigation is still rated as a LOW but with a slightly lower score of 2.3.

As mentioned earlier, there is no feasible design/layout alternative because the study area chosen for the project is already perfect for the activities planned. The preferred design/layout alternative will not have any impact on the aesthetics.

Also, as mentioned earlier, there is no feasible technological alternative because as far reasonably possible, the best technology will be utilised to limit and / or prevent impact on the environment. The preferred technological alternative will not have any impact on the aesthetics.

The cumulative impacts on the visual aesthetic will be medium, as both site alternatives are located directly adjacent to quarries, which already contribute to a negative visual aesthetic.

Proposed mitigation:

- No riparian vegetation should be removed.
- Alien vegetation should be cleared regularly.
- Waste should be disposed of in the correct manner regularly.
- Equipment should be stored in the correct location and not in the open.
- Any spills and/or leakages should be cleaned immediately in the correct manner.

7.2.10 Demographics and Regional Socio-economic Structure

The development will have a positive impact on the demographics and socio-economic structure of the surrounding areas. The development will create multiple jobs during construction and the lifetime of the project. It will also encourage a positive chain of event from the primary sector right through to the tertiary sector in creating possible jobs for both skill and unskilled labour.

8 Conclusion

The proposed establishment of an agricultural development on Portion 1 of the farm Harrisdale 226/1, Barkly West, Northern Cape is an initiative by Dorata (Pty) Ltd. The proposed development will entail the establishment of an agricultural area to cultivate and produce both Lucerne and Pecan nuts for the purpose of high-quality feed for cattle earmarked for meat production and Pecan nuts for human consumption and export.

The site's main and only purpose is that of producing Lucerne and Pecan nuts on an economically viable scale. The site is ideally positioned next to the Vaal River from where water will be sourced to irrigate the Lucerne through pivot irrigation and the Pecan nut trees through underground drip irrigation. The Lucerne will be used as a high-quality feed for cattle earmarked for meat production and the Pecan nuts produced is a high-income generating product for human consumption and exportation. A soil suitability test was conducted in the study area for a plough certificate and continual monitoring of the ground quality as well as the Vaal Rivers up- and downstream quality needs to be measured and implemented as monitoring programs.

The proposed site was used in the past for crop production through pivot irrigation methods followed by alluvial diamond mining (outside study area). The site was then left abandoned for more than 10 years. The applicant simply seeks to continue with agricultural activities through the means of crop production. The site has been overgrown with indigenous vegetation of secondary establishment (mostly grasses), especially where the past pivot irrigation stood. This vegetation will need to be removed and the site levelled for the agricultural process to begin.

By implementing the proposed development, numerous job opportunities will be created, which will have a positive impact on the local economy. Also, local farmers will be directly benefited by improving access to high-quality feed which will indirectly lower meat prices. South Africa's total export will also be positively affected as a majority of Pecan nuts will be exported to foreign markets stimulating the income generated from such activities.

An Ecological Assessment was conducted on the study area to determine the footprint that the development will have on the environment. It was found that the proposed site has a well-developed population of secondary indigenous vegetation consisting of mostly grasses. The site falls within the Kimberly Thornveld vegetation type which is classified as Least Concern and the study area does not fall within any Aquatic or Terrestrial Critical Biodiversity Areas, which further decreases conservation value. No protected, rare or endangered species were observed on site.

There are no watercourses or wetlands present on the study area, but the Vaal River is adjacent to the large Kilmorey property and located 55 m away from the study area. The topography of slopes gently towards the Vaal River in a Westerly direction which may lead to runoff from site entering the Vaal River, which may lead to contamination and sedimentation. However, with the correct mitigation and management measures it is unlikely that the Vaal River will be directly affected by the development.

Furthermore, a Phase 1 HIA and PIA was conducted. The area's heritage significance was assessed on the basis of existing field data, database information and already published literature which was followed by a field survey. The survey found no evidence of archaeological material or historic buildings. The geology underlying the site is also not considered to be paleontologically significant.

8.1 Summary of Significance Rating after mitigation

Impacts Assessed				
	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Geology and Soils	5.1	2,2	5.7	1,8
Climate	No Impact		No Impact	
Land Use	5,0	3,3	15,0	10,7
Plant and Animal Life	7.5	6.8	6.9	5.4
Surface water	7.1	3.7	8.4	4.9
Groundwater	5,9	1,9	6,9	2.1
Air quality and noise	5.0	2.8	5.7	3.5
Heritage	4.5	3.0	6.0	3.0
Visual Exposure	2,7	2,3	1,3	1,0
Grand Totals	5.3	3.3	7.0	4,0

In conclusion the development on site will have a LOW to LOW-MEDIUM impact score. When comparing the two phases of activities the impact assessment indicates that the operational phase will have more of an impact. This is to be expected as the impacts are rated also on duration and frequency, where the constructional phase will last up to 3 months and the operational phase for more than 10 years.

8.2 Motivation for proposed site alternative

All possible alternatives were identified and assessed. There was found that there are no other alternatives available for this project based on the following factors:

- The applicant only wants to develop this area

- The area chosen was used in the past for pivot irrigation
- There are no other alternatives as the applicant doesn't own adjacent land and the boundaries imposed by neighbours, the Vaal River and the old rehabilitated slimes dams keep the study area limited.
- The layout can be changed slightly but due to past crop production, the layout proposed is already the best layout for the study area.

9 Proposed Conditions of Approval

The following measures will have to be implemented and maintained throughout the lifetime of the proposed project:

- A Water Use License should be obtained before commencement with the abstraction of water from the Vaal River.
- Water abstracted from the Vaal River may not exceed the licensed volume.
- No vegetation may be cleared outside the study area boundaries especially the riparian vegetation.
- No burning of waste on site will be allowed.
- Alien vegetation should be monitored and removed regularly. This must adhere to the Alien and Invasive Species Regulations.
- Any soil that is removed should be stockpiled and may not be used for any other activities. Soil stockpiles may not exceed a height of 1.5 m.
- All efforts should be made to limit aesthetic impact on passing motorists and adjacent landowners, by always keeping the site clean and neat and storing of equipment in the correct manner.
- A soil- and river monitoring programme should be implemented to reduce the potential impact and to monitor compliance with the Water Use License conditions.
- All permanently stored potentially hazardous substances should be stored in a bunded area which can contain 110% of the volume of the substance.
- Any spillages should be cleaned immediately by removing the contaminated soil and disposing of it as hazardous waste.
- Stormwater management should be implemented to reduce runoff which may cause contamination and siltation of watercourses, by establishing trenches and/or berms around the site, especially at the western border.
- Should any items of archaeological or palaeontological significance be unearthed or found on the site during the lifetime of the project, a specialist will be appointed to investigate the finds and SAHRA will also be notified thereof.

10 References

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