Final Report

AN AGRICULTURAL ECONOMIC ASSESSMENT OF THE POTENTIAL IMPACT OF THE PLANNED MERCURY – PERSEUS 400 kV TRANSMISSION LINE

CONDUCTED BY
MINNAAR CONSULTING SERVICES
IN CO-OPERATION WITH
STRATEGIC ENVIRONMENTAL FOCUS

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Executive summary

Minnaar Consulting Services were commissioned to conduct an agricultural economic impact assessment of the proposed 400kV transmission line on the communities along the proposed alignments connecting Vierfontein and Dealesville through the north western part of the Free State.

The area under investigation consists of varying land use patterns with divergent profit yielding potential. A number of factors were listed that should be considered when the final choice of the alignment is made. These factors could have an impact on the long-term sustainability of farming and other activities. Due to the lack of a set of formal agricultural economic parameters in South Africa that can be utilised in the assessment of the potential impact of a transmission line, an overview of international information was undertaken. The result is a number of concepts that were formulated and used to compile a set of parameters that can be used for similar future assessments in South Africa.

The four proposed alignments were evaluated on the basis of a matrix of factors and weights allocated to each factor to determine the potential impact of the proposed transmission line. The result was that if Alignment 2 could be modified, it would prove to be the best of the four proposed alignments. The main reason being that this alternative (Alignment 2) follows existing infrastructure such as railway lines, roads and power lines. This alternative is proposed despite the fact that the servitude of the transmission lines needs to be 95 metres (measured centre to centre) apart from the servitude of the provincial road. By following this approach it is believed that it will have the least economic impact on the agricultural sector and communities in the study area. The refinement of the route should be done on a micro-scale for the whole route. For this purpose the satellite images prepared for this study can be a useful tool.

1 Background

This consulting firm, Minnaar Consulting Services (MCS), was requested to conduct an agricultural economic assessment of the potential impact of the respective alignments of the planned 400 kV transmission line through the north western part of the Free State. The planned transmission line will stretch between Vierfontein and Dealesville.

In this economic assessment note was taken of the document titled “Scoping Report For Public Comments”, dated 12 May 2003, which was compiled at the request of Eskom and has been submitted by P D Naidoo & Associates in association with Strategic Environmental Focus (Pty) Ltd (SEF) to the Department of Environmental Affairs and Tourism.

2 Methodology and approach to the investigation

In order to formulate a methodology for the assessment and be able to propose certain actions, a number of questions had to be raised by the MCS team. These questions were typically those that can be asked in a study of this nature and the objective was set to obtain satisfactory answers for the following:

- What economic impacts can a 250km transmission line have on a predominantly agricultural community?
- What were the results of similar studies conducted in the past, internationally and locally and what background information can Eskom make available about similar assessments done in the past?
- If the proposed alignments have already been established, what economic impact can the proposed transmission line have along those alignments?
- What can be done to alter the proposed alignments to lessen the potential impact?
- Which of the proposed alignments has been identified as the preferred one and which one should be the preferred one, based on the results of the economic impact assessment?

MCS compiled a list of factors, which should be considered during the planned field assessments these included the:

- Presence of plantations.
- Presence of existing transmission and distribution lines and other infrastructure elements.
- Intensity of crop production.
- Future agro-tourism development potential.
- Future commercial development potential.
- Operation of local airstrips.

Reports on similar investigations were obtained from the Internet. No relevant information was obtained from Eskom on a set of parameters for use in the investigation.

MCS obtained complete sets of topo-cadastral maps of the area from the Government Printer, with the following enlargements:

- 1: 500 000
- 1: 250 000
- 1: 50 000

On these maps the following were mapped:

- Alignments 1, 2 and 3.
- A proposed Corridor 4, which was only mapped in part with precision.
- A fifth possible alignment as proposed by MCS.

Personnel of MCS conducted a field investigation of the study area to determine the following:

- The spatial distribution of farming and other economic activities.
- The variation in the intensity of farming activities and production value generated in different parts of the study area.
- The sensitivity of farming in general, specialised farming operations in particular and the location of physical structures of a 400 kV transmission line.
- The flexibility of the placement of the respective potential alignments.
- The choice of the best option for the alignment of the transmission line.
- The status and tendencies of agro-tourism (tourism based on farms and farming operations) development as well as the impact of the planned transmission line on development potential.

SEF supplied detailed co-ordinates of the three existing alignments and most of the fourth possible alternative corridor for the planned transmission line. A contractor was commissioned to provide satellite images of the entire study area with a resolution of at least 15-metre pixel size. This mapping detail was

necessary in order to be able to identify sophisticated irrigation installations and other operations, which should receive special attention in the assessment and final alignment of the transmission line. The resolution of the images was found to be sufficient on a 1:100 000 scale to enable MCS to identify the most important land use patterns.

Detailed land type maps were used to draw conclusions about the productive value of the soils of the area.

Most of the existing transmission and distribution lines could be located on the topo-cadastral maps, although additional power lines are evident on the more recent satellite images.

A large number of photographs (refer to Appendix B) were taken during the field investigation to illustrate the farming activities of varying intensities. These were used to support the decisions regarding the placement of the final alignment.

MCS has compiled a matrix of impact factors, with weights allocated to each factor to determine and quantify the potential impact of the various potential alignments of the transmission line. This matrix is discussed in detail in Chapter 6.

3 General factors that should be considered when assessing the agricultural economic impact of power lines: An overview of international data

3.1 Introduction

MCS used international sources in an attempt to set some bench-marking standards (best practice) of factors that need to be considered during the agricultural economic impact assessment of a new transmission line.

According to the Ohio Power Supply Board (USA), the following factors need to be considered before any new electricity infrastructure is erected:

- The facility must comply with all air and water pollution control and solid waste disposal laws and regulations.
- The facility's impact on the continued agricultural viability of any land in an existing agricultural district.
- The facility must incorporate maximum feasible water conservation practices as determined by the Ohio Power Supply Board, considering available technology.

MCS concluded that these parameters should be included in this assessment process.

According to Ohio Power Supply Board the following points should be addressed in greater detail:

- Property values
- Property evaluation methods
- Adverse effects of power lines
- Economic benefits to local communities
- Visual impact
- Aerial crop spraying
- A balanced view to servitude management

3.2 Property values

According to Bolton & Sick (1999) real estate professionals in the USA that are performing studies on behalf of the power line companies conclude that power lines are bad for property values. On the case law front, there is continuing support for the admissibility of expert appraisal evidence based on "fear in the market place".

In 1995, two academics named Stanley Hamilton and Gregory Schwann published an empirical study of residential home prices in Vancouver, British Columbia. The study contrasted sales in four separate Vancouver neighbourhoods of residences adjacent to power lines of 60kV or greater from 1985 to 1991. The sample size was impressive, containing 12 907 transactions in the four study areas. The percentage decreases in property values were not as great as those originally measured in the Houston area in the authors' 1993 study. Hamilton & Schwann nevertheless concluded to an undeniable drop in value: "We find that properties adjacent to a line lose 6,3 percent of their value due to proximity and the visual impact." (Hamilton & Schwann, 1995). The well-supported findings presented in this article leads one to the conclusion that power lines have a depressing effect on property values and is not merely an American phenomenon (Bolton & Sick 1999).

Cowger, Bottemiller & Cahill, three real estate professionals employed by the Bonneville Power Administration in Portland, Oregon, published another study in *Right of Way* magazine in 1996. This study concluded that overhead transmission lines negatively influence value: "Overhead transmission lines can reduce the value of residential and agricultural property. The impact is usually small (0-10%) for single-family residential properties. The greatest impacts have been measured in intensively managed agricultural property (irrigators, rural and vacation home) developments."

In 1995, a group of real estate consultants in Missouri, USA conducted a survey (Development Strategies Survey) of residential brokers and salespersons, some 167 professionals, all in the St. Louis area. The results

were published in a study concluding that 54% of those surveyed believed that high voltage overhead electric transmission lines very negatively affected" residential property values and another 23,8% considered high voltage overhead electric transmission lines to "somewhat negatively" affect property values (Development Strategies Inc, 1995).

According to Bolton & Sick (1999) in late 1997 the Lower Colorado River Authority in the USA commissioned a study to quantify the property value impact of electric transmission lines in and around Georgetown, Texas (Kokel, 1997). The study was performed by local assessors who the Lower Colorado River Authority had also hired to do all of the appraisal work for the concurrent acquisition of numerous easement parcels for a new 138kV line. Well over 100 real estate transactions were analysed, including both sales from eight different residential subdivisions and vacant land sales. From the data analysed, it is concluded that from an overall value perspective, an electric transmission line servitude has less than a 10% impact on price, and in most instances, less than a 5% impact on price (Kokel, 1997: 94).

According to Bolton & Sick (1999) it is important to note that the appraiser in this study was referring to a 10% *overall* impact on price, not just on the value of the land immediately affected by or adjacent to the servitude. For those areas, he reached a specific conclusion: “It is concluded that the area located within an electric transmission line easement has a 90% diminution in value due to the presence of the easement.” … “and it is concluded that an area 200 feet wide adjoining the proposed easement has some diminished value. The extent of the diminished value can be dependent on various factors, which would include the location of the easement relative to the whole area, and the physical characteristics of the remainder price” (Kokel, 1997: 94).

This author’s original 1993 estimate as to the probable width of an effective servitude was 150 feet on either side of the actual servitude. The fact that a study prepared on behalf of a major Texas condemner reached a similar conclusion demonstrates the validity of the effective servitude theory (Bolton & Sick, 1999).

It is clear to MCS that both the construction and operation of a transmission line will inevitably have a negative impact on the value of property. This factor should not be underestimated in any local assessment process. Although the international literature sourced deals predominantly with urban and semi-urban areas, the same negative impact can be expected for land in well-developed rural areas.

3.3 Property evaluation methods

According to Bolton & Sick (1999) “at the fence” (ATF) or true market value is a question of highest and best use. Acquiring rights for communication lines by condemning entities has been fairly rare until recently, primarily because there was no need. As the need for communication lines increased, the utility companies have begun to acquire these property rights. Naturally, the valuation issue is now becoming a factor. The position taken by most companies with the power of eminent domain is to value the property rights as simply the pro rata share of the servitude value as determined by the "at the fence" prices.

According to the authors of the paper a pure appraisal perspective, this method is inappropriate and does not conform to generally accepted appraisal practices set forth in the Uniform Standards of Professional Appraisal Practices (USPAP). "In developing a real property appraisal, an appraiser must be aware of, understand, and correctly employ those recognized methods and techniques that are necessary to produce a credible appraisal." (Standard 1: 1998).

The foundation of proper appraisal methodology is an analysis of a property’s value based on its highest and best use, defined as "[t]he reasonably probable and legal use of vacant land or an improved property, which is physically possible, appropriately supported, financially feasible, and that results in the highest value" (Appraisal Institute: 1993). The basis for appraising property rights of this type is plainly set out in the Appraisal

Institute's text book, which is universally accepted as the best authority: "Analysis of the highest and best use of the property as though vacant and of the property as improved is essential in the valuation process" (Appraisal Institute: 1996: 87).

In the evaluation of additional property rights within an existing right of way corridor, very rarely can the highest and best use be anything other than for those kind of uses that are already found within the corridor. That being the case, those property rights being acquired must be appraised based on that highest and best use. ATF prices rarely have anything to do with the market value of property rights within the established corridor (Bolton & Sick 1999).

Although various methods of evaluation of property values are in use worldwide, the concept of the "highest and best use" should preferably be applied, where possible.

3.4 Adverse effects of power lines

According to Bolton & Sick (1999) an examination of scientific inquiry concerning the existence of actual adverse effects of electromagnetic field radiation (EMF) from major transmission lines on human health has been done. According to them the scientific conclusions are still inconclusive and scientific investigation of the potential adverse impacts of radiated fields has widened to include not only the low frequency emissions of transmission lines, but also high frequency emanations from cellular phone and microwave towers. Though the data indicating that higher frequency emissions may be harmful seems much more settled in the literature than that concerning low frequency emissions, it is probable that public perception blends the two to such an extent that general fear of EMF exists in the public mind across the board.

A British group of epidemiologists known as the Advisory Group on Non-Ionising Radiation (AGNIR) in 1994 however, reserved judgment on the issue with regard to childhood leukaemia: "…epidemiological studies [do] not

establish that exposure to EMFs is a cause of cancer although taken together they suggest that the possibility exists in the case of childhood leukaemia" (NRPB, 1994).

The most recent official pronouncement on the subject reopens the debate more than ever. In June of 1998 an expert panel convened by the National Institute of Environmental Health Sciences ("NIEHS") at the behest of Congress issued an alarming press release. The panel concluded that low frequency EMFs, like those surrounding transmission lines, should be classified as a Group 2B human carcinogen under the International Agency for Research on Cancer classification scheme. A Group 2B classification means, "the agent (mixture) is possibly carcinogenic to humans. The exposure circumstances entail exposures that are possibly carcinogenic to humans" (NIEHS, 1998).

As the look at appraisal literature and common sense clearly indicate, the continuing scientific uncertainty over the adverse health consequences of EMFs only serve to perpetuate the debilitating effect of power lines on abutting property values (Bolton & Sick, 1999).

This is a controversial subject, but the perception of the general public should nevertheless not be underestimated in evaluating the negative impact of a power line on the value of property.

3.5 Visual impact

In the Queensland study (Queensland 1999) one of the communities' concerns was the visual impact of the transmission line and substation on the surrounding communities. In order to compensate local communities for such impacts, the utility administers a Community Offset Programme. It negotiated with local councils to provide projects, which offset the impact of the transmission line. Examples included shade cloth areas for schools, sporting facilities for remote communities and revamping of a local community hall (Queensland: 1999).

According to the Santan Expansion Project of the East Valley in California, USA a new plant at an existing site has less visual impact (landscaping and other visual enhancements can be added to a relatively small site) than miles of new transmission lines that would affect thousands of homes along its path (Santan). The same general principle will also apply when a transmission line already exists in a certain corridor and should a utility company add an additional line next to the existing one, the conclusion could be made that the total visual impact for a study region would be less. This implies that the area that might have been affected will not be affected and the corridor that has already been affected by one line will be less affected than a "virgin landscape". It must be acknowledged that it is not always possible to construct a new line next to an existing line.

It is clear to MCS that the negative visual impact of a transmission line on a pristine rural area has to be taken into consideration. This is especially true of areas, which could be developed into future agro-tourism destinations. It may be sensible to liase with regional environmental and economic planners to identify areas that might be developed as future agro-tourism destinations. This aspect was dealt with to some extent in the Scoping Report.

3.6 Aerial crop spraying

According to a study (Queensland 1999) that was conducted for the Queensland provincial government (Australia), special reference was made to the measures that the utility company adopted to improve the safety of agricultural pilots operating in rural areas. Pilots in low flying aircraft found it difficult to see power lines. Occasionally, this resulted in a serious accident or fatality. Additionally, most of a pilot's work was carried out in the early morning or in the afternoon when the pilot's visibility was most affected. According to the study, the responsibility of aircraft safety lies with the Commonwealth Government under the *Civil Aviation Act (1988*) in Australia. The Act contains requirements regarding the marking of power lines on the approaches to airports, and a duty of care requirement for pilots to undertake

a ground reconnaissance before making low-level flights. In Queensland it is policy to place markers on the line where it runs near a registered landing strip, or a registered flight path (Queensland: 1999).

3.7 A balanced view to servitude management

There should be a balance in the planning, design, maintenance and construction of servitude or rights-of-way (ROW) corridors. There must also be a reconciliation of economic and ecological realities. According to John Huckabee (1979), utilities and environmental agencies would seem to be at cross-purposes in the ROW domain. He suggests that these two groups are not really working against each other. According to him proper management of ROWs can accomplish the objectives of both groups. According to him ROWs are the designs of engineers, but nature, invoking precedence, seeks relentlessly to impose its own designs. The issue thus becomes not if, but how best, to manage nature: fight or finesse. Required management tools have been available for many years, as shown by the scientific literature. The evidence is already in hand showing that a wise and balanced use of these tools, including herbicides, can result in an aesthetically pleasing, almost maintenance-free ROW that also provides excellent habitat for indigenous wildlife. This certainly constitutes proper management: reconciling the economic and ecological realities. The extent to which current ROW management programs involve little more than broadcast spraying of herbicides (fighting) indicates the extent of our failure to reconcile these realities (finessing) (Huckabee: 1979).

According to Bolton & Sick (1999) utility corridors or servitudes can be extremely valuable. During the past few years a new industry has emerged in the USA, requiring the use of right-of-way corridors for communication lines and fibre-optic cables. These communication lines are responsible for transmitting data involving national security, banking, internet applications, teleconferencing, and most types of data transmission. What better avenues to install the hardware necessary for this product than existing utility corridors,

which already offer the physical, economic, and legal attributes for this kind of use.

MCS is of the opinion that the concept of a servitude in which transmission and distribution lines, telecommunications infrastructure as well as other infrastructure are concentrated should be expounded locally. This includes a management model to ensure that the maximum advantages of such a corridor are exploited.

3.8 Conclusions

From the available literature sourced, it is clear that similar assessments to this one have yielded useful insights into the assessment process. A number of the factors encountered in the foreign reports are valid for locally executed projects and include:

- The so-called "fear in the market place" can seriously affect property values. People are not always sure what they should be afraid of but they have the perception that electric power lines are dangerous and they suspect that it might have a negative impact on their everyday living – especially when it is near their homes. This is true for urban and rural areas alike.
- As property evaluation methods of professionals in the field are subjective, the evaluation result can vary considerable. An approach such as "At-the-fence" or true market value refers to "highest and best use" of a certain area of land and can be useful for local evaluations. It is acknowledged locally that more scientific methods may have to be adopted by property assessors to be able to provide a more credible appraisal.
- New scientific research is being conducted and although very controversial it seems that there can be some adverse effects due to electromagnetic field (EMF) radiation. This might play an important role in future.
- In South Africa the government has certain policies in place to assist local communities when projects are undertaken in the region where they live. This practice will make it easier for these rural communities to accept the need for the new project and in such a way win their support.

- The visual impact of a transmission line needs to be considered especially when it will have a negative impact on future agro- tourism.
- Aerial crop spraying is always influenced by power lines and clear markings should be used on the power lines.
- In the development of servitudes or rights-of-way (ROW) corridors there must always be a reconciliation of economic and ecological realities. It is possible to develop these corridors for more than one purpose like telecommunication lines and optic fibre cables.
- South Africans need to take cognisance of international developments to ensure that proper planning is done.

4 Factors to be considered when determining the potential economic impact of the proposed transmission line

4.1 Introduction

From interpretation of maps, satellite images, field visits, information provided in the Scoping Report and discussions with various interested parties, certain land-use patterns of the study area were established. It is clear that a wide variety of farming operations are being conducted and that these operations exhibited different susceptibilities to possible negative impacts of the construction and operation of the proposed transmission line.

The following factors were identified as important to determine the alignment of the proposed transmission line:

- Presence of Eucalyptus plantations.
- Existing power lines and other infrastructure.
- Intensity of crop production.
- Potential for future eco-tourism development and the presence of sensitive ecological systems.
- Presence of local airstrips.
- Compensation of farmers for damages.
- Other concerns raised by farmers and interest groups.

4.2 Presence of Eucalyptus plantations

There are large plantations of mainly Eucalyptus, but also Cypress and other tree types in the North Eastern parts of the target area, namely the Vierfontein, Viljoenskroon and Bothaville areas. The trees in these plantations are generally old and large. Some of these trees may be older than 100 years, with heights of up to 40 metres. The trees serve as windbreaks to protect crops but also as a supply of logs, firewood, and poles and as aesthetic improvements on the farmsteads. There are plantations in the rest

of the study area, but these plantations are generally less dense and further apart. There are not as many plantations in a south and westward direction.

Special consideration should be taken in order to evade the aligning of the planned transmission line through these plantations, as the amounts of money required to be paid out as compensation to farmers could be high and the other effects of deforestation could be negative. Where possible, the new transmission line should be established close to existing power lines, railway lines and roads where the problem of bypassing plantation barriers would be minimised.

4.3 Existing power lines and infrastructure

The study area is bisected with transmission lines and distribution lines. The logical and cost effective move would be to align the planned transmission line as far as possible next to these existing power lines. A number of primary, secondary and tertiary roads as well as railway lines also characterise the area. As these transport arteries are often associated with electricity service lines, telephone lines, servitudes, service roads, etc, preference should be given to aligning the transmission line close to these existing structures. The negative economic impact of the creation of this existing infrastructure has already been absorbed by the local economy and communities. The negative economic impact of the placement of an additional infrastructure element close to the existing infrastructure would therefore be minimised.

4.4 Intensity of crop production

The rainfall decreases in a southerly and westerly direction. As the intensity of dry land crop production is correlated with higher rainfall, it follows that the most intensive dry land production occurs in the north eastern areas. An attempt was made to limit the length of the transmission line across the areas with high productivity dry land soils. In the west and south the proportion of grazing land to cultivated land is larger than further eastward. Some fields that were once ploughed have been converted back to natural grazing.

The Sand-Vet irrigation scheme cuts across the southern area in an east west direction. Although most of the centre pivot and other irrigation systems are found in this area, some irrigation occurs throughout the study area, as can be seen on the satellite images. Irrigated lands have, by far, the highest value of all land as they can be used to generate many times the production to be achieved on any dry land areas, even with superior soil types on some of the latter areas. On irrigated lands vegetables, lucerne, olives, wheat, maize and other crops are being produced. It is expected that the irrigated agriculture of the region will follow the trends in many other irrigated areas of the country. This could implicate that more high volume crops will be planted on irrigated lands.

As the construction of the planned transmission line could have a negative impact on the operation of sophisticated irrigation systems, the alignment of the transmission line through such areas should be avoided where possible by following existing power line routes or other infrastructure. It is clear, however, that overhead irrigation can still be conducted unhindered under such power lines, as evidenced by the irrigation operations of the sugarcane fields in the Mpumalanga Lowveld. The construction phase of the transmission line, and specifically pylons, can nevertheless be a serious impediment to such operations and the economic impact can be severe, if not handled in a sensible manner. This especially applies to high growing tree crops. The features of the dry land areas, irrigation blocks with and without crops that are irrigated, natural grazing, thorn veld, wetlands and other agriculturally important features can be indentified on the satellite images.

Although only at an early stage, farmers have started establishing olive and other perennial crops in some irrigation areas. This represents a huge capital outlay. More farmers can be expected to plant high value crops in future as can be seen in the Lower Orange River basin downstream from Upington where almost all low value crops have during the past fifteen years been replaced by crops rendering a high net farming income through exports. This could also happen in most other irrigation areas of South Africa since it is in line with the new Water Act. This act prescribes the use of scarce irrigation

water only for the production of high value crops and it can be expected that pressure to adhere to the stipulations of the act will increase.

The western and southern most area is characterised by the occurrence of light regic sands with a lower dry land production potential. The soils of the Bothaville area are generally acknowledged as those with the best dry land production potential especially in view of the higher rainfall in the north east of the study area. In some flood plains and other areas of the far south alluvial clay and lime patches occur. These areas are characterised by natural grazing supporting grassland or Acacia veld.

A tendency exists among farmers with large farms in the Bothaville and other high production potential dry land areas to almost fully mechanise crop production. Some of the largest tractors in the world, with power supplies in excess of 400 kW each, are utilised with extremely large implements to cultivate large tracts of land in a short period. Certain ploughs, harrows, planters and cultivators are as wide as 15 metres and more. Farmers on these heavily mechanised farms may complain about the negative effect of the possible placing of the pylon structures and anchor cables of the transmission lines on the operation and manoeuvrability of the large tractors and the wide working implements. Operating efficiencies and production costs can be seriously affected. If transmission lines are erected on such a farm there could also be a significant risk of damage to implements. This factor should be taken into consideration in the establishment of the alignment of the transmission line.

A theory exists among certain farmers in the study area that excavation for the construction of pylon supports could lead to the disturbance of flow of ground water on a regional level. Supporters of this theory are ready to present this theory as a reason why the transmission line should not be constructed in certain areas. However, as this theory would be difficult to substantiate in the presence of a well-informed scientific panel, MCS is of the opinion that it need not be regarded as an important factor to determine the final alignment.

4.5 Presence of local airstrips

There are a number of unregistered airstrips on farms in the study area. These airstrips are used for crop spraying and other purposes. The alignment should not be placed too close to any of these airstrips, as the cost to construct alternative runways could be high. Cleared strips of land which could be airstrips can in some cases be seen on the satellite images, but as MCS was not in a position to verify these through closer inspection on the ground, they were not indicated on the maps.

4.6 Conclusions

Conclusions were drawn from observations during the field visit, maps, the Scoping Report.

- Extensive Eucalyptus plantations that were planted as windbreaks and woodlots, occur more abundantly in the north eastern section of the study area. Where possible the proposed alignment should be planned in such a way that these plantations are not negatively affected as they play an important role in the farming activities.
- New transmission lines should preferably be erected in close proximity to existing infrastructure such as existing power lines, telephone lines, servitudes, roads, etc.
- The intensity of crop production varies in the area. The fact that the proposed transmission line cuts through the Sand-Vet irrigation scheme should be considered. Irrigated lands have by far the highest value of all land as it can be used to generate much more farm income than dryland cropping.
- Towards the south and the west the area is characterised by the occurrence of regic sandy soils with a lower dry land production potential. Soils of Bothaville are acknowledged as those with the best dry land production potential.
- There is a tendency among farmers to use fewer tractors and implements but with a bigger capacity. The negative effect of the placing of pylon

structures and anchor cables of the transmission lines on the operation and manoeuvrability of the large tractors and wide working implements should be acknowledged. Operating efficiencies and production costs can be affected.

- Local airstrips and farm landing strips are increasingly used for crop spraying due to the efficiency of applying pesticides and fertilisers to their crops. It is a diverse area with high yielding farmlands interspersed by land that with a lower production value.
- There should be a trade-off between the cost of erecting the transmission line and giving up high value agricultural production land.

5 The nature of the potential economic impact

5.1 Introduction

The most important factors that influence the economic impact of the 400 kV transmission line were identified. A further step was to describe the manner in which the transmission line can negatively impact on the study area:

- Decrease in agricultural production potential.
- Decrease in land value.
- Increase in security risk.
- Increase in soil erosion by water and wind.
- Safety risks to agricultural aviation.
- Decrease in agro-tourism potential.
- Decrease in future commercial development potential.

It is important to note that during both the construction phase and the operation of the transmission line negative impacts will be experienced by land owners. This negative impact could possibly start exerting itself only after many years, for example future redevelopment of the farms for other purpose than pure agriculture such as agro-tourism.

5.2 Decrease in agricultural production potential

In the short summary provided in Table 1 an indication is given of the average net farming income of a few typical farming activities of the target area. The net income to accrue from a well-managed agro-tourism venture is also shown.

Table 1 Production potential of various categories of farmland

Activity	Long term average yield	Turnover rand per hectare	Net income rand per hectare
Livestock farming on natural veld	10 hectare per LSU*	400	200**
Livestock farming on natural veld combined with crop residues	4 hectare per LSU	1 000	700**
Dry land maize farming with high yields	4 tons per hectare	4 500	1 500***
Dry land maize farming with average yields	2.5 tons per hectare	2 200	200***
Irrigation farming with maize	12 tons per hectare	10 000	5 500***
Irrigation farming with lucerne	20 tons hay per hectare	10 000	7 000
Irrigated vegetables (onions, pumpkins, carrots) for local market.	40 tons per hectare	50 000	35 000****
Irrigated export fruit	25 tons per hectare	75 000	55 000*****
Well-managed agro-tourism using a farmstead and intensively managed farm assets on small areas	1 000 visitors per year	100 000	40 000*****

Footnotes:

* *LSU = Large Stock Units.*

** *Little difference exists between figures for different types of livestock.*

*** *Maize is the most common crop and figures for other crops are fairly similar.*

**** *Only relatively small areas can be grown under vegetables due to the limited market size.*

***** *Development capital is expected to become more accessible in future and there will be an increase of this type of capital investment in projects.*

Sources: These average figures are industry norms collated by MCS over many years from numerous sources and observations and provide an indication of the environment in which the landowners operate.

5.3 Decrease in land value

In order to form an opinion on the potential impact of the presence of the proposed transmission line on the land value, the value of farmland based on land-use patterns for the target area, was assessed according to general accepted norms. These values can be found daily in the press and information sources dealing with auctions, bank actions and Deeds Offices proceedings. MCS regarded the assessment of the status of the following resources and structures along the transmission line alignment as important:

- High production potential soils.
- Irrigated lands.

- The presence of permanent crops under irrigation and dry land cultivation.
- The presence of greenhouses.
- The presence of other large trees and large structures (grain silos, etc).
- The location of runways used in agriculture, reservoirs and other water works used for irrigation.
- Decrease in agro-tourism potential.
- Decrease in future commercial development potential.

A list compiled by MCS as a guideline that can be used in the assessment of land values with different production regimes is provided in Table 2. These values are based on present market tendencies and should only serve as general guidelines to illustrate relative values.

Table 2 Different land uses, market value and relocation flexibility

Examples of land use	Market value rand per hectare	Flexibility of relocation of activities*
Dry land farming areas		
Hilly grazing land such as in the south	600 to 1 000	9
Land only suitable for grazing	800 to 1 300	9
Swampy land only suitable for grazing	1 500	9
Soils with a low crop production potential	1 500	9
Soils with a high crop production potential	1 800	9
Large trees used as windbreaks, shade and aesthetic improvements	10 000 to 50 000	0
Existing runway used for crop-spraying	10 000 to 80 000	6
Open animal handling facilities	5 000 to 50 000	3 to 9
Mining area with reserves	20 000 to 10 million	0
Planned town development	100 00 to 300 000	1 to 3
Irrigation lands		
• **Annual cropping**		
Land value	6 000	NA
Irrigation infrastructure	9 000	1-3
• **Greenhouses and hail netting**		
Land value	6 000 to 30 000	NA
Irrigation infrastructure	12 000 to 16 000	1 – 4
Long term perennial crops	80 000 to 200 000**	0
• **Open cultivated perennial crops such as olives, peaches, apricots**		
Land value	8 000 to 35 000	NA
Irrigation infrastructure	15 000 to 20 000	1 – 3
Long term perennial crops	80 000 to 200 000***	0

Footnotes:

* *0 = plants or objects cannot be moved without being destroyed or becoming redundant;*
5 = structures or objects can possibly be moved at considerable cost;
9 = no or little cost in relocating farming activities

** *Including present costs of design, materials and installation of main supply, inland underground and above ground systems*

*** *Including cost of land preparation, cost of plant material and establishment costs as well as capitalised pre-production costs until full production.*

5.4 Increase in security risk

Farmer groups in various parts of South Africa have expressed their concerns regarding the increased security risk on farms due to the access strangers might have to their farms. In this study area some farmers have already expressed their unwillingness to host construction camps due to a general

expected increase in crime levels associated with construction activities, according to the information provided in the Scoping Report. After construction, uncertainty about the identity of outsiders who could be or could pose as Eskom workers commonly remains a problem during patrolling and maintenance in many areas, despite Eskom's undertaking to manage access in consultation with farmers. In view of the enormous and persistent farm attack problem, it should be recognised as a real factor to be considered. This perceived safety risk can negatively impact on farmland values.

5.5 Increase in soil erosion by water and wind

Where vegetation is removed to create an open corridor below the planned transmission line, increased soil and wind erosion can occur. The light sandy soils that dominate the soil types of the area are especially prone to erosion and erosion control can be an important cost factor. Where the proposed transmission line cuts through a row of trees acting as a windbreak, it can add to the already huge seasonal wind erosion problem of the area. Should Eskom neglect its responsibility to ensure that erosion is kept under control in the vicinity of the planned transmission line, it could lead to a loss of production or additional costs to farmers. This also applies to the sloping areas near the waterways of the area, even where natural grazing is practiced.

5.6 Safety risks to aviation

It is a well-known fact that pilots find it difficult to observe transmission and distribution lines from the air and collisions with power lines are commonplace. Crop spraying pilots often charge a higher tariff where power lines occur. This can cause increased operational costs to farmers. As some farmers also own their own aircrafts and the risk associated with flying is increased, the construction of a transmission line can have a negative effect on the property value.

The resolution of the satellite images that were used in this study is such that on a 1: 50 000 projection the larger airfields can be identified. The resolution is, however, not sufficient to be used in a search for airstrips for which the co-ordinates are not yet known. Certain features observed from the satellite images used, could indicate the presence of airfields, but these could also merely be open patches of land. Confirmation that they are airstrips in active use can only be done by field visits to every farm. Small airstrips which may be actively used for a period of time may then be neglected for a few years due to a change in crop production patterns or the departing of family members with enthusiasm for flying or a lack of funding.

The Civil Aviation directorate could not provide data on the co-ordinates of local airstrips on farms, as it is not compulsory to register these with the authorities. The co-ordinates of a number of larger airfields were obtained from the Department of Transport's Directorate of Civil Aviation in Pretoria. The localities of these airfields are listed in Table 3. The airfields for the study area that were identified are set out in Table 3.

Table 3 Larger airfields in the study area

Airfield	Surface type	Co-ordinates South	Co-ordinates East	Contact numbers	Licensed Yes/No
Bothaville	Tarmac	27° 22' 00"	26° 38' 00"	Tel 056-514 9200 Fax 056-515-3922	Yes
Bultfontein	Grass	28° 16' 00"	26° 08' 00"	Not available	No
Hoopstad	Gravel	27° 49' 30"	25° 54' 45"	Tel 053-444 1897 Cell 082-559 8399	No
Wesselsbron – Public		27° 51' 20"	26° 22' 30"	Tel 057-899 1818	No
Wesselsbron – Private		27° 48' 47"	26° 29' 36.6"	Fax 057-899 1032 Cell 082-494 0500	No

Sources:
1) Aviation for Southern Africa – Directory, Edition 2003/04 Comair / Cessna. Publisher: Aviation Direct, Tel 011 465-2669 or 011 465-5291.
2) Department of Transport's Directorate of Civil Aviation, 281 Middle Street, New Muckleneuk, Pretoria. The contact persons are Messrs Louis Wood and Koos Pretorius, Tel 012-426 0011 or 012 346-5566.

5.7 Decrease in agro-tourism potential

The strong trend, in especially Western Europe, to convert farms into tourism attractions is gradually gaining ground in South Africa. The success of the wine, biltong, mampoer and ostrich routes, farm holidays, game farms, bush retreats, guest houses, hiking trails, bird hunting, conservancies, camp sites and other attractions in local farming areas attest to the large potential still to be exploited. The construction of transmission lines can have a strong detrimental effect on such developments and should be approached with caution. The fact that the present farm operations do not yet include such developments does not imply that this negative impact potential may be ignored.

5.8 Decrease in future commercial development potential

The construction of a transmission line can exert a negative impact on the suitability of farmland to be utilised in future for redevelopment of the farm into non-farming activities such as the development of security townships, golf courses, airfields for motorised aircraft and gliders and other activities. The areas most often targeted for alternative developments are usually more concentrated close to towns to benefit from the commercial infrastructure, but developments in outlying areas also tend to become popular. Real estate traversed by transmission lines has a lower value than more unspoilt areas.

5.9 Conclusions

- The economic impact of the erection of the transmission line was discussed with reference to the agricultural environment. The point is made that not only will the construction, but also the operation of the transmission line, have a negative impact on the value of farms.
- The transmission line will have an impact on agricultural production. In Table 1 the production potential of various categories of farmland is discussed and income for each category is shown.

- Livestock farming on natural grazing has the lowest income per hectare while irrigation lands and agro-tourism projects provide the highest yields.
- The transmission line will have a negative impact on the land value of properties bisected by it.
- In Table 2 different land uses, market value and relocation flexibility are analysed and values awarded. Certain farming activities can be easily relocated, such as cattle farming. Irrigation infrastructure and green houses are much more difficult to move, thus there is a lower flexibility relocation index value.
- During the past decade there has been an increase in the security risks of farmers and an increase in crime levels associated with construction activities can be expected. Security should be recognised as a real factor to be considered and the perceived risk's influence on farmland value should be borne in mind.
- An increase in soil and wind erosion can occur where vegetation is removed to create an open corridor below a new transmission line. Light sandy soils that dominate the area are especially prone to erosion. Certain control measures can be implemented to minimise the erosion.
- Some safety aviation risks were identified and there are certain cost implications where crop spraying is practised. Some larger airfields could be identified in the study area but the exact location of small airfields on farms is difficult to confirm from satellite images.
- Increase in agro-tourism can be expected in future. The fact that such developments are not yet large-scale undertakings does not imply that the impact of a new transmission line may be ignored. It might also have an impact on future redevelopment of farms for commercial purposes such as security townships, golf courses and game parks.

6 Assessment method used on various alignments

6.1 Introduction

The ideal procedure for the execution of the assessment on different proposed alignments would be to visit each individual farm along the proposed alignments. Time would then have to be spent with the landowners of the entire area to gather as much information as possible on all activities and to assess the potential economic impact of the planned transmission line on the farms. The best alternative adopted was to make extensive use of detailed maps and satellite images with a high resolution. Evaluation methods based on land use patterns and industry norms that are generally applied were compiled.

6.2 Matrix method designed for assessments

A matrix method was designed in order to have a tool available, which can be used to quantify the potential impact of the intervention. The matrix contains the following elements:

- The factors listed in Chapter 4, that should be considered when assessing the economic impact on the vertical axis.
- The nature of the potential impact listed above in Chapter 5 on the horizontal axis.
- Weights allocated to each combination, bearing in mind that the weights can be related to monetary values.

The matrix is summarised in Table 4. The result of the application of this matrix is that, for each farm individually, a picture can be formed of the potential monetary loss to be expected from the construction of the transmission line. The result of this present assessment was to be able to determine the relative strength of the potential economic impact of the respective factors and to use these in a qualitative manner to make recommendations regarding adjustments to the alignments. The objective was not to indicate the amount of compensation that should be expected by each landowner. This could be done, however, if required. Although the

same underlying method is the used to achieve the two objectives, this report concentrates on the end result of the choice of the best alignment and its refinement to further improve the feasibility of its placement.

6.3 Results of the matrix process of assessment

The figures compiled in the matrix method of assessment of the potential impact of the presence of transmission lines indicates the following:

- The importance to locate a new line close to an existing line or other infrastructure should not be underestimated.
- Wherever the subject of agro-tourism, people-based commercial development and aviation is applicable, the presence of transmission lines has a negative impact.
- There is a negative impact on land values.
- The high incidence of crime and the constant threat of trespassers throughout the country are enforcing an increasingly negative perception about the potential effect of construction and maintenance of transmission lines.
- The only real impact, as measured by the immediate impact, is farm production, but farm values do not necessarily reflect production value and other non-production factors can play an important role in farm valuations.

International literature and information gathered from the real estate environment will confirm most of the tendencies indicated in the matrix. If the focus of the investigation is allowed to divert somewhat from agriculture as such, to include tourism and commercial development, then the land values move away from the basis of conventional production potential and become fairly uniform. A valid argument of landowners is that farmland should no longer be evaluated on account of agricultural production potential only, as modern market opportunities for agro-tourism and other services have to be considered too.

Table 4 Matrix of factors involved, nature of potential impact and relative values used in the assessment

	Description of the nature and the degree of the potential economic impact					
Factors to be considered when assessing the potential impact	Decreased agricultural production potential	Decreased Land market value	Increased security risk due to access	Increased soil erosion by water and wind	Increased safety risk to agricultural aviation	Decreased commercial development potential
Presence of plantations	2	3	9	9	1	8
Presence of existing transmission & distribution lines & other prominent infrastructure*	5	9	9	9	9	9
Intensity of crop production:						
• Natural grazing	1	1	1	4	1	8
• Low potential dry land cropping	3	3	5	1	2	8
• High potential dry land cropping	5	5	5	1	3	8
• Irrigation of annual crops	7	6	5	1	5	8
• Irrigation of perennial crops	8	7	5	1	4	8
• Irrigation of tree crops	9	8	5	1	4	8
Future agro- tourism development potential **	9	9	9	7	2	9
Future commercial development potential	9	9	9	1	1	9
Operation of local agricultural airstrips	9	5	7	1	9	1

Footnotes:

Scale of potential impact: 1 = little or no impact; 5 = considerable impact; 9 = large impact.

- *If a new line can be placed next to an existing line, the implications are highly significant and positive due to the parallel effects of existing and new infrastructure.*

** *Future agro- tourism development can be influenced by the unsightliness, fear of possible disease caused by strong electro-magnetic fields and accepted ecological impact, by transmission lines represent a total negative.*

7 Discussion of various proposed alignments

7.1 Introduction

Eskom wishes to construct the transmission line in such a manner as to cause the minimum amount of negative impact on the environment in the broadest terms, while also attempting to keep construction costs low. While observing the potential agricultural economic impact described above, the four given proposed alignments or corridors were evaluated. It was noted that Eskom has made it clear that farmers would be duly compensated for any damage caused to property or loss of value to the farmland or other assets during the construction phase. It should nevertheless be attempted to minimise devaluation of property and production capacity of the farms. The objective of this assessment is to ensure that the alignment be directed to have the lowest impact on all the aspects of the agricultural economy. It should be noted that the discussion of the assessment should be read in conjunction with all the maps collated for the study area.

The information obtained from the maps, satellite images as well as the field visit by MCS personnel confirmed that although certain patterns could be observed regarding the intensity and distribution of dry land and irrigated crop production, the presence of irrigation in some form in all the areas, should be seen as an overriding element. The irrigation occurs in the form of blocks on individual farms or larger blocks spanning a few farms or even irrigated belts. This presence of highly productive irrigation fields makes a clear-cut decision about the possible routing of an alignment through an area with low production intensity very difficult. The possibility of allowing the discernable dry land production potential to determine the decision about the feasibility of alignments can therefore not easily materialise as the value of irrigated crops is of far greater importance than that of dry land crops, regardless of the scale of operations. Irrigation agriculture is also much more easily affected by the construction of a transmission line. The amount of irrigated land that is affected is of major importance, regardless of where it is located. Unfortunately it is dispersed throughout the paths of the possible alignments.

7.2 Evaluation of proposed Alignment 1 and Alignment 4

In the Scoping Report for public comments, it was already motivated that Alignment 1 has a less cumulative impact than Alignments 2 and 3. MCS is of the opinion that the advantages offered by the proximity of the road system and existing transmission and distribution lines, where the ecology and farming activities have already been impacted upon have not been sufficiently exploited.

For practical purposes the study area was divided into five sections from South to North as the sections can be delineated according to definite land-use pattern differences. The following sections have been identified:

- Section 1: Dealesville cultivated area.
- Section 2: Bushveld and predominantly natural grazing belt.
- Section 3: Sand-Vet irrigation and adjacent crop production areas.
- Section 4: Wesselsbron pans bottleneck.
- Section 5: Bothaville-Vierfontein corridor.

7.2.1 Section 1: Dealesville cultivated area

In the far south, just northwest and east of Dealesville, a considerable area under crop farming consisting of irrigation and dryland can be found. This is the area roughly south of the line stretching from 28º25'S 25º50'E to 28º75'S 26º25'E.

- In this area Alignment 1 just misses two large pans on the eastern side. It follows close to the gravel road to Bultfontein, which is a good choice.
- Alignment 2 follows an existing power line, which is a good practical measure.
- Alignment 3 runs due northwest but does not manage to evade all cultivated lands.
- Alignment 4 runs in a northerly direction from Dealesville through predominantly grazing area and misses the huge Anna's pan on its western side.

7.2.2 Section 2: Bushveld and predominantly natural grazing belt

The predominantly natural grazing area north of Section 1, up to a line passing just south of Bultfontein in a west-northwest direction to point 28º00'S 25º50'E.

- Through this section, Alignment 1 still follows close to the road to Bultfontein, which is a good practical approach.
- Alignment 2 follows the dual power line in a more easterly direction. From point 2a where this alignment turns away from the existing power line in a northerly direction, the route into the next section (Section 3) is not recommended, as it runs through a number of pans. The diversion from point 2b to point 2c of Alignment 2 that has already been proposed is more acceptable. From Dealesville up to point 2c represents a longer route than Alignment 1 but is a very good alternative.
- Through this section Alignment 3 follows a route of low economic impact potential through natural grazing.
- The route of Alignment 4 also follows roughly the same route as Alignment 3 through this section. It misses more of the fairly intensively cultivated agricultural land and is therefore a better alignment than Alignment 3.

7.2.3 Section 3: Sand-Vet irrigation and adjacent crop production areas

This is an intensively cultivated area north of Section 2, through the Sand-Vet Irrigation Scheme up to the Wesselsbron Bottleneck. It comprises the broad section up to a line that connects point 27º75'S 26º00'E and point 28º00'S 26º25'E.

- Alignment 1 follows more or less along the north south road from point 2c and north of the Sand-Vet Irrigation Scheme it follows the line of a number of farm borders until it reaches a position west of Wesselsbron. This is a fairly good practical arrangement.
- Through this section, Alignment 2 follows the main route to Wesselsbron, which will have the least impact on farming. From point 2d the route that Alignment 2 takes to point 2e, west of Wesselsbron is a good practical route as it runs along a number of farm borders.

- The route of Alignment 3 northwestwards through this area from point 3b has the disadvantage of running through a disproportionately large area of cultivated farmland to point 3c where it joins Alignment 2. The floodplain is at its widest along the route of this alignment.
- The same criticism that applies to Alignment 3 in this section applies to Alignment 4.

7.2.4 Section 4: Wesselsbron pans bottleneck

Around Wesselsbron a huge number of large pans are located which forms a natural barrier to infrastructure alignments. Section 4 spans the area north of section 3 to a line that connects 27º50'S 26º00'E and 28º00'S 27º00'E.

- From the point where Alignments 1,2 and 3 converge west of Wesselsbron, the route of Alignment 1 follows a straight course in the direction of Vierfontein, regardless of land-use patterns and most farm boundaries, although it follows a line along a few farm boundaries.
- Alignments 2 and 3 follow the same route in a northeasterly direction past Wesselsbron along an existing power line. Alignment 2 could be diverted from point 2d along the existing infrastructure to point almost in a straight line to reconnect at point 2h, northeast of Wesselsbron.
- The route of Alignment 4 cuts through intensively cultivated agricultural land with no pattern of farms borders or existing power lines or any other infrastructure.

7.2.5 Section 5: Bothaville Vierfontein section

This section covers the whole area northwards up to Vierfontein.

- Alignment 1 follows the shortest distance through to Vierfontein. From Balkfontein at point 1c, it follows along an existing power line for some distance, which is commendable.
- Alignment 2 follows existing infrastructure from north of Wesselsbron to a point 2f, south east of Bothaville. From this point however, it follows an arbitrary alignment across a large number intensively cultivated farms to join up with Alignment 1 at point 2g, just west of Vierfontein.

- Alignment 3 cuts through a number of intensively cultivated farms without a discernable pattern and follows a very long distance to Vierfontein.
- Alignment 4 cuts through intensively cultivated agricultural land with no pattern of farm borders or existing power lines or any other infrastructure until point 1c at Balkfontein where it joins up with Alignment 1 to follow existing power lines up to Vierfontein. The alignment along with existing power lines in the northern part of the section is practical.

7.4 Conclusions

Judged by the routes of all the alignments in Sections 1 and 2, Alignment 1 and Alignment 4 should be regarded as the best, if Alignment 1 can be placed along the main road between Dealesville and Bultfontein. If the existing proposed diversion of Alignment 2 from point 2b to point 2c can be incorporated, this part of Alignment 2 can be regarded on par with Alignment 1 and Alignment 4.

If Alignment 1 in Section 3 should follow the existing roads up to the Sand-Vet irrigation scheme, it would avoid a considerable negative economic impact. If Alignment 2 could also be made to follow the road right up to Wesselsbron – this could be regarded as the best route. Both Alignment 3 and Alignment 4 can be expected to have a considerable economic impact because it cuts through intensively cultivated land.

It can be concluded that for Sections 1 and 2, both Alignments 1 and 2 (with its existing proposed diversion) should be regarded as the best. Through Sections 3 and 4, Alignment 2 will have the least negative economic impact as through the southern part of Section 5 where it follows the existing railway line. As it follows existing power lines further north it will have minimum negative economic impact. The route followed northwards from Wesselsbron, by Alignment 3 is both too long and interferes too much with farming activities.

The routes taken by both Alignment 1 and Alignment 4 through the southern part of Section 5, up to Balkfontein (point 1c), can have a considerable negative economic effect on farming activities as it cuts through farmlands.

7.5 Recommendations

After reviewing the following, some alternatives are proposed:

- All possible mooted routes discussed;
- The potential negative economic impacts of different alignments and possible adjustments;
- Observation of the land-use patterns from the satellite images;
- Results from the matrix analysis;
- 1: 50 000 topo-cadastral maps;

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8 Findings

From the available satellite maps and topo-cadastral maps, the proposed modified Alignment 2 (light blue line on attached map) seems to avoid an unduly negative economic impact on agriculture and would represent the least amount of conflict. It also seems to be the most acceptable alignment of those parts of the four already completely investigated. This is based on the observations made during the recent field visits by MCS field personnel as well as the use of the detailed satellite images and the associated maps.

From observations of the existing infrastructure it is clear that the agricultural activities in the vicinity have already been negatively impacted upon. This negative impact can be observed for distances of up to 200m from the railway lines, transmission and distribution lines and roads. The presence of fences, lines of trees, drainage ditches to direct rain water away from roads and service roads that accompany the existing infrastructure are clearly limiting agricultural activities. The envisaged negative impact of the proposed placement of additional transmission lines in this already negatively impacted area will be easily absorbed.

On a micro-geographic level, the maps indicate that a number of minor adjustments would have to be considered to avoid sensitive areas on all the proposed alignments. The high-resolution satellite images of 1: 100 000 as printed out and the 1: 50 000 as used on the computer screen, offer assistance to the planners in making adjustments to the alignment to avoid intensively irrigated lands and other operations susceptible to unnecessarily high economic impacts. The compact disc containing the satellite image data for the study area is attached as part of the reporting procedure.

As a number of conflict areas exist (See the summary of the land valuations in Chapter 5 above) the interpretation of the satellite photographic images have indicated that a number of deviations could be considered: These deviations include centre pivot irrigation systems, large irrigation blocks, a few plantations and other obstacles observable on the 1: 250 000 satellite image

that is available for observation. However, it should be noted that the final refinement would have to be undertaken on a micro-scale.

9 Conclusions

MCS has included all possible factors into the assessment of the potential economic impact of the planned transmission line. In using the most modern techniques, this firm was able to obtain a fair understanding of the factors, which could possibly impact on the agricultural economic potential of the area.

Throughout the assessment MCS has adopted a receptive approach to the interests of the farming community. It is a well-known fact that most dry land farming in South Africa is a marginally profitable and a highly risky undertaking. The economic balances at play in the well being of many farming activities are sensitive to disruption by even seemingly small interventions such as the erection and operation of a 400 KV transmission line. Should any factor cause a disruption of the normal activities of the farming operations be enforced on the area, the result could have long-term negative effects and should be avoided if possible. This also applies to the areas where development is only expected to occur in generations to come.

MCS has also consulted with personnel of Eskom and SEF to ensure that the thought patterns pertaining to the choice of alignments were well understood. It should be noted that MCS observed that both the personnel of SEF and Eskom took the interests of the local communities to heart and made serious efforts to constantly reconsider the alignment of the transmission line in order to achieve the most commendable end result.

Eskom has made it clear that farmers and other stakeholders will be fairly compensated in an attempt to overcome the negative economic impact of the construction of the planned transmission line. Apart from the servitude areas that have to be bought out, the farmers should be compensated for potential loss in revenue and reduction in future development potential.

10 Recommendations

It is recommended that Alignment 2 be modified and accepted as the alignment with the lowest potentially negative economic impact on the communities as a whole. It is proposed that Alignment 2 be diverted from point 2b to 2c (See attached map) and then it could follow the road up to Wesselsbron. From point 2d it is proposed that Alignment 2 be realigned to go straight to point 2h on the eastern side of Wesselsbron. From point 2h to 2f it will follow the existing Alignment 2 route. From 2f to 2g we propose that it follows existing power lines until it reaches Vierfontein.

It is also recommended that the resources made available by MCS in the form of maps, photos, valuation guidelines and other information be optimally utilised to complete any further refinement or adjustment to the micro-alignment that might be needed for the planned transmission line.

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US Geological Survey, Terra Satellite - Astra Images with a resolution of 15 metre pixels were obtained from LP DAAC User Services.

List of abbreviations

ATF	At-the-fence
EMF	Electromagnetic field
LSU	Livestock unit
ROW	Rights-of-way
USPAP	Uniform Standards of Professional Appraisal Practices

Glossary of references

Agro-tourism
Tourism based on the utilisation of assets on farms and farming activities.

Alignment
A description of the exact route along which the proposed transmission line will be placed. The deviation of the route should not be more that 500m to either side.

Assessment
A method using measurable as well as subjective elements to determine, measure and describe the nature and the status of an action or quality. In this study generally accepted values and norms have been used wherever possible to guide the assessment.

At the fence (ATF)
Ttrue market value is a question of highest and best use.

Commercial development
Development of a nature other than that which can be regarded as normal agricultural practices. This may include housing, recreational, small industrial and tourism development as well as provision of services to the larger area.

Corridor
A fairly vague description of the route along which the proposed transmission line will be placed. The deviation of the route can substantial to either side and the function of the corridor is to provide a basis for planning and to conduct an economic assessment of the potential impact on the general area.

Distribution line
An electricity power line used to distribute electricity in a region. Such a line normally carries a current less than 400 kV.

Irrigation area
An area where water is sourced from boreholes or rivers or dams to irrigate crop fields at least once a year. Normally some permanent structures such as pumps, motors and main supply lines are present.

Matrix
A method to systematically weigh up individual elements listed on two or more axis against each other to indicate the interaction between the different elements. The interaction can be depicted in a qualitative or quantitative manner.

Power lines
General description of electricity lines where the nature of the lines cannot be indicated with certainty.

Production potential
A measure of the value that can normally be generated on a parcel of land, utilising the best practices generally available to a farming community.

Relocation flexibility
A measure of the ease with which a structure or farming or other activity can be moved from one site to another as prompted by the intervention created by the construction and operation of a transmission line. The relocation flexibility can normally be expressed in monetary terms, except where total disruption of the functioning of the structure is involved.

Right of way
An expression denoting the status of land alienated by a government agency to render it accessible to the public or government employees or accredited persons.

Transmission line
An electricity power line used to convey electricity across a region without supplying electricity to the region. Such a line normally carries a current in excess of 400 kV.

Appendix A: Satellite image with the various alternatives identified

Legend

Map type:	Terra Astra Satellite Image. Source: LPD DAAC User Services, U.S. Geological Survey.
Resolution:	15 metre pixels size.
Projection:	1: 830 000
Y-axis:	Latitudes
X-axis:	Longitudes
Area covered by map:	Vierfontein and Bothaville in the north east. Bloemhof Dam in the central west. Dealesville in the south west.

Appendix B: Photographs of the study area