



WATERLOO RESERVOIR TO SIBAYA DEVELOPMENT NODE PIPELINE

VEGETATION ASSESSMENT OF THE PIPELINE ALIGNMENT

PROJECT NUMBER: 0087
REVISION NUMBER: #1
DATE: 8TH APRIL 2016

Independence

*Kinvig & Associates follow a strict code of conduct which is guided by the **Section 12 & 13** of the National Environmental Management Act, Act 107 of 1998, which requires a specialist to be unbiased, independent and report on observations accurately.*

Copyright

All intellectual property rights and copyright associated with Kinvig & Associates' services are reserved. Project deliverables may not be modified or incorporated into subsequent reports, in any form or by any means, without the authorised written consent of the Director. The report, if the results, recommendations, mapping or conclusions stated in this report are used in subsequent documentation, should be duly acknowledged and appropriately referenced.

Should this report comprise a specialist study to an overarching study, it is Kinvig & Associates' right to request that this report be included in its entirety as an Appendix to the main report.

Indemnity

The project deliverables, including the reported results, comments, recommendations and conclusions, are based on the author's professional knowledge as well as the latest available information.

The study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of survey undertaken.

Kinvig & Associates' therefore reserve the right to modify aspects of the project deliverables should new and / or additional information become available. The source thereof could be from research or additional studies in the applicable field of practice.

Kinvig & Associates' exercise all reasonable skill, care and diligence in the provision of services. No liability or consequential liability for the use of the supplied project deliverables and any information contained therein.

*The client, including their agents, by receiving these deliverables indemnifies Kinvig & Associates' (including directors, employees and sub-consultants) against any actions, claims, demands, losses, liabilities, costs, damages and expenses arising directly or indirectly from or in connection with services rendered under the specified appointment (**Waterloo Reservoir to Sibaya Development Node Pipeline: Vegetation Assessment of the Pipeline Alignment**).*

TABLE OF CONTENTS

| | | |
|-----|--|----|
| 1 | INTRODUCTION AND BACKGROUND | 1 |
| 2 | PROPERTY DESCRIPTION | 1 |
| 3 | RECEIVING ENVIRONMENT GENERAL OVERVIEW | 1 |
| 4 | ASSUMPTIONS & LIMITATIONS | 2 |
| 5 | VEGETATION RECORDED ON-SITE | 2 |
| 5.1 | M4 easterly side..... | 2 |
| 5.2 | M4 westerly side | 4 |
| 5.3 | Embankment Area (Road created for access during the construction of the N2)..... | 4 |
| 5.4 | East of the N2 (seaward side) | 5 |
| 5.5 | West of the N2 | 6 |
| 5.6 | Tarred Sugarcane Road and close proximity to a Substation | 7 |
| 5.7 | Beyond the tarred road crossing towards Waterloo Reservoir | 8 |
| 5.8 | Thin band of woody vegetation | 10 |
| 5.9 | Drainage line prior to Waterloo Reservoir..... | 12 |
| 6 | RECOMMENDATIONS..... | 12 |
| 7 | CONCLUSIONS..... | 13 |

TABLE OF PLATES:

| | | |
|-----------|--|---|
| Plate 1: | <i>Clerodendrum glabrum</i> sounded by <i>Chromolaena odorata</i> on the east of the M4 where the proposed pipe-jacking will occur..... | 3 |
| Plate 2: | <i>Clerodendrum glabrum</i> and <i>Grewia occidentalis</i> growing on the western side of the M4 in a narrow band..... | 3 |
| Plate 3: | <i>Clerodendrum glabrum</i> growing on the road embankment..... | 4 |
| Plate 4: | <i>Tragus berteronianus</i> growing next to the road..... | 5 |
| Plate 5: | The red arrow indicates the pipeline alignment near the culvert that runs under the N2 on the eastern side. The vegetation considered to be scrubby and pioneer in nature..... | 6 |
| Plate 6: | <i>Neonotonia wightii</i> a creeper species that was commonly occurring in shaded areas along the pipeline alignment..... | 7 |
| Plate 7: | Secondary woody vegetation and herbaceous vegetation that has established around a scrub <i>Eucalyptus</i> stand of trees..... | 7 |
| Plate 8: | <i>Schinus terebinthifolius</i> woody vegetation.... | 8 |
| Plate 9: | <i>Apodytes dimidiata</i> juvenile establishing in the under-storey..... | 8 |
| Plate 10: | <i>Burchellia bubalina</i> growing on the periphery of the <i>S. terebinthifolius</i> dominated thicket where it is able to get light and nutrients..... | 9 |

| | |
|---|----|
| Plate 11: <i>Gymnosporia buxifolia</i> with a significant seed set..... | 10 |
| Plate 12: <i>Barleria obtusa</i> growing in the under-storey. | 11 |
| Plate 13: <i>Sansevieria hyacinthoides</i> growing in the under-storey which can be easily uplifted and replanted in future Open Space Areas which mimic its current habitat. | 11 |
| Plate 14: <i>Solanum mauritianum</i> dominating the vegetation within the wetland / drainage line. | 12 |

APPENDICES:

| | |
|-------------------|---------------------|
| Appendix 1 | Mapping |
| Appendix 2 | Species List |

1 INTRODUCTION AND BACKGROUND

Dr. Richard Kinvig of Kinvig & Associates (PTY) Ltd was requested to undertake a vegetation assessment of the proposed pipeline alignment which runs through the Tongaat Hulett Land holdings referred to as Cornubia North and Sibaya.

The proposed properties across which the pipeline is aligned are listed in **Section 2** below. The pipeline is deemed to be urgent in order to supply water to the newly launched Sibaya Node, which has been granted Environmental Authorisation historically.

It is important to note that this report is deemed to be an addendum report to the Vegetation Report compiled by the author whilst employed at SiVEST (**CORNUBIA NORTH: VEGETATION AND ECOLOGICAL ASSESSMENT: Draft Report, April 2014**). This report should be read in conjunction with the over-arching reports. This report speaks directly to the receiving environment that will be affected by the proposed pipeline and is thus site specific and the recommendations and conclusions drawn are specific to the pipeline development only.

It must also be noted that the sites diversity has not changed significantly since the vegetation assessment was conducted in April 2014.

2 PROPERTY DESCRIPTION

The following properties comprise the land holdings identified in **Section 1**.

| | |
|------------|--|
| * I/144 | Rem of Ptn 13 of the Farm Lot 42 No. 1114 |
| * I/605/10 | Ptn 68 of the Farm Cottonlands No. 1575 |
| * E/36/24 | Ptn 42 of the Farm Lot 31 No. 1560 |
| * I/605/17 | Ptn 75 of the Farm Cottonlands No. 1575 |
| * I/605/18 | Ptn 76 of the Farm Cottonlands No. 1575 |
| * I/605/20 | Rem of Ptn 615 (of 275) of the Farm Cottonlands No. 1575 |
| * I/603/4 | Rem of the farm Lot 42 No. 1114 |
| * I/603/3 | Rem of Ptn 7 of the Farm Lot 42 No. 1114 |

3 RECEIVING ENVIRONMENT GENERAL OVERVIEW

The proposed receiving environment through which the pipeline is proposed to be aligned is for the most part dominated by commercial sugarcane production. In areas where the pipeline passes through a number of low lying areas the receiving environment is dominated by wetland habitat and associated wetland vegetation and alien invasive species. There are other limited pockets of vegetation which are not associated with wetland systems, which will also require traversing and / or the pipeline will be aligned adjacent thereto.

The pipeline will also be required to traverse two (2) major roads, namely the M4, which is a Department of Transport Road, managed by eThekweni Municipality and the N2, which is owned and maintained by SANRAL (South African National Roads Agency).

4 ASSUMPTIONS & LIMITATIONS

Please note that the following assumptions and limitations have bearing to this report;

- * The assessment was carried out late in the season and therefore a number of species or individuals of a particular species may not have been recorded;
- * The drought has played a role in determining the presence and absence of plant species especially herbaceous perennial species;
- * The vegetation assessment for the pipeline must be read in conjunction with the previous assessment undertaken for the properties mentioned.

Having noted the assumptions and limitations above it is the author's opinion that the majority of the species were recorded during the field survey, due to the degraded nature of the vegetation occurring in the areas identified to contain vegetation other than sugarcane. The only concern is related to the abundance of *Scadoxus puniceus* a protected plant species under the Ordinance 15 of 1974. A small number, 2 in all were recorded, however, we would assume that this number is probably higher and when applying for the relocation of this species through the issuance of a permit from *Ezemvelo* KZN Wildlife we would apply for an additional number, in order to ensure compliance with the relevant ordinance. In addition, the total number that are identified and relocated will be captured and provided to *EKZN* Wildlife for their records.

5 VEGETATION RECORDED ON-SITE

As mentioned in **Section 3** the land-cover was for the most part dominated by sugarcane, with restricted pockets of mixed indigenous and alien invasive vegetation.

5.1 M4 easterly side

The vegetation that occurs within a thin corridor along the M4 is of limited too no value in terms of the plant diversity. Historic disturbance and the continued agricultural practices adjacent thereto have prevented the vegetation from expanding and "relaxing" out of its current position on the easterly side and on the westerly side the M4 prevents further establishment. The vegetation is therefore contained within this narrow strip of "unusable land".

The most common species occurring within this area are herbaceous or graminoid in nature. Only two (2) trees were encountered, both of which are *Clerodendrum glabrum*, a commonly occurring and often associated ruderal species, which is often associated with the ecotone of more established woody vegetation and thought of as a precursor to later successional forest (**Plate 1**). The vegetation is dominated by pioneer and ruderal indigenous species, as well as alien invasive species, such as; *Chromolaena odorata*, *Ricinus communis*, *Taraxacum officinale* and *Euphorbia hirta*. An expanded list of species may be found at **Appendix 2**.



Plate 1: *Clerodendrum glabrum* sounded by *Chromolaena odorata* on the east of the M4 where the proposed pipe-jacking will occur.



Plate 2: *Clerodendrum glabrum* and *Grewia occidentalis* growing on the western side of the M4 in a narrow band.

5.2 M4 westerly side

The vegetation in this narrow corridor is dominated by woody species, namely, *Clerodendrum glabrum* and *Grewia occidentalis*, both of which are indigenous (**Plate 2**). *Grewia occidentalis* like *C. glabrum* is an opportunistic species which takes advantage of areas which are left fallow or have remained undisturbed by agricultural pursuits and other anthropogenic impacts. The presence of a number of creepers were noted which signifies that this area is less disturbed than the easterly side of the M4. This may be explained by the fact that the sugarcane in the vicinity of the crossing point is a little further removed, as is the road. This vegetation is growing on the top of a cut embankment and therefore road maintenance will not impact on it. The creepers identified were *Senecio deltoideus*, *Microglossa mespilifolia* and *Cissampelos torulosa*. An expanded list of species may be found at **Appendix 2**.

5.3 Embankment Area (Road created for access during the construction of the N2)

The vegetation occurring in this area is dominated by woody species which, by the species assemblage present have been historically planted. The most prevalent species are *Erythrina lysistemon* and *Clerodendrum glabrum*. A number of other tree species have also established as a result of the change to the micro-climate. The following small (young) species were also encountered; *Trichilia emetica*, *Euclea natalensis* subsp. *natalensis* and *Vangueria infausta*. One individual, *Ficus sur* is large, however, it is unlikely that it will be disturbed by the proposed pipeline alignment as it falls about 15 metres from the centre line of the pipeline into the proposed open space network, as per the Sibaya Node 4 (9 March 2016 framework provided by RHDHV) overlay.



Plate 3: *Clerodendrum glabrum* growing on the road embankment

There are also a number of alien plant species, namely; *Melia azedarach* (tree), *Lantana camara* and *Ricinus communis*. In terms of plant species the majority were graminoid species and known invasive

species, with *Tragus berteronianus* (**Plate 4**), *Eragrostis ciliaris*, *Urochloa panicoides* and *Panicum maximum* being the most prevalent. An expanded list of species may be found at **Appendix 2**.



Plate 4: *Tragus berteronianus* growing next to the road.

Due to the size of the trees and the tree species, it may be possible to transplant these trees into the Open Space Network prior to construction commencing. Species such as *Erythrina lysistemon* must be prioritised for transplanting, if necessary, as they have a high transplanting success rate. Should this be undertaken there will be no nett loss of woody species, resulting in a positive outcome.

5.4 East of the N2 (seaward side)

The vegetation in this particular area comprises of predominantly indigenous vegetation, however, the majority of the vegetation is deemed recently established based on its size and the fact that the trees all appear to be of the same cohort (age class). The following woody species were identified and will potentially be lost as a result of the proposed pipeline construction. The trees are *Clerodendrum glabrum*, *Chrysanthemoides monilifera*, *Brachylaena discolor* and *Bridelia micrantha*. The remaining vegetation in this area is comprised of herbaceous indigenous species such as, *Chamaecrista mimosoides*, *Rumex crispus* and *Asystasia gangetica*. The remainder of the indigenous vegetation is comprised of graminoid species, such as, *Chloris guyana*, *Digitaria eriantha*, *Panicum maximum*, *Stenotaphrum secundatum*, *Hyparrhenia hirta* and *Imperata cylindrica*. Several alien plant species were also recorded in the plant species assemblage, namely, *Senna didymobotrya*, *Schinus terebinthifolius*, *Ambrosia artemisiifolia*, *Passiflora foetida*, *Solanum mauritianum* and *Litsea glutinosa*.

Please note that due to the fact that the pipe will be required to be pipe-jacked under the N2 a significant area will be disturbed as a result of the preparation for pipe-jacking with pits having to be excavated in order to facilitate the pipe-jacking. However, based on the vegetation recorded, it is not providing any

significant value in terms of conservation or diversity and due to its isolated and its constrained nature, its loss or disturbance will not have a significant impact on the environment at large.



Plate 5: The red arrow indicates the pipeline alignment near the culvert that runs under the N2 on the eastern side. The vegetation considered to be scrubby and pioneer in nature.

5.5 West of the N2

On the westerly side of the N2 the vegetation is dominated by alien plant species, namely, *Tecoma stans* a Category 1 invader species. In addition, *Litsea glutinosa* was also recorded. The only indigenous woody vegetation recorded were *Brachylaena discolor*, *Bridelia micrantha*, *Albizia adianthifolia* and *Clerodendrum glabrum*. All the indigenous trees were relatively small in stature and their loss would not prove significant. In the under-storey *Microsorium scolopendria*, *Neonotonia wightii* (Plate 6) were commonly occurring. One protected plant species namely *Scadoxus puniceus* was recorded. This individual's presence will require that a licence be obtained for its removal and relocation. The relevant permit will need to be obtained from EKZN Wildlife.



Plate 6: *Neonotonia wightii* a creeper species that was commonly occurring in shaded areas along the pipeline alignment.

5.6 Tarred Sugarcane Road and close proximity to a Substation

The vegetation in this area is all secondary in nature. The vegetation close to where the tar commences has established due to the presence of an old *Eucalyptus* scrub plantation.



Plate 7: Secondary woody vegetation and herbaceous vegetation that has established around a scrub *Eucalyptus* stand of trees.

The trees are old and as a result thereof, vegetation has established in the under-storey (**Plate 7**). The majority of the indigenous vegetation that has established are *Ficus natalensis* trees which have grown around the *Eucalyptus* sp. individuals.

In addition, a number of small individuals of *Deinbollia oblongifolia* were recorded. The other indigenous trees which were recorded were *Clerodendrum glabrum*, *Dovyalis longispina*, *Psychotria capensis* and *Ptaeroxylon obliquum*, all of which are relatively newly established given their small stature. The predominant groundcover is *Asystasia gangetica*. *Jasminum multipartitum* was recorded growing on an old *Eucalyptus* stump. The vegetation in this area is not significant as it grows within a narrow band, with agricultural pursuits occurring on the northerly side and the tar road and associated reserve on the southerly side. A number of aliens were also present, with *Litsea glutinosa* being the dominant species growing in the under-storey.

Along the road towards the substation and where the pipeline is proposed to cross the road there are a number of trees which are growing either singly or in small clumps. These are for the most part comprised of indigenous tree species, however there are some alien woody species as well. In terms of the indigenous trees the following were recorded; *Bridelia micrantha*, *Albizia adianthifolia* and *Clerodendrum glabrum*. In terms of the alien trees *Psidium guajava*, *Syzygium cumini* and *Ricinus communis* were the largest and most common. Attached at **Appendix 1** is a map illustrating their positions. An expanded list of species may be found at **Appendix 2**

5.7 Beyond the tarred road crossing towards Waterloo Reservoir

This section of the pipeline is aligned adjacent to a waste area, which has established vegetation, with the predominant woody vegetation being *Schinus terebinthifolius* (**Plate 8**). In addition, *Arundo donax* is dominant in the easterly corner.



Plate 8: *Schinus terebinthifolius* woody vegetation



Plate 9: *Apodytes dimidiata* juvenile establishing in the under-storey

This area is adjacent to the M27, which is situated on an elevated embankment to the north. Storm water generated off the road is directed into this area and facilitates the establishment of *Arundo donax* and limited *Phragmites australis* stands. Within this area is a significant amount of builder's rubble and general waste that has been deposited throughout the easterly section as a result of its proximity to an egress point off the M27.



Plate 10: *Burchellia bubalina* growing on the periphery of the *S. terebinthifolius* dominated thicket where it is able to get light and nutrients.

As one moves in a westerly direction along the pipeline alignment the embankment becomes steeper and from this point woody vegetation dominates the vegetation assemblage. As mentioned earlier the vegetation is dominated by *Schinus terebinthifolius*. Some indigenous vegetation is recorded within this area however it is dispersed and most of the trees are growing singly amongst the *S. terebinthifolius*. The following species were recorded; *Searsia chirindensis*, *Apodytes dimidiata* (Plate 9), *Burchellia bubalina* (Plate 10), *Canthium inerme* and *Ekebergia capensis*. Limited indigenous vegetation was recorded in the under-storey, with the majority noted on the periphery where these species are able to access light and water.

One individual of *Scadoxus puniceus* was recorded in this area, given the conditions it is likely that additional individuals will be present, but as this species is a bulb, it is often not evident as the leaves are produced early in September, may have already flowered the leaves have died back and the bulb is thus not evident. This species should be actively searched for prior to the pipeline being constructed and any individuals removed and relocated into Open Space or into a nursery.

Within the thickest vegetation the *S. terebinthifolius* canopy was so intertwined and thick that there was no under-storey to speak of. This species is also thought to produce allelochemicals into the soil which prevents other species from establishing and the result is the formation of homogenous stands of woody vegetation.

The pipeline then changes direction and moves away from the road and the associated woody vegetation. It crosses a field of sugarcane and a loading zone prior to entering another narrow band of woody vegetation.

5.8 Thin band of woody vegetation

This portion of the pipeline crosses through the vegetation at right angles. The predominant vegetation in this area is indigenous vegetation. It is also the most diverse vegetation in terms of the indigenous woody component. However, this area is adjacent to a sugarcane road which bisects the woody vegetation. Further, this area has also been utilised as a site for illegal dumping and is thus quite transformed, particularly in terms of the under-storey. The most common woody species are; *Gymnosporia buxifolia* (**Plate 11**), *Maytenus peduncularis*, *Burchellia bubalina*, *Searsia chirindensis* and *Acacia nilotica*. Two creeper species were quite apparent, *Dioscorea cotinifolia* and *Secamone alpina*, and these were growing on the trees. The only two indigenous species growing in the under-storey at the position of the crossing point are; *Barleria obtusa* (**Plate 12**) and *Sansevieria hyacinthoides* (**Plate 13**). The *Sansevieria hyacinthoides* are not protected species however, they are easy to uplift and propagate and thus an effort to do so should be made.



Plate 11: *Gymnosporia buxifolia* with a significant seed set.

The pipeline once it has traversed this area heads in a straight line in a westerly direction towards Waterloo Reservoir. It passes through a wetland area, where there is limited wetland plant species present due to the historic farming activities that have taken place. In addition, the most dominant species is an alien invasive species, namely *Canna indica*, an alien invasive which seems to proliferate in conditions where there are significant inputs of water and fertile soils. The vegetation within this area cannot be considered to be of any value as it appears to have recently established as a result of the sugarcane only recently having been replanted in this area.



Plate 12: *Barleria obtusa* growing in the under-storey.



Plate 13: *Sansevieria hyacinthoides* growing in the under-storey which can be easily uplifted and replanted in future Open Space Areas which mimic its current habitat.

5.9 Drainage line prior to Waterloo Reservoir

This drainage line and associated wetland is dominated by alien vegetation where the pipeline is proposed to cross. Within the drainage line the dominant species are *Canna indica*, *Solanum mauritianum*, *Schinus terebinthifolius* *Ricinus communis* and *Chromolaena odorata*. (Plate 14)



Plate 14: *Solanum mauritianum* dominating the vegetation within the wetland / drainage line.

On the sugarcane road on the easterly side and adjacent to the pipeline alignment are a number of *Syzygium cumini* trees which should fall outside of the pipeline corridor. However, these species are alien and thus their removal would be recommended.

6 RECOMMENDATIONS

The following recommendations are made based on the findings of the specialist field survey that was undertaken;

- * A licence must be obtained from EKZN Wildlife for the *Scadoxus puniceus* individuals that were recorded during the field survey. In addition, in order to ensure compliance the licence must apply for a greater number of individuals than were recorded as it is likely that some were missed during the field survey, due to the relatively late undertaking of the specialist assessment. The *S. puniceus* should be placed into bags and taken to the nursery site at Cornubia.
- * The *Sansevieria hyacinthoides* species which occur along the pipeline route denoted and described in **section 5.8** should be uplifted, bagged and taken to the nursery site at Cornubia.
- * A number of the indigenous trees currently have seed on them and we would suggest that this presents an opportunity for the “treepreneurs” to obtain seed from these trees, which may be

lost as a result of the pipeline construction, to be grown and later supplied back to developments in and around eThekweni.

- * The *Erythrina lysistemon* trees which have been planted on the embankment described and denoted in **section 5.3** should be either transplanted into the Open Space Network proposed at Sibaya Node 4, or they may be cut and truncheons planted to establish more trees. Again these truncheons could be supplied to the “treepreneurs” for the purposes of creating additional tree stocks for supply to new developments over time.
- * The pipeline for the most part runs adjacent to areas which are not planted to sugarcane. We would recommend that avoidance is the most suitable option. However, where this is not possible, the impact must be reduced through careful clearing and management of the construction process. Coupled with this is the utilisation of plant parts of trees that will be destroyed as identified above.
- * An alien management plan should be drawn up to deal with alien plant species, particularly in light of the fact that both Cornubia North and Sibaya are to be developed over the next few years and clearing and management of aliens now will reduce the capital costs of management and removal in the future. In addition, this alien management will comply with the provisions of Conservation of Agricultural Resources Act (CARA).

7 CONCLUSIONS

The vegetation that occurs in non-cultivated areas is considered to be transformed and secondary in nature. The indigenous woody and herbaceous plant species that occur within these areas are pioneer or early successional species which are able to with time create an environment in which succession may occur. However, the positioning of these species within the landscape will preclude this based on their very small size and isolated nature. Further the agricultural practices taking place adjacent thereto as well as the roads network prevents any succession from occurring as there is continued anthropogenic influences being imparted on these areas. It must be noted that with the exception of the area described in **section 5.8** the development of woody vegetation has been opportunistic as it has established as a result of the areas not being utilised for agricultural pursuits and where for the most part fire has been excluded. This establishment infers that much of the vegetation may not be growing in the ideal positions within the landscape and thus succession will not occur.

In the author’s opinion should the recommendations made in **Section 6** be implemented the proposed impact of the development of the Waterloo Reservoir to Sibaya pipeline will have an exceedingly low impact on the receiving environment from a vegetation perspective and would thus support the pipelines development in its current alignment.

8 REFERENCES:

1. Boon, R. (2010) ***Pooley's Trees of Eastern South Africa. A complete Guide.*** Flora and Fauna Publications Trust. Durban, South Africa
2. Bromilow, C. (2001) ***Problem plants of South Africa: a guide to the identification and control of more than 300 invasive plants and other weeds.*** Briza Publications, Arcadia, South Africa
3. Pooley, E. (1997) ***A complete field guide to trees of Natal, Zululand and Transkei.*** Natal Flora Publications Trust. Durban, South Africa.
4. Pooley, E. (1998) ***A field guide to wildflowers of KwaZulu-Natal and the eastern region.*** Natal Flora Publications Trust. Durban, South Africa.
5. Scott-Shaw, R. (1999) ***Rare and threatened plants of KZN and neighbouring regions – a plant red data book.*** Biodiversity Conservation Planning Division, Ezemvelo KZN Wildlife, P. O. Box 13053, Cascades, Pietermaritzburg, 3202
6. van Oudtshoorn, F. (1992) ***Guide to grasses of South Africa.*** Briza Publications, Arcadia, South Africa.



APPENDIX A: MAPPING

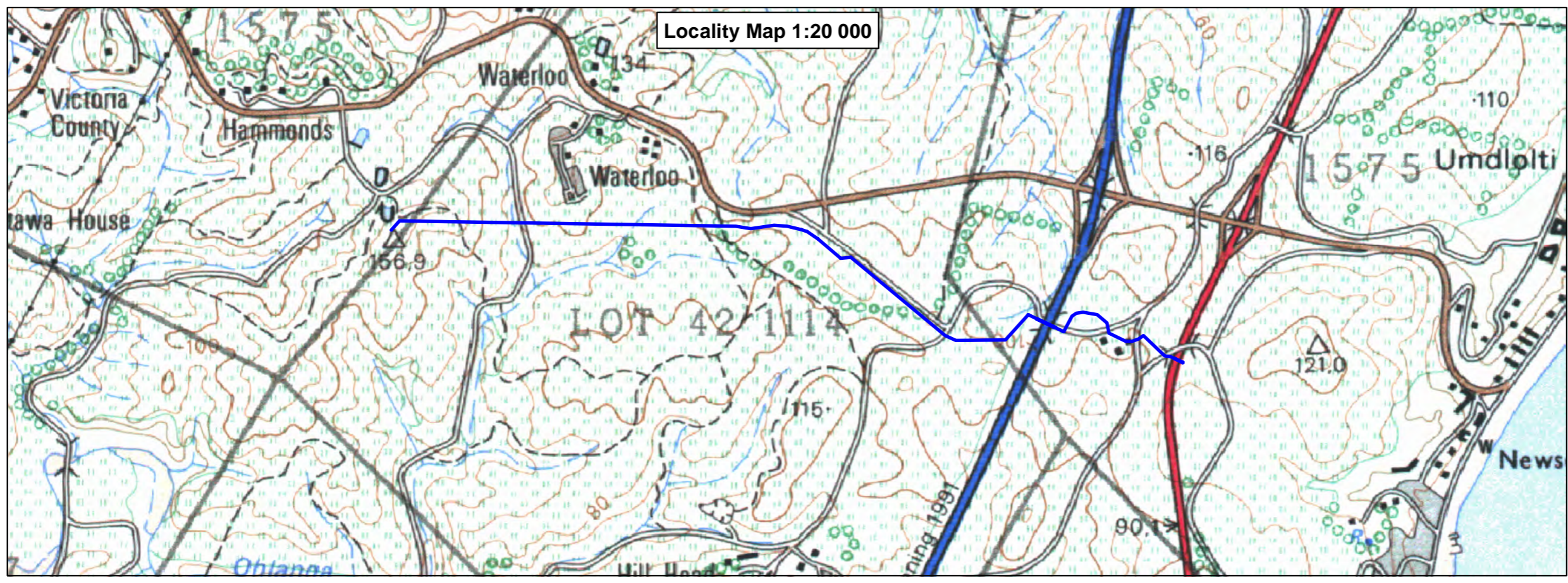
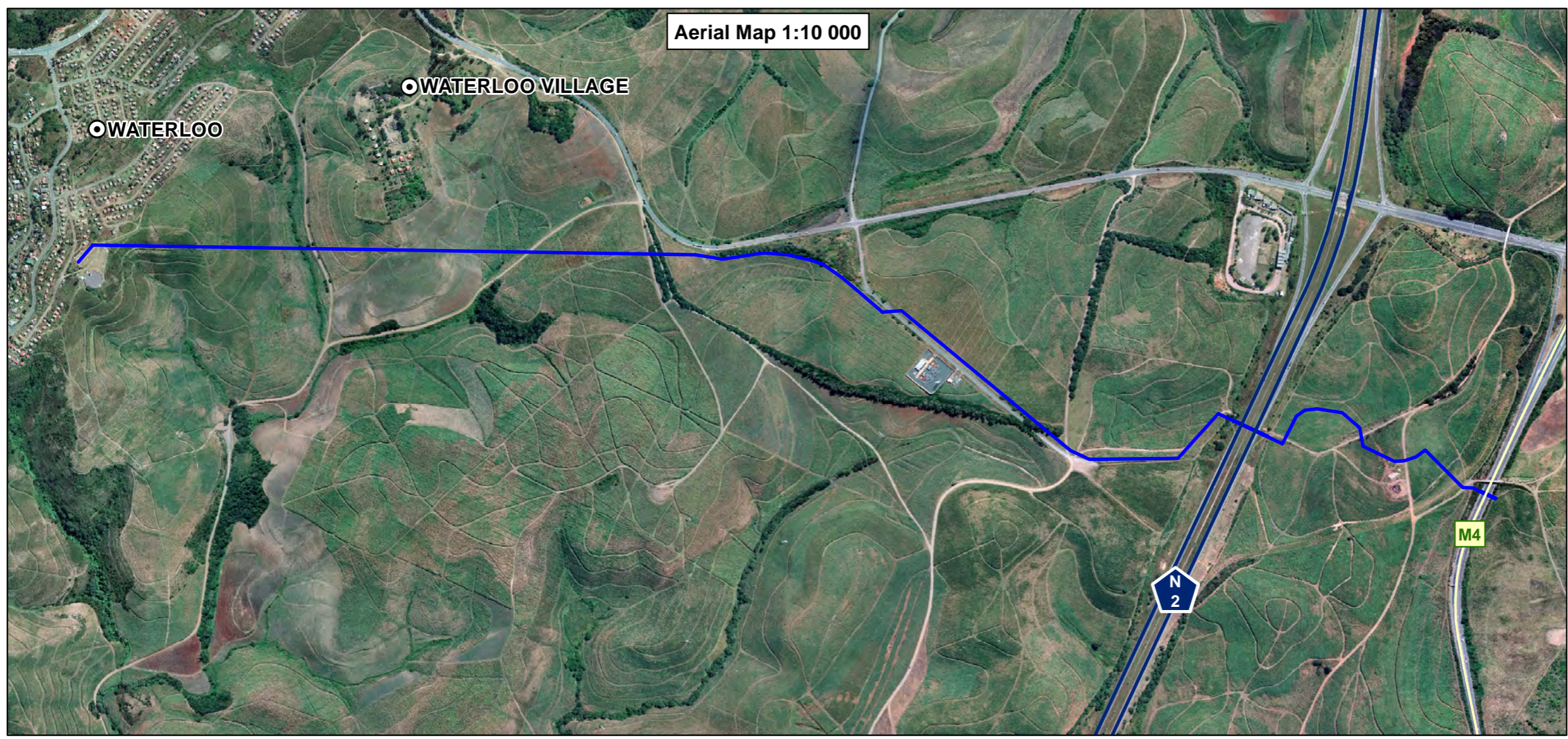
MAP 1: AERIAL & LOCALITY MAP

MAP 2: VEGETATION ON-SITE OVERVIEW MAP

MAP 3: VEGETATION ON-SITE 5.1 – 5.5 MAP

MAP 4: VEGETATION ON-SITE 5.6 – 5.7 MAP

MAP 5: VEGETATION ON-SITE 5.8 – 5.9 MAP



WATERLOO PIPELINE

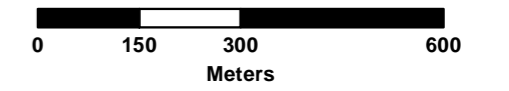
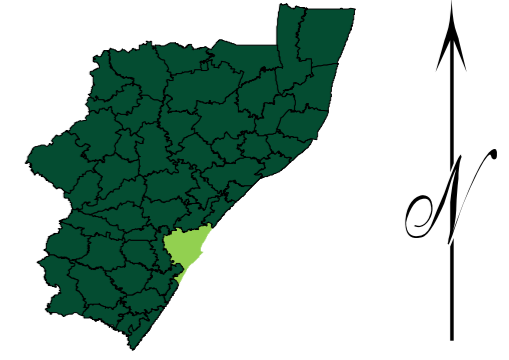
Aerial & Locality Map

1:11 000

Legend

- Placenames
- Pipeline

KwaZulu-Natal: eThekweni Municipality



SOURCE: Chief Directorate of Survey & Mapping
Aerial Imagery: 2012

KINVIG & ASSOCIATES
ENVIRONMENTAL CONSULTING

Kinvig & Associates (PTY) Ltd
Suite 3 Park Villages
Victoria Country Club Estate
Montrose
Pietermaritzburg
South Africa
3201

Phone: +27 83 463 2919
e-mail: richard@kaec.co.za

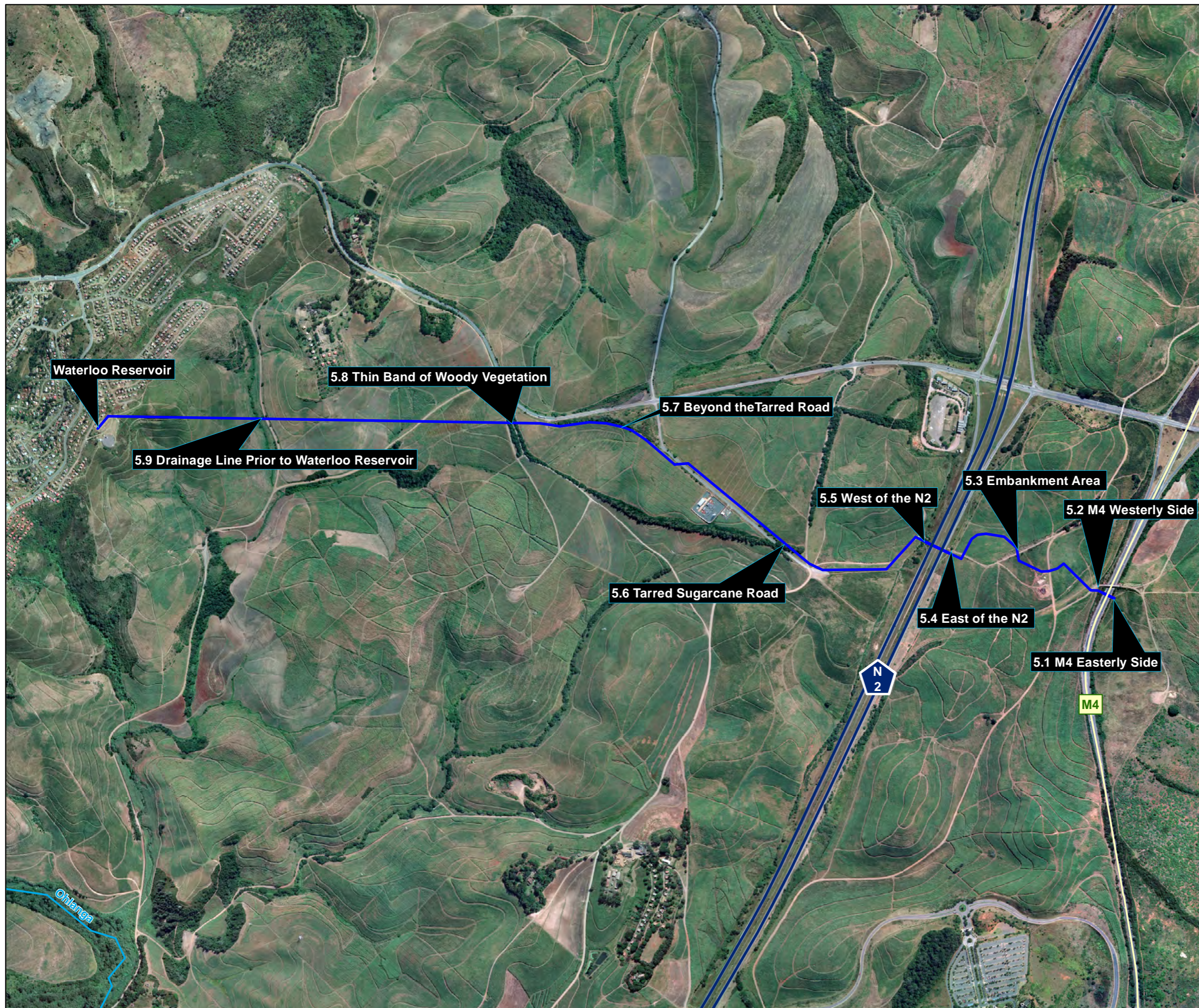
| Project No | Map Ref No | Prepared By | Date |
|------------|------------|-------------|------------|
| 0087 | ALM 1.0 | LVB | 07.04.2016 |

WATERLOO PIPELINE

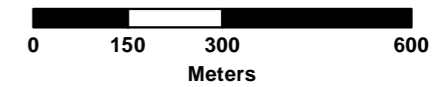
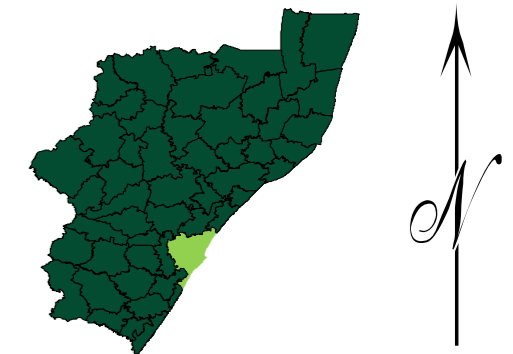
Vegetation On-Site
Overview Map
1:12 000

Legend

 Pipeline



KwaZulu-Natal: eThekweni Municipality



SOURCE: Chief Directorate of Survey & Mapping
Aerial Imagery: 2012



Kinvig & Associates (PTY) Ltd
Suite 3 Park Villages
Victoria Country Club Estate
Montrose
Pietermaritzburg
South Africa
3201



Phone: +27 83 463 2919
e-mail: richard@kaec.co.za

| Project No | Map Ref No | Prepared By | Date |
|------------|------------|-------------|------------|
| 0087 | VOOM 1.0 | LVB | 07.04.2016 |

WATERLOO PIPELINE

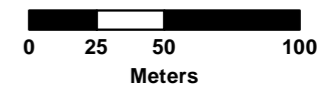
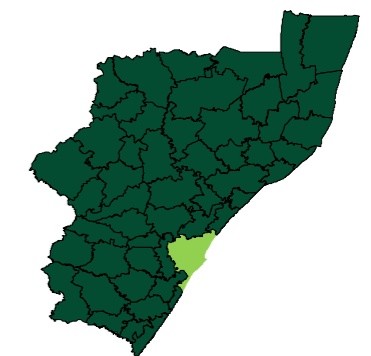
Vegetation On-Site
5.1 - 5.5 Map
1:2 800

Legend

-  Pipeline
-  *Scadoxus puniceus*



KwaZulu-Natal: eThekweni Municipality



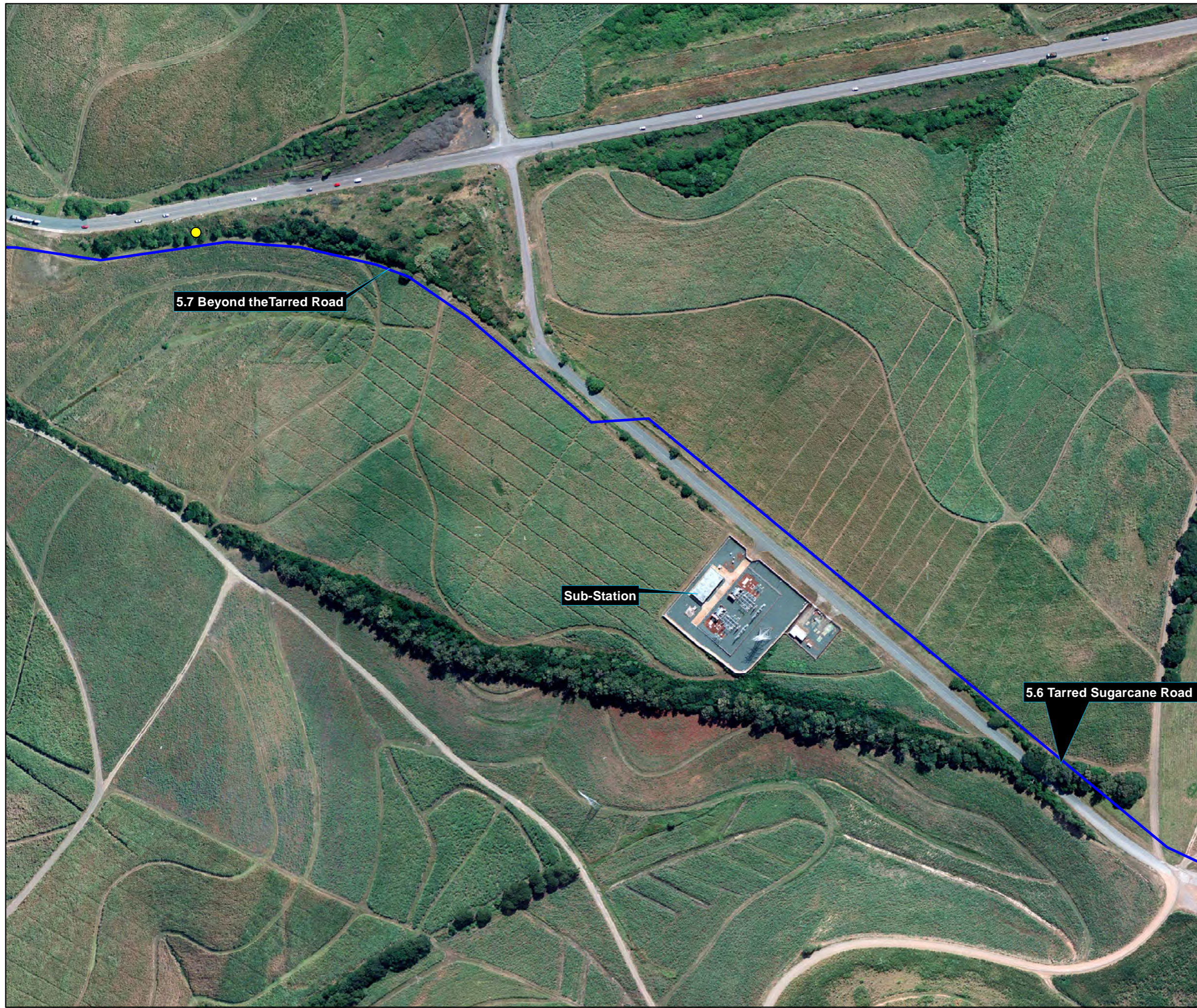
SOURCE: Chief Directorate of Survey & Mapping
Aerial Imagery: 2012



Kinvig & Associates (PTY) Ltd
Suite 3 Park Villages
Victoria Country Club Estate
Montrose
Pietermaritzburg
South Africa
3201

Phone: +27 83 463 2919
e-mail: richard@kaec.co.za

| Project No | Map Ref No | Prepared By | Date |
|------------|---------------|-------------|------------|
| 0087 | VO5.1-5.5 1.0 | LVB | 07.04.2016 |



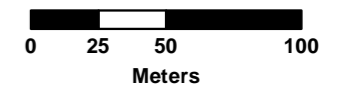
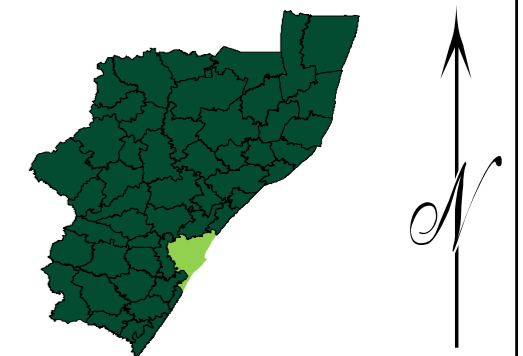
WATERLOO PIPELINE

Vegetation On-Site
5.6 - 5.7 Map
1:2 800

Legend

- Pipeline
- *Scadoxus puniceus*

KwaZulu-Natal: eThekweni Municipality

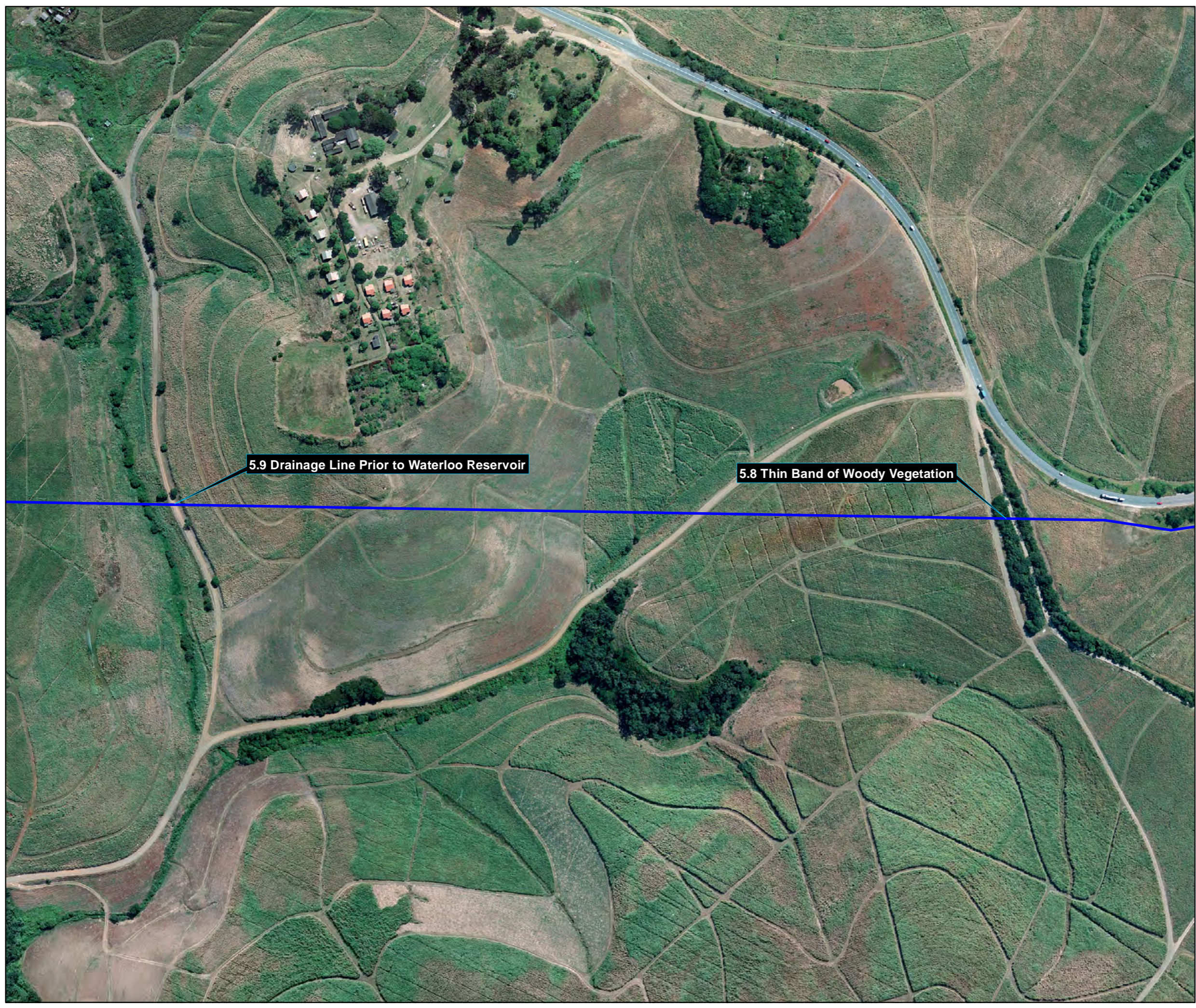


SOURCE: Chief Directorate of Survey & Mapping
Aerial Imagery: 2012

Kinvig & Associates (PTY) Ltd
Suite 3 Park Villages
Victoria Country Club Estate
Montrose
Pietermaritzburg
South Africa
3201

Phone: +27 83 463 2919
e-mail: richard@kaec.co.za

| Project No | Map Ref No | Prepared By | Date |
|------------|---------------|-------------|------------|
| 0087 | VO5.6-5.7 1.0 | LVB | 07.04.2016 |



WATERLOO PIPELINE

Vegetation On-Site
5.8 - 5.9 Map
1:3 500

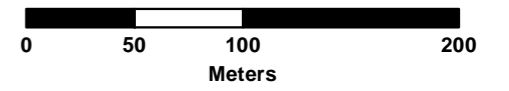
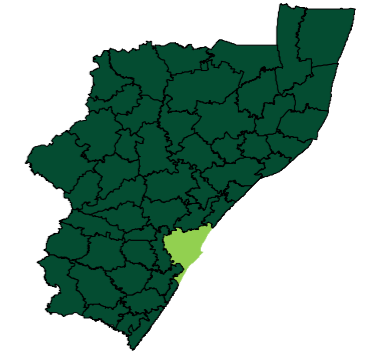
Legend

 Pipeline

5.9 Drainage Line Prior to Waterloo Reservoir

5.8 Thin Band of Woody Vegetation

KwaZulu-Natal: eThekweni Municipality



SOURCE: Chief Directorate of Survey & Mapping
Aerial Imagery: 2012



Kinvig & Associates (PTY) Ltd
Suite 3 Park Villages
Victoria Country Club Estate
Montrose
Pietermaritzburg
South Africa
3201

Phone: +27 83 463 2919
e-mail: richard@kaec.co.za

| Project No | Map Ref No | Prepared By | Date |
|------------|---------------|-------------|------------|
| 0087 | VO5.8-5.9 1.0 | LVB | 07.04.2016 |



APPENDIX B: SPECIES LIST

Table 1: Section 5.1 Species List

| Scientific Name | Growth Form | Status |
|--------------------------------|-------------|------------|
| <i>Asystasia gangetica</i> | Creeper | Indigenous |
| <i>Brachiaria eruciformis</i> | Graminoid | Indigenous |
| <i>Chamaecrista mimosoides</i> | Herb | Indigenous |
| <i>Chromolaena odorata</i> | Shrub | Alien |
| <i>Clerodendrum glabrum</i> | Tree | Indigenous |
| <i>Commelina benghalensis</i> | Creeper | Indigenous |
| <i>Conyza</i> sp. | Herb | Alien |
| <i>Cyperus esculentus</i> | Sedge | Indigenous |
| <i>Desmodium dregeanum</i> | Herb | Indigenous |
| <i>Eragrostis ciliaris</i> | Graminoid | Indigenous |
| <i>Eragrostis curvula</i> | Graminoid | Indigenous |
| <i>Euphorbia hirta</i> | Herb | Alien |
| <i>Helichrysum aureum</i> | Herb | Indigenous |
| <i>Ipomoea simplex</i> | Creeper | Indigenous |
| <i>Lactuca</i> sp. | Herb | Indigenous |
| <i>Melinis repens</i> | Graminoid | Indigenous |
| <i>Panicum maximum</i> | Graminoid | Indigenous |
| <i>Rhynchosia caribaea</i> | Creeper | Indigenous |
| <i>Ricinus communis</i> | Tree | Alien |
| <i>Senecio chrysocoma</i> | Herb | Indigenous |
| <i>Sida cordifolia</i> | Herb | Indigenous |
| <i>Tagetes minuta</i> | Herb | Alien |
| <i>Taraxacum officinale</i> | Herb | Alien |

Table 2: Section 5.2 Species List

| Scientific Name | Growth Form | Status |
|------------------------------------|-------------|------------|
| <i>Acanthospermum australe</i> | Creeper | Alien |
| <i>Chromolaena odorata</i> | Shrub | Alien |
| <i>Chrysanthemoides monilifera</i> | Shrub | Indigenous |
| <i>Cissampelos torulosa</i> | Creeper | Indigenous |
| <i>Clerodendrum glabrum</i> | Tree | Indigenous |
| <i>Gomphrena celosioides</i> | Herb | Alien |
| <i>Grewia occidentalis</i> | Tree | Indigenous |
| <i>Lantana camara</i> | Shrub | Alien |
| <i>Neotonia wightii</i> | Creeper | Indigenous |
| <i>Panicum maximum</i> | Graminoid | Indigenous |
| <i>Senecio deltoideus</i> | Creeper | Indigenous |
| <i>Sida cordifolia</i> | Herb | Indigenous |
| <i>Verbena bonariensis</i> | Herb | Alien |

Table 3: Section 5.3 Species List

| Scientific Name | Growth Form | Status |
|---|-------------|------------|
| <i>Clerodendrum glabrum</i> | Tree | Indigenous |
| <i>Eragrostis ciliaris</i> | Graminoid | Indigenous |
| <i>Erythrina lysistemon</i> | Tree | Indigenous |
| <i>Euclea natalensis</i> subsp. <i>natalensis</i> | Tree | Indigenous |
| <i>Euphorbia inaequilatera</i> | Herb | Alien |
| <i>Ficus sur</i> | Tree | Indigenous |
| <i>Lantana camara</i> | Shrub | Alien |
| <i>Melia azedarach</i> | Tree | Alien |
| <i>Momordica balsamina</i> | Creeper | Indigenous |
| <i>Panicum maximum</i> | Graminoid | Indigenous |
| <i>Ricinus communis</i> | Shrub | Alien |
| <i>Tragus berteronianus</i> | Graminoid | Indigenous |
| <i>Trichilia emetica</i> | Tree | Indigenous |
| <i>Urochloa panicoides</i> | Graminoid | Indigenous |
| <i>Vangueria infausta</i> | Tree | Indigenous |

Table 4: Section 5.4 Species List

| Scientific Name | Growth Form | Status |
|------------------------------------|-------------|------------|
| <i>Ambrosia artemisiifolia</i> | Herb | Alien |
| <i>Asystasia gangetica</i> | Creeper | Indigenous |
| <i>Brachylaena discolor</i> | Tree | Indigenous |
| <i>Bridelia micrantha</i> | Tree | Indigenous |
| <i>Chamaecrista mimosoides</i> | Herb | Indigenous |
| <i>Chloris guyana</i> | Graminoid | Indigenous |
| <i>Chrysanthemoides monilifera</i> | Shrub | Indigenous |
| <i>Clerodendrum glabrum</i> | Tree | Indigenous |
| <i>Digitaria eriantha</i> | Graminoid | Indigenous |
| <i>Hyparrhenia hirta</i> | Graminoid | Indigenous |
| <i>Imperata cylindrica</i> | Graminoid | Indigenous |
| <i>Litsea glutinosa</i> | Tree | Alien |
| <i>Melia azedarach</i> | Tree | Alien |
| <i>Panicum maximum</i> | Graminoid | Indigenous |
| <i>Paspalum urvillei</i> | Graminoid | Indigenous |
| <i>Passiflora foetida</i> | Creeper | Alien |
| <i>Rumex crispus</i> | Herb | Alien |
| <i>Schinus terebinthifolius</i> | Tree | Alien |
| <i>Senna didymobotrya</i> | Tree | Alien |
| <i>Solanum mauritianum</i> | Tree | Alien |

Table 5: Section 5.5 Species List

| Scientific Name | Growth Form | Status |
|---------------------------------|-------------|------------------|
| <i>Albizia adianthifolia</i> | Tree | Indigenous |
| <i>Brachylaena discolor</i> | Tree | Indigenous |
| <i>Bridelia micrantha</i> | Tree | Indigenous |
| <i>Chromolaena odorata</i> | Shrub | Alien |
| <i>Desmodium dregeanum</i> | Herb | Indigenous |
| <i>Litsea glutinosa</i> | Tree | Alien |
| <i>Microsorium scolopendria</i> | Fern | Indigenous |
| <i>Neotonia wightii</i> | Creeper | Indigenous |
| <i>Scadoxus puniceus</i> | Bulb | Protected |
| <i>Tecoma stans</i> | Tree | Alien |

Table 6: Section 5.6 Species List

| Scientific Name | Growth Form | Status |
|--------------------------------|-------------|------------|
| <i>Achyranthes aspera</i> | Herb | Alien |
| <i>Albizia adianthifolia</i> | Tree | Indigenous |
| <i>Asystasia gangetica</i> | Creeper | Indigenous |
| <i>Berkheya bipinnatifida</i> | Herb | Indigenous |
| <i>Bridelia micrantha</i> | Tree | Indigenous |
| <i>Centella asiatica</i> | Creeper | Alien |
| <i>Clerodendrum glabrum</i> | Tree | Indigenous |
| <i>Commelina benghalensis</i> | Creeper | Indigenous |
| <i>Deinbollia oblongifolia</i> | Tree | Indigenous |
| <i>Dovyalis longispina</i> | Tree | Indigenous |
| <i>Eucalyptus sp.</i> | Tree | Alien |
| <i>Ficus natalensis</i> | Tree | Indigenous |
| <i>Jasminum multipartitum</i> | Creeper | Indigenous |
| <i>Litsea glutinosa</i> | Tree | Alien |
| <i>Nemesia dentata</i> | Herb | Indigenous |
| <i>Psidium guajava</i> | Tree | Alien |
| <i>Psychotria capensis</i> | Tree | Indigenous |
| <i>Ptaeroxylon obliquum</i> | Tree | Indigenous |
| <i>Rhoicissus tomentosa</i> | Creeper | Indigenous |
| <i>Ricinus communis</i> | Shrub | Alien |
| <i>Senecio madagascarensis</i> | Herb | Indigenous |
| <i>Sphagneticola triloba</i> | Creeper | Alien |
| <i>Syzygium cumini</i> | Tree | Alien |

Table 7: Section 5.7 Species List

| Scientific Name | Growth Form | Status |
|---------------------------------|-------------|------------------|
| <i>Albizia lebbbeck</i> | Tree | Alien |
| <i>Apodytes dimidiata</i> | Tree | Indigenous |
| <i>Arundo donax</i> | Graminoid | Alien |
| <i>Asystasia gangetica</i> | Creeper | Indigenous |
| <i>Barleria obtusa</i> | Herb | Indigenous |
| <i>Berkheya bipinnatifida</i> | Herb | Indigenous |
| <i>Burchellia bulbina</i> | Tree | Indigenous |
| <i>Canthium inerme</i> | Tree | Indigenous |
| <i>Clerodendrum glabrum</i> | Tree | Indigenous |
| <i>Desmodium dregeanum</i> | Herb | Indigenous |
| <i>Ekebergia capensis</i> | Tree | Indigenous |
| <i>Erythrina lysistemon</i> | Tree | Indigenous |
| <i>Helichrysum kraussii</i> | Herb | Indigenous |
| <i>Lantana camara</i> | Shrub | Alien |
| <i>Leucaena leucocephala</i> | Tree | Alien |
| <i>Melia azedarach</i> | Tree | Alien |
| <i>Passiflora suberosa</i> | Creeper | Alien |
| <i>Phragmites australis</i> | Graminoid | Indigenous |
| <i>Scadoxus puniceus</i> | Bulb | Protected |
| <i>Schinus terebinthifolius</i> | Tree | Alien |
| <i>Searsia chirindensis</i> | Tree | Indigenous |
| <i>Smilax anceps</i> | Creeper | Indigenous |
| <i>Solanum mauritianum</i> | Tree | Alien |
| <i>Trichilia emetica</i> | Tree | Indigenous |

Table 8: Section 5.8 Species List

| Scientific Name | Growth Form | Status |
|----------------------------------|-------------|------------|
| <i>Melia azedarach</i> | Tree | Alien |
| <i>Neonotonia wightii</i> | Creeper | Indigenous |
| <i>Gymnosporia buxifolia</i> | Tree | Indigenous |
| <i>Secamone alpina</i> | Creeper | Indigenous |
| <i>Sansevieria hyacinthoides</i> | Herb | Indigenous |
| <i>Maytenus peduncularis</i> | Tree | Indigenous |
| <i>Burchellia bulbina</i> | Tree | Indigenous |
| <i>Searsia chirindensis</i> | Tree | Indigenous |
| <i>Barleria obtusa</i> | Herb | Indigenous |
| <i>Abutilon sonneratianum</i> | Herb | Indigenous |
| <i>Alternanthera pungens</i> | Herb | Alien |
| <i>Dioscorea cotinifolia</i> | Creeper | Indigenous |

Table 9: Section 5.9 Species List

| Scientific Name | Growth Form | Status |
|---------------------------------|-------------|--------|
| <i>Ricinus communis</i> | Shrub | Alien |
| <i>Solanum mauritianum</i> | Tree | Alien |
| <i>Chromolaena odorata</i> | Shrub | Alien |
| <i>Canna indica</i> | Herb | Alien |
| <i>Schinus terebinthifolius</i> | Tree | Alien |