DEPARTMENT OF WATER AFFAIRS AND SANITATION

SPECIALIST STUDY

Proposed Development of Foxwood Dam & Associated Infrastructure – Agricultural Impact Assessment

October 2015

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Contents

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1 BACKGROUND

The Department of Water and Sanitation (DWS) is investigating the feasibility of developing a multi-purpose dam on the Koonap River outside of Adelaide in the Eastern Cape. The proposed site is known as the Foxwood Dam site.

Nemai Consulting was appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the proposed project; who in turn appointed INDEX (Pty) Ltd to undertake the Agricultural Impact Assessment.

1.1 LOCATION

The project area is situated in central part of the Eastern Cape, in the Amatole District Municipality and Nxuba Local Municipality. From a southern direction the proposed dam wall site (coordinates 32˚40'30"S, 26˚16'0"E) is accessed via the R344 (off the R63). Adelaide town is located south-east of the proposed dam site.

Figure 1. Locality of the dam

1.2 TERMS OF REFERENCE – SPECIFIC TO STUDY

Provide detail discussion of Key Issues & Triggers that was identified during Scoping Phase.

- I&AP issues –

  - Loss of agricultural land.
  - Viability of remaining farming operations.

- Loss of fertile soil, cultivated areas and grazing land in inundation area.
- Disruptions to farming practices during construction.
- Loss of farming-related infrastructure.

Approach

- Determine agricultural potential in project footprint.
- Determine impacts of project from an agricultural perspective.
- Suggest suitable mitigation measures to address the identified impacts.

The project consists of the components listed below:

Table 1. Components of the project

Project Components	Associated Infrastructure
Foxwood Dam	1. Dam wall 2. Embankment 3. Dam outlet works 4. Access roads (construction and operation) 5. Quarry and earth fill borrow areas 6. Electrical supply 7. Construction camp (temporary) 8. Operator's offices and accommodation (permanent)
Bulk water supply pipeline	1. Pump station 2. Pipeline and associated structures
Gauging Weir	1. Weir and associated instrumentation 2. Access roads (construction and operation) 3. Electrical supply 4. Satellite construction camp
Relocation of Infrastructure	1. Relocate water supply canal 2. Relocate R344 3. Relocate MR00639 4. Relocate Telkom telephone line 5. Relocate Eskom power line

The alternatives to the project components are listed in **Table 2**. A description of the alternatives are provided in the Scoping Report.

Table 2. Alternatives that should be discussed

Component	Alternatives
Gauging Weir	Option 1
	Option 2
Power Line Deviation	Alignment A
	Alignment B

2 LAND USE

The land use for the farming unit as well as the portion that will be inundated are provided below.

- The delineation of the land uses were done on GIS from satellite images dated 2015;
- A buffer area of 20 metres on either side of electricity, Telkom, roads and canals was used to calculate areas of impact;
- Temporary impacts are construction related items that will be repaired and rehabilitated once the work had been completed;
- Field crops are land recently irrigated and probably planted to fodder;
- Irrigable and arable land could potentially be irrigated or planted to crops if the season is favourable;
- Wetlands are areas with clear riparian vegetation;
- Horticulture are orchards.

2.1 LAND OWNERSHIP

Six farming units will be influenced by the proposed development (refer to Table 3).

Table 3. Ownership of affected land

Farm	Owner	Size
Farm Unit 1		
• Elands Drift 86 Ptn 3 Fort Beaufort R	Bennet, Neill Lennox	18.3
• Elands Drift 86 Ptn 5 Fort Beaufort D	Bennet, Neill Lennox	14.3
• Elands Drift 86 Ptn 6 Fort Beaufort D	Bennet, Neill Lennox	4.0
• Elands Drift 86 Ptn 7 Fort Beaufort D	Bennet, Neill Lennox	5.7
• Farm 111 Fort Beaufort RD	Bennet, Neill Lennox	81.8
• Mancasana 126 Bedford RD	Bennet, Neill Lennox	205.5
• Mancasana 126 Ptn 1 Bedford RD	Bennet, Neill Lennox	33.5
• Mancasana 126 Ptn 2 Bedford RD	Bennet, Neill Lennox	322.1
• Mancasana 126 Ptn 3 Bedford RD	Bennet, Neill Lennox	2.6
• Rooidam 86 Fort Beaufort RD	Bennet, Neill Lennox	34.8
• Farhers Poort 116 Bedford RD	Bennet, Peter John	712.9

Farm	Owner	Size
Farm Unit 2		
• Olifant Drift 87 Fort Beaufort RD	Bosch	125.4
Farm Unit 3		
• Elands Drift 86 Ptn 1 Fort Beaufort RD	Gradwell, David Elliot	466.5
Farm Unit 4		
• Eilands Hoek 85 Fort Beaufort RD	Keevy, John Martin	708.3
• Olifant Drift 87 Ptn 2Fort Beaufort RD	Keevy, Neville William	172.2
Farm Unit 5		
• Leeuw Hoek 129 Bedford RD	Knox, Anne Mari	244.2
• Leeuw Hoek Re/2/129 Bedford RD	Knox, Anne Mari	125.4
Farm Unit 6		
• Elands Drift 86 Ptn 2 Fort Beaufort RD	Moolman, Antonie Michael	250.9

Farming units are as follows:

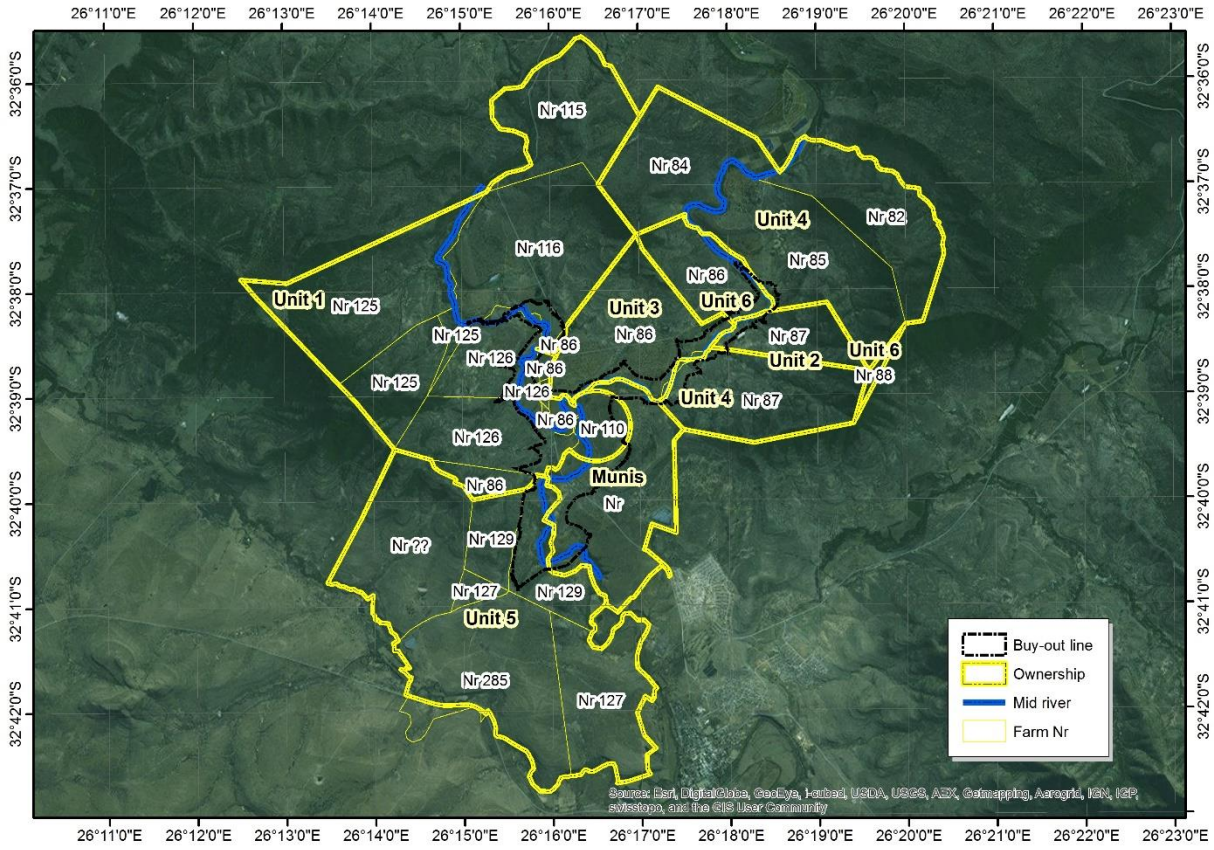


Figure 2. Farming units on the affected farms

2.2 LAND USE OF AFFECTED FARMING UNITS

The farmers practice a mixed farming system that consists of animals with some lands planted to fodder and other crops to augment the grazing. Units 4 and 6 also have orchards.

Arable lands seems to be planted only when there is sufficient rain.

The land use of the farms is indicated in Table 44 and Figure 3.

Although the dam will only affect relative small portion of the farms, it inundates the fertile alluvium along the river banks, and will therefore have a significant financial impact.

Table 4. Land use on the total farming unit

Unit	Field crops	Grazing	Horticulture	Irrigable/Arable	Total farm unit
Unit 1	37,6	2 536,4		66,1	**2 640,1**
Unit 2		179,1		7,1	**186,2**
Unit 3		448,3		25,4	**473,6**
Unit 4	11,2	1 836,7	38,6		**1 886,5**
Unit 5	10,4	1 819,2		21,9	**1 851,4**
Unit 6	2,2	223,9	17,8	3,7	**247,6**
Municipal		558,5			**558,5**
Total	**61,2**	**7 602,0**	**56,4**	**124,1**	**7 843,9**

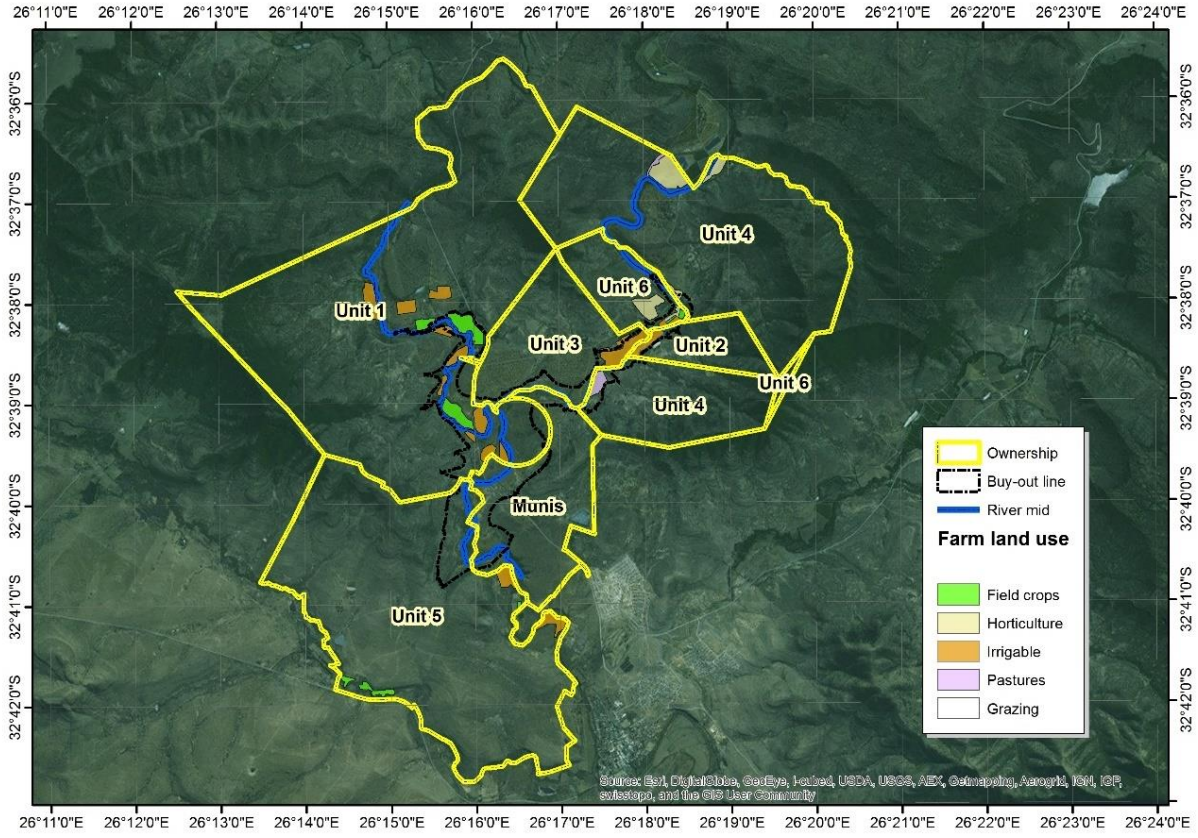


Figure 3. Land use on the affected farms

2.3 LAND USE WITHIN THE BUY-OUT LINE

The land use within the impounded area within the buy-out line is as follows:

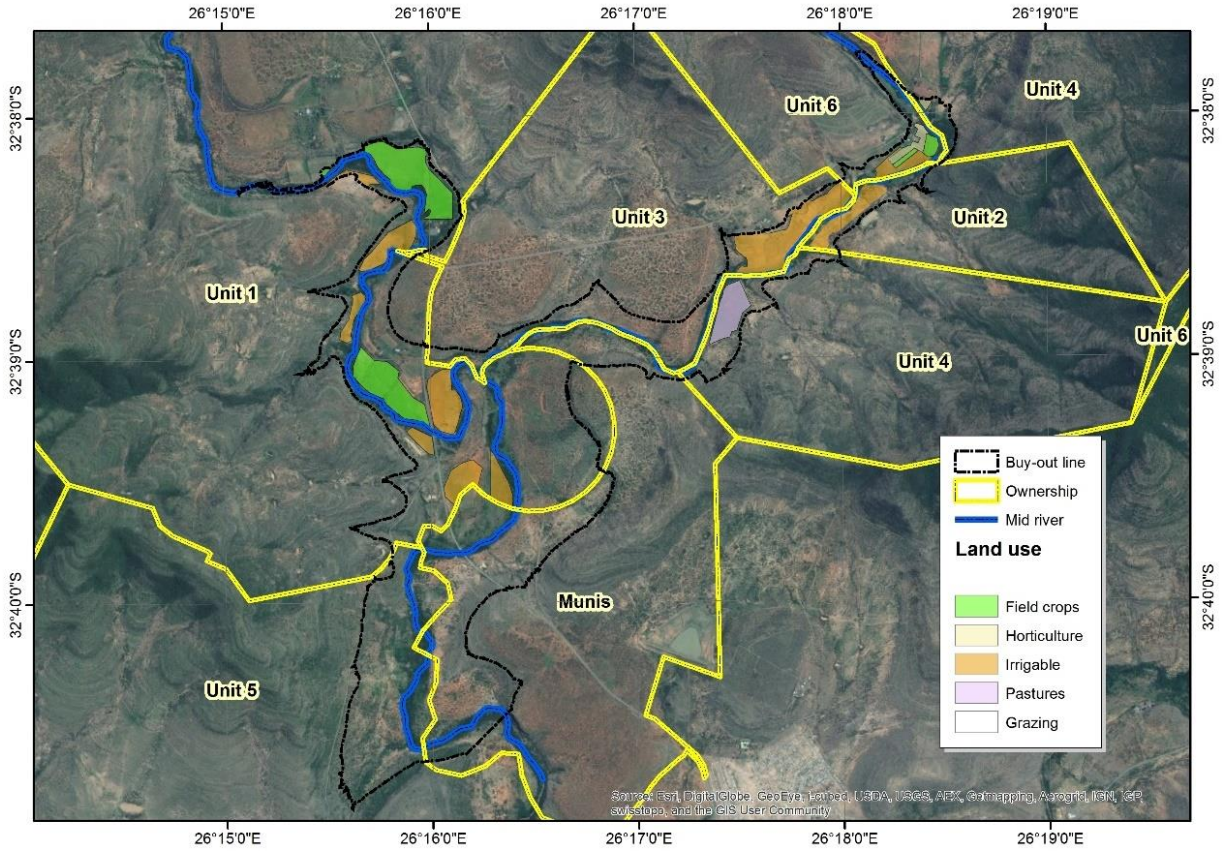


Figure 4. Land use of the land portions directly affected by the dam's construction

A distinction was made between dry lands that are potentially arable and those that were recently planted.

Table 5. Land uses within the impounded portion of the farm

Owner	Field crops	Grazing	Horticulture	Irrigable/arable	Pastures	Total
Unit 1	31,96	205,99		33,02		**270,97**
Unit 2		11,09		7,10		**18,20**
Unit 3		47,67		22,47		**70,14**
Unit 4		30,06	0,68		7,93	**38,67**
Unit 5		97,30				**97,30**
Unit 6	2,24	13,90	2,56	3,69		**22,39**
Municipal		148,19				**148,19**
Total	**34,21**	**554,20**	**3,24**	**66,28**	**7,93**	**665,85**

A total of 455 hectare will be inundated and lost for farming if the dam is built. The land within the buy-out line is 665,9 hectares. In addition the farmers will also loose irrigation infrastructure like pumps and water supply lines as well as a strip of land above the high water mark that is likely become wet and where riparian vegetation will develop. Land in the buy-out line will be used to calculate the financial impact.

3 AGRICULTURAL POTENTIAL

3.1 CLIMATE

The site is located south of the great escarpment that has cold winters and hot summers. The average temperature In July is 5 to 7 ^{o}C and 29 ^{o}C in summer. Rainfall is around 400mm per year.

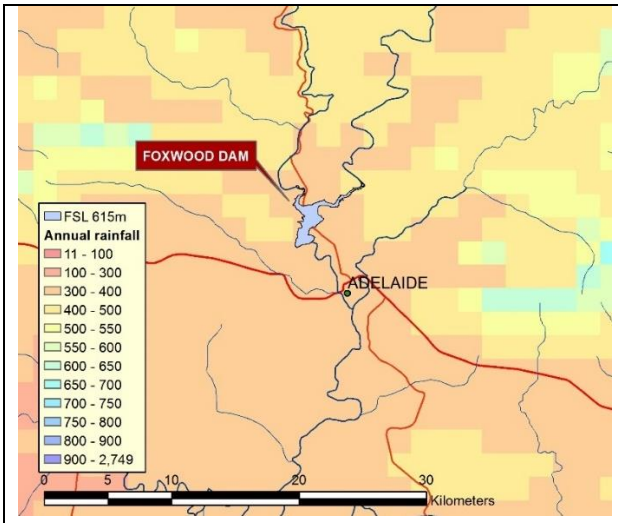


Figure 5. Average annual rainfall

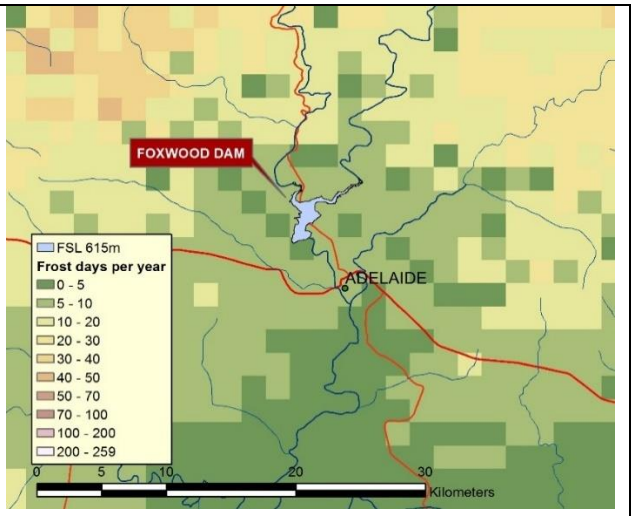


Figure 6. Number of days per year with frost

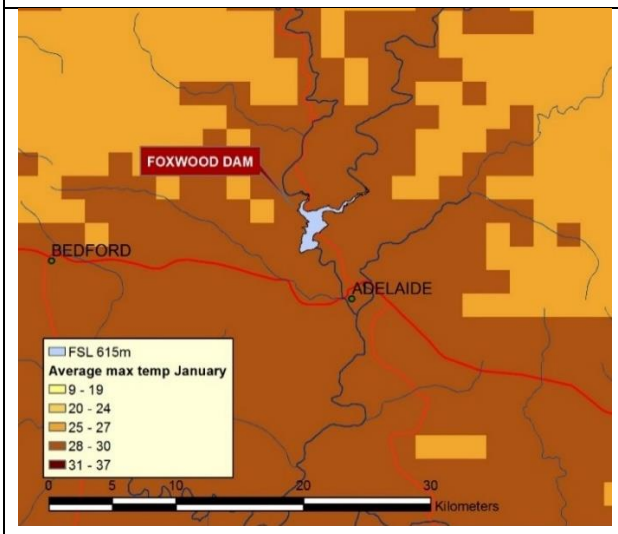


Figure 7. Average maximum temp in January

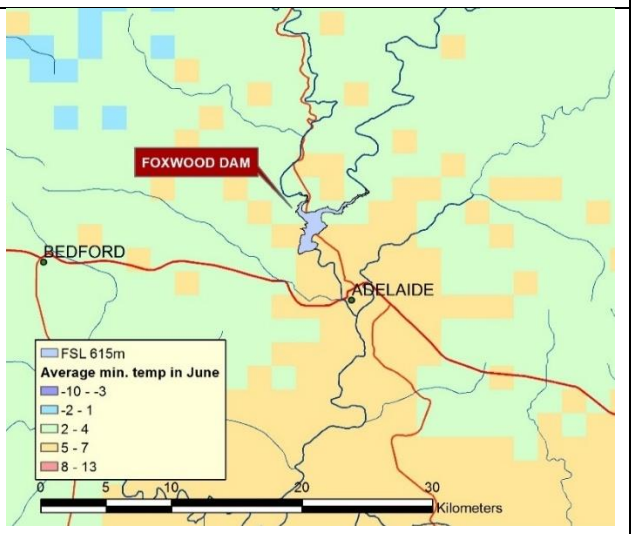


Figure 8. Average minimum temp in June

The rainfall statistics for the area is indicated below:

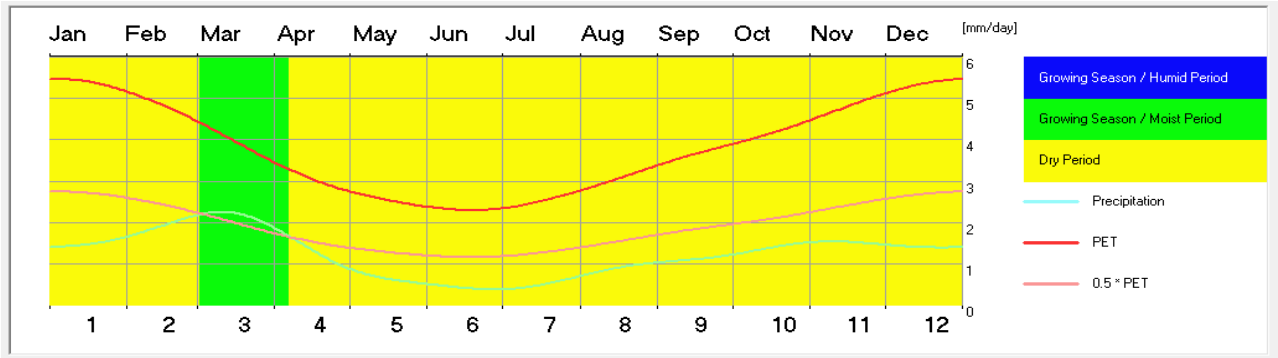
Annual Cycles of Derived Variables

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
Ground Frost Frequency [%]	0	0	0	0	2	10	10	7	1	0	0	0	3
Effective Rain [mm]	43	46	65	32	19	13	15	28	29	39	44	39	413
Effective Rain Ratio [%]	93	92	88	95	97	98	98	95	95	93	92	93	93
Rainy Days	5	6	9	5	3	2	3	5	5	6	6	5	60
Solid Precipitation Ratio [%]	0	0	0	0	1	1	1	1	0	0	0	0	0

Adelaide is in an arid hot area where commercial dryland cropping is not feasible. All cropping is dependent of irrigation.

3.2 CLIMATOGRAM

When the rainfall is plotted against the temperature at a ratio of 1:3, the resulting graph indicates the growing season. The climate is harsh with only a very short period where there is sufficient moisture to sustain normal plant growth: the month of March and the first week of April. The rest of the year is arid.



3.3 VEGETATION

3.3.1 Grazing capacity

The grazing capacity of natural veld, according to the Department of Agriculture, is estimated at 6 hectares per LSU for the northern portion and 7,5 for south of the confluence of the Koonap and Mankazane Rivers. However, the very short growing season will require of the farmers to produce fodder for the lean periods.

3.4 SOIL

The soil derived mainly from mudstone of the Adelaide Formations. Dolerite intrusions occur in the northern portion of the site.

3.4.1 Soil types

Shale and mudstone, especially in the more arid regions produce shallow rocky soils called Lithosols. The products of the weathering process is then deposited on the foot slopes of the landscape or in the case of material transported by the rivers, deposited as alluvial soils on the floodplains. The latter are the arable soils that will be inundated.

Three soil units, largely based on terrain geomorphology were delineated, i.e., Lithosols, alluvium and wetlands.

The soil types associated with each group are as follows:

1) Lithosols: Mispah and Glenrosa.
2) Alluvium: Dundee, Oakleaf, Sterkspruit, Valsrivier, Sepane, etc.
3) Wetlands: Portions with riparian vegetation

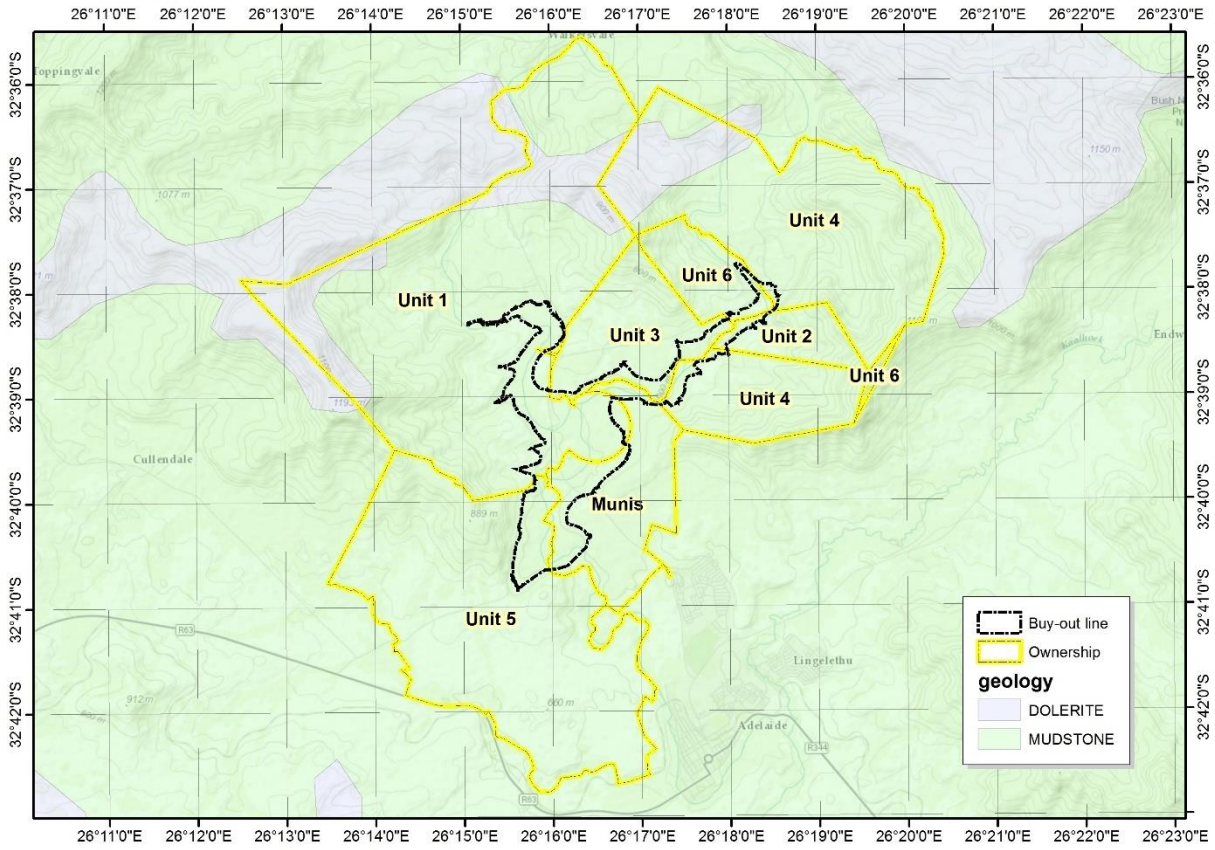


Figure 9. General geology of the area

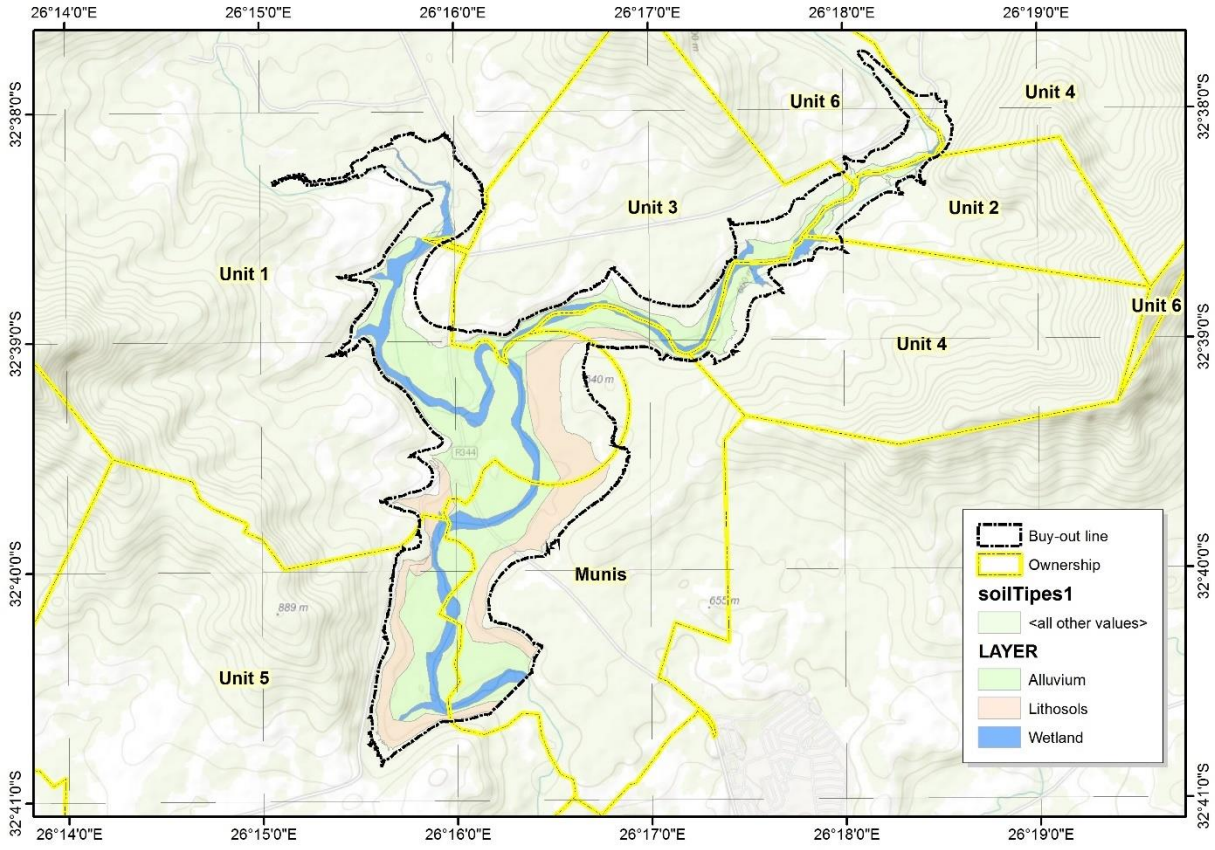


Figure 10. Soil types in the inundated land

3.4.2 Land use potential

Agricultural land is considered to be of high potential if it may be cultivated in terms of Part 1 of the regulations of Conservation of Agricultural Resources Act 43 of 1983, and is:

(a) Under permanent irrigation, or

(b) Can be classified into one of the soil forms and families, where applicable, as listed in Report Number GW/A/2002/21

None were listed in the report; therefore, only land under permanent irrigation is considered as high potential.

3.4.3 General soil potential

Soil potential describes the arability of land; it does not regard available irrigation water and areas where cultivation of specialist crops is possible.

Table 6. Soil potential rating of land in the impounded area

Potential	Map units	Area (ha)
High	-	0
Low	Alluvium, but potentially arable	256,0
Very Low	Wetlands, Lithosols	198,7
Grand Total		**454,7**

Notably, however, is that some of the alluvium along the river is irrigated from farm dams or boreholes and that some land is also planted after rains to produce green feed for animals during parts of the year when additional fodder is required.

3.4.4 Analysis of land for different land uses

Land use patterns more often than not, follow the situation experienced on the farm rather than land use potential. Shallow and moderate potential land that is not economically viable for cash crop production is sometimes cultivated and planted to maize or other crops because of the contribution it can make in the total fodder flow where cattle and crop production takes place in a mixed farming unit. In addition, where irrigation water is available, it changes marginal land to high potential.

The potential of a specific crop can also change with market price fluctuations. Furthermore, the financial ability of the farmer changes over time and even seasonally; influencing the land use in general. It may also be altered seasonally or even be abandoned until financial conditions changes or return to normal.

The following analysis is done for various enterprises from a natural resource perspective, in other words, purely based the climate, soil properties and water availability, and will apply to the portions that are already under cultivation.

3.5 WATER

3.5.1 Groundwater

Adelaide Formations are not aquifers with high sustainable yields, wells on the mudstone in general yield sufficient water for household use and for animal watering. According the Database of the Department of Water Affairs, the water quality of groundwater in the area is fair, the conductivity is between 70 and 150 mS/m.

3.5.2 Runoff water

There are two rivers that flows through the farms, the Mankazane and the Koonap Rivers. Runoff in the Koonap River is highly variable from year to year and also exhibits strong seasonal variability. This is a reflection of the climatic conditions in the project area. There are a number of dams in the smaller catchments within the different farms that augments water from the Mankazane and the Koonap Rivers and from boreholes.

Historically water is abstracted from both the rivers and distributed through furrows to lands where it is used for irrigation. The present practice is also to pump water directly from the river or from weirs constructed in the rivers.

Water rights will ultimately determine the amount of water that is irrigated.

Water rights are as follows:

- Farm unit 1: no rights
- Farm unit 2: unknown
- Farm unit 3: unknown
- Farm unit 4: unknown
- Farm unit 5: has rights but size is unconfirmed
- Farm unit 6: 25 hectares
- Municipality: unknown

4 INCOME POTENTIAL FROM FARMING

The income from farming will be based on the farm potential and not necessarily from the present farming activities (although this will be taken into consideration). Water rights will also be assumed where it is unknown. The animal numbers are based on the long term carrying capacity of the farming unit, accepting that a measure of lands will be cultivates to support the fodder requirements of the farm.

The gross margins for enterprises on which the feasibility is based, are as follows:

4.1.1 Cash crops

For the purposes of this study the average gross margin of maize and soya will be used for financial impacts.

The site visits found that these two crops are the most widely planted. Their stover are also used as fodder during winter. This contribution, however, was not included in income projections. The projected gross margins are as follows:

Table 7. Gross margins of Soya and maize

	Unit	Soya	Maize	average
Yield	t/ha	3.2	12	
Nett Farm Price	R/ton	5 039	1 679	3 359
Gross Income	**R/ha**	**16 125**	**20 148**	**18 137**
PRE HARVEST COST	**R/ha**	**5 418**	**7 942**	**6 680**
Seed	R/ha	754	1 395	1 075
Fertilizer	R/ha	63	2 285	1 174
Lime	R/ha	224	224	224
Herbicides	R/ha	457	483	470
Pesticides & Fungicides	R/ha	155	446	300.5
Crop Insurance	R/ha	1 109	302	705.5
Fuel	R/ha	431	451	441
Repairs & Maintenance	R/ha	361	361	361
Interest on Working Capital	R/ha	193	313	253
Irrigation	R/ha	1200	1200	1200
Harvesting Costs	R/ha	298	309	303.5
Labour costs	R/ha	173	173	173
Gross margin	**R/ha**	**10 707**	**12 206**	**11 457**

4.1.2 Livestock

A commercial / stud system was used as basis to calculate the income from cattle production. It was assumed that the herd will consist of 250 large livestock and from this an average income per livestock unit was calculated. The projected gross margin is as follows:

Table 8. Gross margin calculation of cattle production

	Units	Price	Year 1	Year 2	Year 3	Average
Livestock Units (LSU)	250					
Cattle and calves	325					
Breeding cattle	195					
Cow weight	450					
Weaning weight	225					
Progeny (90%, 10% cull)	176					
Heifers (90% stud, 10% cull)	79	15 000	1 184 625	1 184 625	1 184 625	**1 184 625**
Bulls (50% stud, 50% cull)	44	25 000	1 096 875	1 096 875	1 096 875	**1 096 875**
Cull	52	20	232 976	232 976	232 976	**2 32976**
INCOME			2 514 476	2 514 476	2 514 476	**1 944 101**
Per LSU			10 058	10 058	10 058	**7 776**
Expenses						**2 614**
Margin						**5 162**

4.1.3 Orchards

Citrus and avocados are planted.

4.1.4 Supplemental fodder for cattle

Some luserne was planted under irrigation to supply protein to cattle during winter. Kikuyu pastures were planted next to the rivers to provide green fodder.

4.1.4.1 Summary of gross margins

The following margins will be used to calculate income.

Table 9. Gross margins of some enterprises

Enterprise	Unit	Income	Expenses	Gross margin
Beef cattle	LSU	R5 162	R2 614	**R5 162**
Crops under irrigation (average)	Ha	R18 147	R6 507	**R11 457**
Lucerne	Ha	R18 147	R6 507	**R11 457**
Orchards	Ha	R150 181	R65284	**R84 897**

5 IMPACT

5.1 LOSS OF AGRICULTURAL LAND

Approximately 998ha of agricultural land will be permanent influenced by the construction of the dam.

5.1.1 Permanent impact

Table 10. Agricultural land that will be permanently lost due to construction of the dam

Land use	Dam area	Relocate MRS 639	Relocate R344	West access 1	West access 2	Borrow areas	Canal diversion
Farm unit 1							
Field crops	31,9	1,1					
Grazing	206,0	10,6	0,3			90,4	
Arable	33,0						
Farm unit 2							
Grazing	11,1		1,4				1,0
Arable	7,1		1,1				0,4
Farm unit 3							
Grazing	47,7	0,3	11,5			27,0	
Arable	22,5						
Farm unit 4							
Grazing	30,1		6,4				4,0
Pastures	0,7						
Horticulture	7,9						
Farm unit 5							
Grazing	97,3	0,5		4,0	4,0		
Farm unit 6							
Grazing	2,2		2,4				
Horticulture	13,9						
Field crops	2,6						0,2
Arable	3,9						
Municipal							
Grazing	148,2		10,7	1,0	1,0		0,7
TOTAL	**665,9**	**12,4**	**33,8**	**5,0**	**5,0**	**117,4**	**6,3**

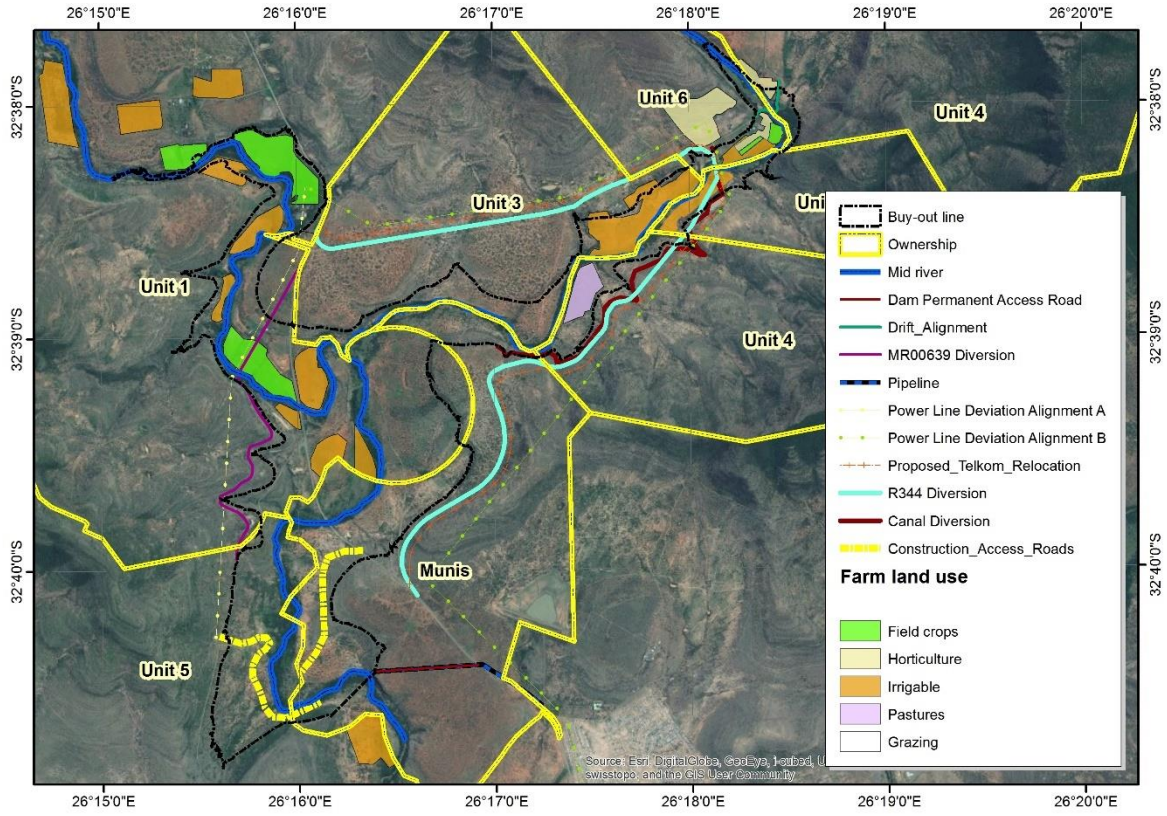


Figure 11. Infrastructure that will impact on farming

Table 11. High potential and arable land that will be lost due to construction of the dam

Owner	Land use	Dam area	Relocate MRS 639	Relocate R344	Access 1	Access 2	Borrow areas	Canal diversion	TOTAL
Unit 1	Field crops	21,4	1,1						**22,5**
Unit 1	Arable	31,5							**31,5**
Unit 2	Arable	7		1,1				0,4	**8,5**
Unit 3	Arable	19,9							**19,9**
Unit 4	Pastures	7,9							**7,9**
Unit 4	Horticulture	1,3							**1,3**
Unit 6	Horticulture	11,3							**11,3**
Unit 6	Field crops	2,2						0,2	**2,4**
Unit 6	Arable	3,5							**3,5**
TOTAL		**106,0**	**1,1**	**1,18**	**0**	**0**	**0**	**0,6**	**108,8**

5.1.2 Temporary impact

Some activities, like relocating power lines and temporary access roads will be temporary by nature and will only last as long as construction lasts and the period for the soil to recover. The following activities fall into this class:

Table 12. Activities that will impact only during construction (short term impacts)

Owner	Land use	Relocate Telkom	Pipeline	Relocate Power A	Relocate Power B	Construction access	TOTAL
Bennet	Field crops			1.7	0.6		**2.3**
Bennet	Grazing			10.4	0.4		**10.8**
Bosch	Grazing	2.1			2.2		**4.3**
Bosch	Arable	0.5			0.5		**1.0**
Gradwell	Grazing	10.4		0.4	9.8		**20.6**
Keevy	Grazing	6.6			6.4		**13.0**
Knox	Grazing			2.9	1.5	5.2	**9.6**
Moolman	Grazing	0.3			3.1		**3.4**
Moolman	Arable	3.3					**3.3**
Municipal	Grazing	10.2	5.9		11.2	6.2	**33.5**
TOTAL		**33.4**	**5.9**	**15.4**	**35.7**	**11.4**	**101.8**

5.1.3 Financial impact

The financial impact is calculated on the enterprise income and does not include capital redemption, financing of inputs, overhead costs or entrepreneur's salary.

Table 13. Financial impact of the development on the local farmers

Owner	Total farm income	Permanent income lost	% of permanent income lost	Temporary income loss
Farm unit 1	R2 300 875	R604 405	26.3	R33 384
Farm unit 2	R132 070	R9 932	7.5	R3 141
Farm unit 3	R330 552	R63 788	19.3	R15 265
Farm unit 4	R4 631 805	R700 545	15.1	R9 631
Farm unit 5	R1 460 188	R78 027	5.3	R7 042
Farm unit 6	R1 701 563	R1 230 892	72.3	R2 478
Municipal	R411 889	R109 287	26.5	R24 667
Total	**R10 968 943**	**R2 796 875**	**25.5**	**R95 608**

From the above, it is clear that the income of 3 of farming units 1, 3 and 6, as well as the municipality will be severely affected. The permanent loss of income from farming is estimated as R2,8 million per year and R95 608 per year for the period that construction takes place.

5.2 LOSS OF FARMING-RELATED INFRASTRUCTURE

Fourteen dwellings, stores or sheds, 4 irrigation canals, 17 irrigable lands some of which have irrigation distribution lines, 2 pump stations and 6 farm dams will be influenced by the construction. Details are below. The items were identified from satellite images and must be ratified and valued by a sworn valuator.

Table 14. Farm infrastructure that will be lost with construction of the dam

Row Labels	Municipal	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Total
Building		3				3	1	**7**
Canal	1				2		1	**4**
Dam			1					**1**
Farm dam	1	4				1		**6**
House		4						**4**
Irrigable	1	9	1	2	1	2	1	**17**
Irrigation					1		1	**2**
Labour house		1			1			**2**
Outbuildings		2						**2**
Pump station					1		1	**2**
Shed		1						**1**
Tennis courts		1						**1**
Total	**3**	**25**	**2**	**2**	**6**	**6**	**5**	**49**

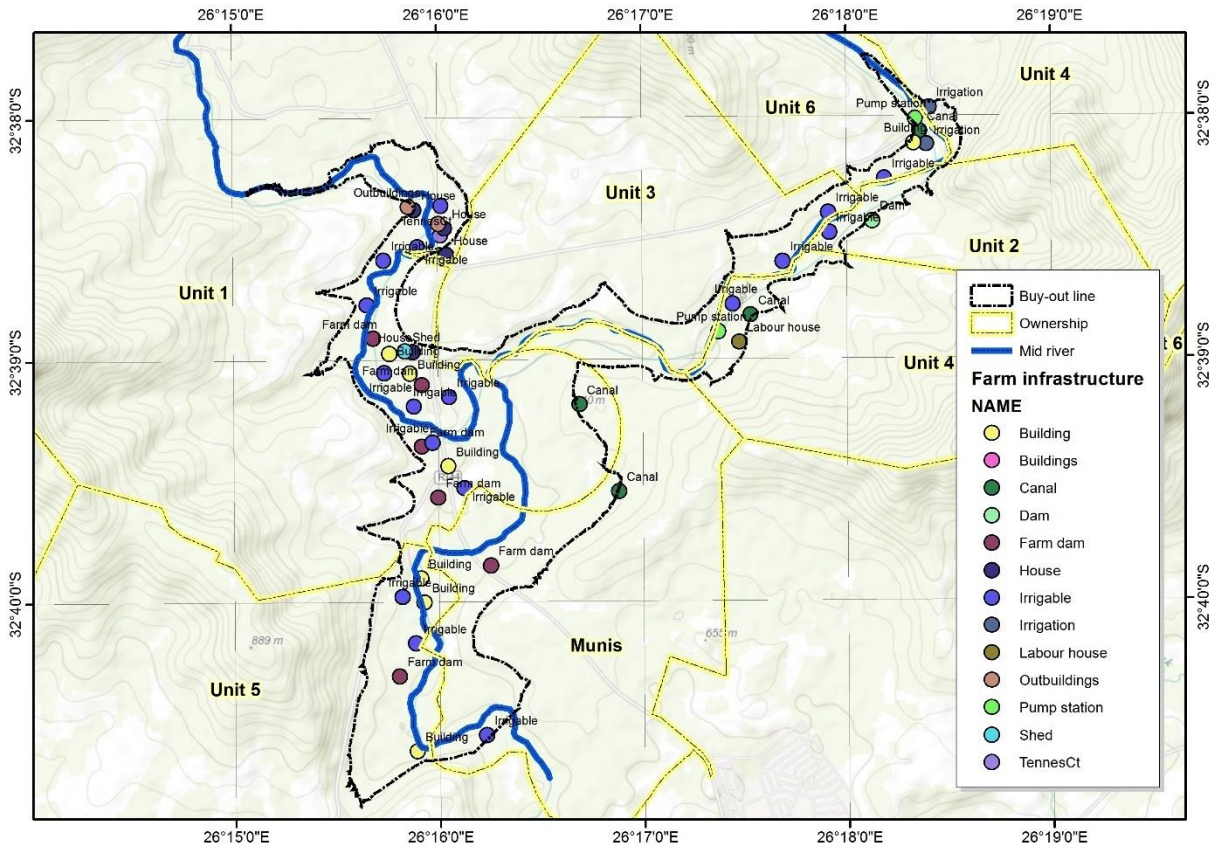


Figure 12. Farm infrastructure

5.3 BORROW PITS AND QUARRIES

Seven borrow pits or quarries have been proposed to serve the construction. Only two, one on Farm unit 1 and one on Farm unit 3 property, falls outside the boundary of the dam high water level. These two will have an impact on farming. The others will not influence agriculture once the land is submerged.

Quarry area on Farm Unit 1 is 90 ha that is now used for grazing, and BP C3, which is on Unit 3, also used as grazing, is 27 hectares. These figures were included in the financial calculation in Chapter 0.

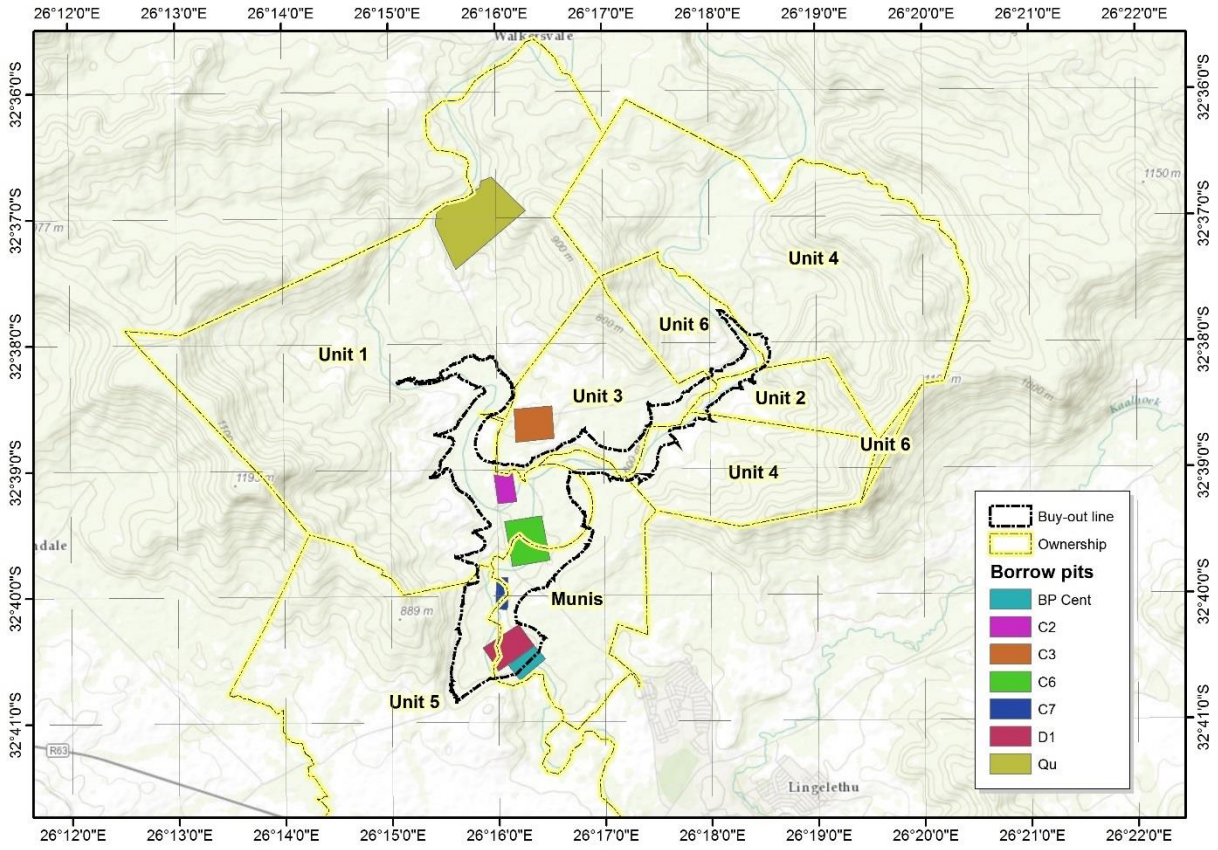


Figure 13. Locations of the quarry and borrow pits

5.4 WEIR POSITION

The positions of the proposed gauging weirs are indicated below. From a farming perspective there is no preferred location.

Figure 14. Positions of Alternative gauging weirs

The two options are located within the riparian zone that has no agricultural value.

5.5 DISRUPTIONS TO FARMING PRACTICES DURING CONSTRUCTION

Major disruptions is the faring operations during construction include the following:

1) Access to the farms are more difficult by diversions of roads and construction vehicles;
2) The farmers are largely dependent on fodder production that takes place on the alluvium along the river. This is also where abstraction of water for irrigation takes place. It will take time to relocate the irrigation related infrastructure in order to continue with the existing operations. This is especially true in the case of Farm Unit 4 and 6.
3) The farmers will have to investigate alternative sources of fodder for livestock. Because the alluvium will be submerged, it will unfortunately require off-farm production or purchases.
4) Farm Units 1 and 6 will lose much of the farm buildings, including most or all of the houses. This will cause major diversion of effort and time for it to be re-established.
5) In order for the pipelines and overhead cables to be constructed, portions of the fields will not be accessible or production for the construction period will cease.

5.6 VIEW OF THE FARM OWNERS

The farmers were contacted on 15 October 2015 and had the following comments:

Table 15. View of farm owners

Farm owner / Farm Unit	Irrigation rights	Land use	Comment
Keevy			Not available
Moolman (FU6)	25ha from river. Irrigation also takes place from boreholes.	Citrus Avocados (13,5ha) Kikuyu Lucerne Grazing	Farms with cattle. 5ha of lucerne and citrus will be submerged. This farm also supplies fodder to father's farm upstream. Will lose house sheds, 3 boreholes and irrigation supply lines. It is the farmer's view that the farm will not be viable if the land is lost.
Bennet (FU1)	No water rights	Cattle farming	500 livestock. Two labour houses, furrows and boreholes will be lost.
Bosch (FU2)			Could not be contacted
Knox (FU4)	Has irrigation rights	Cattle farming	Farms with cattle, goats and sheep. About 200ha will be inundated. Irrigation rights lost above the dam should be replaced below the wall.
Gradwell (FU3)		Cattle farming	Not available
Municipality		Cattle farming	Not available

5.7 VIABILITY OF REMAINING FARMING OPERATIONS

The following should be seen as a theoretical exercise that looks at the development potential of each property. More input and discussion with the farmers is essential to fully assess the viability of the individual farming units.

This discussion will, however, provide some views on the general feasibility of the farming units and the impact that the development will have on their production potential.

The analysis will only consider the land that is permanently lost and is based on the assumptions made earlier in the report.

5.7.1 Farm Unit 1

The estimated farming income is R2,3 million and the loss of income due to construction of the dam, R604 405. It is a loss of 26,3% of the farming income.

It is the view of Index that the farm will remain viable, depending on the overhead cost, like repayment of loans for infrastructure and other debt is not too high.

Table 16. Viability of Farming unit 1 Bennet

Owner	Area		Income
Total farm	2 536		2 300 875
Total lost	369		604 405
Dam and buffer	*266*		*517 389*
Infrastructure	*102*		*87 016*
% income lost			26,3
Remaining income			**1 696 470**

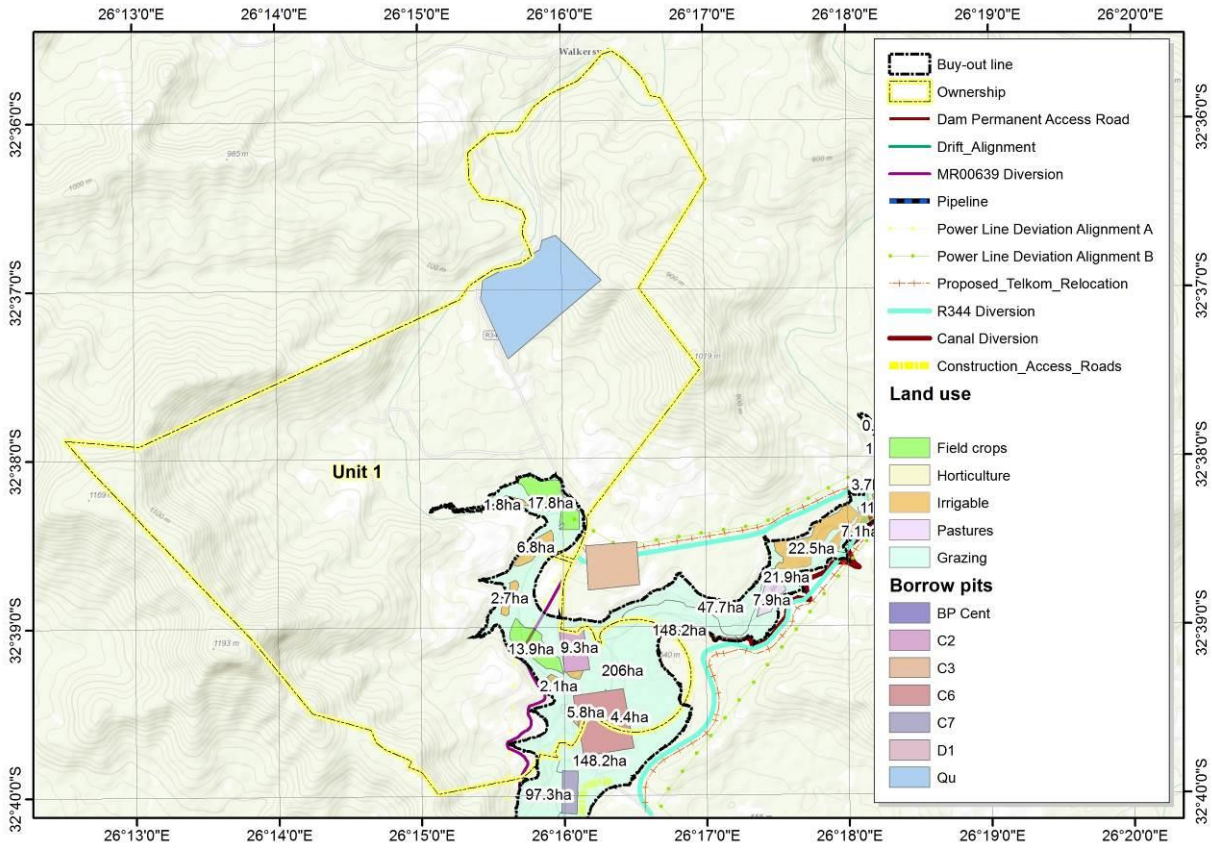


Figure 15. Land use of Farm Unit 1

5.7.2 Farm unit 2

The estimated farming income is R132 070 and the loss of income due to construction of the dam, R9 932. It is a loss of 7,5% of the farming income.

It is the view of Index that the farm is not viable in its present form and is even worst of after construction.

Table 17. Viability of Farm Unit 2

Owner	Area		Income
Total farm	186		132 070
Total lost	26		9 932
Dam and buffer	*22*		*8 185*
infra-structure	*4*		*1 746*
% income lost			7,5
Remaining income			**122 138**

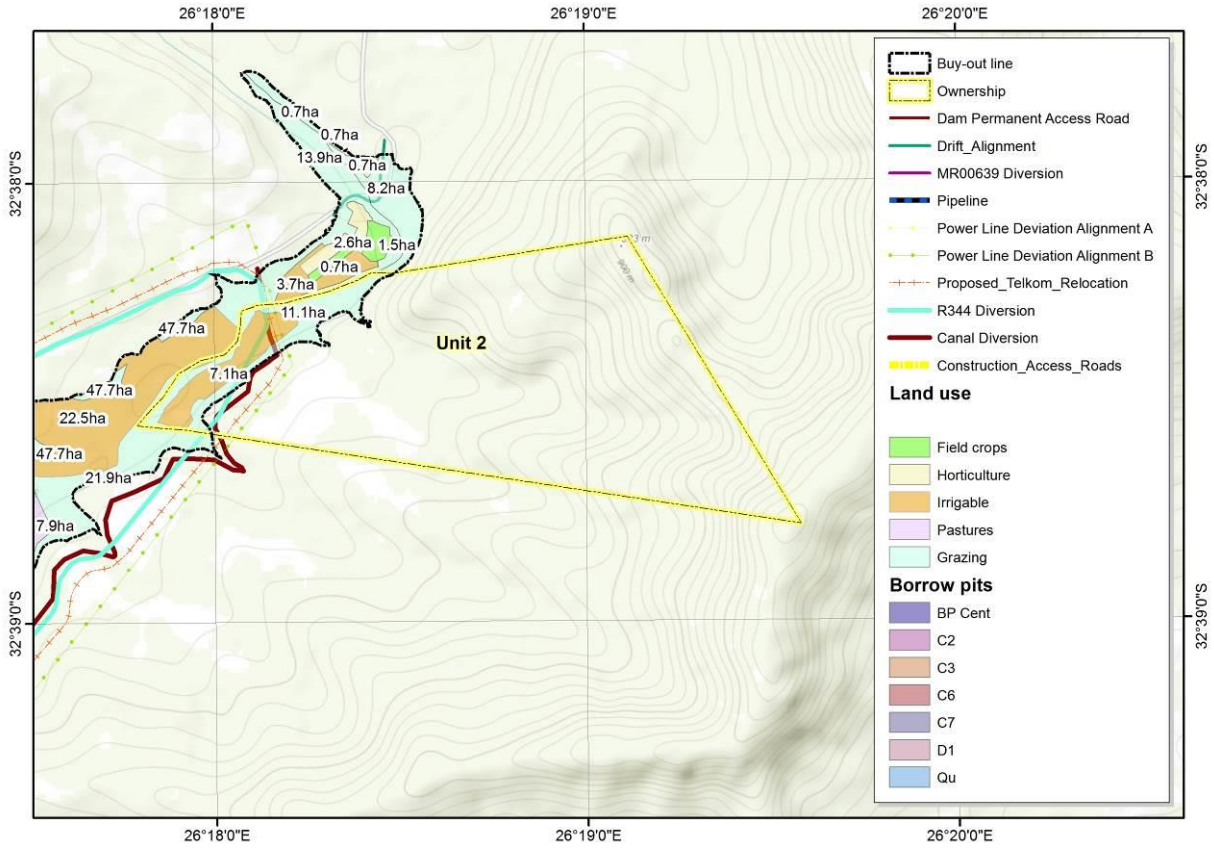


Figure 16. Land use of Farm Unit 2

5.7.3 Farm Unit 3

The estimated farming income is R330 552 and the loss of income due to construction of the dam, R63 788. It is a loss of 19,3% of the farming income.

It is the view of Index that the farm is not viable in its present form and is even worse off after construction.

Table 18. Viability of Farm Unit 3

Owner	Area		Income
Total farm	474		330 552
Total lost	119		63 788
Dam and buffer	*80*		*35 175*
infra-structure	*39*		*28 612*
% income lost			19,3
Remaining income			**266 765**

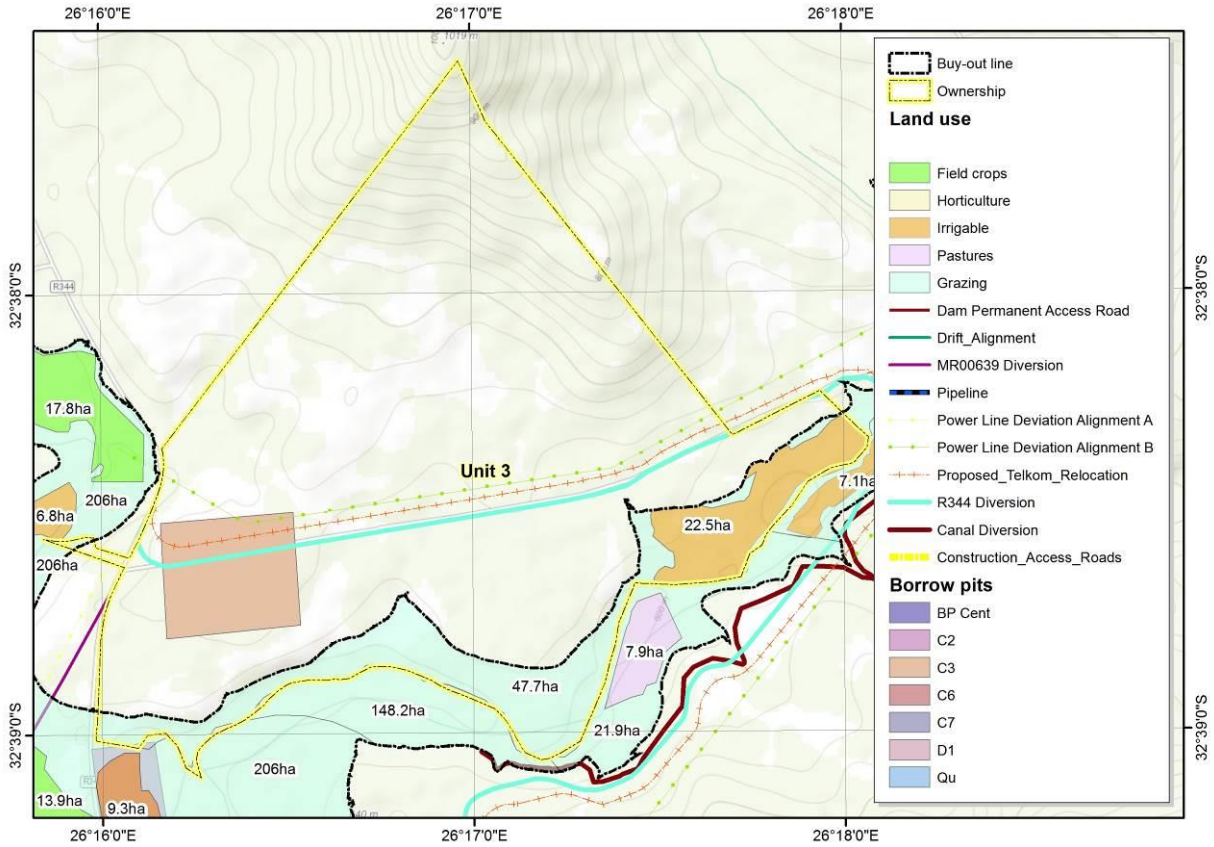


Figure 17. Land use of Farm Unit 3

5.7.4 Farm Unit 4

The estimated farming income is R4.6 million and the loss of income due to the construction of the dam is R700 545. It is a loss of 15,1% of the farming income.

It is the view of Index that the farm will remain viable, depending on whether or not the overhead cost, like repayment of loans for infrastructure and other debt is not too high.

Table 19. Viability of Farm Unit 4

Owner	Area		Income
Total farm	1 887		4 631 805
Total lost	56		700 545
Dam and buffer	*46*		*692 883*
infra-structure	*10*		*7 662*
% income lost			15,1
Remaining income			**3 931 261**

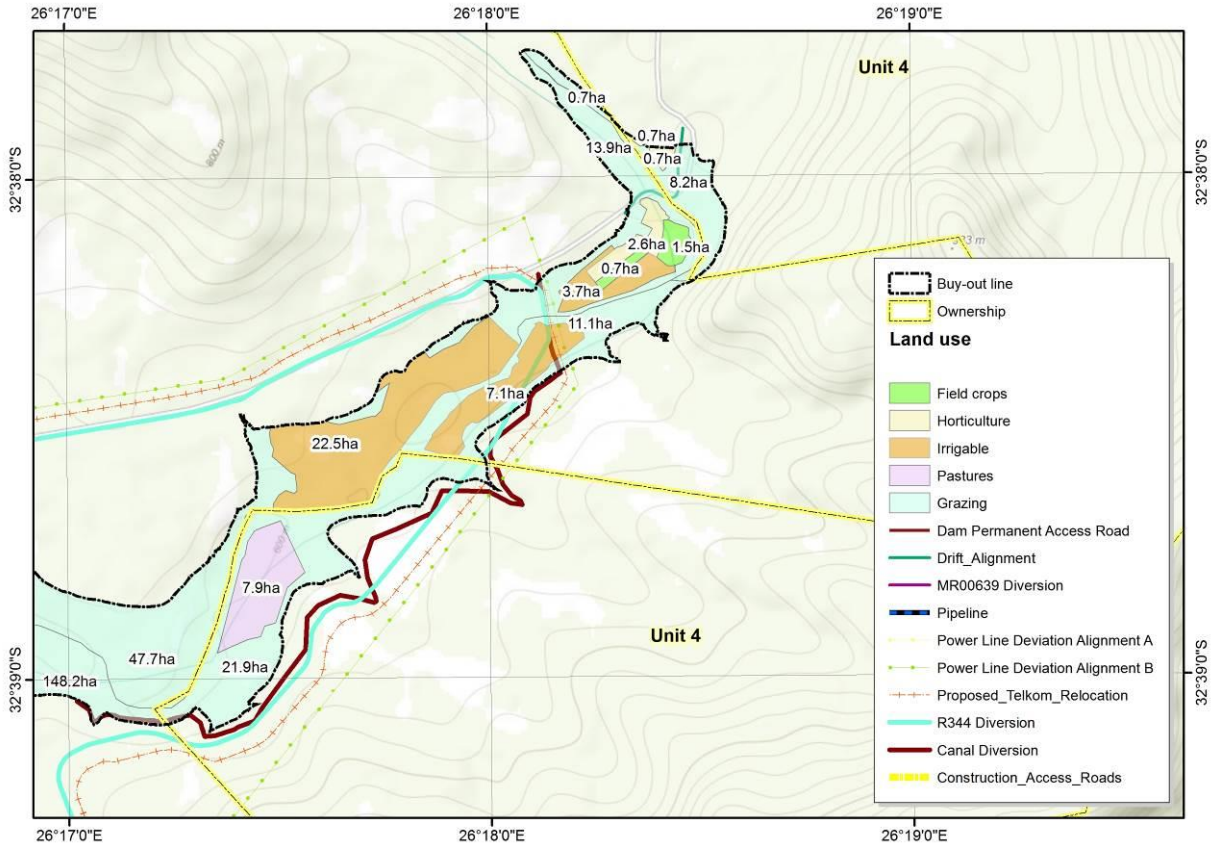


Figure 18. Land use of Farm Unit 4

5.7.5 Farm Unit 5

The estimated farming income is R1,4 million and the loss of income due to construction of the dam, R78 027. It is a loss of 5,3% of the farming income.

It is the view of Index that the farm will remain viable, depending on whether or not the overhead cost, like repayment of loans for infrastructure and other debt is not too high.

Table 20. Viability of Farming Unit 5

Owner	Area		Income
Total farm	1 851		1 460 188
Total lost	121		78 027
Dam and buffer	*112*		71 752
infra-structure	*9*		6 276
% income lost			5,3
Remaining income			**1 382 160**

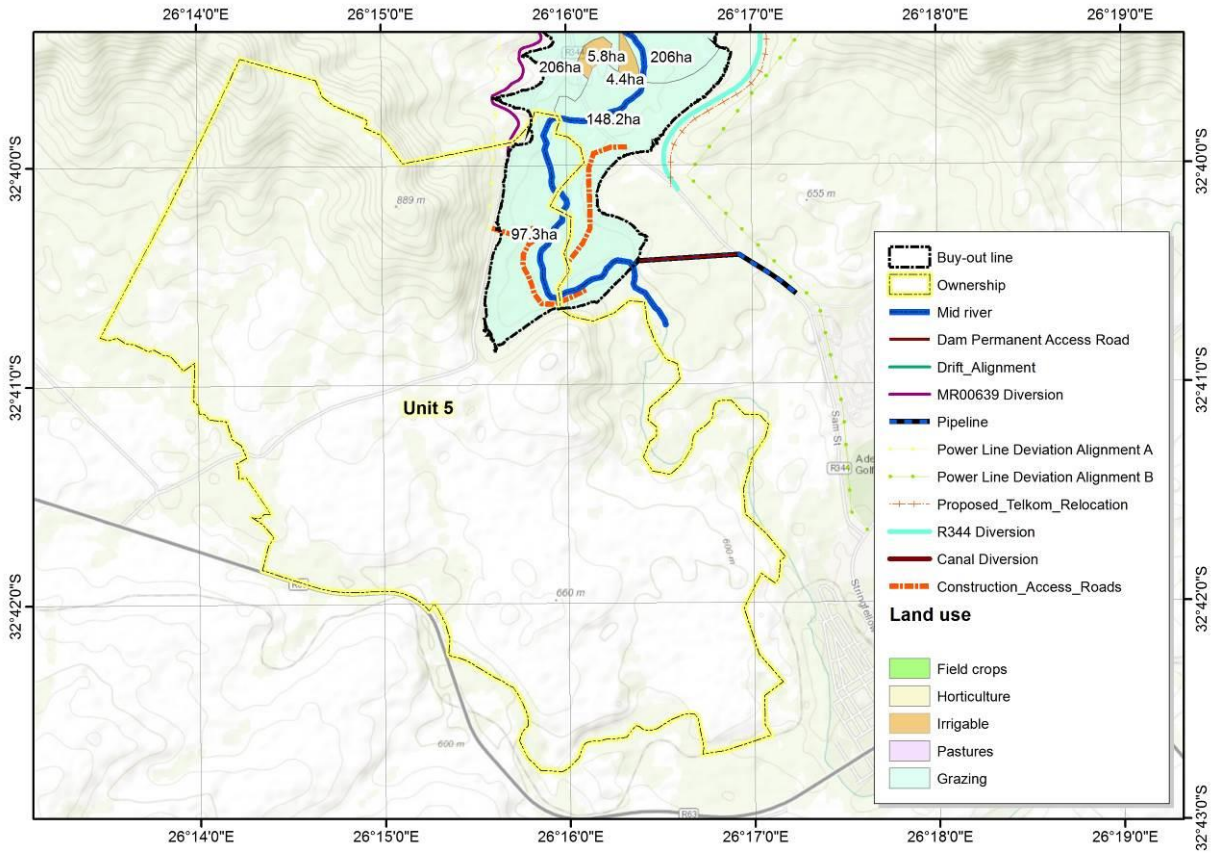


Figure 19. Land use of Farm Unit 5

5.7.6 Farm Unit 6

The estimated farming income is R1,7 million and the loss of income due to construction of the dam, R1 230 892. It is a loss of 72,3% of the farming income.

It is the view of Index that the farm will remain viable, depending on whether or not the overhead cost, like repayment of loans for infrastructure and other debt is not too high.

Table 21. Viability of Farming Unit 6

Owner	Area		Income
Total farm	248		1 701 563
Total lost	22		1 230 892
Dam and buffer	*19*		*1 226 373*
infra-structure	*3*		*4 519*
% income lost			72,3
Remaining income			**470 672**

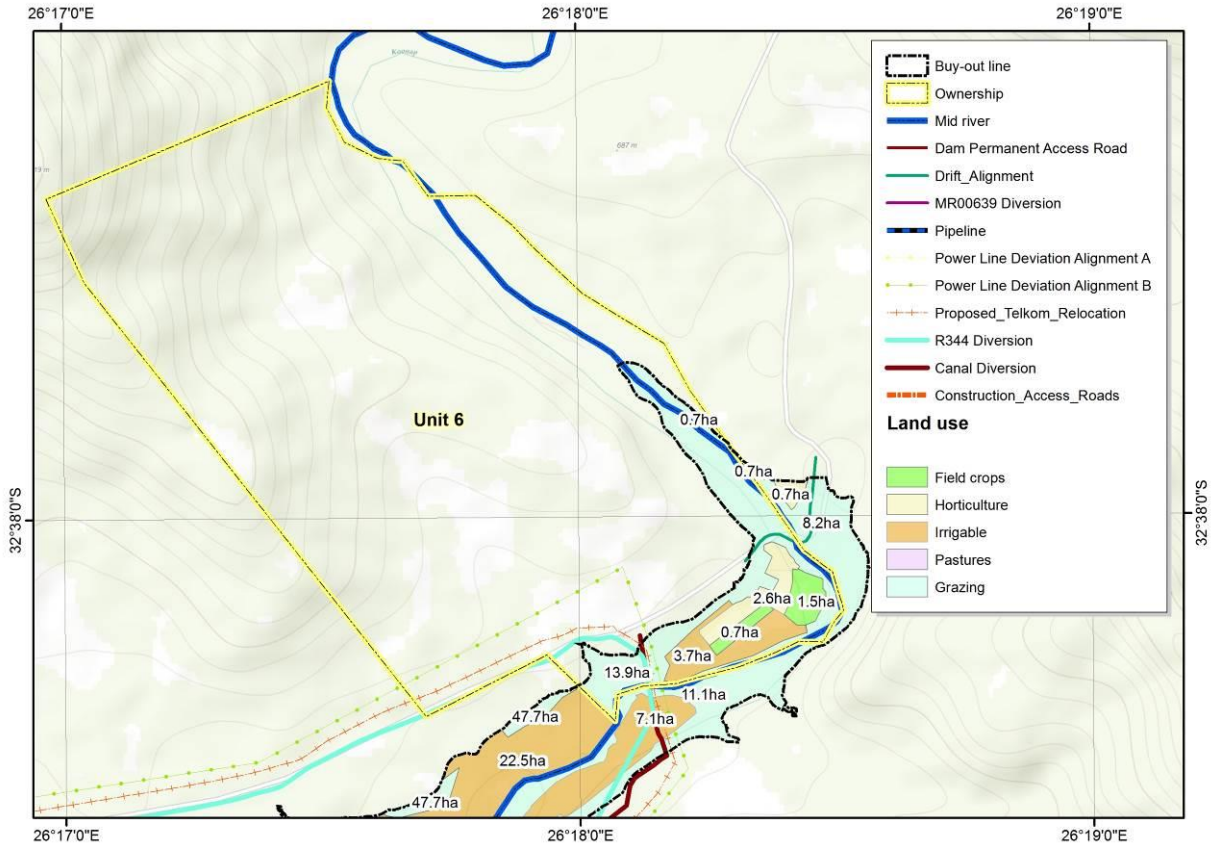


Figure 20. Land use of Farm Unit 6

5.7.7 Municipality

The estimated farming income from the municipal land is R441 889 and the loss of income due to construction of the dam, R109 287. It is a loss of 26,5% of the farming income.

- It is the view of Index that the farm is not a viable, farming unit.

Table 22. Viability of Municipality farming unit

Owner	Area		Income
Total farm	559		411 889
Total lost	185		109 287
Dam and buffer	*172*		*109 287*
infra-structure	*13*		*0*
% income lost			26,5
Remaining income			**302 603**

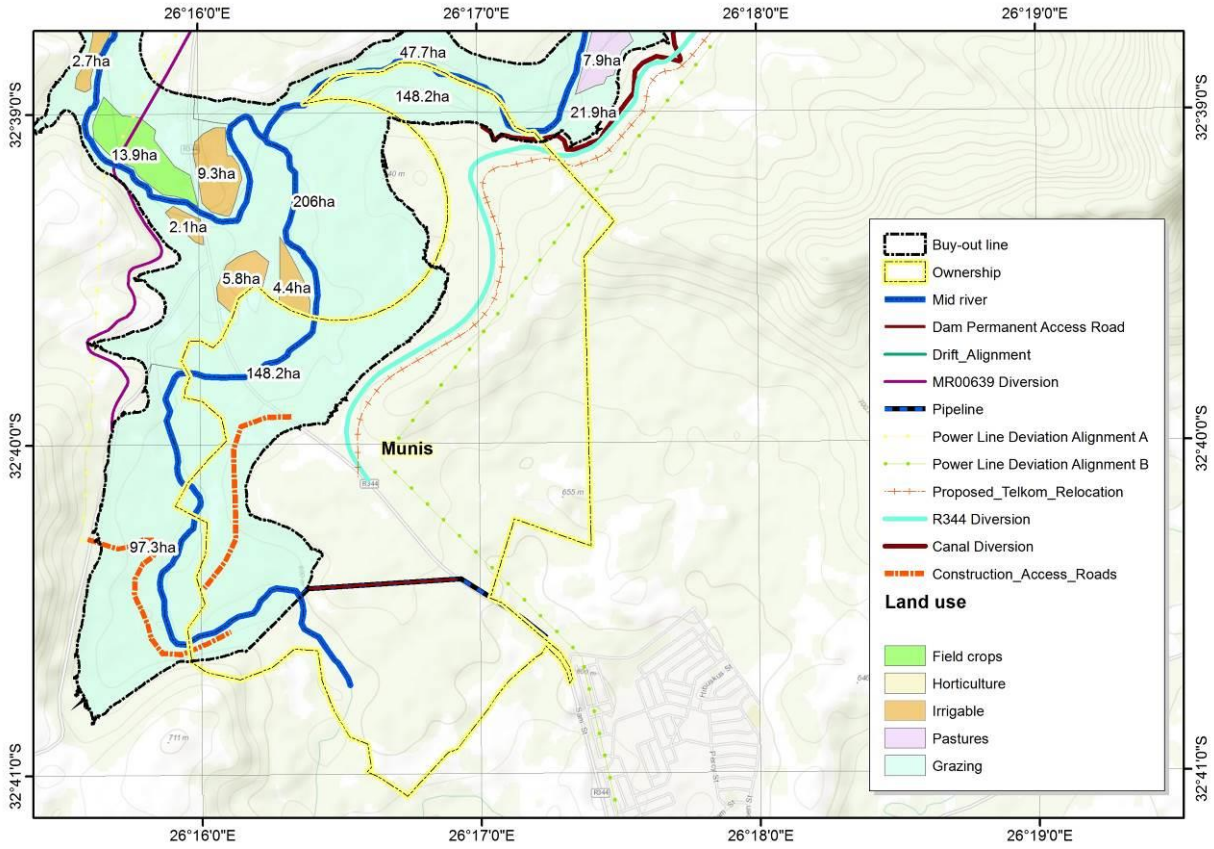


Figure 21. Land use of municipality land

6 ALTERNATIVES OF PROJECT COMPONENTS

6.1 STORAGE DAM

The type of storage dam will not influence agriculture. The construction site is located in the watercourse that may not be used for farming purposes.

Table 23. Preference of storage dam construction type

Alternatives	Order of preference 1 (most preferred) to 4 (least preferred]	Motivation	Fatal Flaws / Significant residual impacts after mitigation
1. Earthfill 2. Rockfill 3. Concrete Gravity 4. Composite Gravity Spillway and Earthfill	No Preference	The type of storage dam will not influence agriculture. The construction site is located in the watercourse that may not be used for farming purposes.	

6.2 COMPARISON OF OPTIONS – GAUGING WEIR

The positions of the proposed gauging weirs are indicated below. From a farming perspective there is no preferred location.

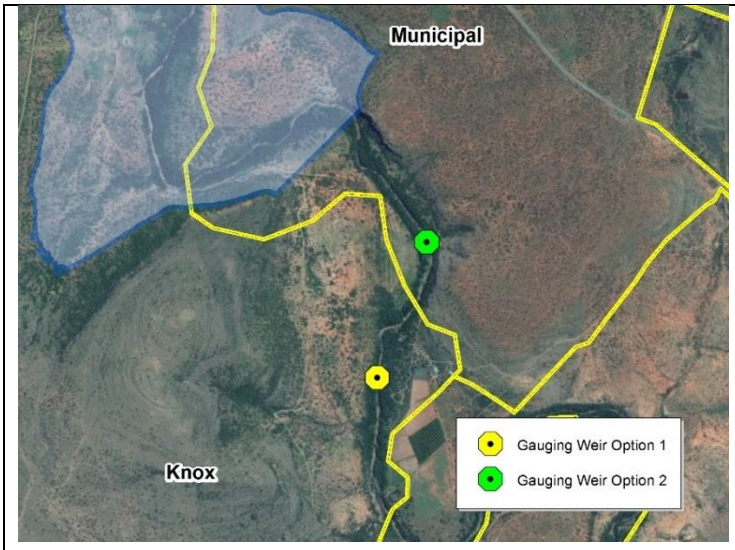


Figure 22. Positions of Alternative gauging weirs

The two options are located within the riparian zone that has no agricultural value.

Table 24. Preference of Gauging Weir positions

Alternatives	Order of preference 1 (most preferred) to 2 (least preferred)	Motivation	Fatal Flaws / Significant residual impacts after mitigation
Option 1 Option 2	No preference	The two options are located within the riparian zone that has no agricultural value.	

6.3 COMPARISON OF OPTIONS – POWER LINE DEVIATION

Option A is preferred.

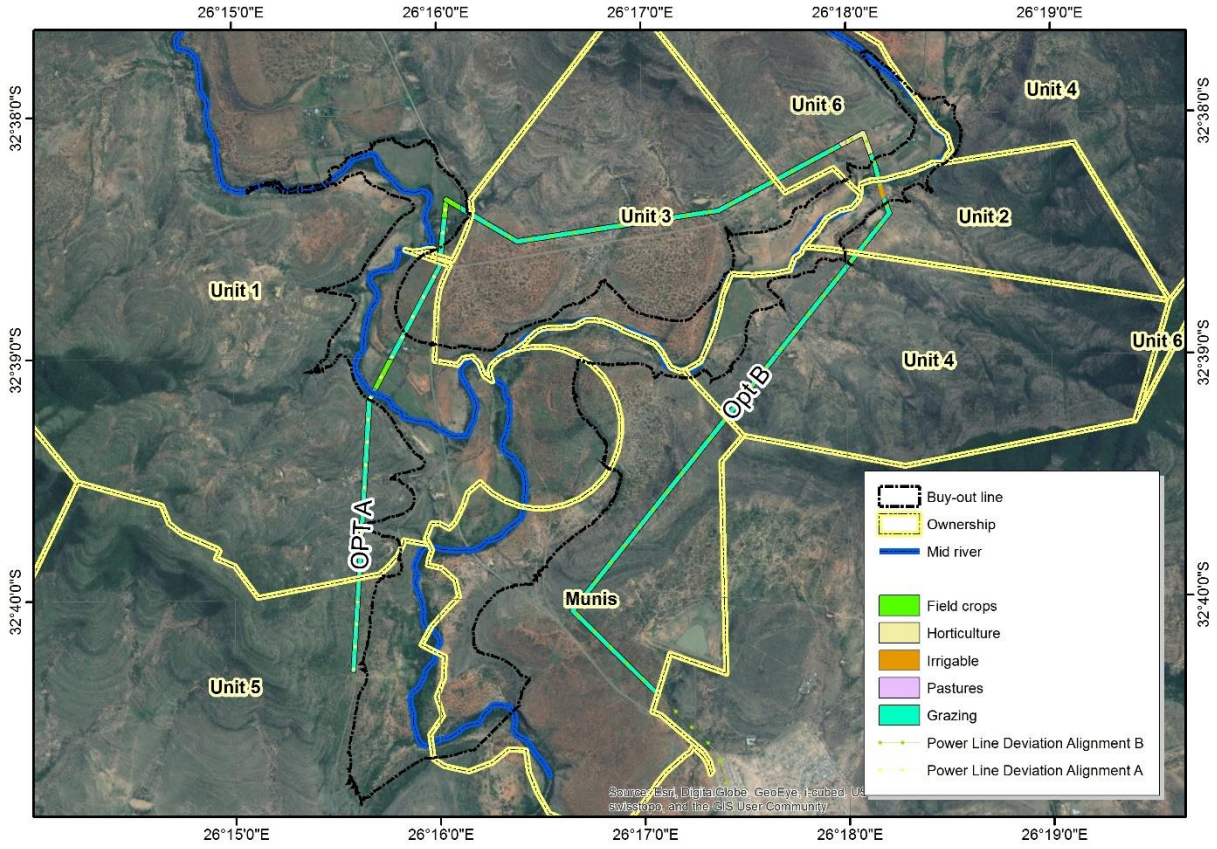


Figure 23. Comparison of Power line deviations

Alternatives	Order of preference 1 (most preferred) to 2 (least preferred)	Motivation	Fatal Flaws / Significant residual impacts after mitigation
Alignment A	1	Less land will be influenced.	
Alignment B	2	Will destroy permanent crops. These however will be within the buy-out line. It will disrupt 36 hectares, which is more than double the size of option B	

6.4 COMPARISON OF OPTIONS – LAYDOWN AREA

Option 1 is preferred.

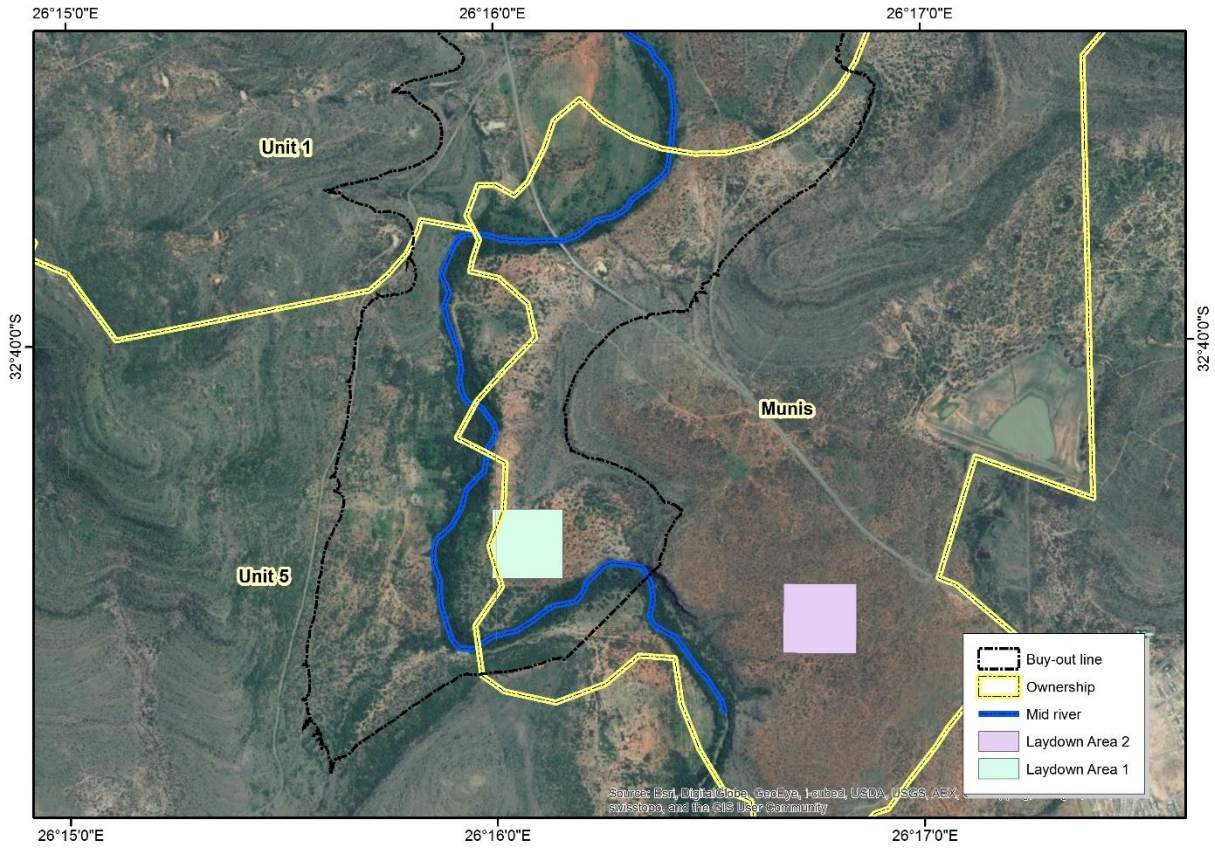


Figure 24. Comparison of laydown areas

Table 25. Comparison of laydown areas

Alternatives	Order of preference 1 (most preferred) to 2 (least preferred)	Motivation	Fatal Flaws / Significant residual impacts after mitigation
Option 1	1	Is within the submerged area and will therefore have no impact on farming.	
Option 2	2	Grazing land will be lost	

7 MITIGATION MEASURE

In addition to the loss of land and the associated mitigation, the impact of the construction process on farming land is temporary. As discussed, for horticulture, the impact will be until trees damaged during construction is replaced grow to maturity and is again productive.

Construction brings with it security problems – this can be mitigated. One must keep in mind that the theft and vandalism associated with construction is often perpetrated by people not related to the project.

Mitigation measures proposed are as follows:

1) Keep the footprint during construction as small as possible;
2) Maintain security of the sites by appointing guards and providing support to the local farmers;
3) The three unsustainable units, i.e., Units 1 and 3 and the municipality should be bought and consolidated into a sustainable unit or made part of the adjoining units;
4) Unit 6 will become unfeasible. It should also be bought;
5) Dust along the main roads created by large trucks could have as a severe impact on crop yield and on the livestock production. Spraying water on the roads can mitigate dust;
6) Potential deterioration of water quality and volume available to farming can detrimentally affect farming. The extent of pollution and availability cannot be determined at this stage and will only be apparent when during after mining, lastly,
7) Compensate the farmers for the financial loss and discomfort. Buying out the properties to further the objectives of the state's land reform objectives should be discussed with the farmers.

8 CONCLUSIONS

The benefit of controlled flow of the Koonap River on irrigation is obvious. However, the development will impact of the 7 land owners in varying degrees.

Adelaide is arid with high summer temperatures where the farmers depend on irrigation and deep fertile alluvial soils for their livelihood. This development will influence their income, and for the smaller land-owners, to the degree that the farms are no longer viable. While some mitigation is possible, buying these properties and consolidate them with adjoining properties may be the only option.

9 ADDENDA

9.1 SOURCES OF INFORMATION

1) Soil Classification Workgroup, 1991. Soil Classification, a taxonomic system for South Africa, Department of Agricultural Development, Pretoria.
2) ABSA, Agri Trends –Weekly Market Analysis, September 2014.
3) Database of Department of Water Affairs and Forestry
4) Communication with farmers
5) LocClim estimator, FAO