

## **5 DESCRIPTION OF THE AFFECTED ENVIRONMENT**

### **5.1 ECOLOGICAL DESKTOP DESCRIPTION**

The following sections (Sections 5.1.1 – 5.1.6) present data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the study area's actual site characteristics. This information is however considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and special attention will be afforded to areas indicated to be of higher conservation importance.

#### **5.1.1 National List of Threatened Terrestrial Ecosystems for South Africa (2011)**

The National List of Threatened Terrestrial Ecosystems for South Africa provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS).

According to the National List of Threatened Terrestrial Ecosystems (2011) sections of the proposed road upgrades, southern section of the pipelines, all three alternatives of the power lines, the medium and long hydro-tunnel and a very small portions of the Lalini Dam fall into a vulnerable ecosystem in terms of the original and remaining extent of the associated indigenous vegetation types (**Figure 2**). The vulnerable ecosystem indicates that a loss of structure, function and composition has occurred and that any further degradation should be prevented or minimised where possible. The Ntabelanga Dam road upgrades (new access roads and re-alignment of roads) and the irrigation areas and pipeline infrastructure also fall into a vulnerable ecosystem in terms of the original and remaining extent of the vegetation types. The Ntabelanga Dam and the primary and secondary pipelines fall into a least threatened ecosystem in terms of the original and remaining extent of the associated vegetation type (**Figure 3-4**).

#### **5.1.2 National Protected Area Expansion Strategy (NPAES, 2010)**

The goal of NPAES is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. It deals with land-based and marine protected areas across all of South Africa's territory (SANBI BGIS).

According to the NPAES database, the proposed dam infrastructure in the study area, besides the power transmission line 1, Lalini Dam long hydro tunnel and the Lalini roads towards the Tsitsa River, do not form part of areas earmarked as part of the NPAES

**(Figure 5).** Therefore, it will be important that mitigation measures are adhered too in areas that are considered to be NPAES areas.

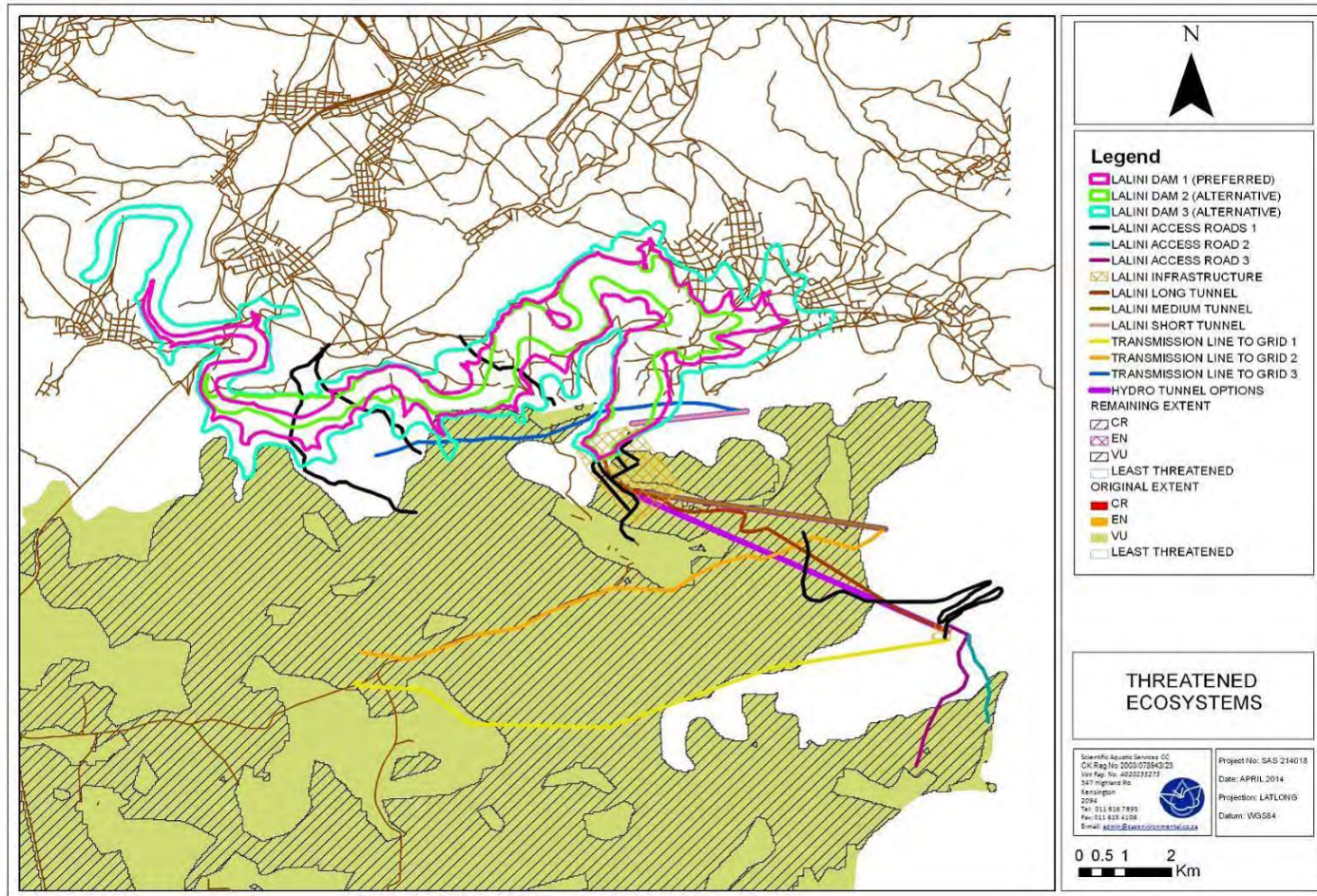


Figure 2: Threatened Ecosystems in terms of the original and remaining extent of the associated vegetation type distributed near the Lalini Dam and associated infrastructure (National List of Threatened Terrestrial Ecosystems, 2011).

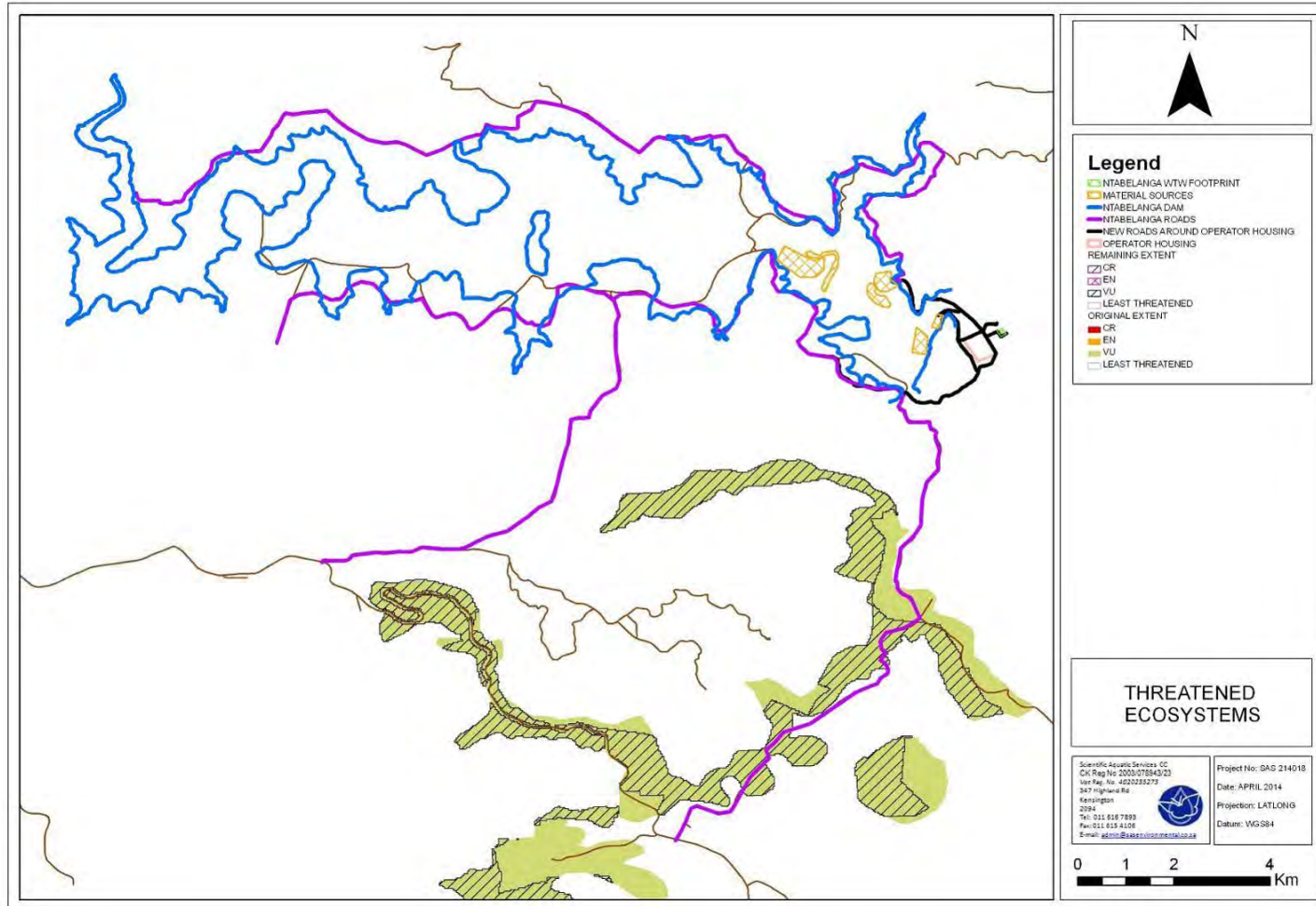


Figure 3: Threatened Ecosystems in terms of the original and remaining extent of the associated vegetation type distributed near the Ntabelanga Dam road upgrades (National List of Threatened Terrestrial Ecosystems, 2011).

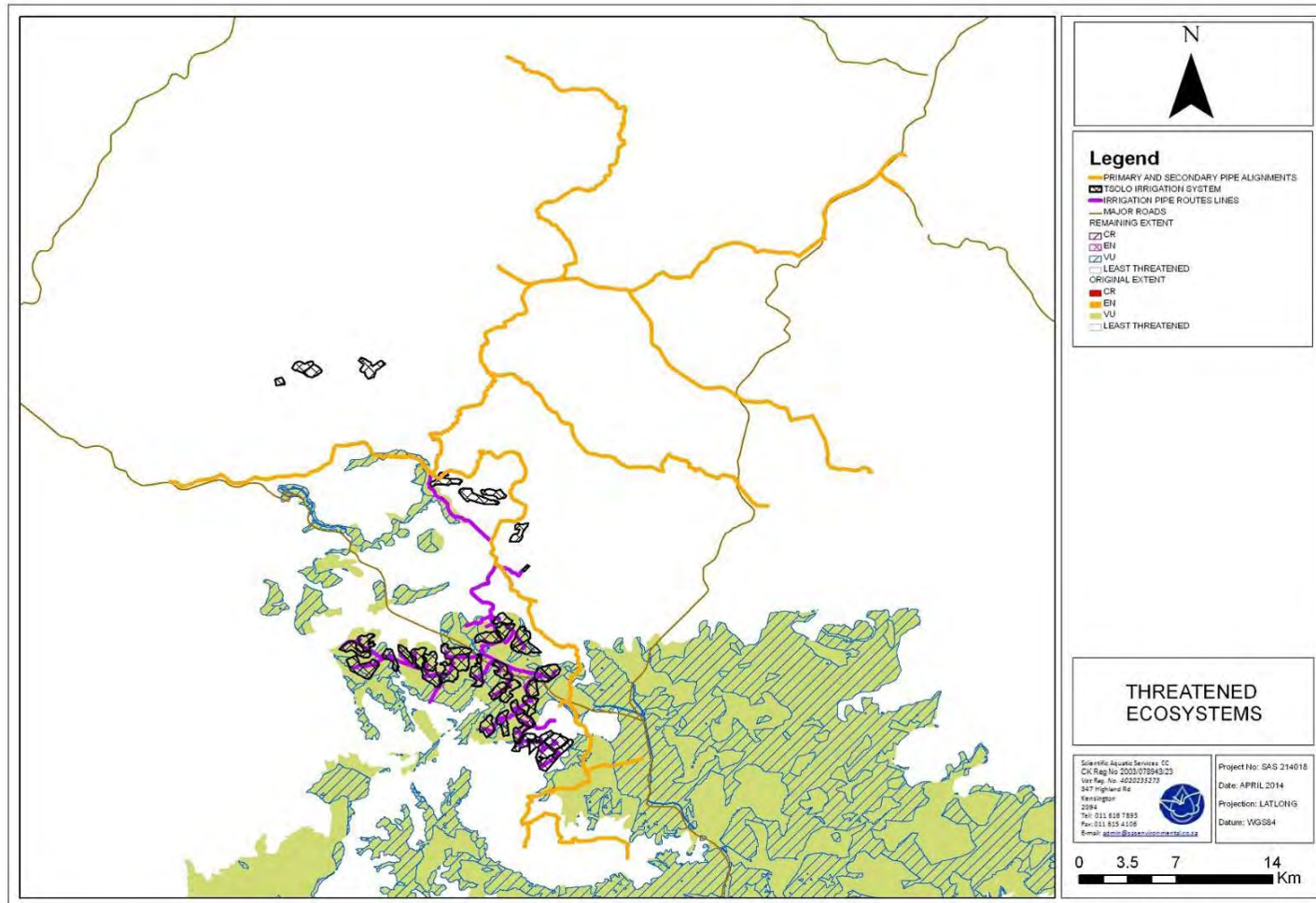


Figure 4: Threatened Ecosystems in terms of the original and remaining extent of the associated vegetation type associated with the irrigation areas and irrigation pipelines (National List of Threatened Terrestrial Ecosystems, 2011).

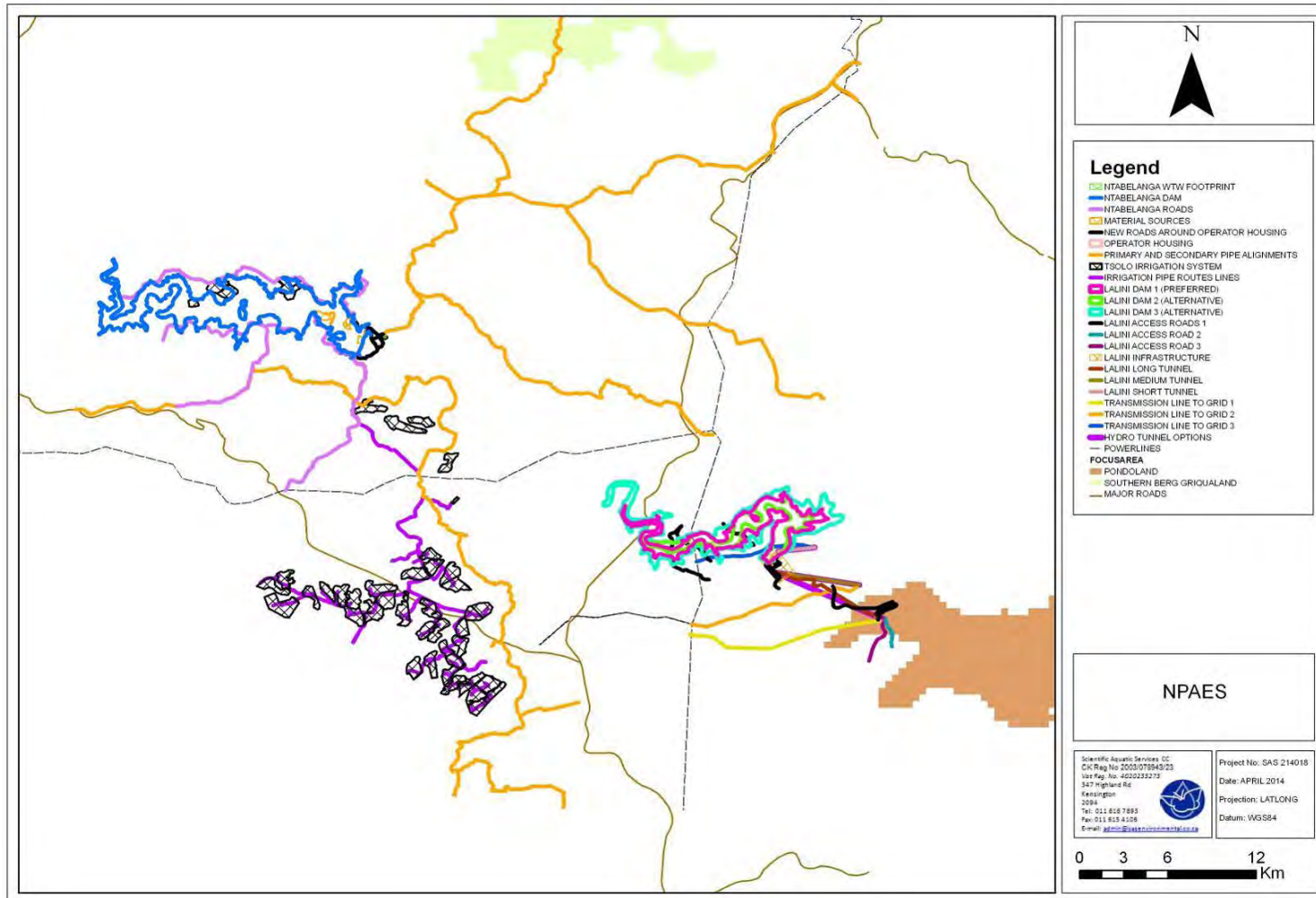


Figure 5: NPAES focus areas identified within the study area (National Protected Area Expansion Strategy, 2010).

### 5.1.3 National Biodiversity Assessment (NBA, 2011)

The recently completed NBA provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA was led by the SANBI in partnership with a range of organisations. It follows on from the National Spatial Biodiversity Assessment (NSBA, 2004), broadening the scope of the assessment to include key thematic issues as well as a spatial assessment. The NBA includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local levels (SANBI BGIS).

The assessment of ecosystem level is then evaluated as the proportion of each vegetation type protected relative to the biodiversity target. According to the NBA, the locations for the proposed Lalini and Ntabelanga Dams are not located within a formally or informally protected area and are classified as *hardly protected*.

### 5.1.4 Importance According to the Eastern Cape Biodiversity Conservation Plan (ECBCP, 2007)

The Eastern Cape Biodiversity Conservation Plan (ECBCP) is a broad scale-biodiversity plan based on identifying Critical Biodiversity Areas (CBAs) and associated land use guidelines (bgis.sanbi.org). It recommends limits to the total amount of land transformation that should be allowed if biodiversity is to be conserved. The approach rests on the concept of Biodiversity Land Management Classes (BLMCs). Each BLMC sets out the desired ecological state that an area should be kept in to ensure biodiversity persistence. Only land use types that are compatible with maintaining this desired state should be allowed.

The ECBCP of the study area has indicated that:

- Besides the southern section of the pipelines, the study area does not fall into an Aquatic CBA.
- The southern pipelines and lower irrigation areas are categorised as an Aquatic CBA 1 area (A1 - *important river sub-catchments and all wetlands* and ABLMC1 - *Natural State*) (**Figure 6**).
- Small portions of the Lalini Dam and infrastructure and the majority of the Ntabelanga Dam and road upgrades are situated in a Terrestrial CBA 2 (BLMC 2 - *Near Natural landscape*) (**Figures 7-8**). These CBA areas provide ecological corridors as identified by other / previous studies or identified by the ECBCP.
- The primary and secondary pipelines and irrigation areas borders into Terrestrial CBA 1 (BLMC 1- *Natural Landscape*) and traverse CBA 2 (BLMC 2-*Near natural landscape*) areas (**Figure 9**).

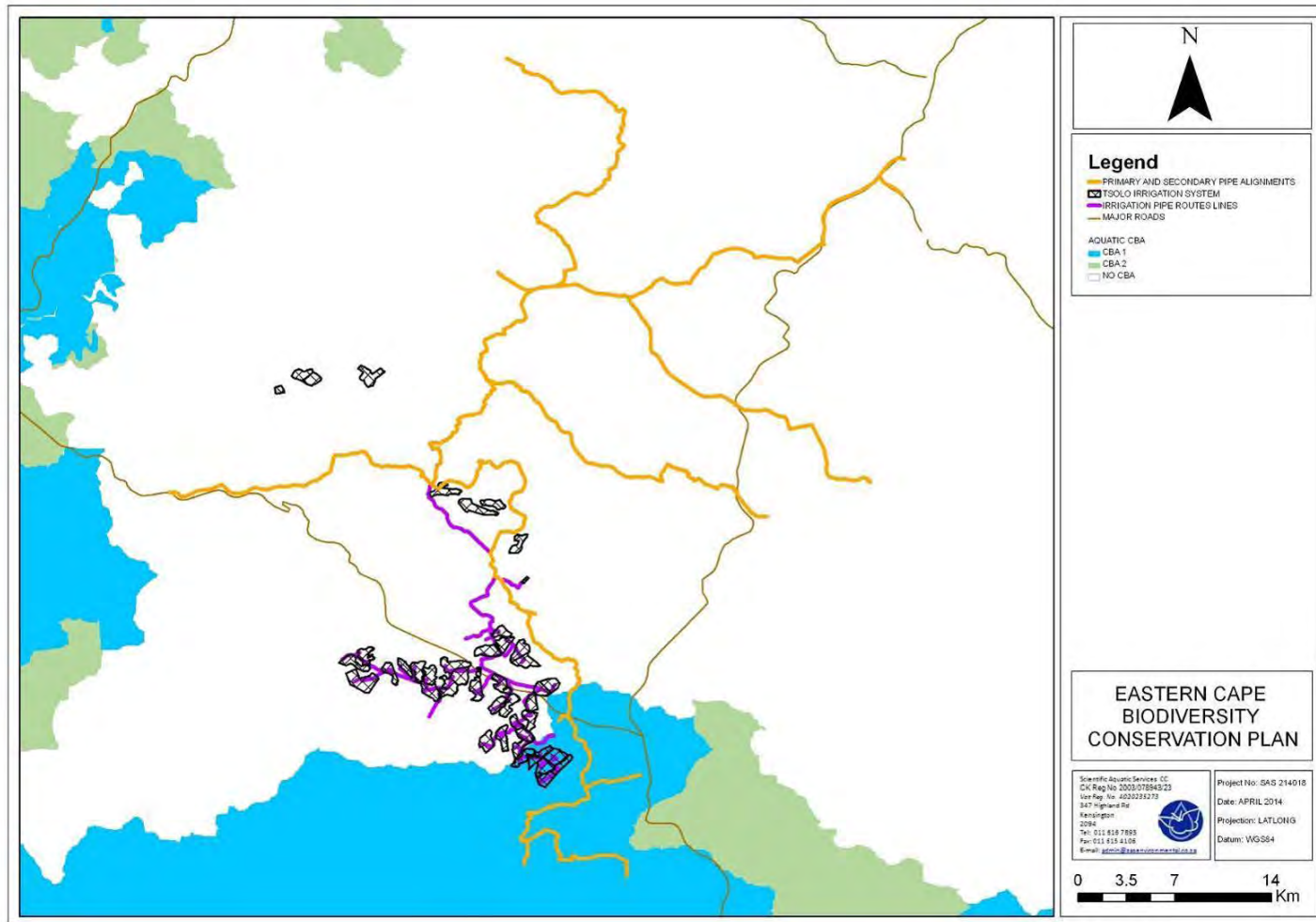


Figure 6: Aquatic Critical Biodiversity Areas associated with the southern section of the pipelines.



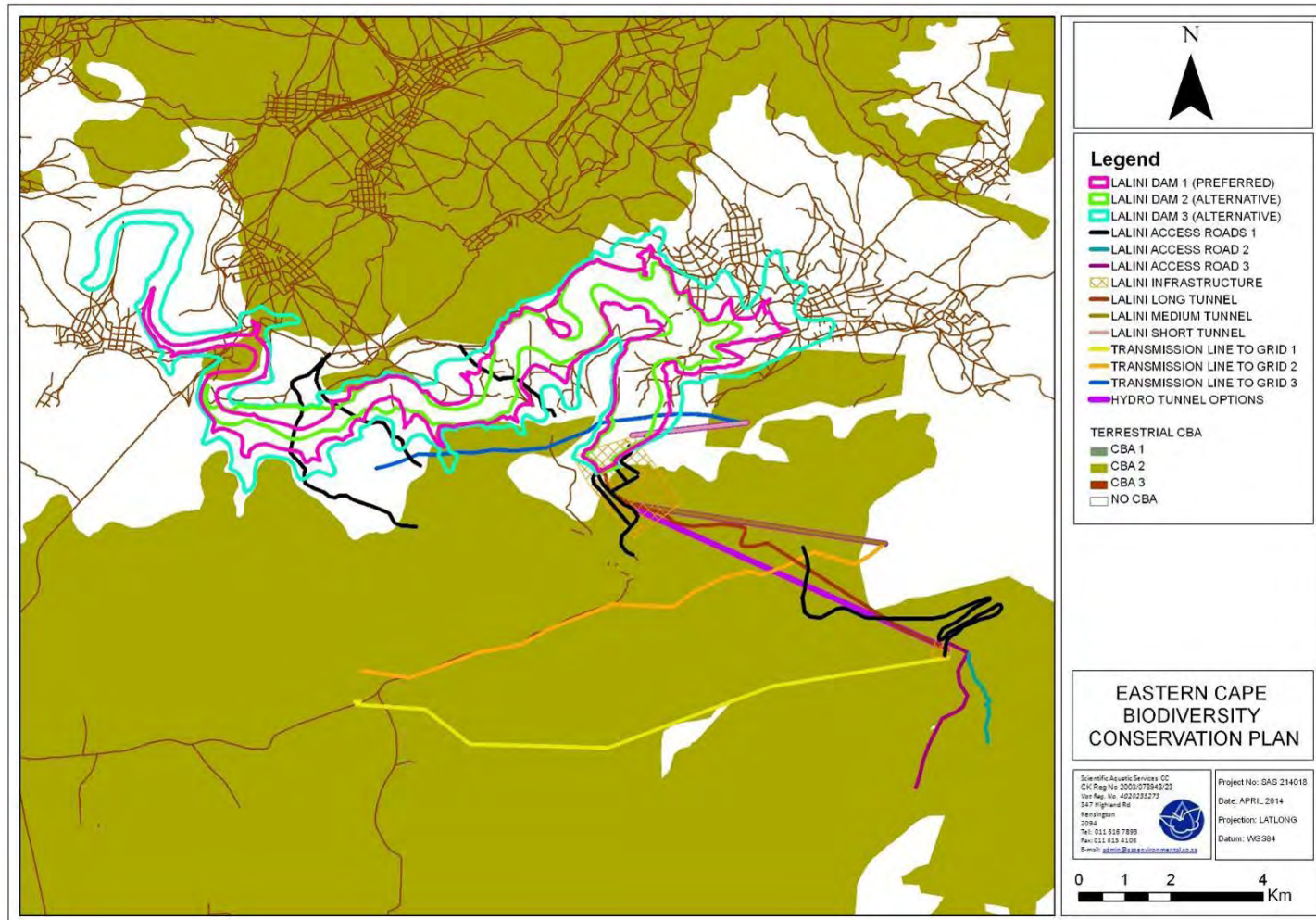


Figure 7: Terrestrial Critical Biodiversity Areas associated with Lalini Dam.

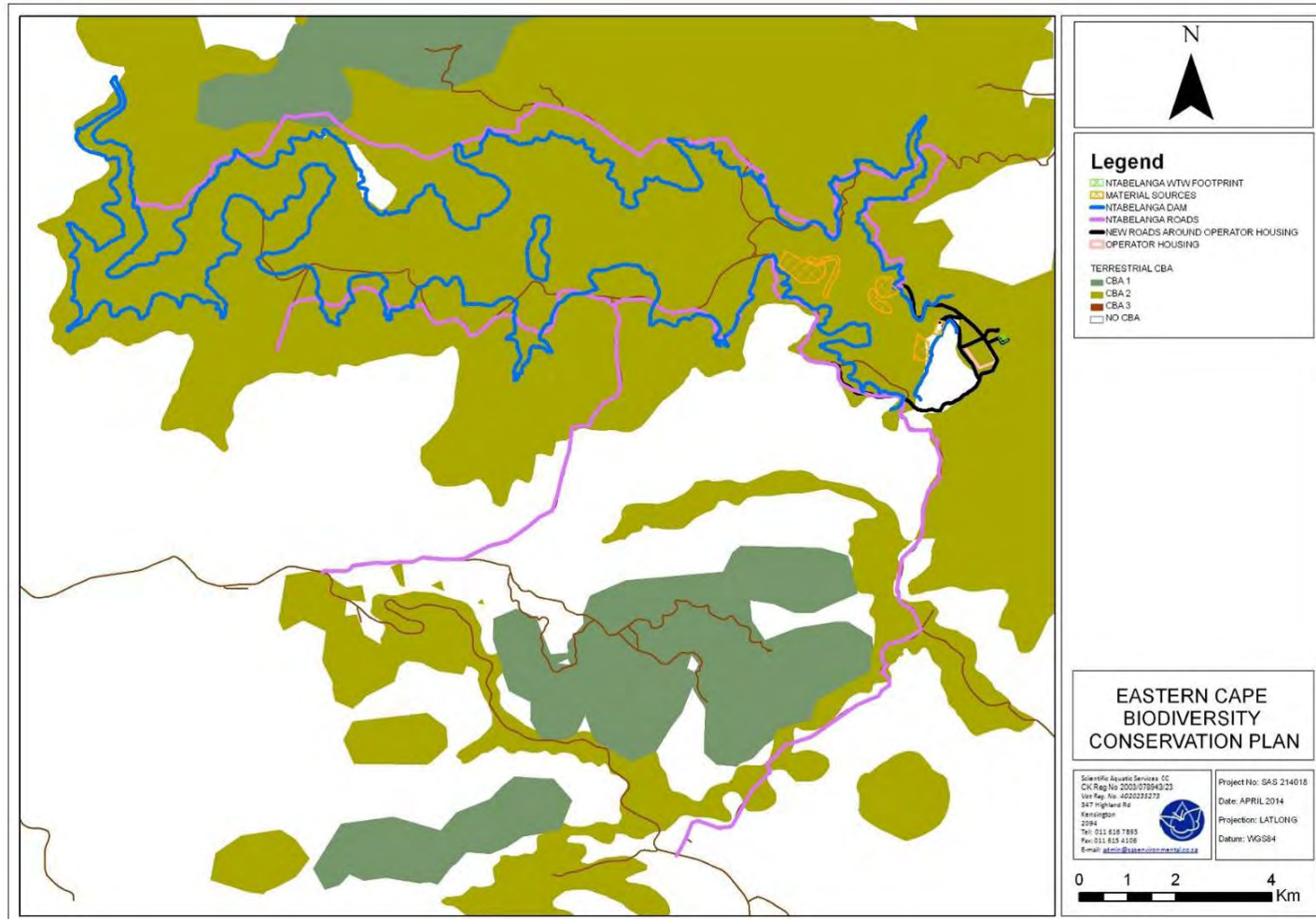


Figure 8: Terrestrial Critical Biodiversity Areas associated with Ntabelanga Dam and the road upgrades.

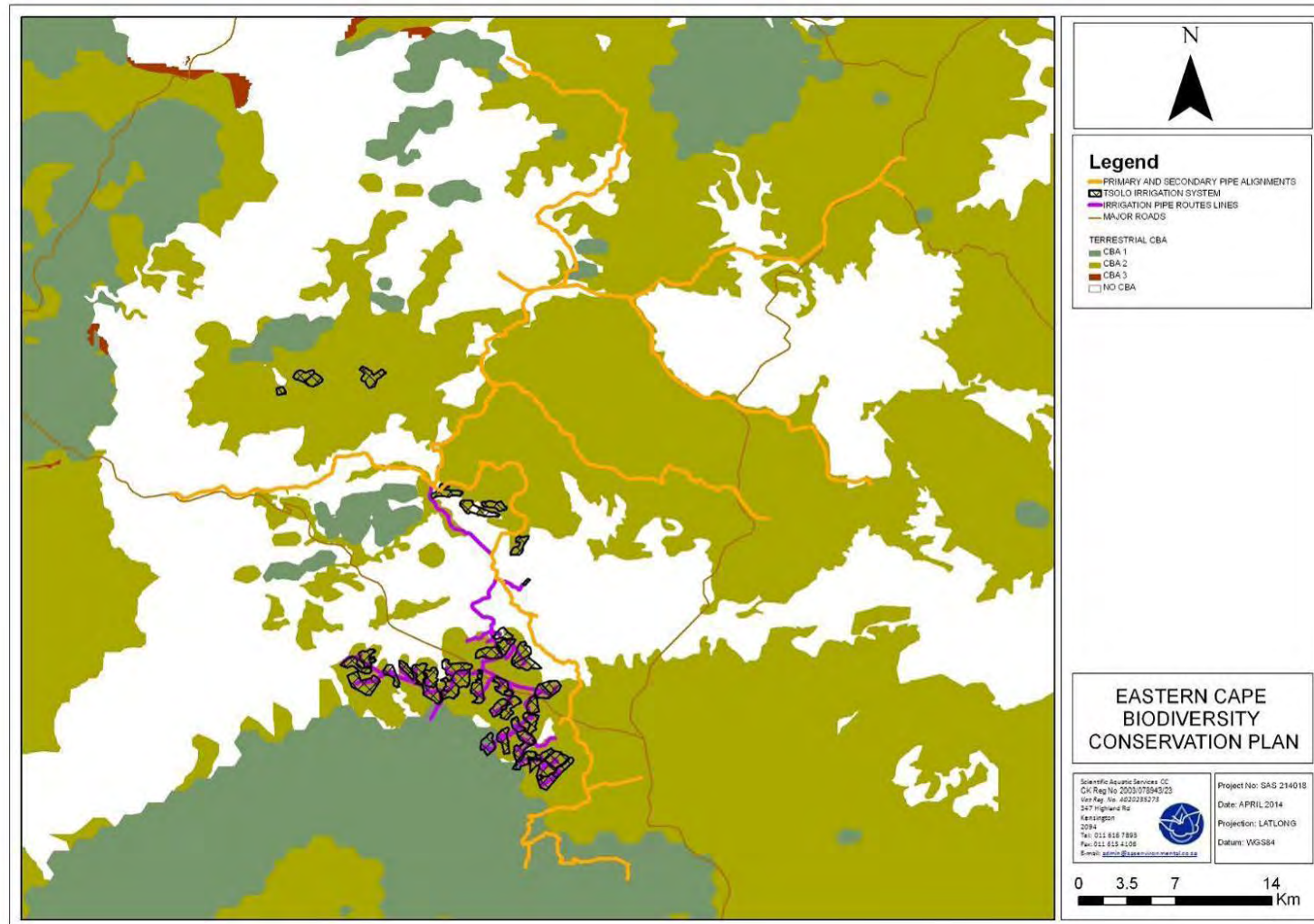


Figure 9: Terrestrial Critical Biodiversity Areas associated with the pipelines and irrigation areas.

### **5.1.5 Biomes and Bioregions**

Biomes are broad ecological units that represent major life zones extending over large natural areas (Rutherford, 1997). The study area falls within both the Savanna and Grassland biome (Rutherford and Westfall, 1994). Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The study area falls within the Sub-escarpment Grassland and Sub-escarpment Savanna Bioregion (Mucina and Rutherford, 2006) (**Figures 10-12**).

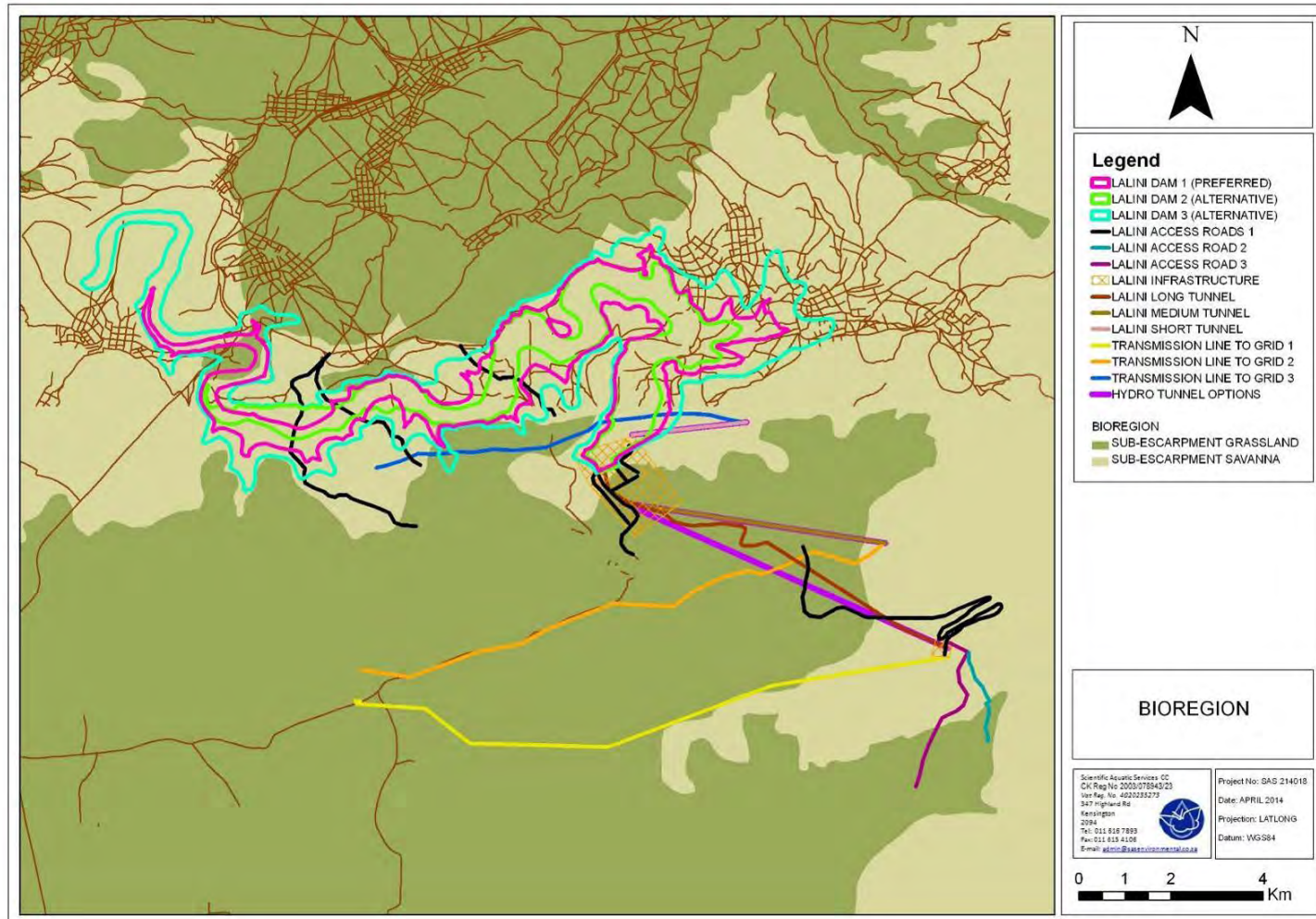


Figure 10: The bioregion associated with Lalini Dam (Mucina and Rutherford, 2006).

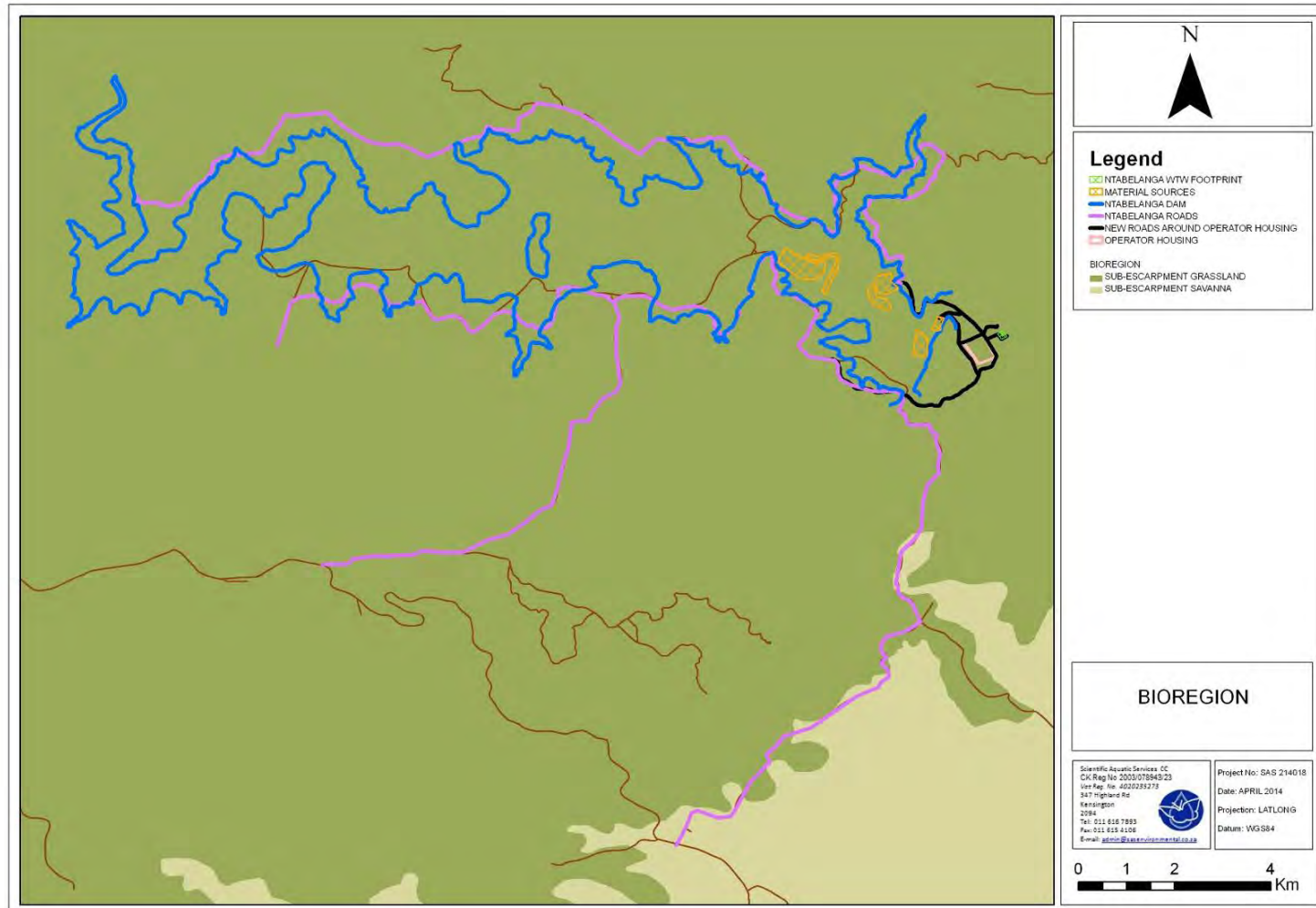


Figure 11: The bioregion associated with Ntabelanga Dam and the road upgrades (Mucina and Rutherford, 2006).

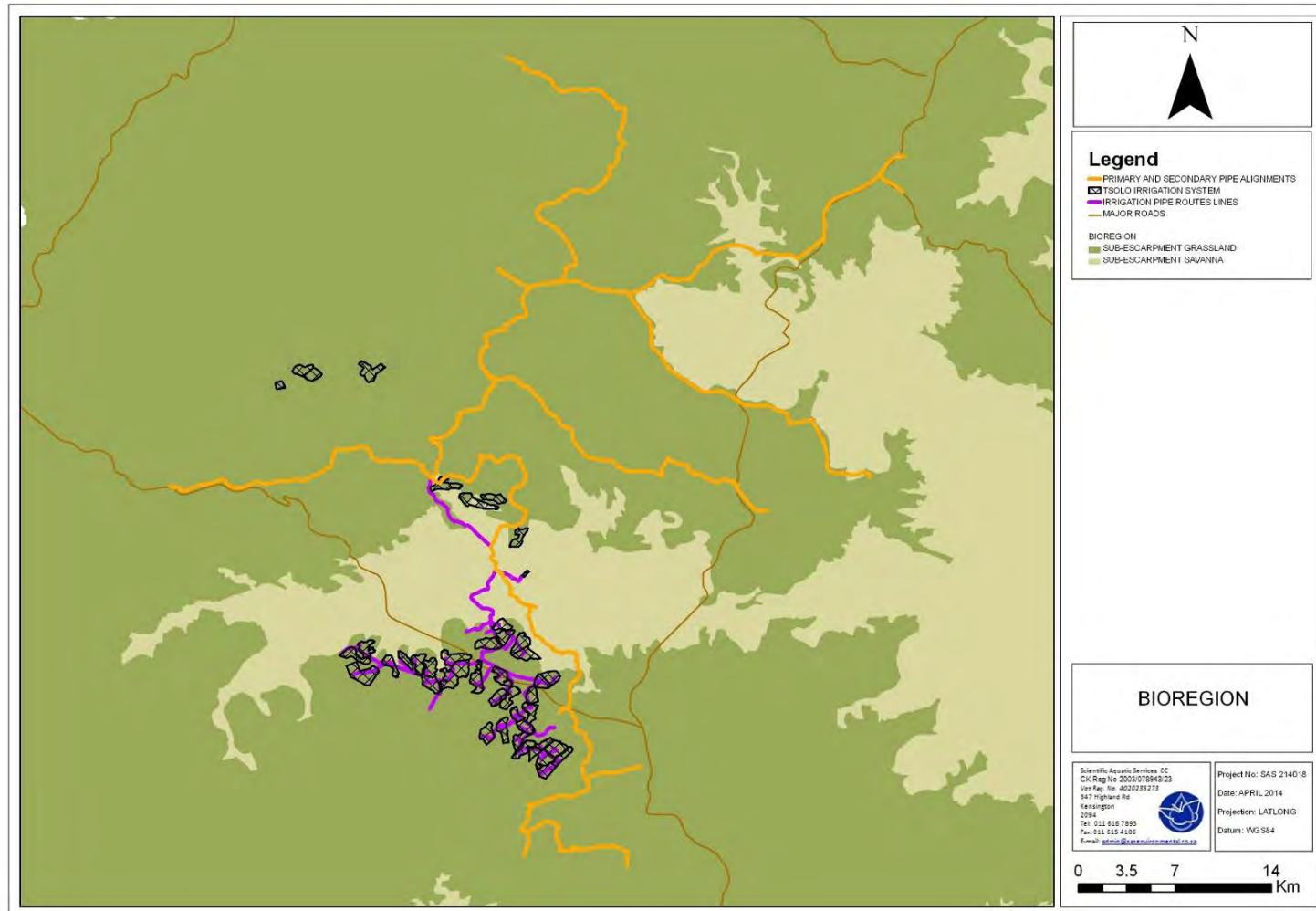


Figure 12: The bioregion associated with the pipelines (Mucina and Rutherford, 2006).

### 5.1.6 Vegetation Type

While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area. Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the assessment site was in a pristine condition, which can then be compared to the observed floral list and so give an accurate and timely description of the ecological integrity of the assessment site. When the boundary of the study site is superimposed on the vegetation types of the surrounding area (**Figure 13-15**), it is evident that the study area falls within a several vegetation types (Mucina and Rutherford, 2006). These include the *Bisho Thornveld*, *Drakensberg Foothill Moist Grasslands*, *Eastern Valley Bushveld*, *Eastern Griqualand Grassland*, *Mthata Moist Grassland* and *Southern Mistbelt Forest*. The characteristic of these vegetation types are discussed in the sections below.

**Table 9: Primary vegetation types applicable to proposed dams and infrastructure.**

Proposed development	Primary Vegetation types
Lalini Dam and associated infrastructure	<i>Bisho Thornveld</i> <i>Eastern Valley Bushveld</i> <i>Eastern Griqualand Grassland</i> <i>Mthata Moist Grassland</i>
Ntabelanga Dam, associated infrastructure and the road upgrades	<i>Eastern Griqualand Grassland</i> <i>Drakensberg Foothill Moist Grasslands</i> <i>Mthata Moist Grassland</i> <i>Eastern Valley Bushveld</i>
Pipelines and irrigation areas	<i>Eastern Griqualand Grassland</i> <i>Drakensberg Foothill Moist Grasslands</i> <i>Mthata Moist Grassland</i> <i>Eastern Valley Bushveld</i>



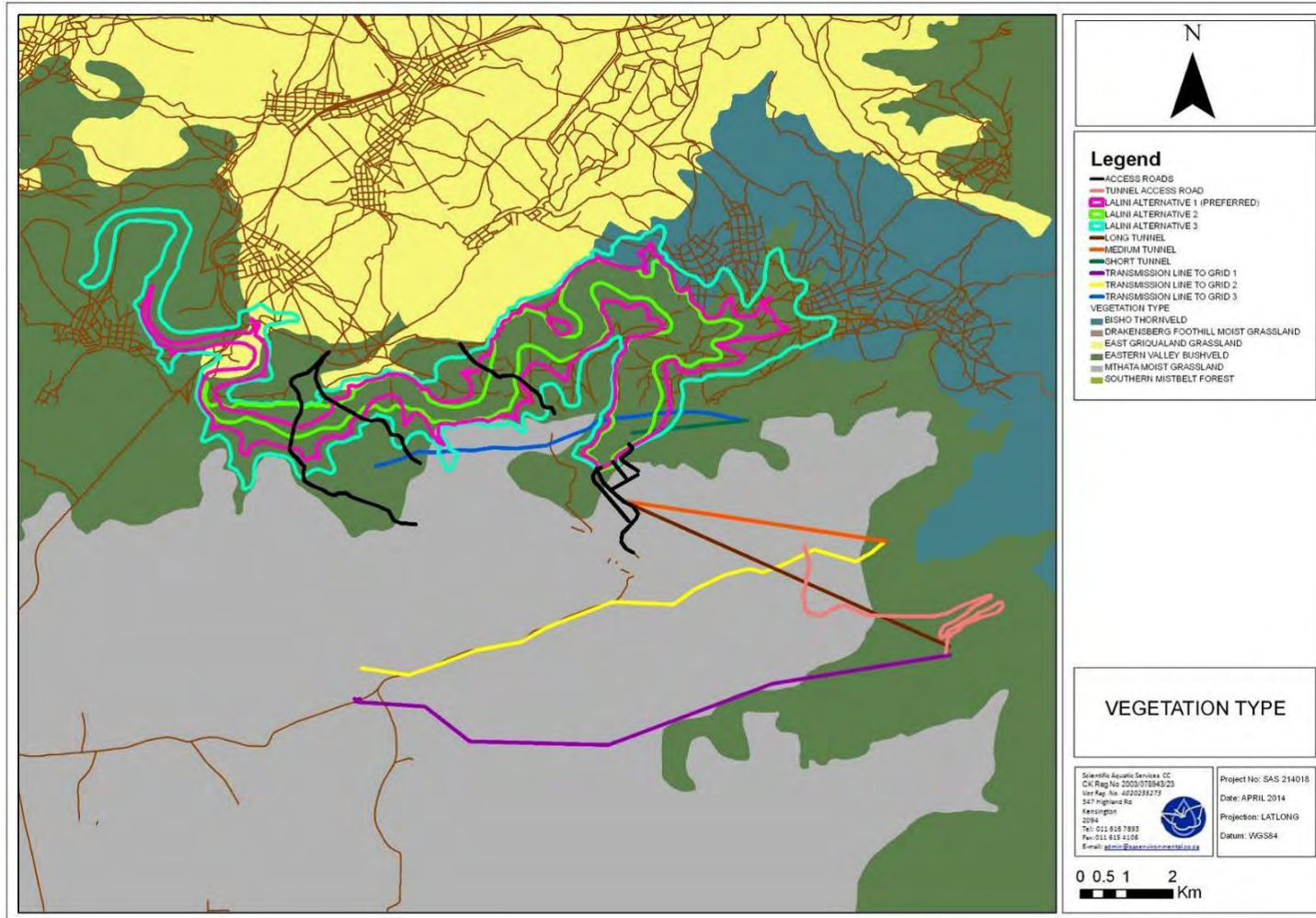


Figure 13: The vegetation type associated with Lalini Dam (Mucina and Rutherford, 2006).

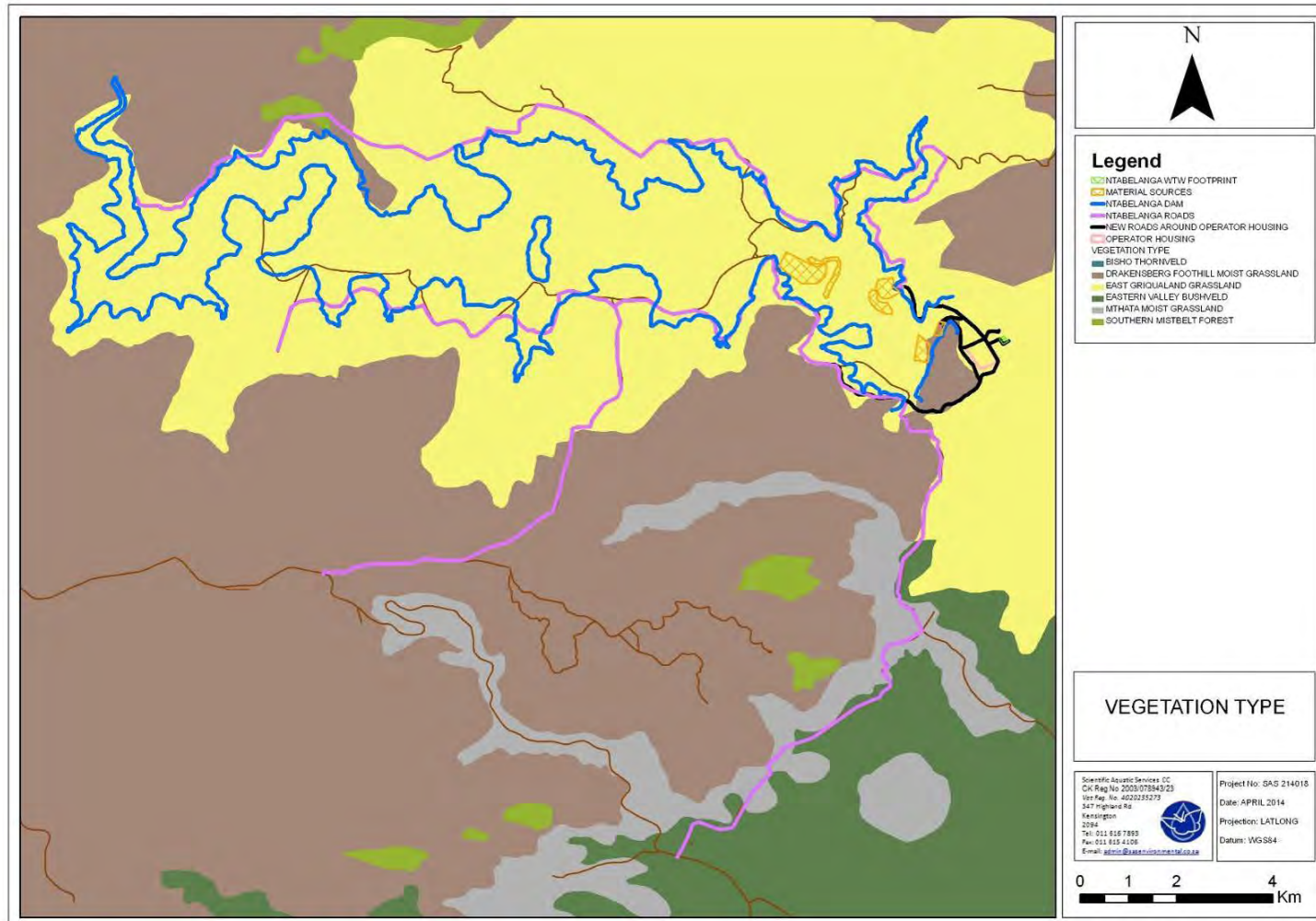


Figure 14: The vegetation type associated with Ntabelanga Dam and the road upgrades (Mucina and Rutherford, 2006).

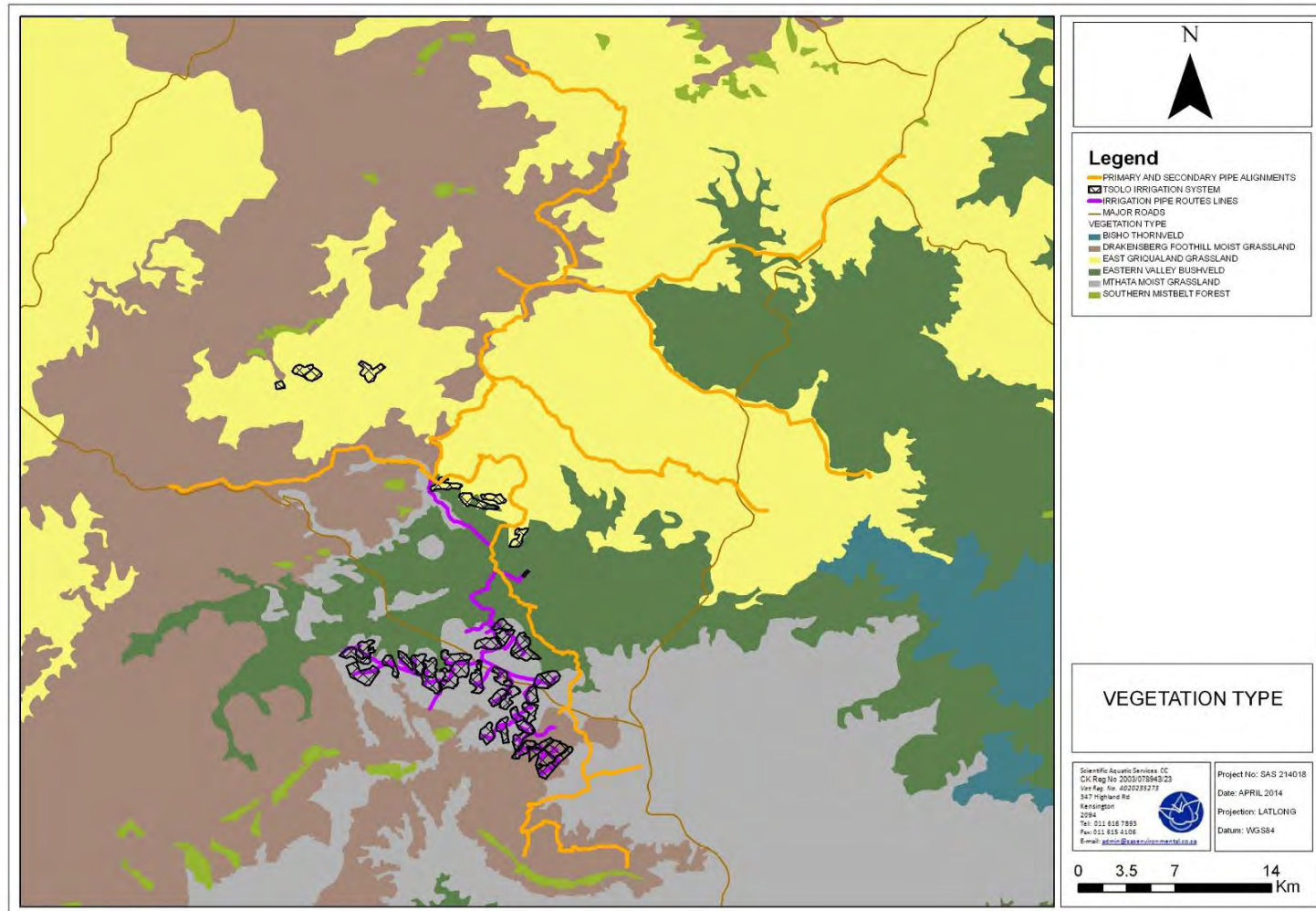


Figure 15: The vegetation type associated with the pipelines (Mucina and Rutherford, 2006).

#### 5.1.6.1 Bisho Thornveld

##### Distribution

The *Bisho Thornveld* vegetation is distributed in the Eastern Cape Province from near Mthata in a band parallel to but inland of the coast to north of East London. It also extends to the southern side of the Amathole Mountains as far as Fort Beaufort. It is found at altitude spanning 200-700 m.

##### Conservation

The *Bisho Thornveld* vegetation is formally classified as a *Least Threatened* vegetation type (provincial conservation target is 25%). Up to 20% has been transformed for cultivation, urban development or plantations. Erosions range from low to moderate.

#### 5.1.6.2 The Drakensberg Foothill Moist Grassland

##### Distribution

The Drakensberg Foothill Moist Grassland vegetation is distributed in KwaZulu-Natal and the Eastern Cape Province within a broad arc of Drakensberg piedmonts covering the surrounds of Bergville in the north, Nottingham Road, Impendle, Bulwer in the east and Kokstad, Mount Currie, Underberg and the surrounds of Mt Fletcher, Ugie, Maclear and Elliot in the south west. It is found at altitudes spanning 880-1 860 m.

##### Conservation

The Drakensberg Foothill Moist Grassland vegetation is formally classified as a *Least Threatened* vegetation type (provincial conservation target is 23%). Almost 20% has already been transformed for cultivation, plantations and urban sprawl. Alien woody species of *Rubus*, *Acacia dealbata* and *Solanum mauritianum* are potential invasive species in certain areas. Erosion ranges between very low (49%), low (28%) and moderate (17%). Biogeographically important taxa include *Schizochilus bulbinella* and *Schoenoxiphium burtii*.

#### 5.1.6.3 Eastern Valley Bushveld

##### Distribution

The Eastern Valley Bushveld vegetation is distributed in KwaZulu-Natal and the Eastern Cape Province within deeply incised valleys of rivers including the lower reaches of the Thukela, Mvoti, Mgeni, Mlazi, Mkhomazi, Mzimkulu, Mzimkulwana, Mtamvuna, Mtentu, Msikaba, Mzimvubu (and its several tributaries), Mthata, Mbhashe, Shixini, Qhorha and the Great Kei. It very seldom extends to the coast. It is found at altitudes spanning 100-1 000 m.

##### Conservation

The Eastern Valley Bushveld vegetation is formally classified as Least Threatened (provincial conservation target is 25%). Up to 15% has been transformed mainly by cultivation. Alien plant invasion are a serious threat with *Chromolaena odorata*, *Lantana camara* and *Caesalpinia decapetala* being the most problematic species.

#### 5.1.6.4 Eastern Griqualand Grassland

##### Distribution

The Eastern Griqualand Grassland vegetation is distributed in KwaZulu-Natal and the Eastern Cape Province with a major portion of this unit covering most of East Griqualand (with Kokstad and Matatiele as centres). It is found at altitudes spanning 920-1 740 m.

##### Conservation

The East Griqualand Grassland is formally classified as a Vulnerable vegetation type (provincial conservation target is 23%). Over one quarter of the area has already undergone transformation due to cultivation of maize, plantations and urban sprawl. *Acacia dealbata* and *Acacia mearnsii* are invading this grassland in some places. Erosion ranges between low (31%), very low (30%) and moderate (30%) (Mucina and Rutherford, 2006). Biogeographically important taxon includes *Encephalartos friderici-guilielmi*.

#### 5.1.6.5 Mthata Moist Grassland

##### Distribution

The Mthata Moist Grassland vegetation is distributed in the Eastern Cape Province on plains between Mthata and Butterworth parallel to the coastline and excluding the river valleys that intrude landwards into this unit. It is found at altitudes spanning 600-1 080 m.

##### Conservation

The Mthata Moist Grassland is formally classified as an Endangered vegetation type (provincial conservation target is 23%). More than 40% of the vegetation has been transformed for cultivation and plantations or by dense human settlements. Previous cultivated or fallow lands possibly constitute an estimated addition 25%. *Acacia mearnsii*, *Solanum mauritianum* and *Richardia humistrata* are the most important aliens. Erosion is a serious problem with high to very high erosion levels in 34% of the unit, moderate erosion in 35% and the remainder having low and very low erosion.

#### 5.1.6.6 Southern Mistbelt Forest

##### Distribution

The Southern Mistbelt Forest vegetation is distributed in KwaZulu-Natal and the Eastern Cape Province. Forest patches vary in size and occur in fire-shadow habitats on south- and southeast-facing slopes located along the Great Escarpment, Somerset East, the

Amathole Mountains, scarps of Transkei to the KwaZulu-Natal Midland and as far east as Ulundi. It is found at altitudes spanning 850-1 600 m (most patches occur between 1 000 and 1 400 m).

### **Conservation**

The Southern Mistbelt Forest is formally classified as a Least Threatened vegetation type (provincial conservation target is 30%). Almost 5% has already been transformed for plantations. Invasive aliens include *Solanum mauritianum*, *Rubus* species and several *Acacia* and *Eucalyptus* species. Uncontrolled harvesting of timber, poles and firewood, overexploitation of non-timber forest products and grasslands are considered as current major threats.

## **5.2 HABITAT UNITS**

Four habitat units have been identified within the study area, namely the Mountain / Rocky Outcrops habitat unit, Grassland / *Acacia* Thornveld habitat unit, Riparian / Wetland habitat unit and the Transformed (Grassland) habitat unit.

The sections below described the habitat units found within the three areas namely, the Ntabelanga Dam (**Figure 16**), Lalini Dam (**Figure 23**) and the road upgrades, pipelines and irrigation infrastructure and areas (**Figure 34-38**).

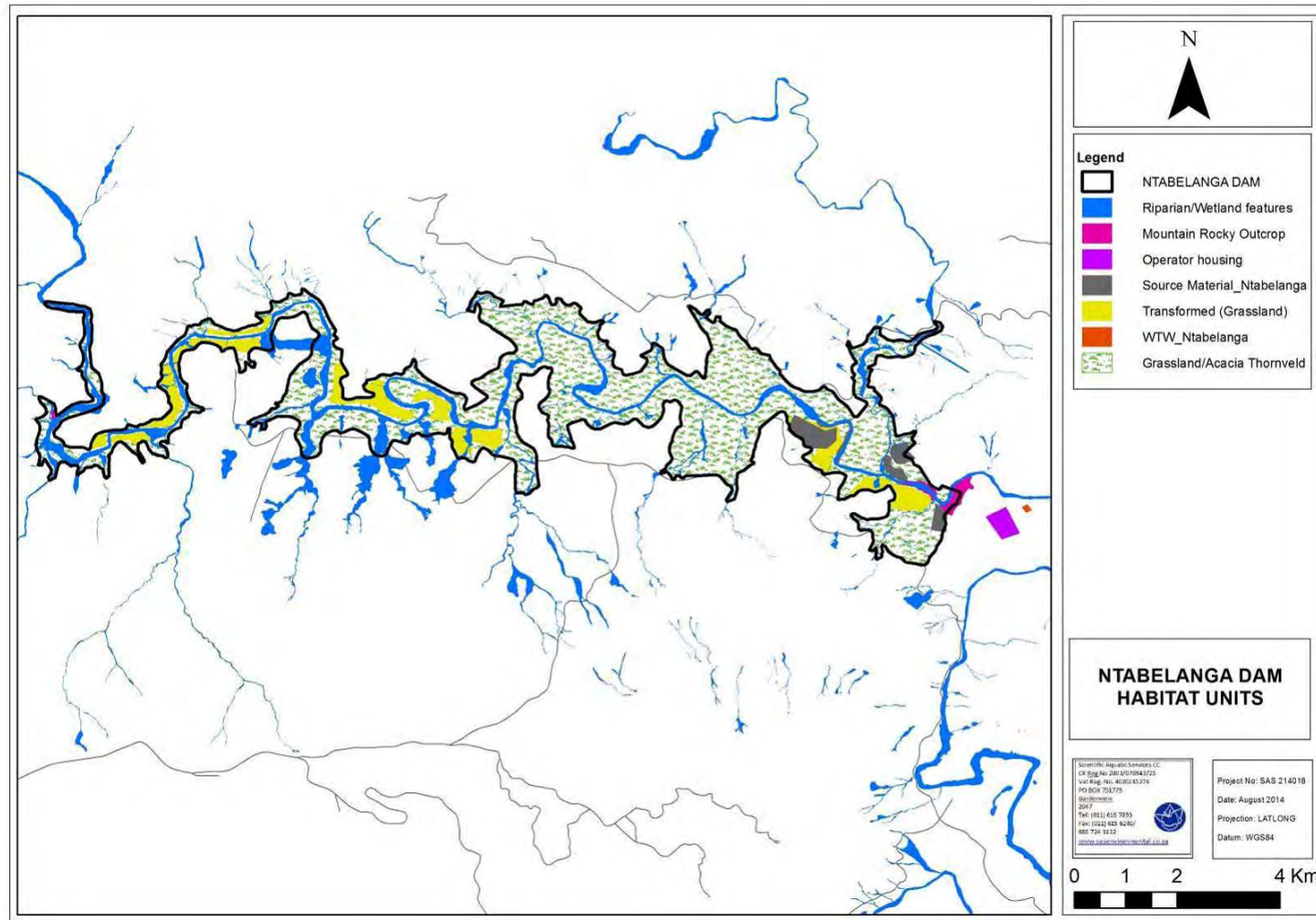


Figure 16: Habitat units identified within the Ntabelanga Dam study area.

### 5.3 NTABELANGA DAM

#### 5.3.1 Mountain / Rocky Outcrop habitat unit

The Mountain / Rocky Outcrop habitat unit is limited to small sections within the Ntabelanga Dam study area. This habitat unit comprises areas of natural vegetation, which have remained largely undisturbed by historic agricultural activities, overgrazing and vegetation clearance from rural communities. These areas consist of well-developed grass and tree layers that provides habitat for a number of floral species considered indicators of the Eastern Griqualand Grassland vegetation type such as *Acacia karroo*, *Ziziphus mucronata* and *Leucosidea sericea*. Dominant woody species, in addition to the species mentioned previously, include *Searsia pyroides*, *Celtis africana*, *Cassonia spicata*, *Acacia caffra*, *Gymnosporia buxifolia*, *G. harveyana* and *Dovyalis caffra*. Graminoid layer is dominated by *Eragrostis curvula*, *Harpochloa falx*, *Melinis nerviglumis* and *Hyparrhenia hirta*. Forb species include *Aloe aborescence*, *Aloe ferox*, *Berkheya* species and *Kalanchoe thyrsiflora*.

Although the construction of the dam will most likely affect the immediate floral biodiversity and possibly the surrounding area by decreasing the floral species, it is important to note that most of the Mountain / Rocky Outcrop habitat occurs above the full supply level of the dam.



**Figure 17: Mountain / rocky outcrop vegetation located within the A) western section of the Ntabelanga Dam footprint area and B) within the eastern section at the dam wall.**

**Table 10** presents the dominant floral species encountered within the Mountain / Rocky Outcrops habitat unit during the assessment.

**Table 10: Dominant species encountered in the Mountain / Rocky Outcrops habitat unit. Alien species are indicated with an asterisk (\*).**

Tree species	Grass species	Forb species
<i>Acacia caffra</i>	<i>Aristida congesta</i>	<i>Aloe aborescence</i>
<i>Acacia karroo</i>	<i>Cymbopogon validus</i>	<i>Aloe transvaalensis</i>
* <i>Acacia mearnsii</i>	<i>Eragrostis curvula</i>	<i>Berkheya sp.</i>
<i>Buddleja saligna</i>	<i>Eragrostis plana</i>	<i>Helichrysum herbaceum</i>



Tree species	Grass species	Forb species
<i>Cussonia paniculata</i>	<i>Eragrostis racemosa</i>	<i>Crassula ericoides</i>
<i>Cassonia spicata</i>	<i>Harpochnoa falx</i>	<i>Crassula nudicaulis</i>
<i>Celtis africana</i>	<i>Hyparrhenia hirta</i>	<i>Helichrysum nudifolium</i>
<i>Dovyalis caffra</i>	<i>Hyparrhenia tamba</i>	<i>Hermannia depressa</i>
<i>Gymnosporia buxifolia</i>	<i>Melinis nerviglumis</i>	<i>Kalanchoe thyrsiflora</i>
<i>Gymnosporia harveyana</i>	<i>Setaria nigrirostris</i>	<i>Senecio retrorsus</i>
<i>Gymnosporia nemerosa</i>	<i>Sporobulus africanus</i>	<i>Vernonia natalensis</i>
<i>Searsia denticata</i>		
<i>Searsia pentheri</i>		
<i>Searsia pyroides</i>		
<i>Trema orientalis</i>		
<i>Ziziphus mucronata</i>		

The ecological function and habitat of the Mountain / Rocky Outcrops habitat unit is considered to be moderate to high due to the few disturbances from agricultural activities, overgrazing and alien floral encroachment. In terms of conservation value, the moderate to high ecological functionality, good habitat integrity, the low incidence of bush or alien floral encroachment, combine to increase the ecological sensitivity of this habitat unit.

### 5.3.2 Grassland / Acacia Thornveld habitat unit

The Grassland / Acacia Thornveld habitat unit includes areas where poor veld management practices has led to extensive bush encroachment in some areas and changed the vegetation structure, as well as areas where historical cultivation activities have taken place. This habitat unit covers small sections within the Ntabelanga study area and in its present state consists of secondary bushveld, with lower expected floral species diversity. Other grassland areas occurred within mountain and rocky areas. These grasslands had some disturbance from grazing of livestock, but more natural species such as *Eragrostis* species, *Aristida* species and *Cymbopogon* species occurred here.

Dominant floral species within the Grassland / Acacia Thornveld habitat unit include the woody species *Acacia karroo*, *A. mearnsii*, *A. dealbata*, and *A. baileyana*. Most of these *Acacia*'s species are associated with disturbance and declared alien and/or invader floral species. A number of herbaceous species are present in this habitat unit and includes *Aloe marlothii*, *Helichrysum oreophilum*, *Hermannia transvaalensis* and *Taraxacum officinale*.



**Figure 18: *Acacia karroo* dominating within the grassland / *Acacia* Thornveld habitat unit.**

The section selected for the placement of infrastructure is located behind the Ntabelanga Dam wall within a grassland area. This area has undergone transformation due to historic agricultural activities. Currently the veld is dominated by *Hyparrhenia hirta*. This area is therefore low in floral diversity. It should also be noted that a floodplain wetland system is located further downwards downstream of the proposed dam wall construction site.



**Figure 19: Veld dominated by *Hyparrhenia hirta* where the construction site will be located. A floodplain wetland feature located further downwards of the proposed site.**

**Table 11** outlines the dominant vegetation species encountered within this habitat unit.

**Table 11: Dominant species encountered in the Grassland / *Acacia* Thornveld habitat unit. Alien species are indicated with an asterisk (\*).**

Tree species	Grass species	Forb species
<i>Acacia karroo</i>	<i>Andropogon contortus</i>	<i>Aloe marlothii</i>
<i>Acacia caffra</i>	<i>Aristida congesta</i> var. <i>congesta</i>	<i>Aloe ferox</i>
* <i>Acacia mearnsii</i>	<i>Aristida congesta</i> var. <i>barbicollis</i>	<i>Berkheya bipinnatifida</i>
* <i>Acacia dealbata</i>	<i>Bulbostylis hispidula</i>	<i>Helichrysum oreophilum</i>
* <i>Acacia baileyana</i>	<i>Chloris virgata</i>	<i>Helichrysum nudifolium</i>
<i>Carissa bispinosa</i>	<i>Cymbopogon validus</i>	<i>Helichrysum krebsianum</i>
* <i>Eucalyptus grandis</i>	* <i>Cynodon dactylon</i>	<i>Hermannia transvaalensis</i>

Tree species	Grass species	Forb species
<i>*Eucalyptus camaldulensis</i> <i>Flacourtia indica</i>	<i>Dactyloctenium giganteum</i> <i>Eragrostis chloromelas</i> <i>Eragrostis curvula</i> <i>Eragrostis gummiflua</i> <i>Harpochloa falx</i> <i>Heteropogon contortus</i> <i>Hyparrhenia hirta</i> <i>Melinis repens</i> <i>Panicum maximum</i> <i>Sporobulus africanus</i> <i>Schoenoplectus corymbosus</i>	<i>*Taraxacum officinale</i>

A decrease in floral diversity has occurred as a result of the edge effects from ploughing and crop cultivation, overgrazing, trampling by livestock and vegetation clearance causing severe soil erosion. The Grassland / *Acacia* Thornveld habitat unit is considered to have a medium to low ecological sensitivity and conservation value due to the change in floral species composition and vegetation structure as a result of the above mentioned impacts. This habitat unit is furthermore well represented within the region, and loss thereof as a result of the dam construction will not significantly affect the floral conservation in the region.

### 5.3.3 Riparian / Wetland habitat unit

Various drainage lines, small tributaries and valley bottom wetlands traverse the study area, including the larger Tsitsa River, which drain in an eastern direction towards the dam wall.

The vegetation present within the Riparian / Wetland habitat unit contains many species observed within the Grassland / *Acacia* Thornveld habitat unit, but also includes a number of obligate wetlands species such as *Bulbostylis hispidula*, *Schoenoplectus corymbosus*, *Typha capensis* and *Cyperus* species. Vegetation within the Riparian / Wetland habitat unit varies from being woody along the larger rivers with associated riparian systems with more open grasslands due to vegetation clearance and erosion along the drainage lines and smaller tributaries.



Figure 20: Riparian and wetland vegetation along the Tsitsa River and smaller tributaries.

Large areas along the riparian features contain alien tree species such as *Acacia mearnsii*, *A. dealbata*, *A. baileyana*, *Eucalyptus grandis* and *E. camaldulensis*. These declared alien invader species compete with and replace indigenous grasslands and riverine species.



**Figure 21: Alien invader species such as *Acacia dealbata* dominating the vegetation in the riparian zones of the main riparian systems.**

**Table 12** outlines the dominant vegetation species encountered within this habitat unit.

**Table 12: Dominant species encountered in the Riparian / Wetland habitat unit. Alien species are indicated with an asterisk (\*).**

Permanent zone	Seasonal / temporary zone	Terrestrial zone
<i>Phragmites australis</i>	* <i>Cynodon dactylon</i>	<i>Acacia karroo</i>
<i>Schoenoplectus corymbosus</i>	<i>Andropogon contortus</i>	* <i>Acacia baileyana</i>
<i>Typha capensis</i>	<i>Persicaria serrulata</i>	* <i>Acacia dealbata</i>
<i>Miscanthus junceus</i>	<i>Persicaria attenuata</i>	* <i>Acacia mearnsii</i>
<i>Leersia hexandra</i>	<i>Phragmites australis</i>	<i>Acacia polycantha</i>
<i>Miscanthus capensis</i>	<i>Schoenoplectus corymbosus</i>	<i>Asparagus larinicus</i>
<i>Bulbostylis hispidula</i>	<i>Typha capensis</i>	<i>Combretum erythrophyllum</i>
	<i>Schoenoplectus brachycerus</i>	* <i>Eucalyptus grandis</i>
	<i>Brachyaria sp.</i>	* <i>Eucalyptus camaldulensis</i>
	<i>Cyperus mariscus</i>	<i>Gymnosporia senegalensis</i>
	<i>Helichrysum sp.</i>	<i>Searsia pyroides</i>
	<i>Imperata cylindrica</i>	<i>Senecio decurrens</i>
	<i>Miscanthus junceus</i>	* <i>Taraxacum officinale</i>
	<i>Sporobolus africana</i>	<i>Aristida congesta subsp. barbiculus</i>
	<i>Sporobolus festivus</i>	<i>Berkheya bergiana</i>
	<i>Setaria sphacelata var. sericea</i>	<i>Chloris virgata</i>
	<i>Eragrostis plana</i>	<i>Cynodon dactylon</i>
	<i>Eragrostis chloromelas</i>	<i>Dactyloctenium giganteum</i>
	<i>Eragrostis curvula</i>	<i>Paspalum dilatatum</i>
	<i>Eragrostis gummiflua</i>	<i>Helichrysum cerastioides</i>
	<i>Cymbopogon validus</i>	<i>Helichrysum nudifolium</i>
	<i>Arundinella nepalensis</i>	<i>Helichrysum krebsianum</i>
		<i>Hyparrhenia hirta</i>
		* <i>Taraxicum officinale</i>

The Riparian / Wetland habitat unit is considered to be of high ecological sensitivity due to the contribution of the various wetland and riparian systems to wetland ecoservices provision and the habitat provided for floral species. Although large sections along the riparian system are dominated by alien invader floral species, pockets of indigenous tree species exist along the Tsitsa River.

Wetlands (and riparian areas) contribute to the maintenance of biodiversity through the provision of habitat and maintenance of natural processes. The integrity of a wetland or riparian feature contributes strongly to the capacity of such a feature to provide this benefit, in addition to specific attributes such as the presence of threatened faunal or floral species (Kotze *et al.*, 2009).

#### **5.3.4 Transformed (Grassland) habitat unit**

The Transformed (Grassland) habitat unit includes areas where vegetation has been completely transformed by historic and on-going small scale agricultural activities and overgrazing of livestock causing erosion and a decrease in vegetation in these areas. Where vegetation has recovered from historic transformation, very little floral diversity occurs. Species dominating this habitat unit is usually associated with disturbance or grows in areas that have been previously cultivated such as *Hyparrhenia hirta*, *Heteropogon contortus* and *Eragrostis curvula*. *Acacia mearnsii* and *Acacia dealbata* were also common tree species located close to this habitat unit.

### **5.4 LALINI DAM**

#### **5.4.1 Mountain / Rocky Outcrop habitat unit**

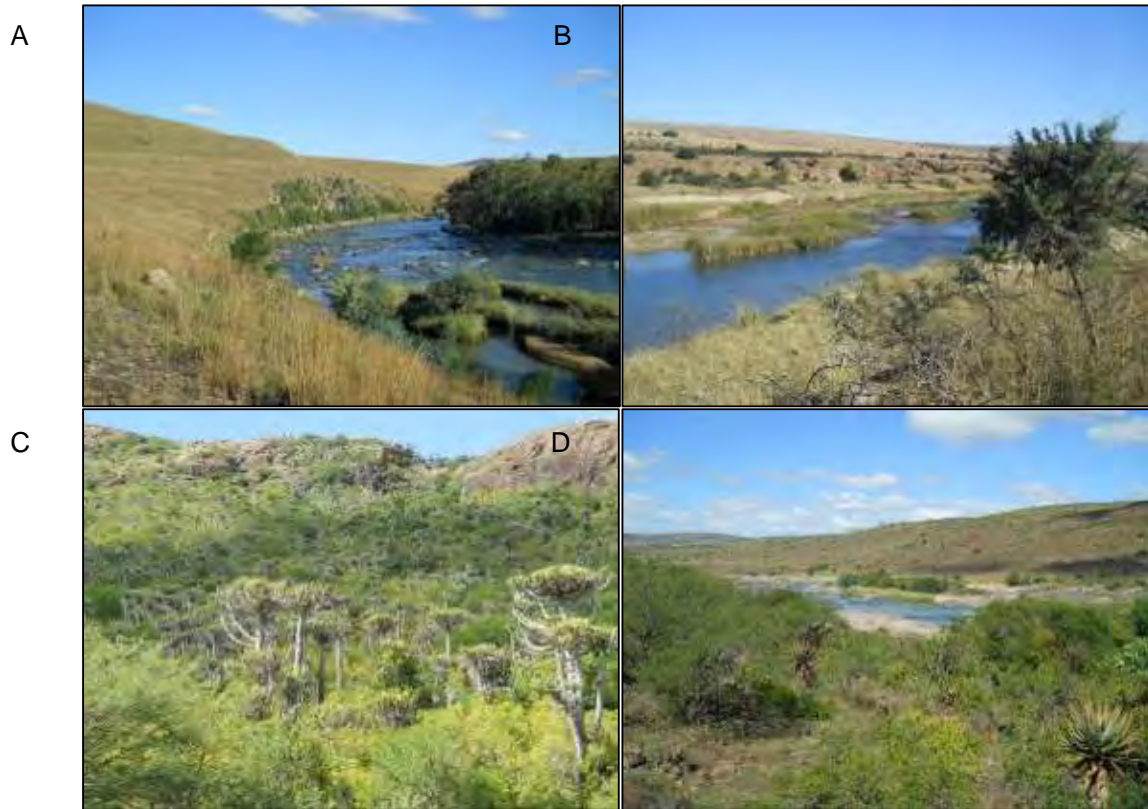
The Mountain / Rocky Outcrop habitat unit is limited to small sections within the Lalini Dam study area. The eastern section of the dam where the largest section of this habitat unit is located comprises of a *Euphorbia* forest and other indigenous tree species.

The *Euphorbia* forest comprises areas of natural vegetation, which have remained largely undisturbed by historic agricultural activities, overgrazing and vegetation clearance from rural communities due to the relative inaccessibility of these areas. These areas consist of well-developed grass and woody layers that provides habitat for a number of floral species considered indicators of the Eastern Griqualand Grassland vegetation type such as *Acacia karroo* and *Ziziphus mucronata*. Dominant woody species, in addition to the species mentioned previously, include *Euphorbia ingens*, *Euphorbia tirucalli*, *Gymnosporia senegalensis*, *Combretum erythrophyllum*, *Portulacaria afra* and *Ziziphus mucronata* and Graminoid layer is dominated by *Eragrostis curvula*, *Cymbopogon validus*, *Melinis nerviglumis* and *Hyparrhenia tamba*. Forb species include *Aloe aborescence*, *Berkheya* species, *Kalanchoe rotundifolia*, *Crassula* species, *Bulbine abyssinica*, *Ledebouria ovatifolia* and *Senecio decurrens*.

Other Mountain / Rocky Outcrop areas were located mostly along the Tsitsa River, also comprising of indigenous tree and forb species. Species located in the western section of the Lalini Dam were the same as the *Euphorbia* forest section, although not as diverse as the eastern section close to the proposed dam wall. More bush encroached areas and alien invader species were located along the eastern section.

Although the construction of the dam will most likely to affect the immediate floral biodiversity and possibly the surrounding area by decreasing the floral species, it is important to note that the most significant impact will be on this vegetation type will be as a result of the flooding of the valley and a significant amount of this vegetation will be drowned once the dam reaches the full supply level.

Construction material for the Lalini Dam will be collected from the footprint area within the Lalini Dam. Section located within the Mountain / Rocky Outcrop where material will be collected needs to take the sensitive habitat into account, since possible protected tree species or other floral of conservational concern could occur within this area.



**Figure 22: Mountain / rocky outcrop vegetation located within the A-B) western section of the Lalini dam footprint area and C-D) within the eastern section at the dam wall.**

The ecological function and habitat of the Mountain / Rocky Outcrops habitat unit is considered to be moderate to high due to the few disturbances from agricultural activities, overgrazing and alien floral encroachment. In terms of conservation value, the moderate to high ecological functionality, good habitat integrity, the low incidence of bush or alien floral encroachment, combine to increase the ecological sensitivity of this habitat unit.

No protected or RDL floral or tree species were located during the time of the site assessment but there is a high probability that such species could be present within this habitat unit.

**Table 13** presents the dominant floral species encountered within the Mountain / Rocky Outcrops habitat unit during the assessment.





**Table 13: Dominant species encountered in the Mountain / Rocky Outcrops habitat unit. Alien species are indicated with an asterisk (\*), Cremnophyte species are indicated in bold.**

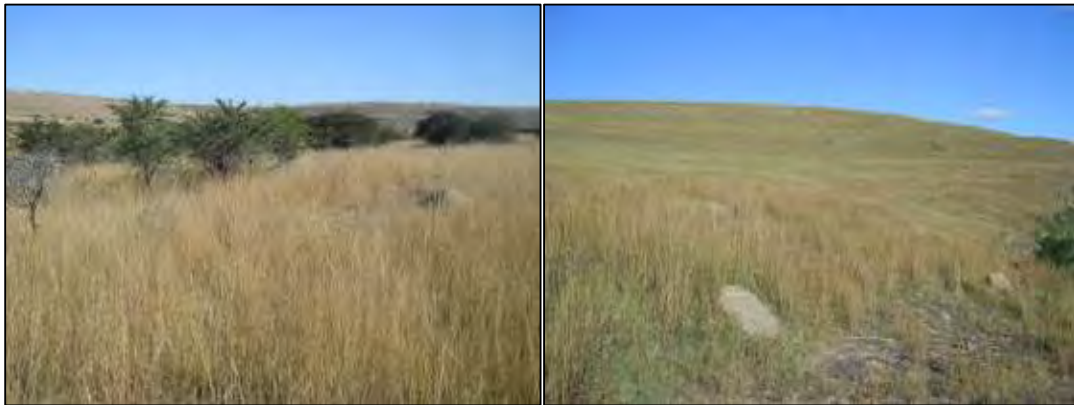
Tree species	Grass species	Forb species
<i>Acacia burkei</i>	<i>Andropogon eucomus</i>	<i>Aloe arborescense</i>
<i>Acacia caffra</i>	<i>Aristida congesta var congesta</i>	<i>Aloe marlothii</i>
<i>Acacia karroo</i>	<i>Bothriochloa insculpta</i>	<i>Aloe ferox</i>
<i>Acacia polycantha</i>	<i>Cymbopogon validus</i>	<i>Asparagus laricinus</i>
<i>Athrixia phyllicoides</i>	<i>Eragrostis gummiiflua</i>	<i>Ammi visnaga</i>
<i>Canthium inerme</i>	<i>Eragrostis curvula</i>	<i>Bauhinia tomentosa</i>
<i>Combretum erythrophyllum</i>	<i>Eragrostis cilianensis</i>	<i>Bulbine abyssinica</i>
<i>Cussonia paniculata</i>	<i>Hyparrhenia hirta</i>	<i>Chironia krebsii</i>
<i>Dovyalis caffra</i>	<i>Hyparrhenia tamba</i>	<i>Conium chaerophylloides</i>
<i>Ehretia rigida</i>	<i>Melinis nerviglumis</i>	<b><i>Crassula ericoides</i></b>
<i>Euclea crispa</i>	<i>Melinis repens</i>	<b><i>Crassula nudicaulis</i></b>
<i>Euphorbia ingens</i>	<i>Sporobolus africanus</i>	<b><i>Crassula obovata</i></b>
<i>Euphorbia tirucalli</i>		<b><i>Crassula lanceolata</i></b>
<i>Ficus indica</i>		<b><i>Crassula pellucida</i></b>
<i>Gymnosporia senegalensis</i>		<i>Delosperma caespitosum</i>
<i>Gymnosporia polycantha</i>		<i>Erica frigida</i>
<i>Portulacaria afra</i>		<i>Gazania krebsiana</i>
<i>Olea capensis</i>		<i>Haplocarpha scaposa</i>
<i>Opuntia ficus-indica</i>		<i>Hermannia transvaalensis</i>
<i>Rhus gueinzii</i>		<i>Indigofera species</i>
<i>Ziziphus mucronata</i>		<i>Ipomoea aquatica</i>
		<b><i>Kalanchoe rotundifolia</i></b>
		<b><i>Kalanchoe luciae</i></b>
		<i>Lampranthus stipulaceus</i>
		<i>Ledebouria ovatifolia</i>
		<i>Nemesia fruticans</i>
		<i>Nerine angustifolia</i>
		<i>Nerine appendiculata</i>
		<i>Pelargonium luridum</i>
		<i>Pellaea calomelanos</i>
		<i>*Plantago lanceolata</i>
		<i>Plectranthus spicatus</i>
		<i>Polygala hottentotta</i>
		<i>Rhodohypoxis rubella</i>
		<i>Senecio decurrens</i>
		<i>Walenbergia cuspidata</i>

#### 5.4.2 Grassland / *Acacia* Thornveld habitat unit

The Grassland / *Acacia* Thornveld habitat unit includes areas where poor veld management practices has led to extensive bush encroachment in some areas and changed the vegetation structure, as well as areas where historical cultivation activities have taken place. This habitat unit covers small sections along the Tsitsa River within the Lalini study consisting of open grassland areas with a variable density of indigenous bush vegetation. Over grazing by livestock from the surrounding communities is one of the main contributors, where indigenous shrubs and trees increase in density to such as extent that other vegetation such as grass species is excluded.

Dominant floral species within the Grassland / *Acacia* Thornveld habitat unit include the woody species *Acacia karroo*. A number of herbaceous species are present in this habitat

unit and includes *Aloe marlothii*, *Berkheya bipinnatifida*, *Hermannia transvaalensis*, *Kalanchoe rotundifolia*, *Tagetes minuta* and *Bidens pilosa*. Graminoid layer is dominated by *Eragrostis curvula*, *Eragrostis gummiflua*, *Bothriochloa insculpta*, *Melinis nerviglumis*, *Sporobolus africanus* and *Hyparrhenia tamba*. All species mentioned here except for *Melinis nerviglumis* occur in areas associated with disturbance or trampled, overgrazed veld, indicating that a greater portion of the graminoid species located within this habitat unit grows in more disturbed areas.



**Figure 24: Open grassland areas along the Tsitsa River on the western section of the Lalini dam study area.**



**Figure 25: *Acacia karroo* dominating within the grassland / *Acacia* Thornveld habitat unit.**

**Table 14** outlines the dominant plant species encountered within this habitat unit.

**Table 14: Dominant species encountered in the Grassland / *Acacia* Thornveld habitat unit. Alien species are indicated with an asterisk (\*).**

Tree species	Grass species	Forb species
<i>Acacia karroo</i>	<i>Andropogon eucomus</i>	<i>Asparagus larycinus</i>
<i>Acacia burkei</i>	<i>Aristida congesta</i> var. <i>congesta</i>	<i>Aloe marlothii</i>
<i>Acacia caffra</i>	<i>Bothriochloa insculpta</i>	<i>Aloe ferox</i>
* <i>Acacia mearnsii</i>	<i>Cynodon dactylon</i>	<i>Bauhinia tomentosa</i>
<i>Acacia tortilis</i>	<i>Cymbopogon validus</i>	<i>Berkheya bipinnatifida</i>
<i>Combretum erythrophyllum</i>	<i>Cymbopogon excavatus</i>	* <i>Bidens pilosa</i>
* <i>Eucalyptus grandis</i>	<i>Dactyloctenium giganteum</i>	<i>Conium chaerophylloides</i>

Tree species	Grass species	Forb species
<i>*Eucalyptus camaldulensis</i>	<i>Dactyloctenium australe</i>	<i>Helichrysum oreophilum</i>
<i>Ziziphus mucronata</i>	<i>Eragrostis curvula</i>	<i>Hermannia transvaalensis</i>
	<i>Eragrostis gummiiflva</i>	<i>Ipomoea purpurea</i>
	<i>Eragrostis inamoena</i>	<i>Kalanchoe rotundifolia</i>
	<i>Hyparrhenia hirta</i>	<i>Kalanchoe luciae</i>
	<i>Melinis nervigulumis</i>	<i>*Tagetes minuta</i>
	<i>Melinis repens</i>	
	<i>Panicum maximum</i>	
	<i>Paspalum distichum</i>	
	<i>*Pennisetum clandestinum</i>	
	<i>Sporobulus africanus</i>	
	<i>Sporobulus fimbriatus</i>	

A decrease in floral diversity has occurred as a result of overgrazing, trampling by livestock and vegetation clearance causing severe soil erosion. The Grassland / *Acacia* Thornveld habitat unit is considered to have a medium to low ecological sensitivity and conservation value due to the change in floral species composition and vegetation structure as a result of the above mentioned impacts. This habitat unit is furthermore well represented within the region, and loss thereof as a result of the dam construction will not be significantly affect floral conservation in the region.

#### 5.4.3 Riparian / Wetland habitat unit

Various drainage lines, small tributaries traverse the study area, including the larger Tsitsa River. The vegetation present within the Riparian / Wetland habitat unit contains woody species, exotic and indigenous as observed within the Grassland / *Acacia* Thornveld habitat unit. Large areas along the riparian features contain alien tree species such as *Acacia mearnsii*, *Eucalyptus grandis* and *E. camaldulensis*. These declared alien invader species compete with and replace indigenous grasslands and riverine species. The remainder of the vegetation found within the drainage lines includes a number of obligate wetlands species such as *Bulbostylis hispidula*, *Schoenoplectus corymbosus*, and various *Cyperus* species.



Figure 26: Riparian and wetland vegetation along the Tsitsa River.

**Table 15** outlines the dominant plant species encountered within this habitat unit.

**Table 15: Dominant species encountered in the Riparian / Wetland habitat unit. Alien species are indicated with an asterisk (\*).**

Permanent zone	Seasonal / temporary zone	Terrestrial zone
<i>Phragmites australis</i>	* <i>Cynodon dactylon</i>	<i>Acacia karroo</i>
<i>Schoenoplectus corymbosus</i>	<i>Persicaria serrulata</i>	* <i>Acacia mearnsii</i>
<i>Typha capensis</i>	<i>Persicaria attenuata</i>	<i>Acacia polycantha</i>
<i>Miscanthus junceus</i>	<i>Phragmites australis</i>	<i>Asparagus larinicus</i>
<i>Leersia hexandra</i>	<i>Schoenoplectus corymbosus</i>	<i>Combretum erythrophyllum</i>
<i>Miscanthus capensis</i>	<i>Typha capensis</i>	* <i>Eucalyptus grandis</i>
	<i>Schoenoplectus brachycerus</i>	* <i>Eucalyptus camaldulensis</i>
	<i>Brachyaria sp.</i>	<i>Gymnosporia senegalensis</i>
	<i>Cyperus mariscus</i>	<i>Searsia pyroides</i>
	<i>Helichrysum sp.</i>	<i>Senecio decurrens</i>
	<i>Imperata cylindrica</i>	* <i>Taraxacum officinale</i>
	<i>Miscanthus junceus</i>	<i>Aristida congesta subsp. barbiculus</i>
	<i>Sporobulus africana</i>	<i>Berkheya bergiana</i>
	<i>Sporobulus festivus</i>	<i>Chloris virgata</i>
	<i>Setaria sphacelata var. sericea</i>	<i>Cynodon dactylon</i>
	<i>Eragrostis plana</i>	<i>Dactyloctenium giganteum</i>
	<i>Eragrostis chloromelas</i>	<i>Paspalum dilitatum</i>
	<i>Cymbopogon validus</i>	<i>Hyparrhenia hirta</i>
	<i>Arundinella nepalensis</i>	
	<i>Zantedeschia species</i>	

The Riparian / Wetland habitat unit is considered to be of high ecological sensitivity due to the contribution of the various wetland and riparian systems to faunal migratory connectivity, wetland ecoservices provision and the habitat provided for floral species. Although large sections along the riparian system are dominated by alien invader floral species, pockets of indigenous tree species exist along the Tsitsa River.

#### 5.4.4 Transformed (Grassland) habitat unit

The Transformed (Grassland) habitat unit includes areas where vegetation has been completely transformed by historic and on-going small scale agricultural activities and overgrazing of livestock causing erosion and a decrease in vegetation in these areas. Where vegetation has recovered from historic transformation, very little floral diversity occurs. Numerous communities / villages also occur outside of the Lalini Dam footprint area, also contributing towards the decrease in ecological integrity of the area. Species dominating this habitat unit is usually associated with disturbance or grows in areas that have been previously cultivated such as *Hyparrhenia hirta*, *Heteropogon contortus* and *Eragrostis curvula*. *Acacia mearnsii* and *Acacia dealbata* were also common tree species located close to this habitat unit.

## 5.5 ROAD UPGRADES AND PIPELINES

### 5.5.1 Road upgrades at Ntabelanga and Lalini Dams

Some new sections of road will be constructed either to provide access to the construction sites or to replace existing roads that will be inundated. In addition to this, some existing roads will be upgraded by resurfacing and improving river crossings. The road upgrades are mostly in the Ntabelanga Dam study area. In terms of vegetation diversity, the edge effects of the existing roads has transformed the vegetation to the extent that only grass species such as *Eragrostis curvula*, *E. chloromelas*, *Hyparrhenia hirta*, *Sporobolus africanus* and *Cynodon dactylon*, which are associated with more disturbed areas, occur alongside the current access roads. Other areas of the road upgrade are located within the higher altitude areas. Indigenous species such as *Aloe marlothii*, *Aloe ferox* and *Aloe aborescence* occurred alongside the current road. These and other indigenous species could be relocated should they occur within the road upgrade footprint area.



**Figure 27: Transformed grassland areas alongside the road upgrade area. Indigenous species such as *Aloe ferox* and *Aloe aborescence* located alongside the road to be upgraded entering the Ntabelanga site.**

Numerous drainage lines, seeps, riparian systems and valley bottom wetland features traverse the road to be upgraded. The wetland features need to be considered when construction of the road upgrades commences to ensure that e.g. sedimentation of wetland features does not take place, wetlands that have undergone severe erosion close to the road, be reinforced to prevent further degradation and stream flow is established.