4 PROJECT ALTERNATIVES

4.1 Introduction

In terms of the EIA Regulations published in Government Notice R543 of 2 August 2010 in terms of Section 24 of the National Environmental Management Act (Act No. 107 of 1998), feasible and reasonable alternatives have to be considered within the Environmental Scoping Study, including the 'No Go' option. All identified, feasible and reasonable alternatives are required to be identified in terms of social, biophysical, economic and technical factors.

A key challenge of the EIA process is the consideration of alternatives[1]. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- incrementally different (modifications) alternatives to the project; and
- fundamentally (totally) different alternatives to the project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognise the limitations of project-specific EIAs to address fundamentally different alternatives.

4.2 The 'no go' alternative

In the Hendrina ash disposal project, the 'no go' alternative is the option of not expanding the ashing system at the Hendrina Power Station.

Eskom's core business is the generation, transmission and distribution of electricity throughout South Africa. Electricity, by its nature, cannot be stored and must be used as it is generated. Therefore electricity is generated according to supply-demand requirements. The reliable provision of electricity by Eskom is critical to industrial development and poverty alleviation in the country.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users in South Africa, it has to continually expand its infrastructure of generation capacity and transmission and distribution power lines. This expansion includes not only the building of new power stations but also expanding and upgrading existing power stations to extend their life.

[1] In terms of the EIA Regulations published in Government Notice R543 of 2 August 2010 in terms of Section 24 (5) of the National Environmental Management Act (Act No. 107 of 1998), the definition of "alternatives" in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity which may include alternatives to: (a) the property on which or location where it is proposed to undertake the activity; (b) the type of activity to be undertaken; (c) the design or layout of the activity; (d) the technology to be used in the activity; (e) the operational aspects of the activity and (f) the option of not implementing the activity.

The Hendrina Power Station, in the Mpumalanga Province currently uses a wet ashing system for the disposal of ash. Hendrina Power Station currently has five wet ash disposal facilities, of which two (Ash dam 3 and 5) are currently in operation, the other three (Ash dam 1, 2 & 4) are not in use for the following reasons:

- Having reached full capacity (Dam 1)
- Stability issues (Dam 2)
- Temporary decommissioning (Dam 4).

At the current rate of disposal on Dams 3 and 5, the rate-of-rise will exceed 4m/year in 2018, which is not acceptable in terms of structural stability, and associated potential environmental consequences. The Hendrina Power Station is anticipated to ash approximately 64.2 million m^3 until the end of its life span which is currently estimated to be 2035.

It has been determined, through studies, that the existing ashing facilities are not capable to provide sufficient ash disposal capacity for this amount of ash for the full life of the station. The existing facilities (Ash Dams 3 and 5) allow for the disposal of 20.9 million m^3. Therefore, Hendrina Power Station proposes to extend its ashing facilities and associated infrastructure with the following development specifications:

- Additional airspace of 43.3 million m^3
- Wet ash disposal facility ground footprint of 139 ha
- Ground footprint of associated infrastructure such as Ash Water Return Dams, ash water return channels, pump stations, drainage channels, access roads, switchgear room, ash lines of 70 ha

The need for this extension is to allow the Hendrina Power Station to continue ashing in an environmentally responsible way for the duration of the operating life of the Power Station. The need for the extension is related to the deteriorating coal quality, higher load factors, the installation of the Fabric filter plant (to meet requirements in terms of the National Environmental Management: Air Quality Act (Act 39 of 2004)) and the need to extend station life.

The 'no go' option will, therefore, contribute negatively to the provision of reliable base load power to the national grid. It will result in the need to close down the power station due to the lack of ash disposal facilities, causing a long term reduction in electricity supply. It is important to note that the additional power output from Hendrina Power Station is still required to meet the national demand irrespective of the new-build activities.

The 'no go' alternative has been investigated further in this EIA report as an alternative as required by the EIA Regulations.

4.3 Ash Disposal Method

The coal-fired power generation process results in large quantities of ash, which is disposed of in wet ash disposal facilities. In recent times, Eskom has access to coal of a low grade (called middlings coal) which produces a larger mass of ash during combustion. Over time, the quality of the coal provided to Eskom has degraded, due to higher ash quantities in the coal. With regards to ash management, Eskom uses either wet or dry methods of ash disposal. The Hendrina Power Station utilises a wet ashing disposal method. This process entails the hydraulic conveyance of ash where ash is mixed with water and pumped in the form of slurry via steel pipelines. The slurry is allowed to settle in the wet ash disposal facilities, and the water decanted to storage dams for re-use.

Although wet ashing utilises more water than dry ashing, a large amount of this water is recovered and recycled back to the power station. Wet ashing also produces less dust than the dry ashing alternative.

Due to the fact that Hendrina Power Station utilises a wet ashing disposal method, a strategic recommendation was for the new proposed wet ash disposal facility to be constructed to continue with a wet ashing process. Therefore, no alternative ash disposal methods were investigated.

4.4 Location Alternatives

Hendrina Power Station is located in the Mpumalanga Province approximately 24 km south of Middleburg and 20 km North of the town of Hendrina. The power station and its surroundings fall within the Steve Tshwete Local Municipality which forms part of the Nkangala District Municipality.

The greater part of the study area is made up of agricultural and mining activities. In order to identify alternative sites for the proposed new wet ash disposal facility a study area was required to be defined. The proposed study area is located within an 8 km radius of the centre point of the Hendrina Power Station Site (**Figure 4.1**). The 8 km radius was a strategic decision by the power station as the furthest distance within which construction and operational costs, including environmental, technical and financial costs, are deemed to be feasible.

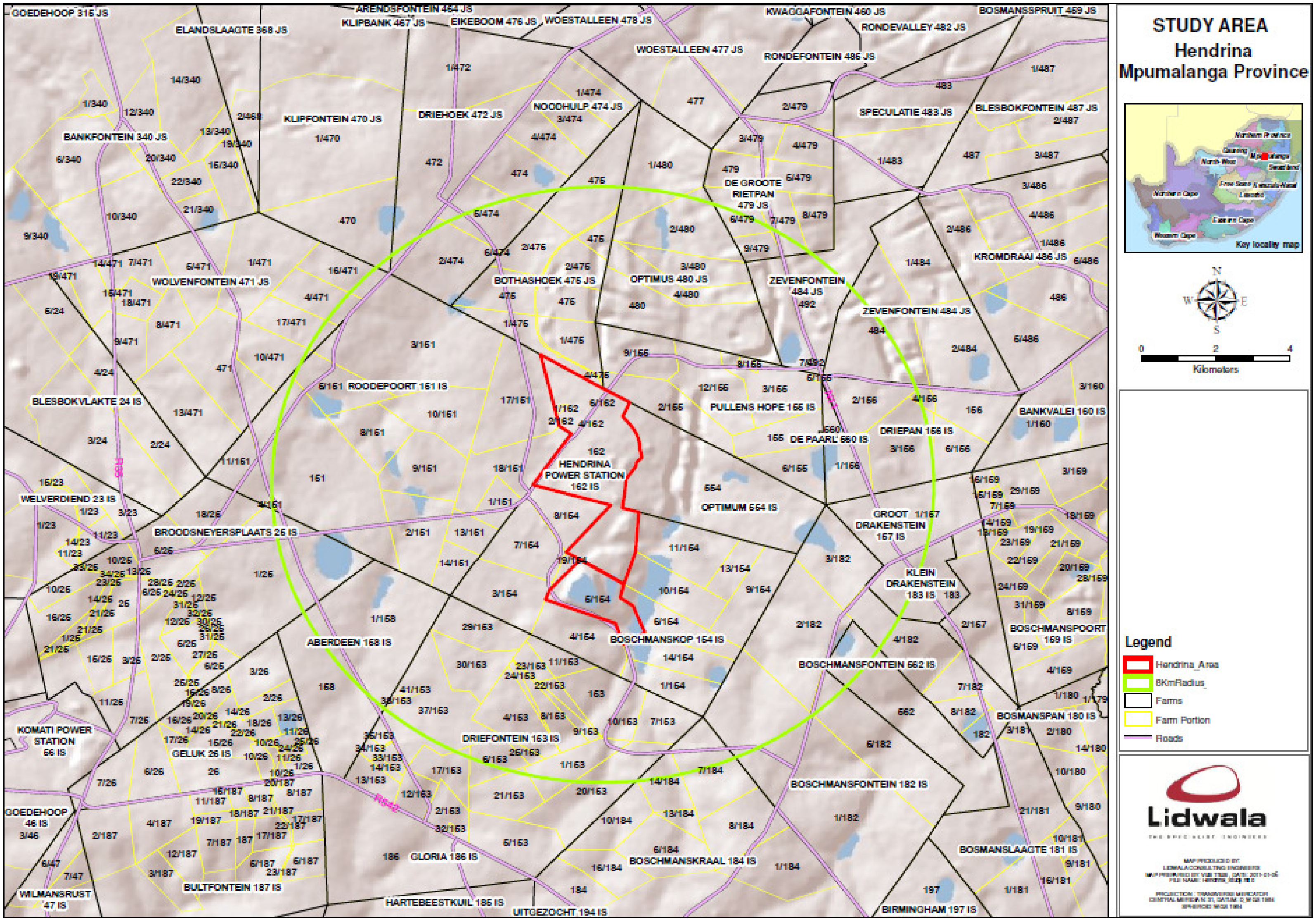


Figure 4.1: Proposed Study Area within which Alternative sites were to be identified

4.4.1 Screening Analysis and Methodology

A screening study was initiated upfront in the process in order to identify potential sites within the study area that would be suitable for use as alternative sites for the proposed new ash disposal facility. The study area was demarcated using an 8 km radius around the Hendrina Power Station. Within this 8km radius further demarcations where included, although based on technical requirements such as the costs involved in the project and the risk of security of supply, the distances involved also take into account the potential additional environmental impacts in terms of the distance required for new infrastructure to be constructed and operated.

- 0 - 3 km radius within which no additional technical costs would be incurred in terms of the construction and operational of the proposed new wet ash disposal facility;
- 3 - 5 km radius within which minimal additional technical costs would be incurred in terms of the construction and operation of the proposed new wet ash disposal facility
- 5 – 8 km radius within which major additional technical costs would be incurred in terms of the construction and operation of the proposed new wet ash disposal facility.

In order to ensure that sites were identified in the most objective manner possible, a sensitivity mapping exercise was undertaken for the study area. The purpose of such an exercise was to identify suitable areas within the study area that could accommodate the proposed new wet ash disposal facility and associated infrastructure and to pro-actively identify sensitive areas (i.e. fatal flaws) that should be avoided. The sites identified during this exercise were evaluated during the scoping phase of the project.

- ***Sensitivity Mapping***

The qualitative sensitivity mapping exercise divided the study area into three categories *viz.* lower, medium and higher sensitivity areas. A sensitivity map for the study area was requested from each of the following specialist fields:

Biophysical
- Groundwater
- Surface Water
- Fauna and Flora
- Avifauna

Social
- Social
- Heritage
- Visual

Table 4.1 provides a description of the various categories used in the sensitivity mapping.

Table 4.1 Description of the various categories used in the sensitivity mapping

Study Component	Category	Description
Biophysical Components		
Fauna and Flora	Higher Sensitivity	Areas of atypical habitat, conservation areas, riparian and wetland habitat, known presence of plant species of concern, not regarded suitable for proposed development, expected impacts likely to be unacceptable on a local or regional scale, adverse impact not possible to mitigate
	Medium Sensitivity	Associated with natural/ pristine regional habitat, moderate likelihood of harbouring species and habitat of concern, moderate suitability for proposed development. Even with careful site selection, expected impacts could be potentially significant, but possible to mitigate through site-specific mitigation measures and site selection
	Lower Sensitivity	Associated with transformed habitat, not likely to contain biodiversity attributes of sensitivity, considered suitable for proposed development, expected impacts regarded to be of low significance, possible to mitigate through generic mitigation measures. The status of specific areas is also influenced by the presence of nearby sites of sensitivity
Surface Water	Higher Sensitivity	100 m zone from the edge of the permanent wet zone for valley bottom and pan systems.
	Medium Sensitivity	100 m buffer zone from the edge of the temporary zones, or the edge of the riparian zones.
	Lower Sensitivity	Higher lying areas, reflecting terrestrial soils and no obligate, facultative hydrophilic vegetation
Ground Water[2]	Higher Sensitivity	Those areas within the 250 m surface water buffer zone.
	Medium Sensitivity	Areas falling within the area classified as D3, but still outside of all areas within the 250 m surface water buffer zone.
	Lower Sensitivity	Areas falling outside of the 250 m buffer around surface water features, and outside of the area classified as "D3" on the general hydrogeology map series (GRA1 data).

[2] Depth of groundwater across the site is not known with accuracy, but is almost certainly shallower closer to surface water features - hence the higher sensitivity assigned to a 250 m buffer zone adjacent to surface water features. Permeability (rate at which water can "penetrate" ground) is covered by the DWA hydrogeological classification - essentially the same across the site ("D2"), except for the small area classified as "D3" - which has higher borehole yields and likely higher permeability, and has therefore been classified as medium sensitivity rather than lower sensitivity. The 250 m buffer is a horizontal distance, not a depth.

Study Component	Category	Description
Avifauna	Higher Sensitivity	Wetlands, rivers and streams, farm dams, CWAC sites,
	Medium Sensitivity	Remaining cultivated lands and farm lands
	Lower Sensitivity	Built up areas, roads, mines, existing wet ash disposal facilitys, railway lines and high voltage power lines
Social Components		
Social: Distance from proposed Wet ash disposal facility	Higher Sensitivity	500 – 1000 meters
	Medium Sensitivity	1000 – 1500 meters
	Lower Sensitivity	1500 meters or more
Social: Settlement Type	Higher Sensitivity	Residential
	Medium Sensitivity	Informal Community
	Lower Sensitivity	Single Housing
Social: Settlement Farms	Higher Sensitivity	Community
	Medium Sensitivity	Farm House
	Lower Sensitivity	No housing
Social: Health Risk – air quality	Higher Sensitivity	High risk within radius of 500 – 1000m
	Medium Sensitivity	Medium risk within radius of 1000 – 1500m
	Lower Sensitivity	Low risk within radius of more than 1500m
Social: Dust pollution (visibility/health/quality)	Higher Sensitivity	Above legal standard
	Medium Sensitivity	Within limits
	Lower Sensitivity	Below legal limits
Social: Visual Impact (quality of life)	Higher Sensitivity	Within 1000m
	Medium Sensitivity	Within 1500m
	Lower Sensitivity	Within 3000m
Social: Economic impact on agriculture	Higher Sensitivity	Private farmland
	Medium Sensitivity	Eskom land (but farmed)
	Lower Sensitivity	Denuded land
Heritage	Higher Sensitivity	Heritage resources with qualities so exceptional that they are of special national significance.
	Medium Sensitivity	Heritage resources which, although forming part of the national state, can be considered to have special qualities which make them significant within the context of a province or a region. Medium sensitivity areas also include areas where little work has been undertaken and therefore the presence of significant heritage resources is not known.

Study Component	Category	Description
	Lower Sensitivity	Other heritage resources worthy of conservation, and which prescribes heritage resources assessment criteria, consistent with the criteria set out in section 3(3) of the National Heritage Resources Act (Act No 25 of 1999), which must be used by a heritage resources authority or a local authority to assess the intrinsic, comparative and contextual significance of a heritage resource and the relative benefits and costs of its protection, so that the appropriate level of grading of the resource and the consequent responsibility for its management may be allocated in terms of section 8 of the said Act.
Visual	Higher Sensitivity	Restricted location for the proposed development with highest visual sensitivity – no positive criteria and one or more restrictions (negative criteria).
	Medium Sensitivity	Acceptable or suitable location for the proposed development with neutral visual sensitivity – no positive criteria, but no restrictions (negative criteria) either.
	Lower Sensitivity	Preferred or ideal location for the proposed development with lowest visual sensitivity – complies with the positive criteria with no restrictions (negative criteria)

- ***GIS Layer Amalgamation and Sensitivity Indice Calculation***

In order to calculate a combined sensitivity rating for the study area, all the GIS layers received from each specialist area of study (e.g. ground water, biosensitivity etc) were combined to form one integrated layer (**Figure 4.2**). During this integration, string arrays were built containing information on the layer name, the assigned sensitivity rating for each particular area and the adjustment factor for the particular layer (**Figure 4.3**).

Three resultant ratings (**Figure 4.3**) were then calculated from the integrated layer (**Figure 4.2**) by unnesting and summarising the string array data using the following logics:

- **maximum sensitivity wins:**
  The maximum sensitivity rating found in the array became the sensitivity index.
- **sum of all sensitivity ratings:**
  The sensitivity index was the sum of each sensitivity rating found in the array.
- **sum of all adjusted sensitivity ratings:**
  Each sensitivity rating found in the array was adjusted by the assigned adjustment factor for each particular layer. The sensitivity index was then the sum of these.

The presented maps were then created by reclassifying each logic result into five classes, namely:

- low sensitivity (light green),
- low medium sensitivity (green)
- medium sensitivity (yellow)
- medium high (orange)
- high sensitivity (red).

Finally, the reclassified layer was clipped with the pre-determined no-go areas layer (to remove them from consideration) and further clipped with the 8km radius study area buffer to remove any extraneous features.

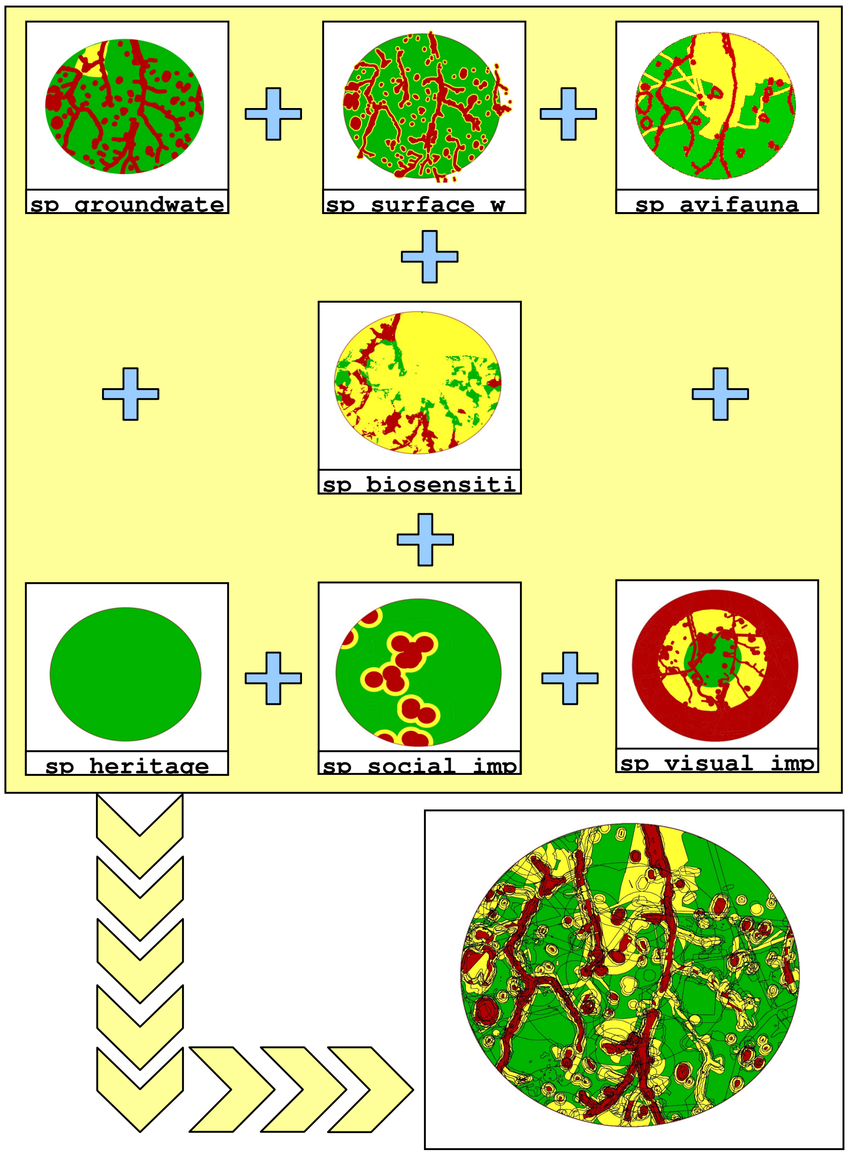
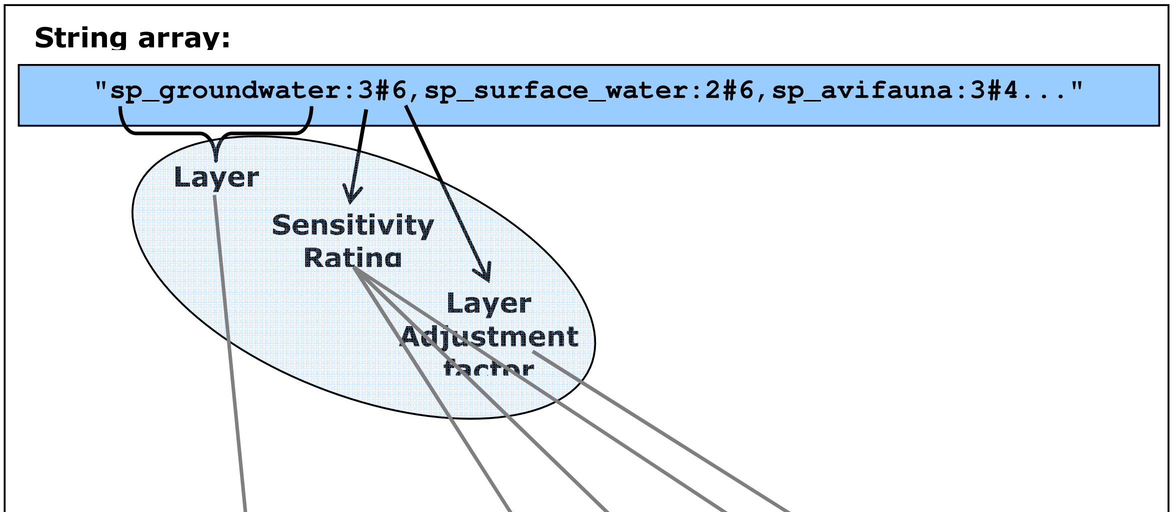


Figure 4.2: Layer integration



Layer	Max Wins	No Factor	With Adjustment Factor
sp_g roundwater	3	3 x 1 (3)	3 x 6 (18)
sp_s urface_water	2	2 x 1 (2)	2 x 6 (12)
sp_a vifauna	3	3 x 1 (3)	3 x 4 (12)
sp_b iosensitivity	1	1 x 1 (1)	1 x 4 (4)
sp_h eritage	2	2 x 1 (2)	2 x 2 (4)
sp_v isual_impact	1	1 x 1 (1)	1 x 2 (2)
sp_s ocial_impact	1	1 x 1 (1)	1 x 2 (2)
Sensitivity Rating	**3**	**13**	**54**

Figure 4.3: String array parts and resultant indice calculations: max wins; sensitivity rating as is and sensitivity with an applied factor.

- ***Adjustment Factor / weighting factor Methodology***

In order to give each component a weighting factor with which to adjust the layers, the following methodology was utilised.

In a weighted matrix each variable / component is given a different importance weighting. In order to ensure that consensus is obtained with regards to the weighting / adjustment factors input from the project team and all specialists was obtained. Each member of the Project team was asked to rank each variable according to their own understanding of its significance, utilising the following ratings:

- 1 - low significance
- 2 - medium significance
- 3 - high significance

Once all the input was received, the rating provided for each variable was added and then divided by the number of people that took part in the exercise in order to obtain an average rating. Three sets of ratings were collected, namely:

- Specialist and Lidwala Project Team ratings (**Table 4.2**)
- Client ratings (**Table 4.3**)
- Combined ratings (**Table 4.4**)

The final decision to utilise the combined rating as the final weighting factors for the sensitivity analysis was due to the fact that the client's ratings did not dilute the weighting factors, they actually made the weighting factors stricter.

Table 4.2: Specialist and Lidwala Project Team ratings

	Specialists and Lidwala Project Team												
Aspect	Social	Fauna and Flora	Surface Water	Ground water	Design	Geotech	Avifauna	Project Manager	GIS	Soil	Final Total	Number participants	Average Rating
Social	3	1	2	3	2	2	1	2	1	1	18	10	1.80
Fauna and flora	2	3	2	2	1	1	3	2	2	2	20	10	2.00
surface water	2	3	3	3	2	2	2	3	3	2	25	10	2.50
groundwater	2	3	3	2	2	2	2	3	3	2	24	10	2.40
heritage	1	2	2	1	1	1	1	1	1	1	12	10	1.20
visual	2	2	1	1	3	3	1	2	1	1	17	10	1.70
technical and cost	1	1	1	3	3	3	1	3	2	1	19	10	1.90
Avifauna	2	3	2	2	2	2	3	2	3	1	22	10	2.20

Table 4.3: Client ratings

	Eskom Team					
Aspect	Env	Civil	Mech	Final Total	Number participants	Average Rating
Social	2.5	1	2	5.5	3	1.83
Fauna and flora	2	3	1.75	6.75	3	2.25
surface water	2.5	3	2.25	7.75	3	2.58
groundwater	2.5	3	2.25	7.75	3	2.58
heritage	1	2	1.5	4.5	3	1.50
visual	1.5	1	1.25	3.75	3	1.25
technical and cost	2	2	2.75	6.75	3	2.25
Avifauna	1.5	2	1.75	5.25	3	1.75

Table 4.4: Combined ratings

	Specialists and Lidwala Project Team			Eskom Team			Final Combined Ratings		
Aspect	Final Total	Number participants	Average Rating	Final Total	Number participants	Average Rating	Final Total Combined	Number participants	Final Average Rating
Social	18	10	1.80	5.5	3	1.83	23.5	13	1.81
Fauna and flora	20	10	2.00	6.75	3	2.25	26.75	13	2.06
surface water	25	10	2.50	7.75	3	2.58	32.75	13	2.52
groundwater	24	10	2.40	7.75	3	2.58	31.75	13	2.44
heritage	12	10	1.20	4.5	3	1.50	16.5	13	1.27
visual	17	10	1.70	3.75	3	1.25	20.75	13	1.60
technical and cost	19	10	1.90	6.75	3	2.25	25.75	13	1.98
Avifauna	22	10	2.20	5.25	3	1.75	27.25	13	2.10

The final weighting factors for each aspect are therefore as follows:

- Social = 1.81
- Fauna and Flora = 2.06
- Surface Water = 2.52
- Ground Water = 2.44
- Heritage = 1.27
- Visual = 1.60
- Avifauna = 2.10
- Technical and Cost = 1.98

4.4.2 Final Screening Results

- ***<u>Consolidated Biophysical Sensitivity</u>***

The individual biophysical maps were overlaid and integrated to form the following combined biophysical sensitivity maps utilising the methodologies indicated above.

It can be noted that in terms of biophysical criteria, the most sensitive areas are those surrounding surface water structures, it will therefore be critical to ensure that the areas are avoided, as much as possible, in terms of the identification of alternative sites.

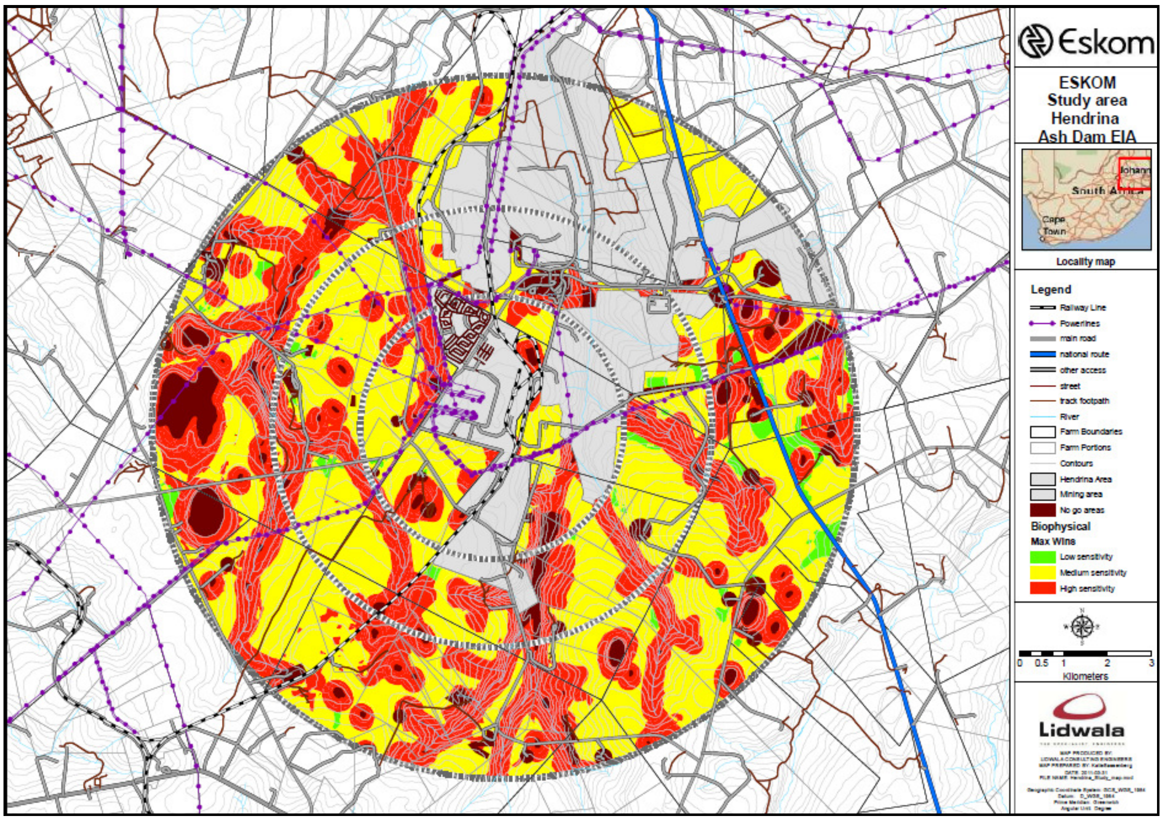


Figure 4.4: Combined Biophysical Sensitivity (Max Wins)

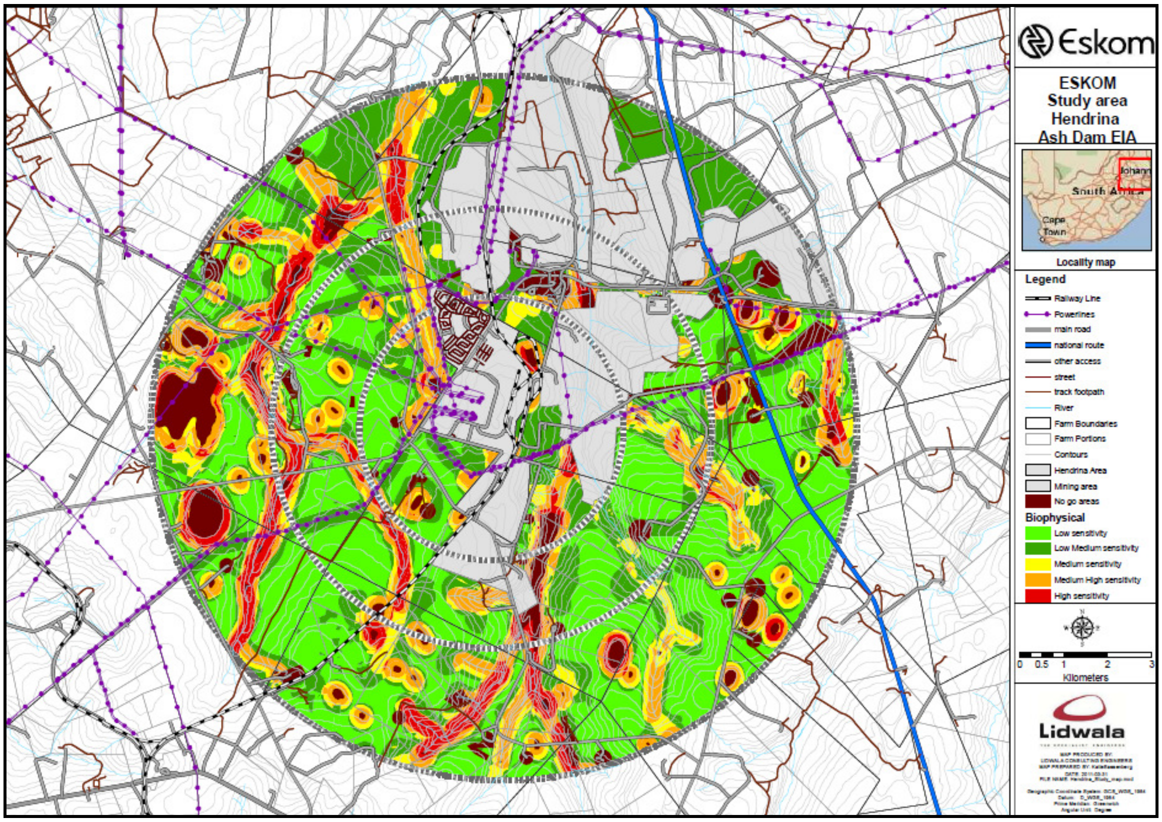


Figure 4.5: Combined Biophysical Sensitivity (no factor)

- ***Consolidated Social Sensitivity***

The individual social maps were overlaid and integrated to form the following combined social sensitivity maps utilising the methodologies indicated above.

It can be noted from the combined social sensitivity map that the closer the proposed new wet ash disposal facility is to the power station, the better. It can clearly be seen that the sensitivities in terms of the social environment increase as one moves further from the power station.

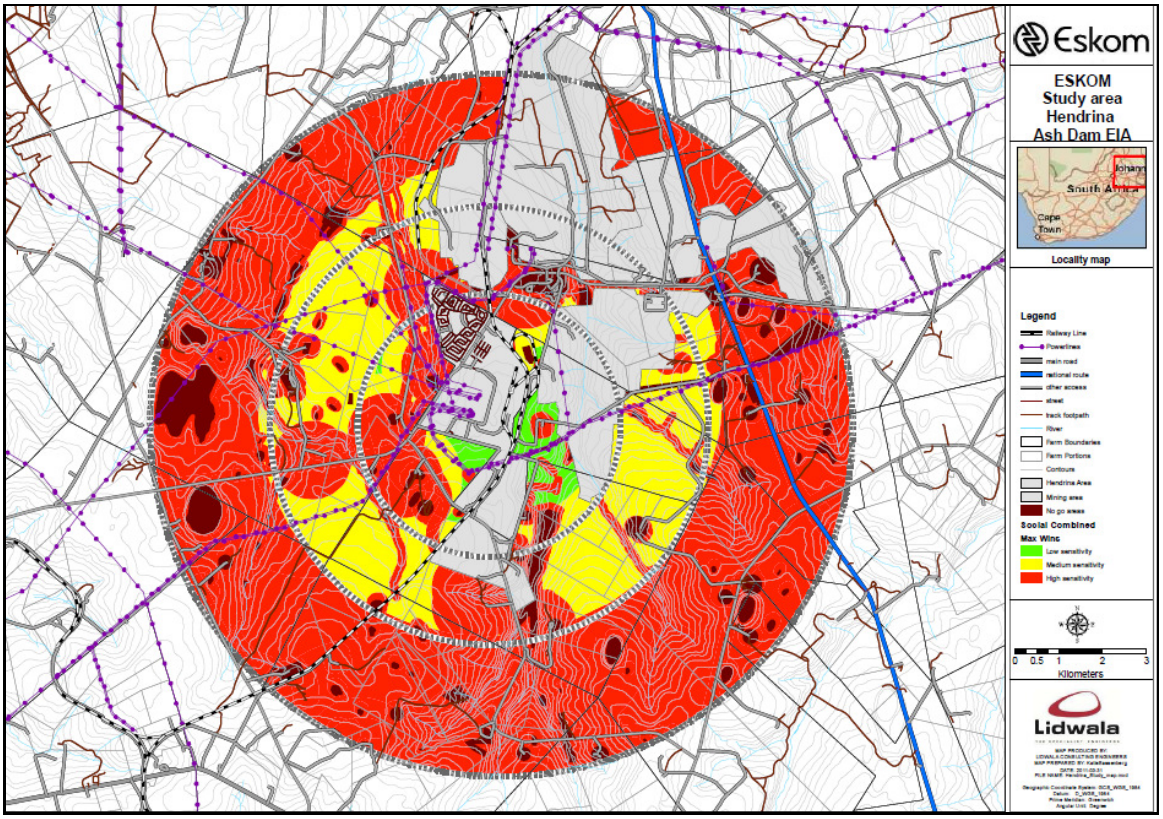


Figure 4.6: Combined Social Sensitivity (Max Wins)

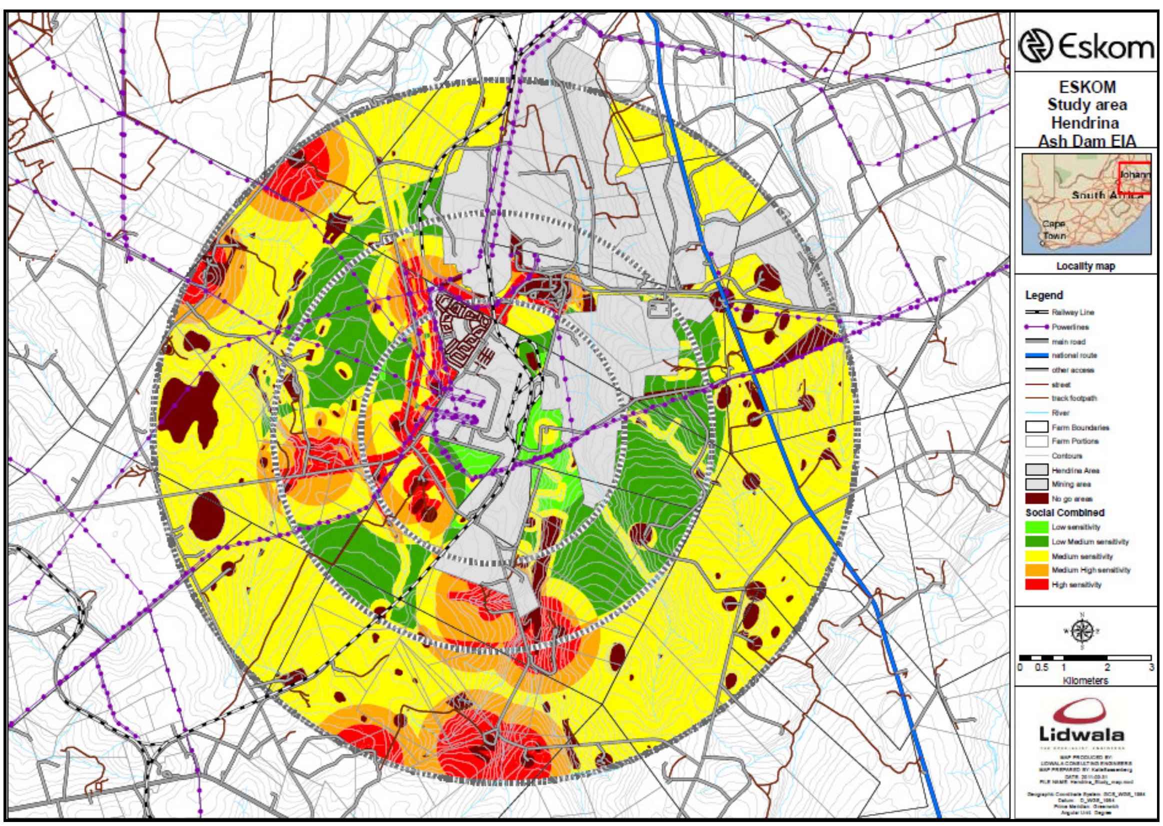


Figure 4.7: Combined Social Sensitivity (no factor)

- ***Final Combined Sensitivity Maps***

Figure 4.8 to **4.13** are the results of overlaying the social, biophysical and technical input maps together, thereby illustrating the overall environmental sensitivity of the area. These maps have been done both with and without the influence of the technical / cost layer in order to ensure that this aspect did not overshadow / influence the outcome of the mapping process.

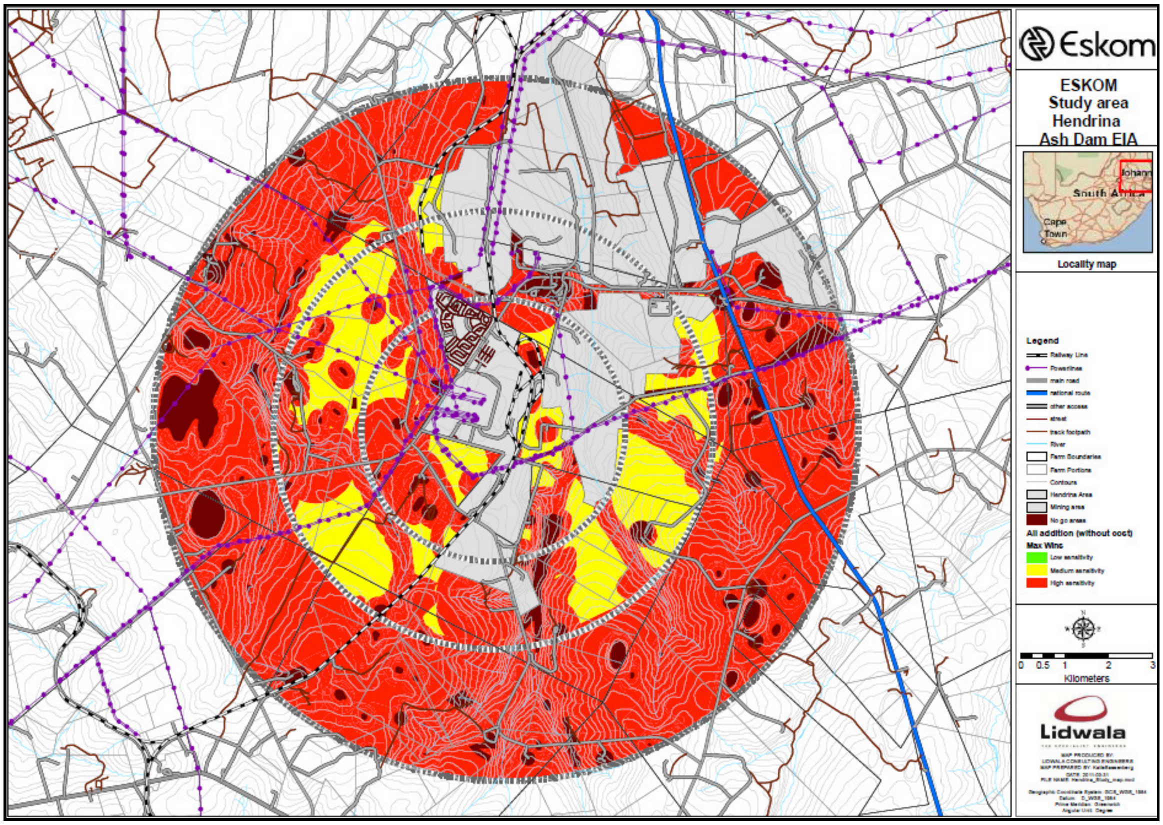


Figure 4.8: Overall Environmental Sensitivity (Max Wins – without technical / cost)

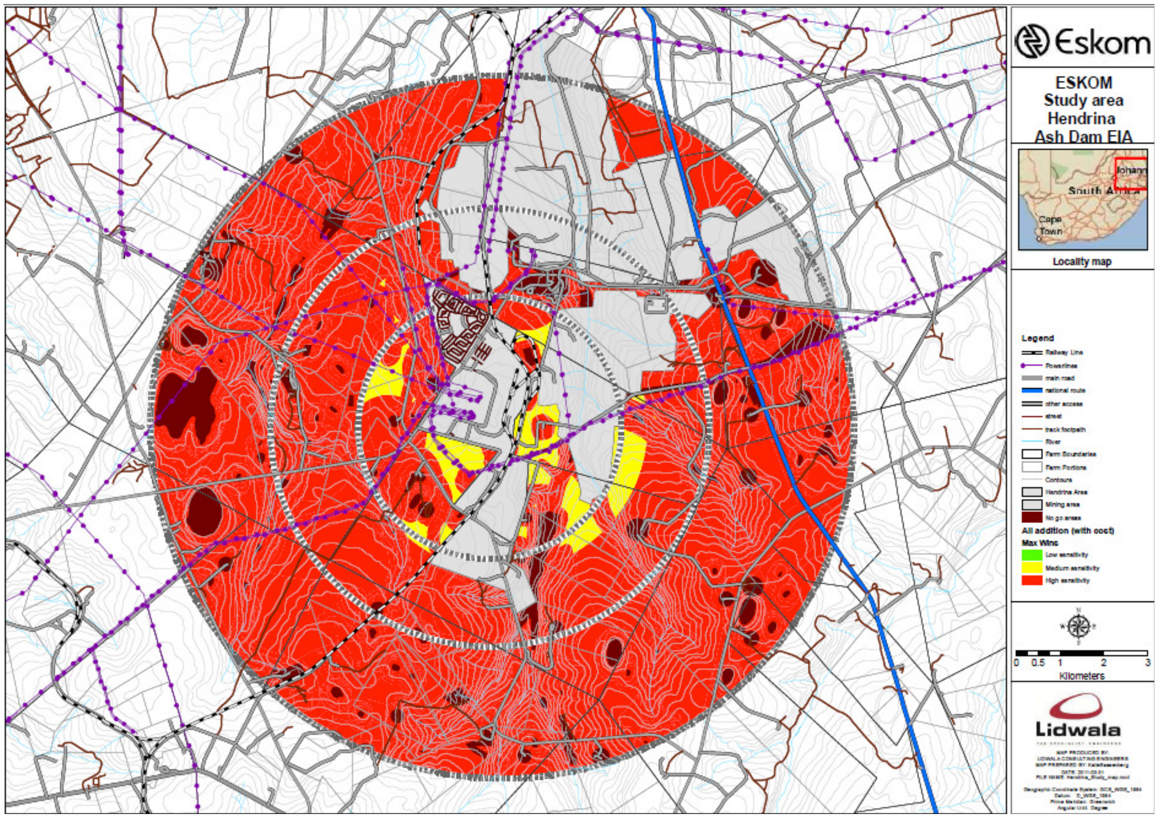


Figure 4.9: Overall Environmental Sensitivity (Max Wins – with technical / cost)

In terms of the "Max wins" mapping system, the technical / cost layer does influence the outcome with far fewer areas being considered suitable for the placement of the proposed new wet ash disposal facility.

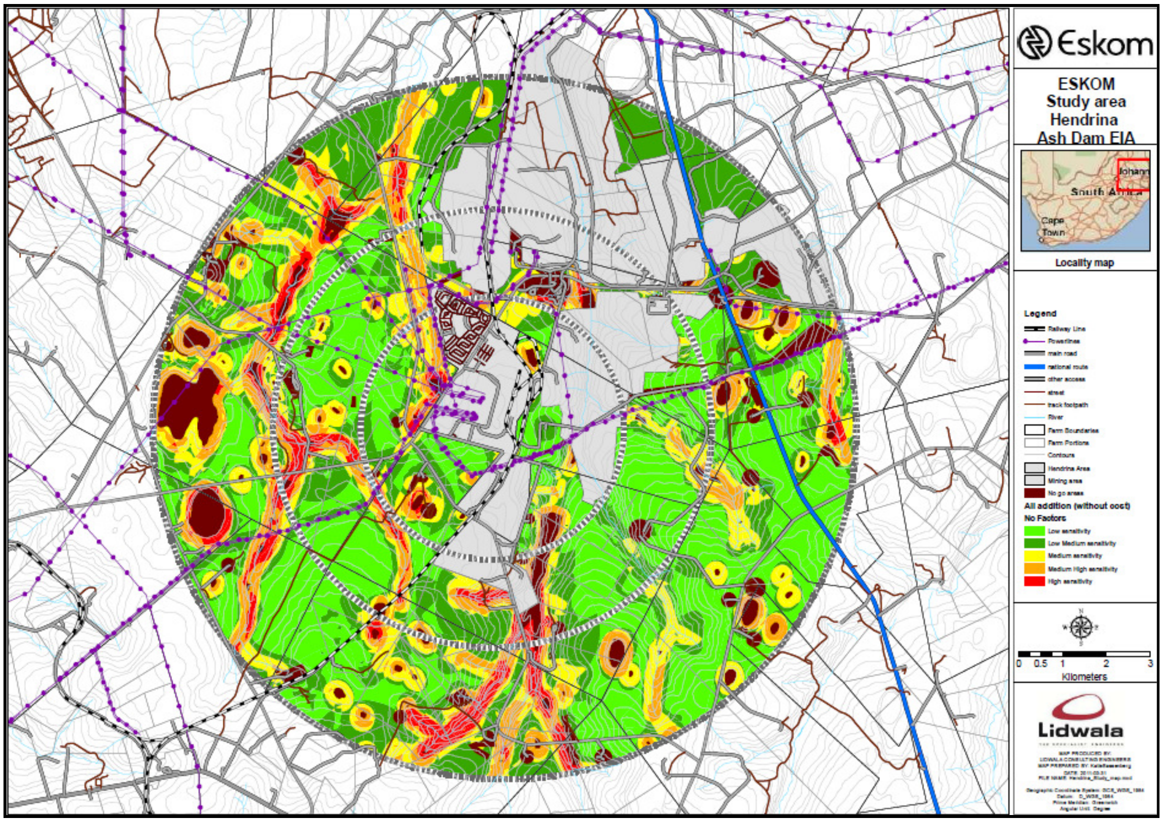


Figure 4.10: Overall Environmental Sensitivity (no factor – without technical / cost)

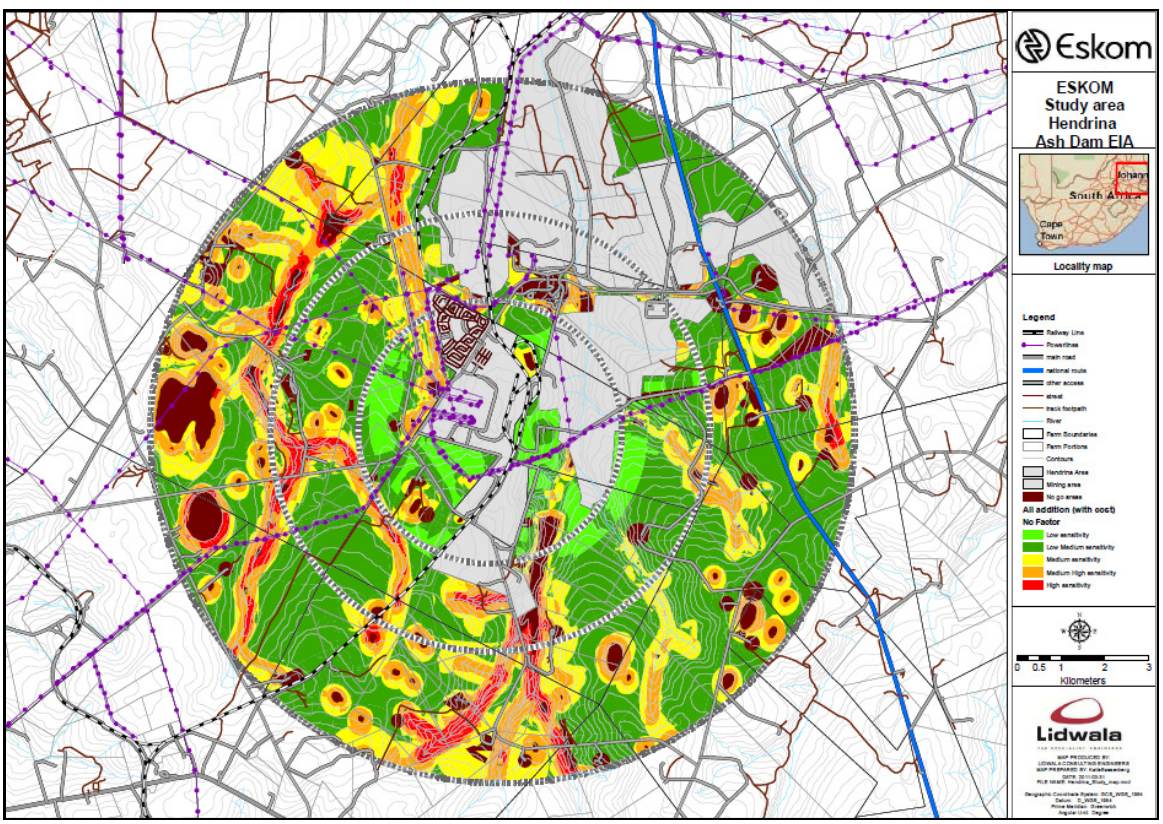


Figure 4.11: Overall Environmental Sensitivity (no factor – with technical / cost)

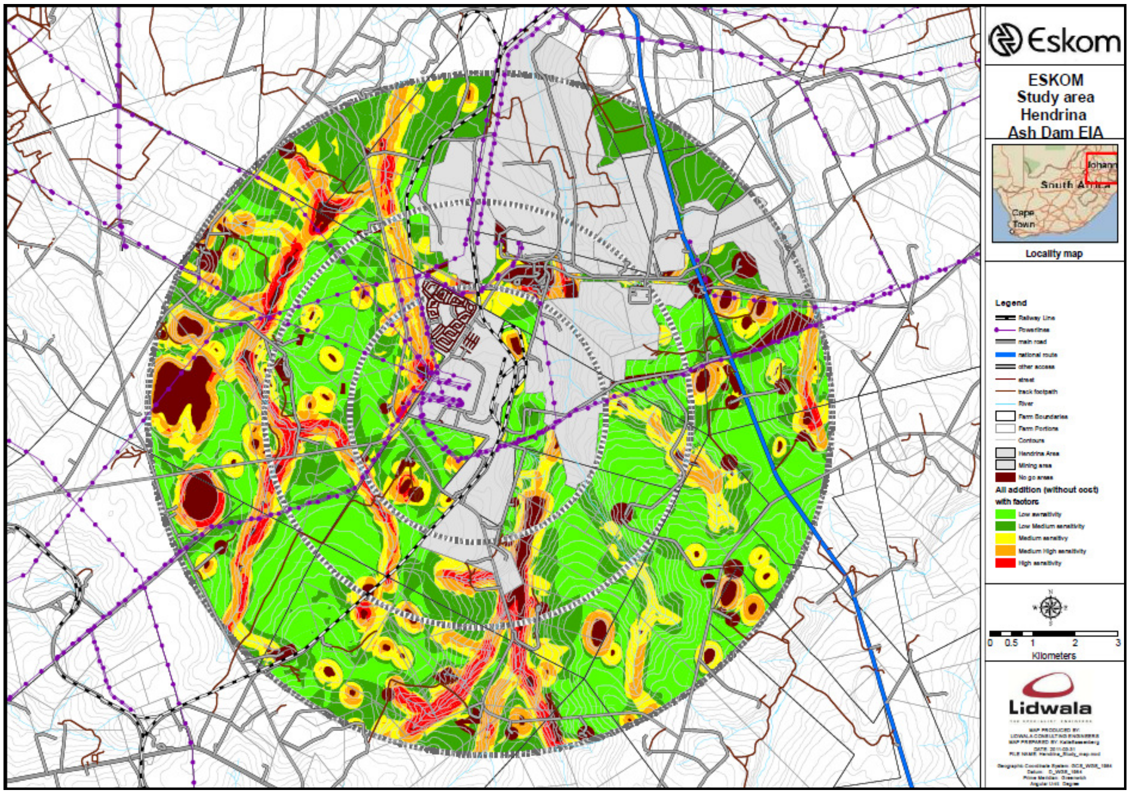


Figure 4.12: Overall Environmental Sensitivity (Adjustment factor included - without technical / cost)

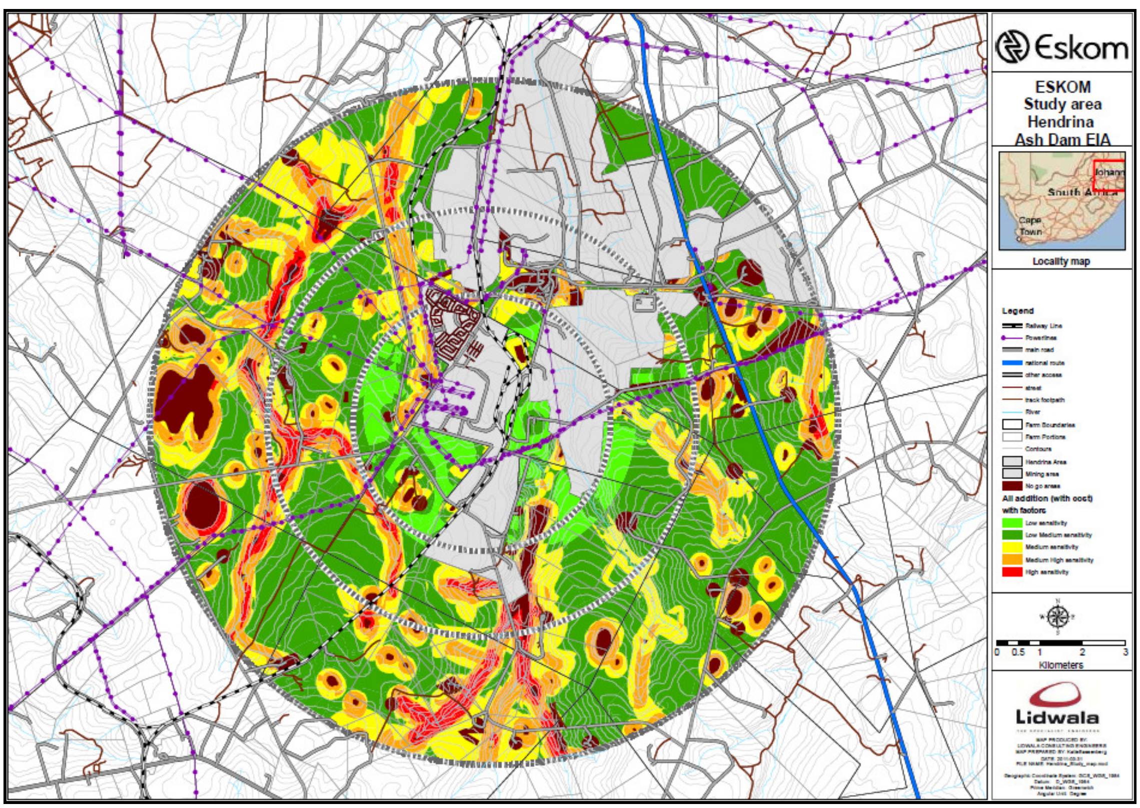


Figure 4.13: Overall Environmental Sensitivity (Adjustment factor included - with technical / cost)

Utilising the straight forward addition analysis including the cost layer (**Figure 4.11**) it can be concluded that the overall sensitivity of the study area falls within the low-medium to medium-high sensitivity range with only small areas being considered of low or high sensitivity. Where the cost layer has been removed the sensitivity reduces to an overall sensitivity of between low and medium (**Figure 4.10**). However, if one utilises the "max wins" (**Figure 4.8**) mapping technique, where any area marked as sensitive is kept sensitive, it is clear that the majority of the study area can be deemed to be sensitive in one way or form with only a few medium sensitivity areas closer to the power station. Once again the cost layer increases the overall sensitivity of the area by reducing the areas available for site selection. From the above analysis it is clear that the proposed new wet ash disposal facility needs to be placed as close to the power station as possible.

The above maps were then utilized in order to determine the least sensitive areas of sufficient size to be considered as alternative sites for the proposed new wet ash disposal facility at Hendrina Power Station. Alternative sites were required to be at least 209 ha in size and where required to fit within the low and low-medium sensitivity areas only.

Figure 4.14, 4.15 and **4.16** indicate the five alternative sites that will be evaluated and assessed in the EIA studies.

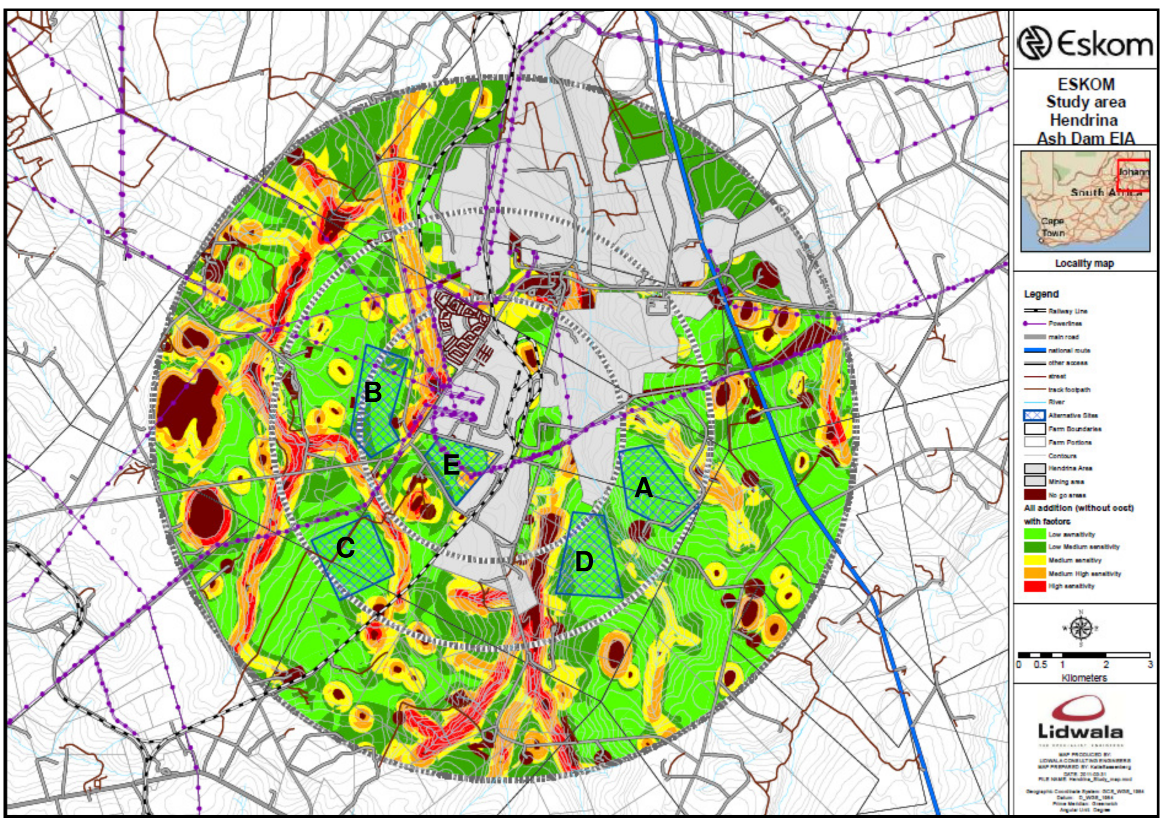


Figure 4.14: Recommended alternative sites (sensitivity map with the adjustment factors without cost)

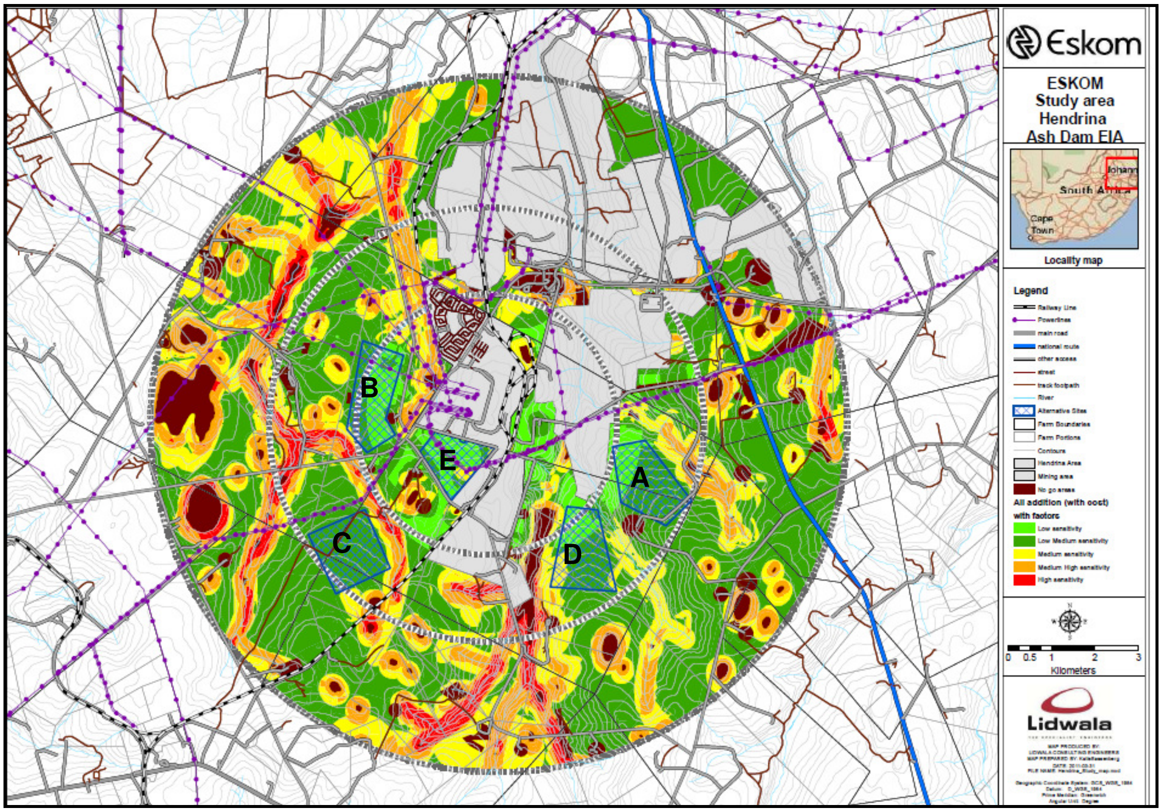


Figure 4.15: Recommended alternative sites (sensitivity map with the adjustment factors with cost)

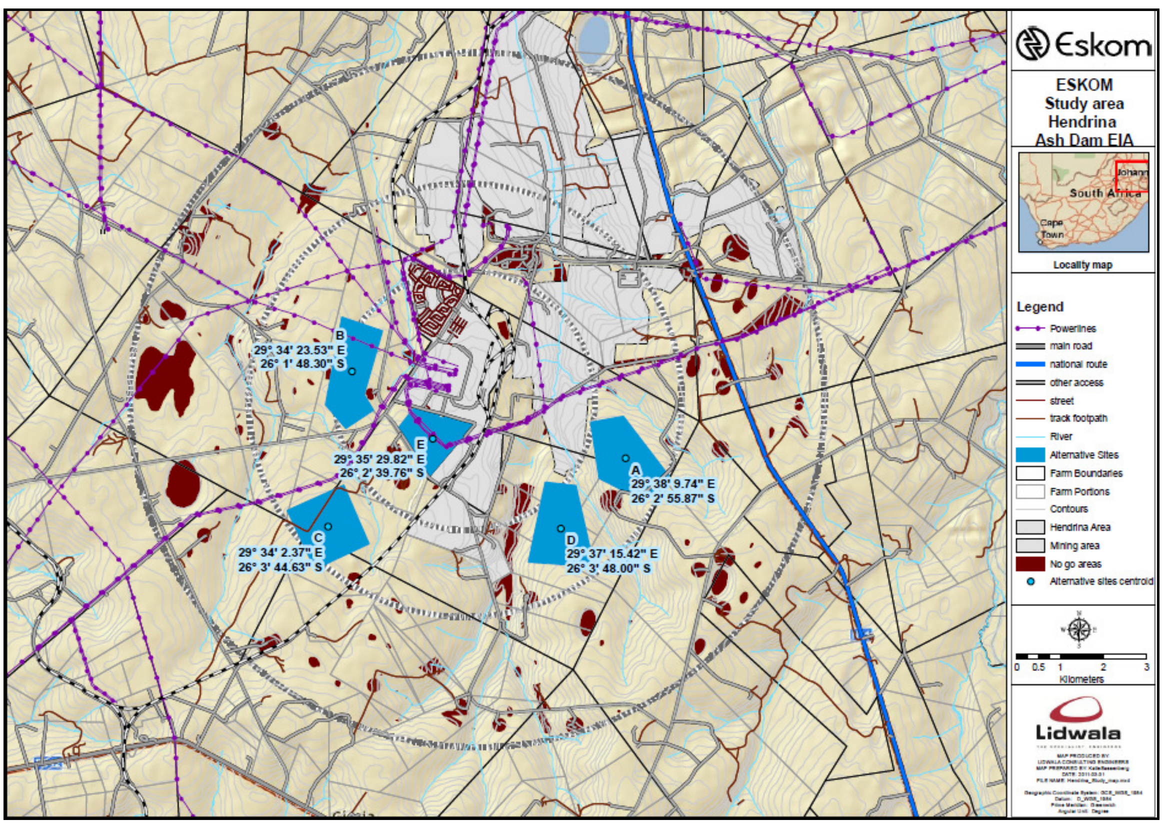


Figure 4.16: Five Alternative sites for further consideration during the Scoping Phase

4.4.3 Identification of the Preferred Alternative

In order to identify which of the five alternative sites is deemed preferred for further investigation during the EIA Phase, the specialists were requested to rank the alternatives sites according to a site ranking methodology.

The evaluation and nomination of a preferred site involved a highly interdisciplinary approach. The approach undertaken involved a number of specialist studies which examined a number of different issues. In order to evaluate sites and determine a preferred site, the studies needed to be comparative and therefore a site rating matrix was developed. The site preference rating system was applied to each discipline, and the rating of each site was conducted according to the following system:

1 = Not suitable for development / No-Go (impact of very high significance - negative)
2 = not preferred (impact of high significance - negative)
3 = acceptable (impact of moderate significance - negative)
4 = Preferred (impact of low or negligible significance - negative)

The final Site Ranking matrix is shown in **Table 4.5**.

Table 4.5: Final Site Ranking Matrix

Study	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Biodiversity	3	3	3	2	2
Avifauna	3	3	2	2	4
Surface Water	2	2	3	1	4
Ground water	2	3	4	2	2
Social	4	2	2	2	4
Visual	2	3	2	3	4
Design and Technical	2	3	2	2	4
Total	**18**	**19**	**18**	**14**	**24**

From the above preference rating results it was clear that Alternative E is by far the preferred site overall with Alternative B as the second most preferred site.

In addition to the screening process and the above site preference rating exercise (**Table 4.5**) the fatal flaws listed in the DWAF Minimum Requirements (1998) were also taken into account in order to ensure that the most preferable site was identified for further study in the EIA phase of this project. The Minimum Requirements require that no landfill / disposal site be developed in an area with an inherent fatal flaw. Through the fatal flaw discussion Alternatives A, B, C and D were eliminated (**Table 4.6**)

Table 4.6: Minimum Requirement Fatal Flaws identified

Fatal Flaw	Discussion	Site eliminated
Unstable areas	No fault zones were identified in the area underlying the various alternative sites. During the public consultation process undertaken during the scoping phase additional information was obtained from the landowner with regards to Alternative C. Alternative C is owned by Koornfontein Mines who currently own the mining rights for this area. This company is currently busy with underground mining in this area (see **Figure 4.17**). It is not yet known exactly how shallow / deep the mining operations are, however, with the existence of open cast coal mining in the area it is anticipated that the mining is fairly shallow. An undermined area can be considered to be a potentially unstable area with regards to potential future subsidence etc.	Alternative C
Any area characterised by any factor that would prohibit the development of a landfill at prohibitive cost	The Eskom technical team deemed that any alternative located within an 8km radius of the power station could be deemed suitable in terms of cost. However, after ground truthing, the independent engineering input received noted that Alternative A is situated directly adjacent to Optimum Mine's open cast mining operation and Alternative D is just east of Total coal's Tumela Mine and on the "opposite" side of the open cast workings and a large dam to the existing power station facilities and is therefore considered too inaccessible. These two sites are therefore not considered technically feasible options without excessive expense.	Alternative A, and D
Areas overlying viable mineral resource	Although this is not deemed a specific fatal flaw in terms of the minimum requirements – it could be linked to a couple of the above items specifically in terms of incompatible land uses. It is also Eskom's policy, where possible, to avoid sterilising viable mineral resources. The entire area is situated on coal resources, the exact viability of which we are unable to determine for certain at this stage. However, Alternative A and D are directly adjacent to both Optimum's and Total's opencast mining operations and are therefore anticipated to be on a viable resource. During a site visit (for ground truthing) it was noted that there are a number of mining right applications on the go within the study area, one particular application, for Kebrafield (Pty) Ltd (DMR Reference number: 30/5/1/2/2/479MR) is situated over a fairly large area to the west of the power station and includes all the farm portions included in the area identified for Alternative B. During the landowner consultation conducted during the	<u>Alternative A, B, C and D</u>

	scoping phase it was found that Alternative C is also underlain by viable mineral resources, the mining rights for which are owned by Koornfontein Mines. This company have existing underground mining operations under Alternative C (See **Figure 4.17**).	

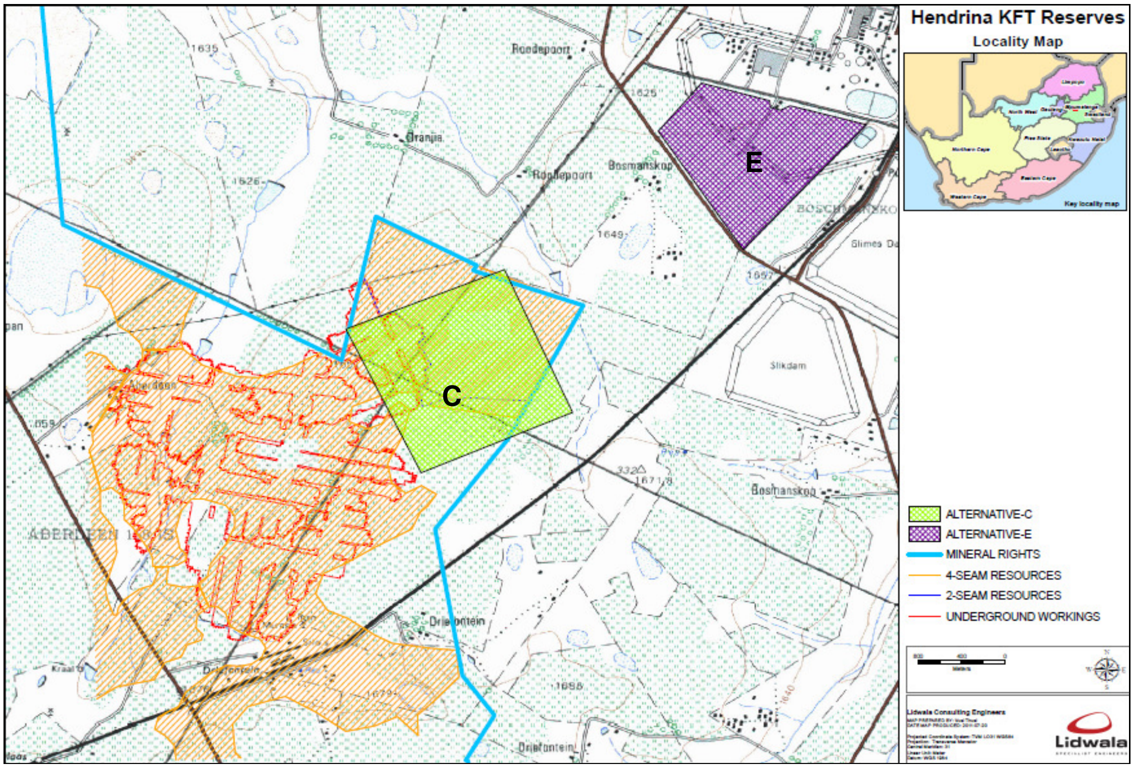


Figure 4.17: Underground mining operations under Alternative C

The preferred sites identified from the site preference rating exercise (**Table 4.5**) included Alternative E and B. The above discussion (**Table 4.6**) with regards to the Minimum requirements fatal flaws excluded Alternatives A, B, C and D for either being deem technically unfeasible (without excessive expense) or being located on a potentially unstable area or overlying viable coal resource.

Therefore, with the results of the two site selection discussions above only one site was left for consideration as an alternative site for the proposed wet ash disposal facility, i.e. Alternative E.

Prior to being eliminated due to potential instability and overlying a viable mineral resource, Alternative C was also eliminated due to sensitivity and surface water issues[3]. The surface water system in question is a perennial system. Nel et al. (2004) lists a status of critically endangered for all the river signatures associated with the study area, which will include the surface water feature that would need to be crossed by linear infrastructure required for a new wet ash disposal facility at alternative C. The ascribed river status indicates a limited amount of intact river systems carrying the same heterogeneity signatures nationally. This implies a severe loss in aquatic ecological functioning and aquatic diversity in similar river signatures on a national scale (Nel et al., 2004). Therefore, it was anticipated that the use of Alternative C as a preferred site would increase the risk of pollution and the associated environmental degradation of the system in question.

Alternative E was considered the most preferred site due to its close proximity to the existing facilities and due to the fact that this alternative would be able to link in with many of the existing associated facilities therefore reducing the required footprint substantially. In terms of the cost mapping, Alternative E is within the 3km radius which does not require any substantial additional costs for the development of the new wet ash disposal facility.

In addition to the above discussion the "Max wins" map (taking cost into account – as required in the minimum requirements) from the screening study can be consulted to support the preference for Alternative E. The "max wins" map was developed by keeping all areas deemed sensitive (in all study areas) sensitive (**Figure 4.9**), Alternative E is clearly shown to be situated in one of the few areas deemed acceptable for the placement of the wet ash disposal facility.

Therefore, the scoping study recommended that Alternative E and the No-go Alternative were carried forward to the EIA phase.

4.5 Linear Infrastructure Alternatives

Due to the identified preferred site, Alternative E, being traversed by three power lines and a DWS bult water pipeline, the EIA is also required to assess alternative corridor alignments for the relocation of these three power lines and the DWS bulk water pipeline that traverse Alternative E (See **Figure 4.18**).

In addition to the DWS pipelines in the area within and surrounding Alternative E there are also two water pipelines belonging to Optimum Mine. Due to their position in relation to

[3] The choice of a preferred site was required to take all aspects of the environment into account, social, biophysical, technical and economic aspects. Alternative C was previously deemed suitable from a cost perspective as it fell within the 8 km radius of the power station, from a technical point of view it was also deemed suitable as apart from being a fair distance from site there are no major barriers (from a technical point of view) that would make the site unfeasible. The social study noted that Alternative C was situated close to a number of agricultural settlements and was also found to have the highest visual exposure of all 5 alternatives. From a biophysical point of view Alternative C was considered to be far less preferred than Alternative E as linear infrastructure required such as access roads, power lines and pipelines would be required to traverse at least 3 – 4 km from the power station to the site without the option of not crossing surface water features that were highlighted as higher sensitive areas by the surface water, biodiversity, avifauna and groundwater specialists during the screening phase.

Alternative E, it is anticipated that neither of the Optimum pipelines will be affected in any way by the construction and operation of the new wet ash disposal facility and all associated infrastructure.

Figure 4.18: Linear infrastructure traversing Alternative E for which deviation alignments were investigated during the EIA phase.

Alternative re-alignment corridors were identified through liaison with the following role players:

- Power station engineers and operators
- Land owner
- Design consultants
- Specialists

The final alternatives identified for the powerlines are shown in **Figure 4.19** and the alternative pipeline route is shown in **Figure 4.20.**

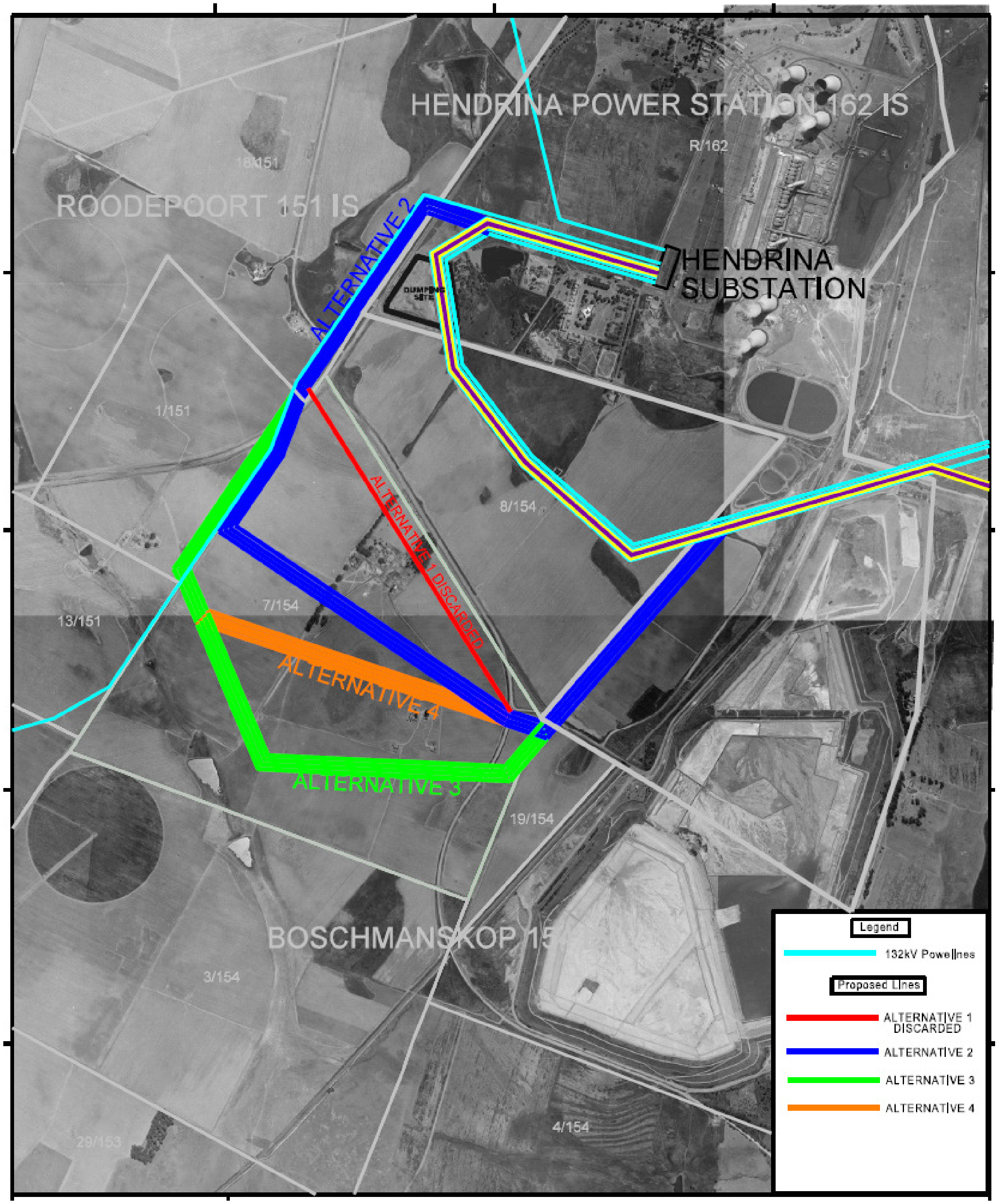


Figure 4.19: Power line re-alignment alternative corridors. Alternative 1 has been discarded following input from the public involvement process.

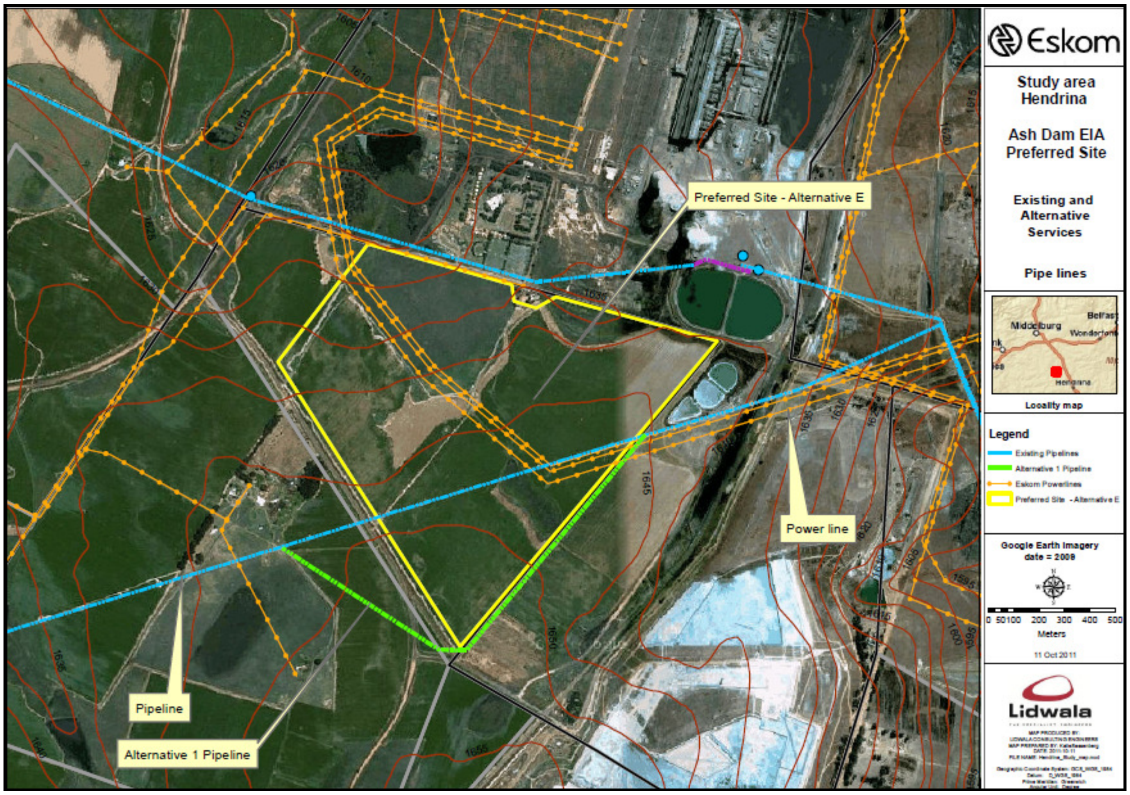


Figure 4.20: DWA Bulk water Pipeline realignment alternative (green line)

As of 7 February 2013, the project team was made aware of the existence of a new powerline alignment that is to traverse Alternative E (preferred EIA site). The project team is aware that an Environmental Authorisation has been granted and a servitude negotiated with the landowner. The new line will be relocated together with the powerlines mentioned above within the same new proposed alignments and corridor.

4.6 Conclusion

This chapter discussed the methodology of how the preferred site was identified through the screening and scoping phases.

Based on the studies undertaken to date no environmental fatal flaws (excluding those listed by the DEA Minimum Requirements for Waste Landfill) have been identified that would prohibit the project from continuing.

The recommendation of the scoping report was that detailed specialist studies were to be undertaken on the preferred site (Alternative E) and the no-go alternative. In addition to this the specialists were also required to assist in the identification and investigation of alternative routes for the re-alignment of the three power lines and the bulk water pipeline that traverse Alterative E. All of these studies have been completed and incorporated into this Environmental Impact assessment.

This EIA report identified, assessed and evaluated the environmental impacts associated with the construction and operation of a new wet ash disposal facility on alternative E and its associated infrastructure, including the re-alignment of the various linear infrastructure that traverses the site. These impacts have been compared to the anticipated impacts associated with the no-go alternative. Mitigation alternatives are included in the EMPr.