8. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Key features of the study area are presented in this chapter.

8.1 CLIMATE

Climate data is provided for the towns of Tsolo and Maclear, which are considered to be representative of the general study area. Both towns have sub-tropical climate with moderate rainfall.

Tsolo receives an average annual rainfall of 749 mm, with most rainfall falling in summer. The lowest (15 mm) average monthly rainfall is experienced in June and the highest (108 mm) in January. The coldest month is July with an average minimum temperature of 3.2℃ and January being the hottest month with an average maximum temperature of 26.5℃ (**Table 15**).

Table 15: Climate data for Tsolo

Tsolo	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Average monthly rainfall (mm)	108	107	107	47	26	15	17	22	42	68	89	101
Average minimum Temp (℃)	15.1	15.2	14.1	9.3	7.1	3.5	3.2	5.2	8.2	11	12.4	13.7
Average maximum Temp (℃)	26.5	26.4	25.7	22.5	21.7	19.5	19.4	21	22.5	23	24.4	25.7

Source: www.climate-data.org

Maclear receives an average annual rainfall of 786 mm, with the wettest month being January receiving an average monthly rainfall of 130 mm. The driest months are June and July with both 13 mm average rainfall. The hottest temperatures are experienced in summer with average maximum temperature of 20.1℃ in January. July is the coldest month with temperatures as low as 0℃ (**Table 16**).

The variations in temperature and rainfall in the two towns is due to the difference in elevation: Maclear lies at an elevation of 1 280 m above mean sea level whereas Tsolo is at an elevation of 945 m.

Table 16: Climate data for Maclear

Maclear	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Average monthly rainfall (mm)	130	121	113	46	24	13	13	21	38	64	88	115
Average minimum Temp (℃)	13.9	13.9	12.6	9.3	5.6	0.8	0	3.1	7.3	9.5	11.3	12.6
Average maximum Temp (℃)	26.3	26	24.8	22.5	20	16.4	16.3	18.8	21.7	23	24.3	25.7

Source: www.climate-data.org

8.2 TOPOGRAPHY

The Ntabelanga Dam basin is located within an east-west valley with rising hills to the north and south.

The Lalini Dam basin is generally U-shaped in an east-west and north-south direction surrounded by hills mainly to the north, east and south. The dam wall is located in the east of the dam on the Tsitsa River. The dam site is located about 3.5 km upstream of the scenic Tsitsa Falls.

Deep dongas are evident where the soils are deep and easily erodible.

South of the proposed Lalini Dam, the proposed power line route linking the hydro power plant to the grid (including power line route alternatives) rise up out of the Tsitsa River valley onto the upper plateau over a rolling open landscape to where it meets the national grid approximately 18 km away.

The area around Tsolo earmarked for irrigation consists of gentle rolling hills, much of which used to be terrace farming. Sections are adjacent to drainage lines while others are on sloped terrain. The areas around the Ntabelanga Dam are mainly on flatter lying land adjacent to the edge of the dam and adjacent to the river downstream of the dam.

8.3 GEOLOGY AND SOILS

The study area is underlain by sedimentary rocks of the Tarkastad Subgroup of the Beaufort of the Karoo Supergroup and post Karoo dolerite intrusives. The Karoo Supergroup consists of light brownish grey, fine to medium grained sandstones and subordinate thinner bluish to reddish grey mudrocks. There are also traces of mudflake conglomerates. These sediments were deposited by north flowing braided river systems (**Figure 28**).

There is a low level of tectonic deformations in this region. Dolerite Sills and Dykes are found with thermally metamorphosed adjacent sediments. The dykes are only a few meters wide but stretch for long distances. Dolerite is a dark basic intrusive igneous rock consisting of plagioclase, feldspar and pyroxenes and its soils generally have high potential for both rain fed and irrigated crops and forestry. Beaufort sediments are characteristically erodible.

The bedrock is the main constituent in the study area with some thick colluvial soil deposits covering it.

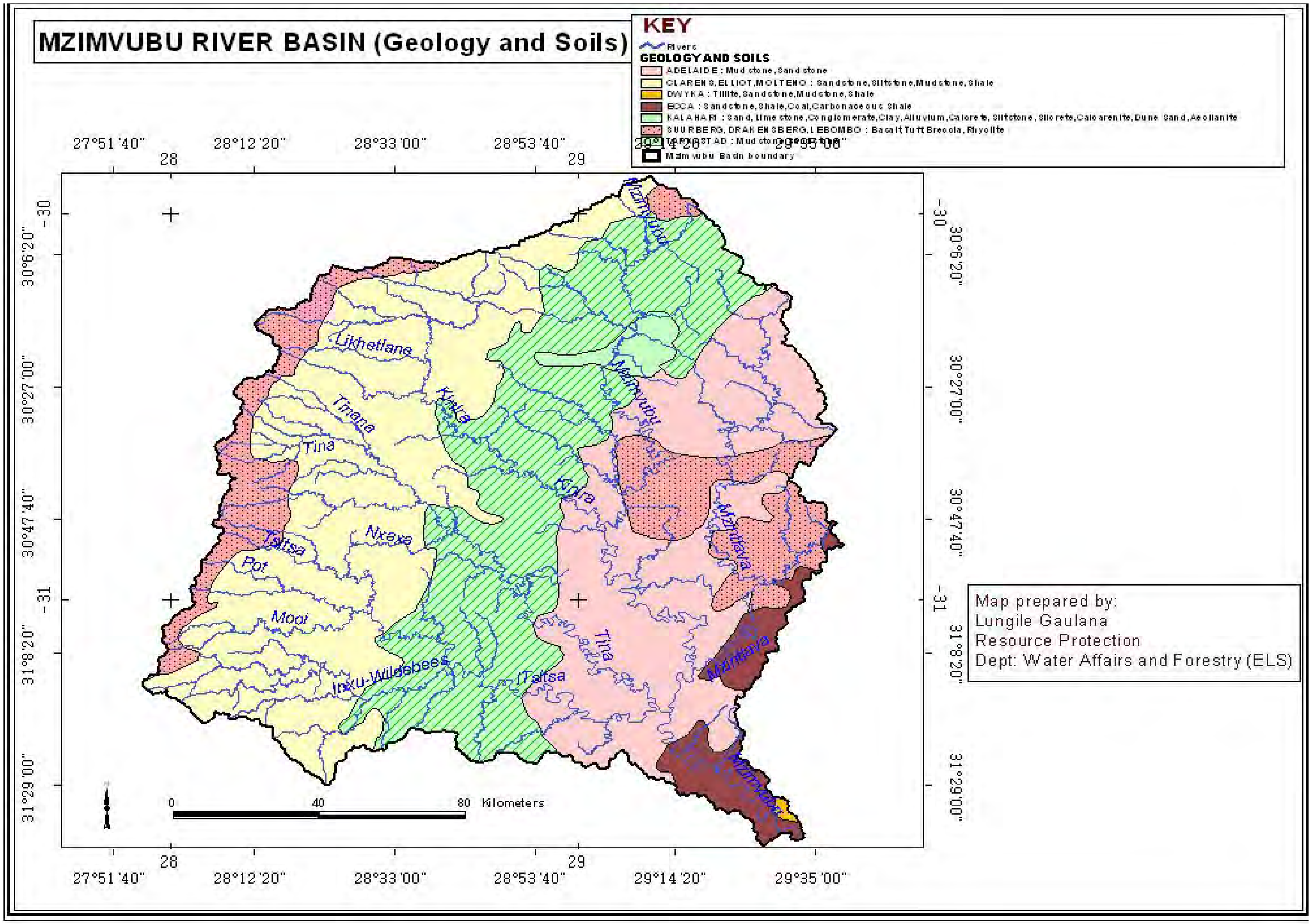

Figure 28: Geology and soils in the Mzimvubu catchment (DWAF, 2008)

Alluvial sand occurs in the course of the Tsitsa River and major tributary rivers and streams. Due to the steep and incised nature of the rivers, sand is mainly confined to the river channel, with few and only localised over-bank deposits (DWA, 2013b).

The area has Hutton 2200 salm and Hutton 2100 salm soil types. Orthic topsoils overlie red apedal subsoils. Topsoil texture is sandy loam becoming sandy clay loam in the subsoil. Soils thus have luvic character as clay has moved from top to subsoil over time. Textural transition from top-to subsoil is gradual providing free root penetration. Soil structure is apedal tending to weak crumb (DWA, 2013a).

Soil erosion

There are extensive areas of severe gulley erosion on the inter-fluvial areas adjacent to stream channels (**Figure 29**). The erosional and piping characteristics are suggestive of the presence of dispersive soils (DWA, 2013b).

In the Mzimvubu and Tsitsa River catchments, soil erosion is an outcome of high rainfall intensities, steep slopes, erodible soils and land use practices that are conducive to erosion. The latter include overgrazing and cultivation on unsuitable thin soils with sloping terrain, which causes grass to not recover, a loss of root structure and sheet erosion.

Figure 29: Donga in the Ntabelanga Dam area

Structures placed in the way of water flow paths have caused the interception of flood paths and springs, cutting off recharge to wetlands and the formation of artificial flood barriers, thereby also causing erosion, as well as sedimentation, and damage to the structures themselves.

Erosion and land degradation affect ecosystem health and negatively impact on the majority of downstream rivers, which are characterised by high turbidity and increased siltation. The high sediment loads in rivers will increase water treatment costs and decreases the lifespan of any dams or hydropower schemes.

A catchment rehabilitation and management programme, aimed at restoring eroded land and thereby reducing the levels of sedimentation that are expected to impact on the yield of the dams, has been initiated in the Mzimvubu River catchment. A budget of R 450 million over the next 10 years has been allocated to the programme. The work has begun in the Tsitsa River catchment in order to synchronise with the proposed new dams currently under investigation. The programme is being implemented by the Department of Environmental Affairs. It will include alien vegetation eradication, the phased restoration of eroded areas and future erosion preventative measures such as sediment trapping and reuse, planting of erosion reducing vegetation, improving land-use practices by rotational usage regime including rotational fencing of grazing areas for protection purposes.

The benefits of the programme include the restoration of wetlands and productive land, reduction of future erosion and land loss, and the reduction of sediment released into the river resulting in improved water quality, reduced water treatment costs and longer operational lifespan of proposed dams and hydropower plants. Improved runoff and river flow regulation via wetlands will improve base flow and reduce peak flood events. The programme will create temporary and permanent jobs.

In order to minimise the impacts on sedimentation within the dam a sediment management program should be implemented as part of the DEA's catchment rehabilitation and management plan for the dam catchments and should include awareness training on sustainable agricultural practices.

While this project will impact positively on the Mzimvubu Water Project, it is conducted as an independent project and its activities are not a part of this EIA.

8.4 FLORA

8.4.1 Bioregions

The study area falls within the Sub-escarpment Grassland and Sub-escarpment Savanna Bioregions (Mucina and Rutherford, 2006) (**Figure 30**).

8.4.2 Vegetation types

The study area falls within 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* (**Figure 33**). These vegetation types are discussed below.

The *Bisho Thornveld* vegetation is found at altitude spanning 200-700 m. It 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. Erosion in this vegetation type ranges from low to moderate.

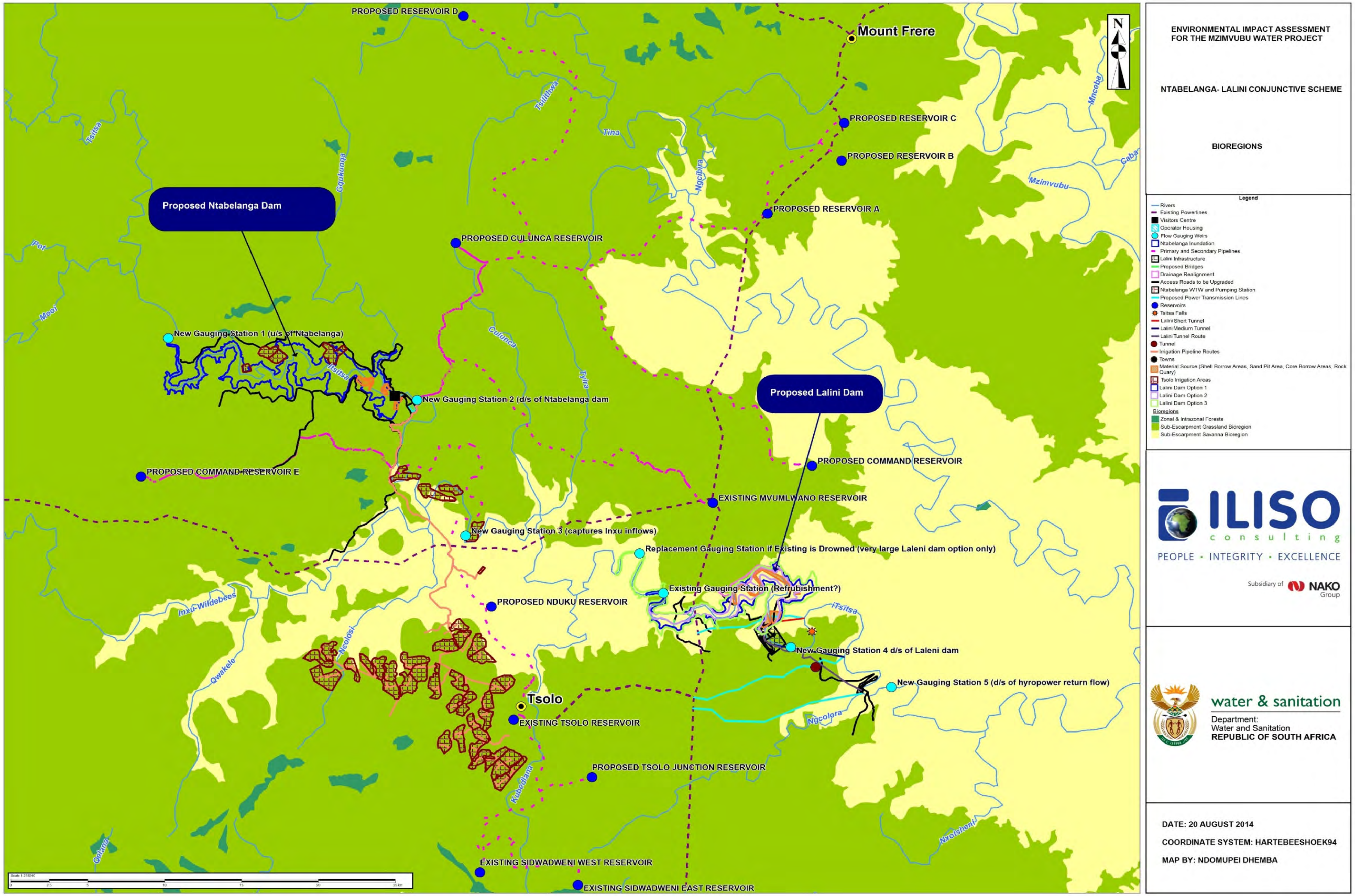

Figure 30: Bioregions

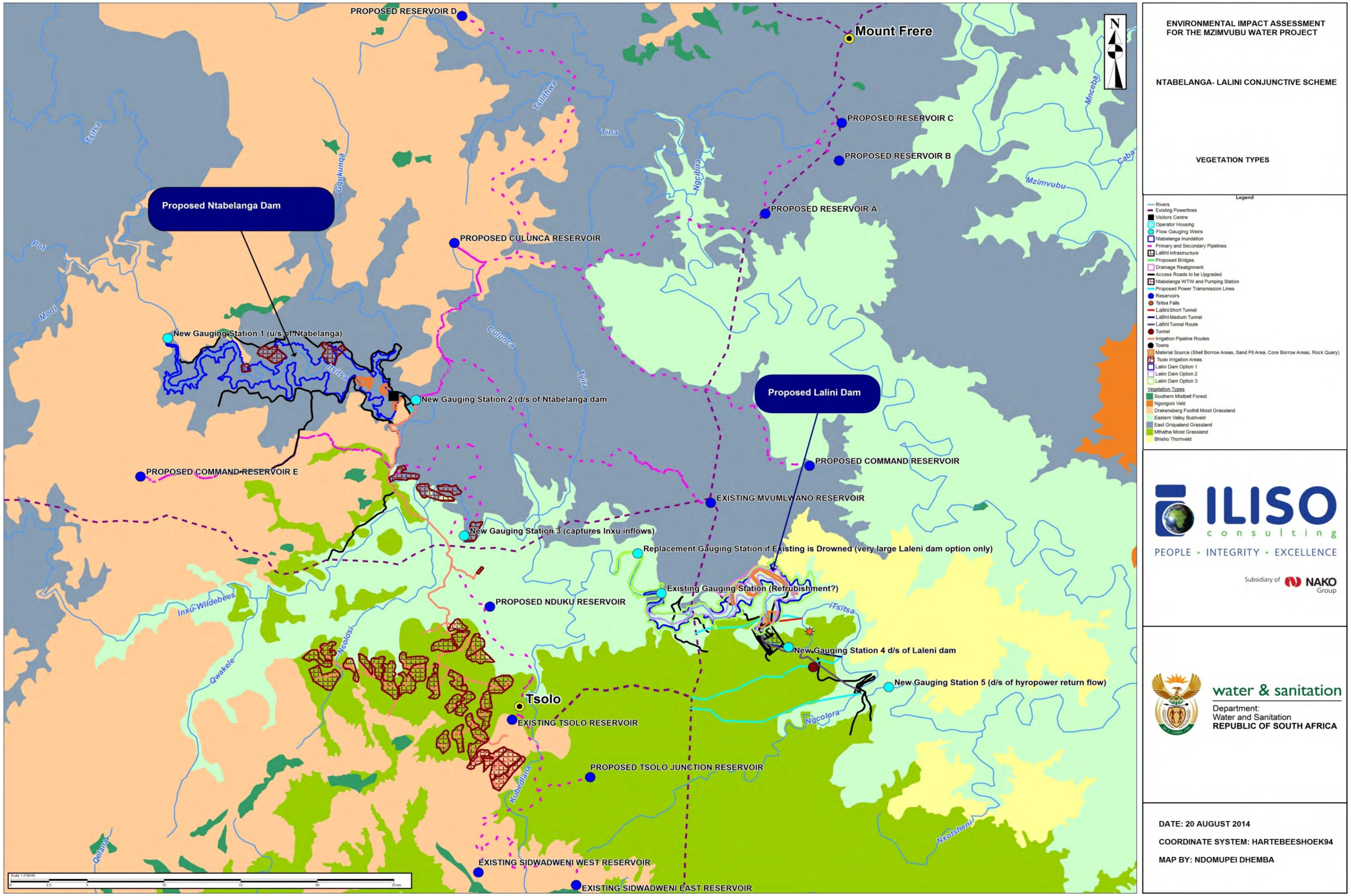

Figure 31: Vegetation types

The *Drakensberg Foothill Moist Grassland* is found at altitudes spanning 880-1860 m. It 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 is very low in 28% of the vegetation type, low in 49% and moderate in 17%. Biogeographically important taxa include *Schizochilus bulbinella* and *Schoenoxiphium burttii*.

The *Eastern Valley Bushveld* vegetation is found at altitudes spanning 100-1 000 m. It is formally classified as 'Least Threatened' (provincial conservation target is 25%). Up to 15% of this vegetation type 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.

The *Eastern Griqualand Grassland* vegetation is found at altitudes spanning 920-1740 m. It 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 these grasslands in some places. Erosion is very low in 30% of the vegetation type, low in 31% and moderate in 30% (Mucina and Rutherford, 2006). Biogegraphically important taxa include *Encephalartos friderici-guilielmi.*

The *Mthata Moist Grassland* vegetation is found at altitudes spanning 600-1080 m. It 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. *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 vegetation type, moderate erosion in 35% and the remainder having low and very low erosion.

The *Southern Mistbelt Forest* vegetation is found at altitudes spanning 850-1600 m (most patches occur between 1000 and 1400 m). It 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 mauitianum, 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.

8.4.3 Habitat units and sensitivity

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 (**Figures 32** to **36**).

Figure 32: Mountain / rocky outcrop vegetation located within the western section of the Ntabelanga Dam footprint area

Figure 33: Mountain / rocky outcrop vegetation located within the A) western section of the Lalini Dam footprint area and B) within the eastern section at the dam wall

Figure 34: *Acacia karroo* dominating within the grassland / *Acacia* Thornveld habitat unit in the Ntabelanga Dam area

Figure 35: Riparian and wetland vegetation along the iTsitsa River and smaller tributaries

Figure 36: Transformed grassland vegetation along the proposed pipeline routes

The Vegetation Index Score (VIS) was determined for each habitat unit (**Table 17**).

Table 17: VIS for each habitat unit assessed.

Habitat unit	Score	Class	Motivation
Mountain/Rocky Outcrops habitat unit	18	**Class B – largely natural with few modifications**	This habitat unit has remained relatively undisturbed and is known to support high levels of biodiversity and is therefore considered of relatively high ecological importance. Although high levels of biodiversity and ecological importance occur within this habitat unit, transformation has occurred in transition areas between the woody mountain habitat and the open veld habitat unit. Protected tree species, *Podocarpus falcatus* and *P. latifolius* were located within this management unit
Riparian/wetland habitat unit	14	**Class C/D – moderately/largely modified**	This habitat unit is characterised by high levels of erosion associated with donga formation. Numerous drainage lines, valley bottom wetlands and seeps are located within the study area.

Habitat unit	Score	Class	Motivation
Transformed habitat unit	5	**Class E – extensive loss of natural habitat**	This habitat unit is associated primarily with community villages' historic cultivated fields and veld overgrazed and trampled by livestock. The ecological functionality and habitat integrity of the Transformed Habitat Unit is regarded as being extremely limited.
Transformed(Grassland) habitat unit	10	**Class D/E – largely modified/Extensive loss of natural habitat**	This habitat unit has undergone transformation due to over-utilisation of veld by cattle grazing and bush encroachment by *Acacia karroo*.

Figures 37 to **39** illustrate the sensitivity of the study area, based on the state and function of each habitat unit.

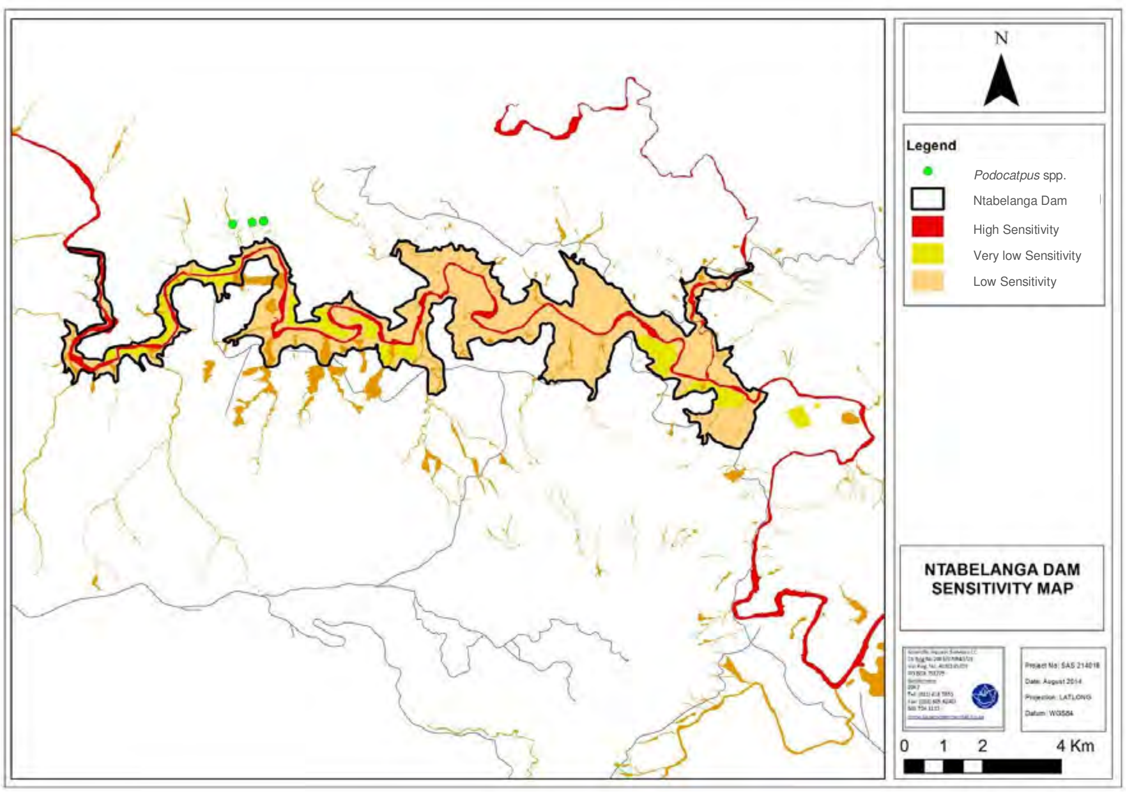

Figure 37: Floral sensitivity map for the Ntabelanga Dam area and associated infrastructure (DWS, 2014a)

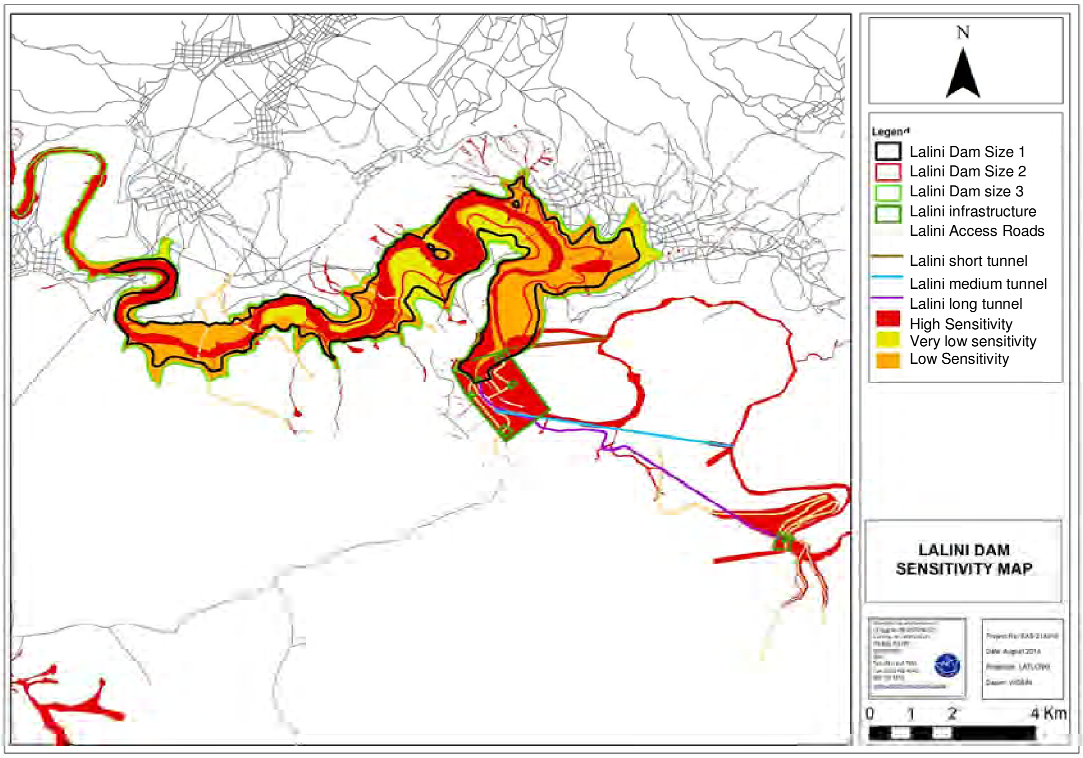

Figure 38: Floral sensitivity map for the Lalini Dam area and associated infrastructure (DWS, 2014a)

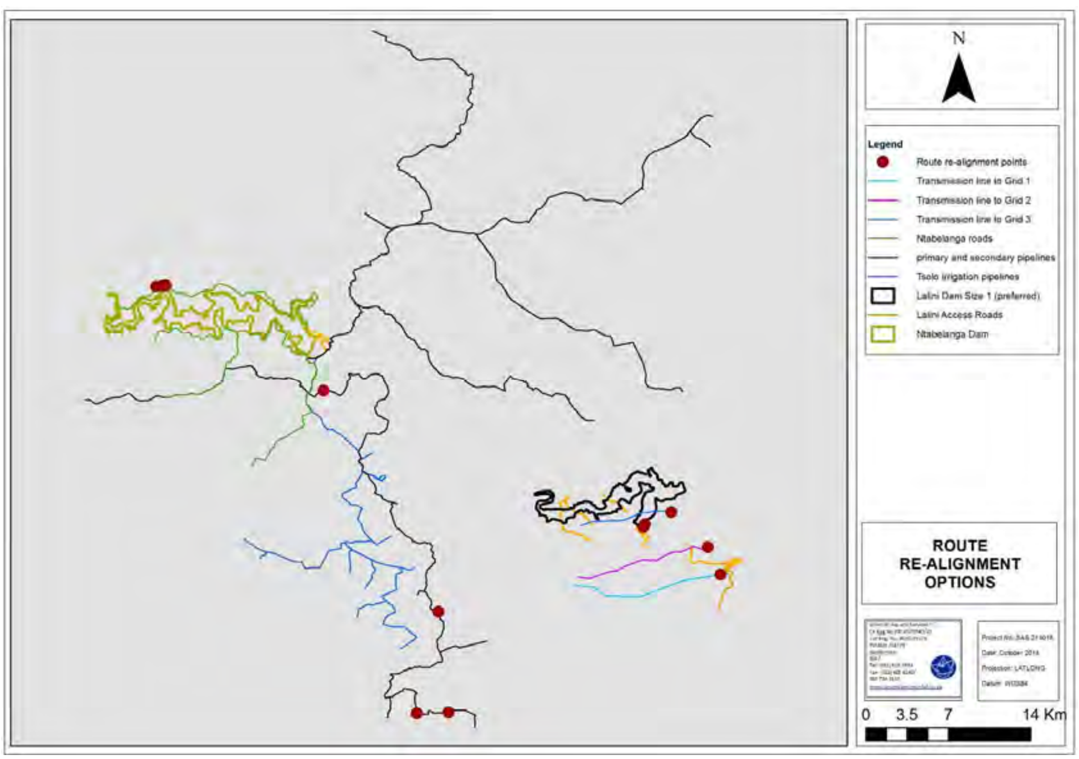

Figure 39: Route realignment areas for the proposed roads and pipelines where sensitive floral habitat or protected tree species are located (DWS, 2014a)

8.4.4 Alien and invasive plant species

A number of alien floral species occur within the study area, especially along the riparian features.

Weed species such as *Bidens pilosa*, *Cynodon dactylon, Ricinus communis* var. *communis, Nicotiana glauca* and *Tagetes minuta* are present that are associated with disturbance and agricultural activities. The transformed (Grassland) habitat unit contained mostly weed species associated with disturbance, overgrazing and trampling of veld by livestock. Very little invader floral species occurred within the Mountain / Rocky Outcrop habitat unit. The Mountain / Rocky Outcrop habitat unit are the most at risk for alien tree species to encroach into the area. These areas need to be monitored during the operational phase of the dam construction to ensure that alien invader tree species does not encroach into this habitat unit.

8.4.5 Medicinal floral species

Medicinal floral species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The medicinal species are all commonly occurring species and are no confined to the study area. A list of traditional medicinal plants identified during the field assessment and their main applications is provided in the Floral Impact Assessment (**Appendix C1**).

8.4.6 Threatened ecosystems

According to the National List of Threatened Terrestrial Ecosystems (2011), sections of the proposed infrastructure (e.g. road upgrades, pipelines and power lines) fall into a vulnerable ecosystem in terms of the original and remaining extent of the associated vegetation types (**Figure 40**). Vulnerable ecosystems have suffered a loss of structure, function and composition and any further degradation should be prevented or minimised where possible.

8.4.7 RDL species

Of the potential RDL species occurring in the area, the majority of the species are highly unlikely to occur due to the transformed vegetation from overgrazing, trampling and historic agricultural activities. The only species that have a moderate probability of occurring are *Pittosporum viridiflorum* and *Catha edulis.*

Podocarpus falcatus and *P. latifolius* were located alongside the road upgrade areas within the Ntabelanga Dam, on the northern section of the dam. More *Podocarpus* species were located on the secondary pipeline route south of the town Tsolo. These species are considered protected according to the notice of the list of protected tree species under the National Forests Act, 1998 (Act No. 84 of 1998). If they are affected, permits for the removal of these protected tree species need to be obtained from the relevant authorities before any construction activities occur within this area.

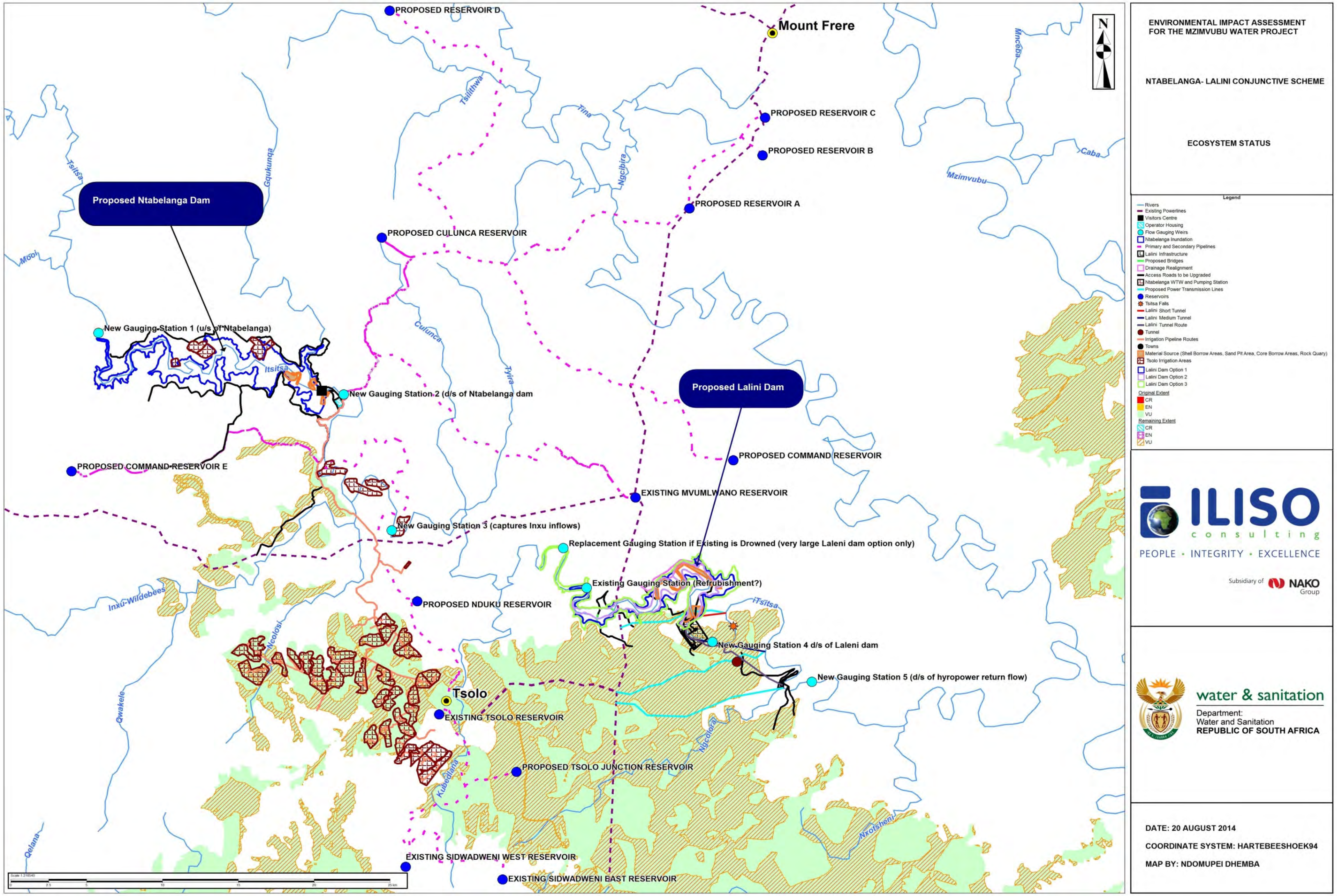

Figure 40: Threatened ecosystems