

GARDEN ROUTE DAM DEVELOPMENT

REPORT 2

BIODIVERSITY IMPACTS OF THE PROPOSED DEVELOPMENT LAYOUT

**PREPARED FOR SHARPLES ENVIRONMENTAL SERVICES
REPRESENTING THE GEORGE MUNICIPALITY**

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1 INTRODUCTION AND BACKGROUND

The Garden Route Dam Development Biodiversity Sensitivity Analysis (GRDBSA) prepared by Conservation Management Services in November 2012 and revised in December 2018, highlights the biodiversity sensitivity of the proposed development and rezoning area (Portion A 464) with respect to fauna, flora and landscape connectivity.

The Garden Route Dam Development Biodiversity Impact Assessment (GRDDBIA) will specifically highlight the biodiversity impacts that may result from the proposed development. The impact assessment also aims to provide suitable mitigation or alternatives for impacts that may be potentially negative.

2 THE DEVELOPMENT PROPOSAL

The George Municipality is in the process of submitting an application to amend the Environmental Authorization and also a Rezoning Application for the proposed development of Erf 464. The development proposal includes tertiary education with ancillary facilities, residential and commercial properties. The land use breakdown of the site is provided in Table 2.1 and the development site layout is shown in Figure 2.1 & 2.2. Please note that there is a mistake in Table 2.1 in the Town Planning motivation: the land use totals 101% instead of 100%. Aurecon is aware of this error and will amend the table.

TABLE 2.1: Land use scheme for Erf 464 (Aurecon, 2019).

Zoning	Land use description	Extent (± ha)	% of Total (approximate)
Community Zone I	Campus University	22.15	19
Business Zone I	Waterfront commercial development	4.31	4
General Residential Zone VI	Hotel	1.15	1
General Residential Zone II	Medium density residential / group housing	4.97	4

General Residential Zone IV	Apartment / Flats / Student housing	6.91	6
Single Residential Zone VI	Free-standing dwelling houses	9.32	8
Open Zone II	Recreational space / Sports fields	8.22	7
Open Zone II	Parks / Natural assets / Preservation areas	52.08	44
Transport Zone II	Roads	9.39	8
Total		118.5 ha	100%

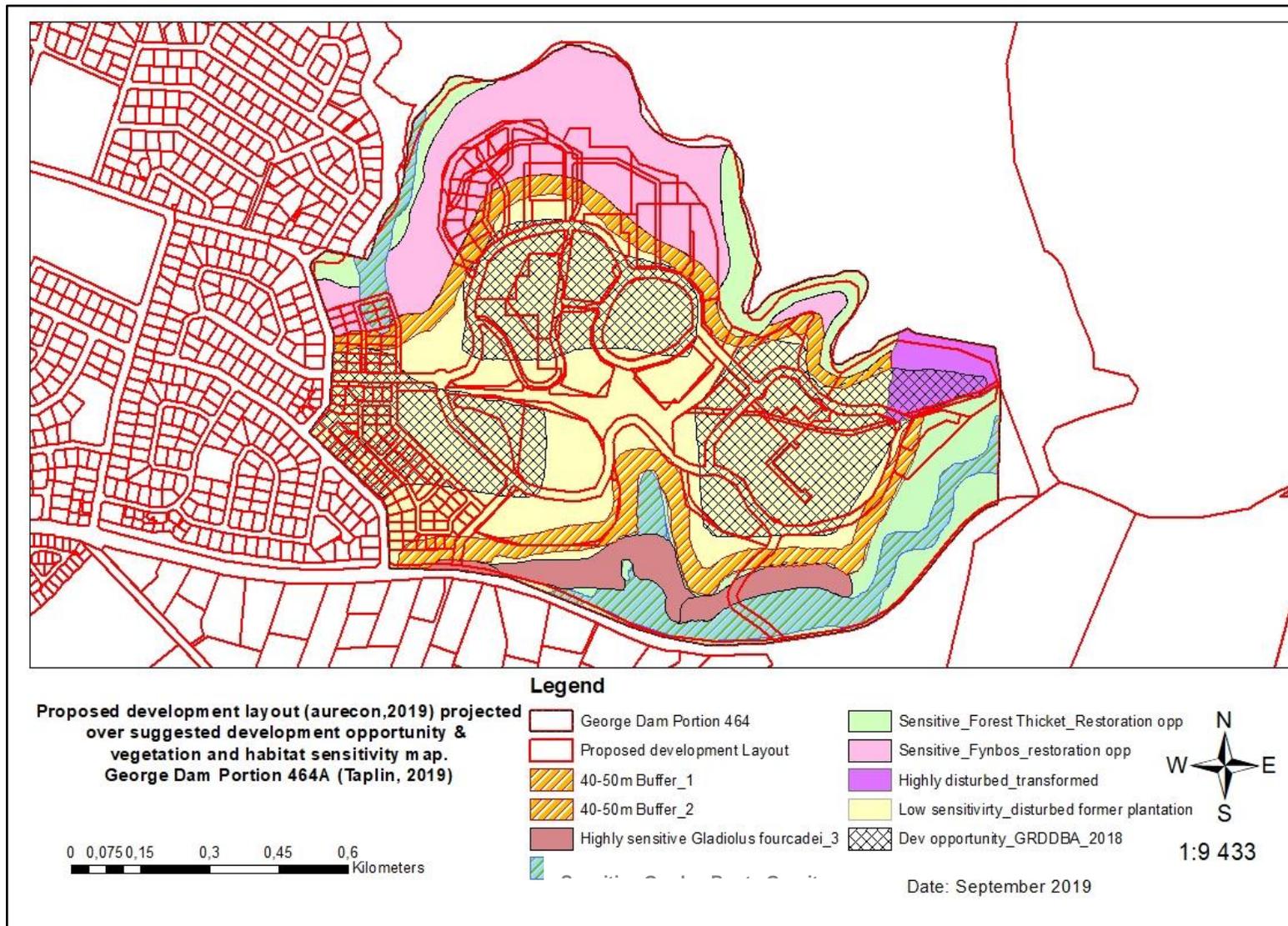


FIGURE 2.1: Illustrates the 2019 proposed development layout in red, the suggested development opportunity in black grid (GRDDBSA 2018), the recommended buffers between the sensitive areas and the development opportunity in orange diagonal and the habitat sensitivity (Taplin, 2019).

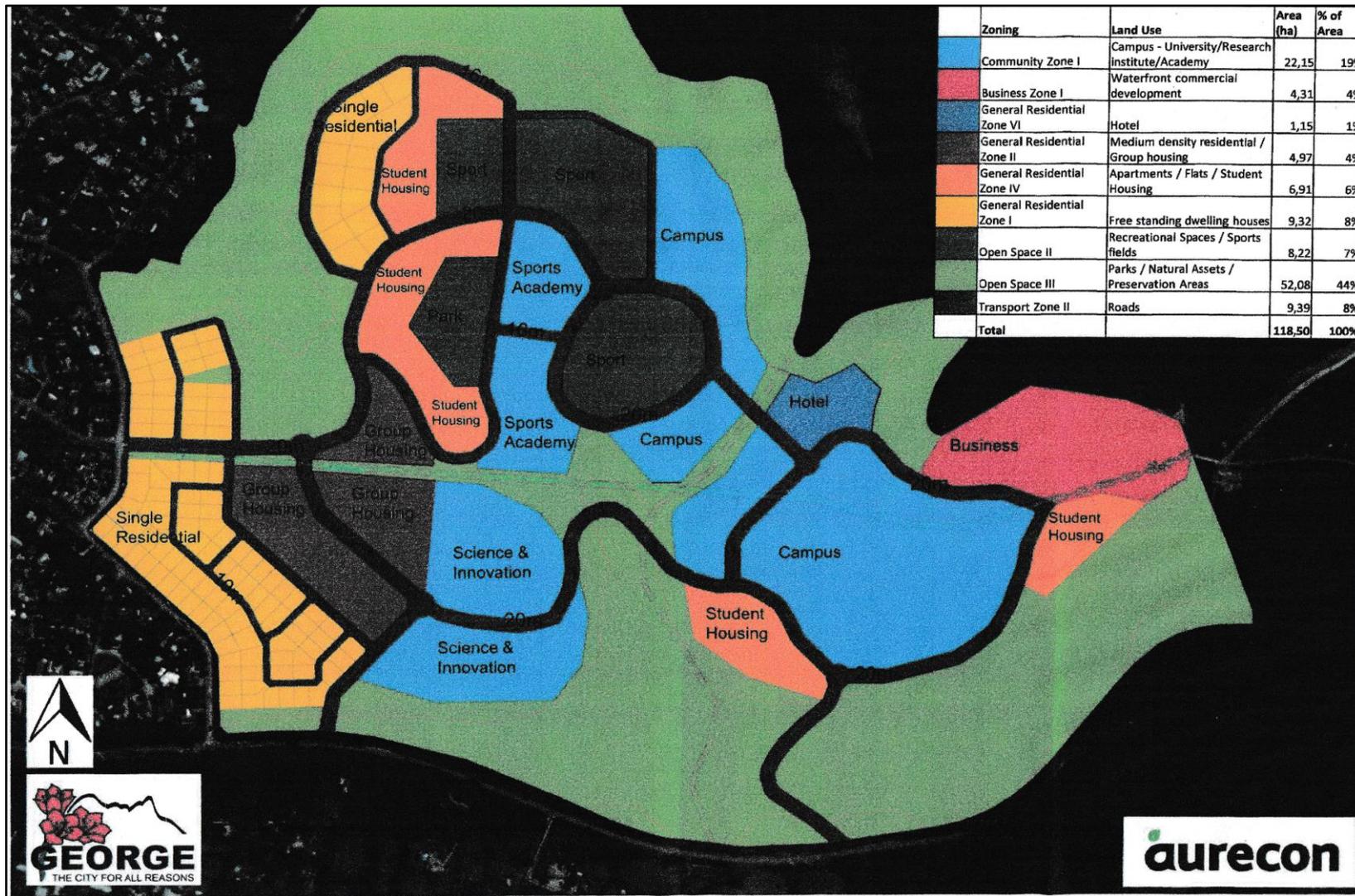


FIGURE 2.2: Illustrates the rezoning and subdivision layout of the proposed 2019 Development (Aurecon, 2019).

3 BIODIVERSITY IMPACT ASSESSMENT

The potential biodiversity impacts have been assessed in terms of vertebrate fauna, vegetation and habitat as well as the ecological connectivity across the landscape. With reference to vertebrate fauna, impacts have been determined based on the vertebrate occurrence tables listed in the 2018 GRDDBSA (Appendix 1.1 to 1.4) which were compiled from confirmed, likely and possible occurrences.

Potential impacts that may arise as a result of the proposed development are discussed in Sections 3.1 to 3.3, while a detailed biodiversity impact assessment including avoidance, management, mitigation and monitoring measures is tabulated at the end of the report (GRDDBIA 2019, Tables 2.2 to 2.4.2). The tabulated biodiversity impacts identified by Coetzee and Taplin for the proposed 2019 development are presented alongside those identified by Coetzee for the 2012 proposed development (see Figure 2.3 and GRDDDSA 2012). This provides a biodiversity impact assessment comparison between the two proposed development layouts.

3.1 POTENTIAL IMPACTS ON VERTEBRATE FAUNA

As a result of the extent of the proposed development area it would be difficult to identify specific sections within which specific fauna would be found. This is largely because the variety of vegetation types provide a large range of habitats for an equally diverse range of animals. As such, the vertebrate section does not refer to a specific animal species, but rather animal types, namely amphibians, reptiles, mammal and birds.

3.1.1 Potential impacts on amphibians

None of the amphibian species listed to occur in the study site (Table 6) by Coetzee (2005, 2012) and Coetzee & Taplin (2018) are listed as Red Data species (Table 10).

Minter *et al.* (2004), states that “habitat loss or modification as a result of agriculture and other forms of human activity remains the most important single threat to the survival of amphibian populations, because of the scale of these changes and their relative permanence”. Amphibians are dependent on a wide range of habitats such as

permanent and temporary waterbodies, dams, wetlands, temporary depressions, sandy soils, open soils, forests and fynbos.

The following potential impacts were identified and could materialize as a result of the proposed development or current habitat condition (see detailed impact assessment Table 2.2):

- Habitat loss – this is presumed not to play a major role, due to most of the area highlighted for the proposed development being completely transformed and unsuitable habitat for amphibians. However, the western section of the proposed development identified as single residential does seem to encroach into the area identified as a sensitive wetland area at its northernmost tip (Figure 2.1 and 2.2).
- Potential change in hydrology and the quality of the aquatic system due to the development and proposed roads in the southern portion of development.
- Pollution impact from household chemicals, herbicides, pesticides and insecticides.
- Potential impacts may arise as a result of nitrogen-based fertilizers being used on sports fields.
- Alien plant invasion - there is a substantial alien invasive plant infestation on the site which may affect water regimes and availability of water.
- Fire regime – amphibian diversity can be particularly high in fire-driven systems and if natural fire regimes are not maintained within the development area, diversity could be lost.

Fortunately, 44% of the total site area has been identified for parks, natural assets or preservation areas. A large portion of these areas are considered ideal amphibian habitat (wetlands and forest thickets). In addition to these areas, suitable habitat is located to the north, east and south of the proposed development area in the form of dams, rivers, waterbodies, forests, seaward coastal forests and fynbos areas.

The following recommendations and mitigation measures are suggested (see detailed impact assessment Table 2.2):

- Avoid development within identified wetland areas (see Figure 2.1 western

portion of development layout) and allow for suitable undeveloped buffer areas between development and wetland habitats (40 to 50 meters).

- Avoid road and pipeline infrastructure through sensitive wetland. If this is not possible, provide suitable culvert bridges for roads and services to ensure the natural hydrology of wetland is maintained.
- Undertake water quality testing during and after development.
- Remove all alien invasive plants.
- Limit the use, and where possible avoid the use, of nitrates.
- Limit the use, and where possible avoid the use, of herbicides, pesticides and insecticides.
- Develop a suitable fire management regime.
- Allow for habitat management and amphibian monitoring post development.

3.1.2 *Potential impacts on reptiles*

None of the reptile species confirmed to occur or predicted to occur in the study site (Table 7) by Coetzee (2005, 2012) and Coetzee & Taplin (2018) are listed as Red Data species (Table 10).

The presence or absence of reptiles is much more difficult to confirm or predict than that of the amphibians, which have a generally more predictable aquatic habitat preference. Nevertheless, the following potential impacts were identified and could materialize as a result of the proposed development;

- Habitat fragmentation – reduction in complexity of habitat, which may force altered behavior and increase predation.
- Increased predation due to habitat change and domestic animals – the proposed development seems to have considerable open space (recreational/sports fields 8%) and reptiles are more easily preyed on in the absence of cover. Domestic pets such as cats are well known for preying on many reptile species.
- Reduced hibernating areas.
- Direct harm – during lawn and garden maintenance.
- Increased risk of fire – due to the increased human population in the area.

When one considers specific reptile habitat requirements, structural diversity is very important. The majority of the proposed development falls within a low sensitivity, disturbed former plantation area, which is structurally uniform. Fortunately, the 44% of the site which will not be developed provides better structural diversity. In addition to these areas, suitable reptile habitat is located to the north, east and south of the proposed development area (fynbos, forests and seaward coastal forests areas). The proposed development site is already heavily disturbed and modified and reptiles that have managed to survive in these very impacted, artificial habitats will probably survive and persist during and after the proposed development as well.

The following recommendations and mitigation measures are suggested (see detailed impact assessment Table 2.2):

- Ensure that sufficient quality and connectivity of habitat is provided to accommodate the reptile population (ecological corridors).
- Protect reptiles from any harm during development.
- Remove alien invasive plants and rehabilitate.
- Where possible translocate reptiles that will be affected by development to an alternative site.
- Allow for habitat management and reptile monitoring post development.

3.1.3 Potential impacts on mammals

Of the 42 mammal species confirmed or predicted to occur on or around the GRDD site, ten are classified as Red Data species according to Friedman & Daly (2004).

To ensure one adequately accounts for the potential impacts on mammals, it is important to have a good understanding of their habitat requirements. Close attention was paid to the habitat requirements of the ten Red Data listed species, with specific reference to the five mammals which are listed as endangered and near threatened (whitetailed mouse, longtailed forest shrew, fynbos golden mole, lesser woolly bat and water rat). The habitat requirements for these mammals includes fynbos, grassland, primary forests, forests, aquatic environments and flooded lowland grassland.

The proposed development is predominantly located on low sensitivity, disturbed former plantation and pioneer fynbos, which has been further disturbed and transformed by recent fires (October 2018). Fortunately, and in accordance to the proposed land use scheme (Table 2.1), at least 44% of the total site area will be allocated to parks, natural assets or preservation areas. There is far more biodiversity value in these areas which consists of wetlands, fynbos and forest thicket areas as appose to the areas identified for development. These areas should provide the necessary habitat for mammals that may be in the area.

Nevertheless, the following potential impacts were identified and could materialize as a result of the proposed development:

- Habitat fragmentation – reduction of available habitat, even if it is suboptimal habitat.
- Increased predation – by domestic pets such as cats and dogs.
- Human activity – could lead to changes in animal behavior.
- Road network – could lead to road kill.
- Increased risk of fire – due to the increased human population in the area.

The following recommendations and mitigation measures are suggested (see detailed impact assessment table 2.2):

- Where possible, ensure sufficient quality and connectivity of habitat is provided to accommodate the mammal population.
- Remove alien invasive plants and rehabilitate.
- Reduce road network where practically possible and implement speed limitations.
- Develop a noise mitigation plan to reduce potential noise impact.
- Allow for habitat management and mammal monitoring post development.

3.1.4 Potential impacts on birds

Of the 97 bird species confirmed or predicted to occur on and around the GRDD site (Table 9), only two are classified as Red Data Species (Table 10) according to Friedman & Daly (2004). These are the black harrier (endangered) and the Knysna

warbler (vulnerable). Preferred habitat types for these two bird species are somewhat different and include fynbos, scrubland, dense tangled scrub and forest edge. As already mentioned, the proposed development is mostly located on low sensitivity, disturbed former plantation and pioneer fynbos areas, which has been further disturbed by recent fires. These areas are not considered to be ideal habitat for these two species. However, there are conservatively 97 species of birds to consider.

Worldwide threats to birds include agriculture, system modification, human disturbance, developments and invasive species (Glennon, Kretser & Hilty, 2014).

The following potential impacts were identified and could materialize as a result of the proposed development:

- Habitat reduction and fragmentation - this impact is normally associated with habitat specialists such as the black harrier (Curtis *et al.*, 2004) and most birds adapt to man-made habitats.
- Increased predation – by domestic pets such as cats and dogs.
- Lighting – may cause a change in nocturnal bird behavior.
- Roads - direct impact (habitat loss and mortality) and indirect impact (noise and artificial lighting).
- Power lines leading into the development may affect birds negatively when birds fly into them and are killed, however they can result in positive features in the landscape for nesting, roosting and ambushing.

Fortunately, and in accordance to the proposed land use scheme listed in Table 2.1, at least 44% of the total site area will be allocated to parks, natural assets or preservation areas. There is far more biodiversity value and habitat suitability in these areas which consists of wetlands, fynbos and forest thicket areas, than in the transformed areas. Birds also adapt very well to man-altered habitats and, in some cases, benefit from them.

The following recommendations and mitigation measures are suggested (see detailed impact assessment Table 2.2):

- Where practically possible, ensure sufficient quality, quantity and connectivity

of habitat - this will mostly be provided in the undeveloped areas.

- Limit the amount of traffic within the development area.
- Establish speed limits and only use street lights where absolutely necessary. Use low impact lighting wherever possible.
- Allow for habitat management and bird monitoring before, during and after development.

3.2 POTENTIAL IMPACTS ON VEGETATION AND HABITAT

Potential impacts on vegetation and habitat types are evaluated in Tables 2.3.1 and 2.3.2. A description of the potential impacts associated with the proposed development as well as mitigating measures is provided below.

The area that supports *Gladiolus fourcadei* can be considered highly sensitive. The plant has been classed as a Red Data listed species and categorized as critically endangered. Where practically possible, all forms of development should be avoided altogether in the area where this plant occurs as the impact of development may negatively affect this critically endangered plant. It is recommended that the two roads planned to transect the Sensitive Garden Route Granite Fynbos and sensitive wetland habitat be reconsidered and an alternative route be found for them. Should this not be possible the following recommendations and mitigating measures are suggested:

- A search and rescue operation be undertaken to locate any *Gladiolus fourcadei* plants that may be affected during the construction of the road. If any such plants are located, they should be carefully removed and transplanted to a suitable site within the same habitat type.
- Suitable culvert bridges should be constructed in accordance with environmental regulatory standards to ensure the least amount of impact on wetland functionality.

The areas identified as wetland habitats are also sensitive and development should not be considered within these areas. It can be noted that the western portion of the development seems to advance into the area identified as wetland habitat (see Figure 2.1). The following recommendations and mitigation measures are suggested:

- Move development footprint out of the area identified as wetland habitat.
- Allow for a suitable buffer between the wetland habitat and the development, minimum of 40-50 metres.

With respect to the sensitive fynbos restoration opportunity areas, the original vegetation and habitat sensitivity classification GRDDBSA (Coetzee, 2012) was retained for the purpose of the more recent GRDDBSA (Coetzee & Taplin, 2018). This was necessary due to the majority of the area having been burnt by the October 2018 fires just before the December 2018 assessment. The areas that remained unburnt were used as a benchmark and indicated that the GRDDBSA (Coetzee, 2012) classification was still accurate and that this habitat still provides a classic fynbos restoration opportunity. However, fires, especially hot fires, have the potential to transform vegetation types and habitats and alien invasive plants and their associated seedbanks often respond aggressively after fire.

During the 2018 assessment, burnt out alien invasive plants were a common feature throughout this habitat and the alien invasive seedbanks had already started to germinate. It is highly likely that alien invasive plants will aggressively persist and are likely to dominate the area if uncontrolled.

Figure 5 in the GRDDBSA (Coetzee & Taplin, 2018) report represents the extent of the October 2018 fire. Figure 2.1 in the GRDDBIA (Coetzee & Taplin, 2019) illustrates how the proposed development will encroach into the sensitive fynbos restoration opportunity habitat. It is the consultant's opinion that the area affected by the fire, which includes the sensitive fynbos restoration opportunity, has been transformed by hot fire and alien invasive plants will dominate if not controlled. This will render the habitat transformed and no longer sensitive. The following potential impacts were identified and could materialize as a result of the proposed development:

- The development will reduce the size of the existing habitat.
- The development will reduce the size and connectivity of the potential ecological corridor.

- Soils were damaged and exposed during the hot fire. The proposed development layout will stabilize the soil surface and prevent erosion from taking place.

The following recommendations and mitigation measures can be considered:

- Consideration can be given to reduce the size of the development footprint to fall within the low-sensitivity disturbed former plantation area, although both habitats may be completely transformed by the effects of the hot fire and the invasive alien plants.
- By reducing the proposed development footprint to fall within the low-sensitivity disturbed former plantation area, the ecological support corridor will be broadened.

The majority of areas identified as sensitive forest thicket have not been considered for development and provide an excellent ecological corridor opportunity for the movement of vertebrates. Unfortunately, even within these sensitive habitats, alien invasive plants persist at varying densities, threatening the habitats ecological integrity.

With regards to the development layout, there seems to be a small part of the development in the eastern portion which is planned for student accommodation that will encroach into the area identified as sensitive forest thicket.

- Although this specific area of the sensitive forest thicket is partly invaded by alien plants, consideration can be given to realigning the student housing so that it falls outside of the area identified as sensitive forest thicket.
- Invasive alien plants are threatening the ecological integrity of this habitat as is the case throughout much of the site. The eradication of these invasive alien plants is highly recommended.

The majority of the proposed development will be focused in habitats identified as low in sensitivity, highly disturbed and transformed, namely pioneer fynbos and

former plantation. The development layout has mainly been restricted to these areas as a result of them being transformed and of low ecological significance. None of these areas were found to have any species of special concern or any rare or endangered plants within them. These areas are in fact mostly transformed and in an active state of deterioration as a result frequent fires and encroachment of alien invasive plants, therefore no notable impacts are mentioned. Both the GRDDBSA (Coetzee, 2012) and the GRDDBSA (Coetzee & Taplin, 2018) recommend these areas for development opportunity due to their low sensitivity and high ecological transformation.

3.3 POTENTIAL IMPACTS ON BIODIVERSITY AND LANDSCAPE CONNECTIVITY

A Critical Biodiversity Area (CBA) map (see Figure 2.4) based on the Western Province Spatial Biodiversity Plan of 2017 (WDSBP, 2017) was developed by the consultants to understand how the proposed layout would align to the CBA areas. The potential impacts on biodiversity and landscape connectivity are evaluated in Tables 2.4.1 & 2.4.2. A description of the potential impacts associated with the proposed development as well as mitigating measures is provided below.

Protected Areas are benchmarks for biodiversity and provide important ecological support areas. The Katriver Nature Reserve Protected Area (KRNPA) is not likely to be directly impacted on apart from what seems to be a GIS projection issue or a layout oversight. There is a portion of road cutting through the southwestern-most tip of the KRNPA. This will need further investigation and possible realignment to ensure there is no intrusion into the KRNPA. Fauna seeking to use the area as a corridor may be indirectly impacted through the additional lighting at night, elevated noise levels and the presence of domestic pets such as cats and dogs. The KRNPA extends alongside residential area to the west of the study site and the entire nature reserve is heavily infested with alien invasive plants.

Critical Biodiversity Areas 1 & 2 are largely avoided by the development layout. However, the layout does encroach on the CBA's in the following areas:

- The two proposed roads in the southern portion cut through CBA 1 & 2.
- Roads in the centre of the development cut into CBA 2 areas.

- The proposed residential area overlays a CBA 2 area.

Of the three listed areas, only the southern portion where the roads cut through the CBA 1 can be classified as sensitive and important for connectivity. The other two areas are largely transformed. Considerations can be given to redirecting the roads and pipeline infrastructure to align with existing roads already developed on the site. However, if this is not possible or practical then a suitably experienced search and rescue team should move any rare or endangered species out of the affected area and transplant these to a suitable site. The provision of a suitably constructed culvert bridge (roads and services) will assist to ensure that the hydrology of watercourse and quality of water are optimal.

Ecological support areas are not essential in meeting biodiversity targets, but play an important role in supporting the functioning of PA's, CBA's, landscape connectivity and are often vital for delivering ecosystem services. The proposed development layout acknowledges the importance of ecological support areas by allowing 44% of the total site area to remain undeveloped. The three ecologically significant areas which will provide connectivity between the site and the surrounding landscape (southern, northern and western portions) will remain undeveloped. The development provides very little additional ecological connectivity potential as the centre of the property is proposed to be developed.

The following potential impacts were identified and could materialize as a result of the proposed development:

- The proposed development will occupy the central portion of the site, this will limit faunal movement from one side of the site to the other.
- The extensive road network is likely to have a negative impact on faunal movement and possibly increase road kill mortalities.

The following recommendations and mitigation measures can be considered:

- Consideration can be given to additional open space in the centre of the development which may allow for improved fine-scale or site-specific ecological functioning. The value of such open space is often determined by form and quantity; however, emphasis should rather be placed on its function and quality. A minimum ecological corridor of undeveloped open space of

approximately 100-150m wide should be considered. A “Y-shaped” open space corridor running through the center of the site, connecting the sensitive habitats on the peripherals, makes the most sense from a functionality perspective. This is directly aligned to the recommendations in the opportunities and constraints section (Table 5 and Figure 7) of the GRDDBSA, 2018 report drafted prior to the current development proposal layout. The fine-scale open space corridor aims to promote biodiversity in mixed-use developed urban areas. The corridor will also improve aesthetics within surrounding urban areas.

- Consideration can be given to reduce the road network layout. The two roads which exit the property in the sensitive southern area may be redirected to exit the site at the western portion where the road network already exists. However, it seems the essential bulk water supply and sewage system layout requirement follows the same route as the proposed road network and will also service the neighbouring developments. Therefore, this consideration may not be practical.
- The control and eradication of alien invasive plants will assist in the following way:
 - Improve the ecological and biodiversity value on the site.
 - Provide more suitable habitat which will promote improved ecological connectivity.
 - Reduce the risk of ecologically-damaging fires as well as the risk to human life.

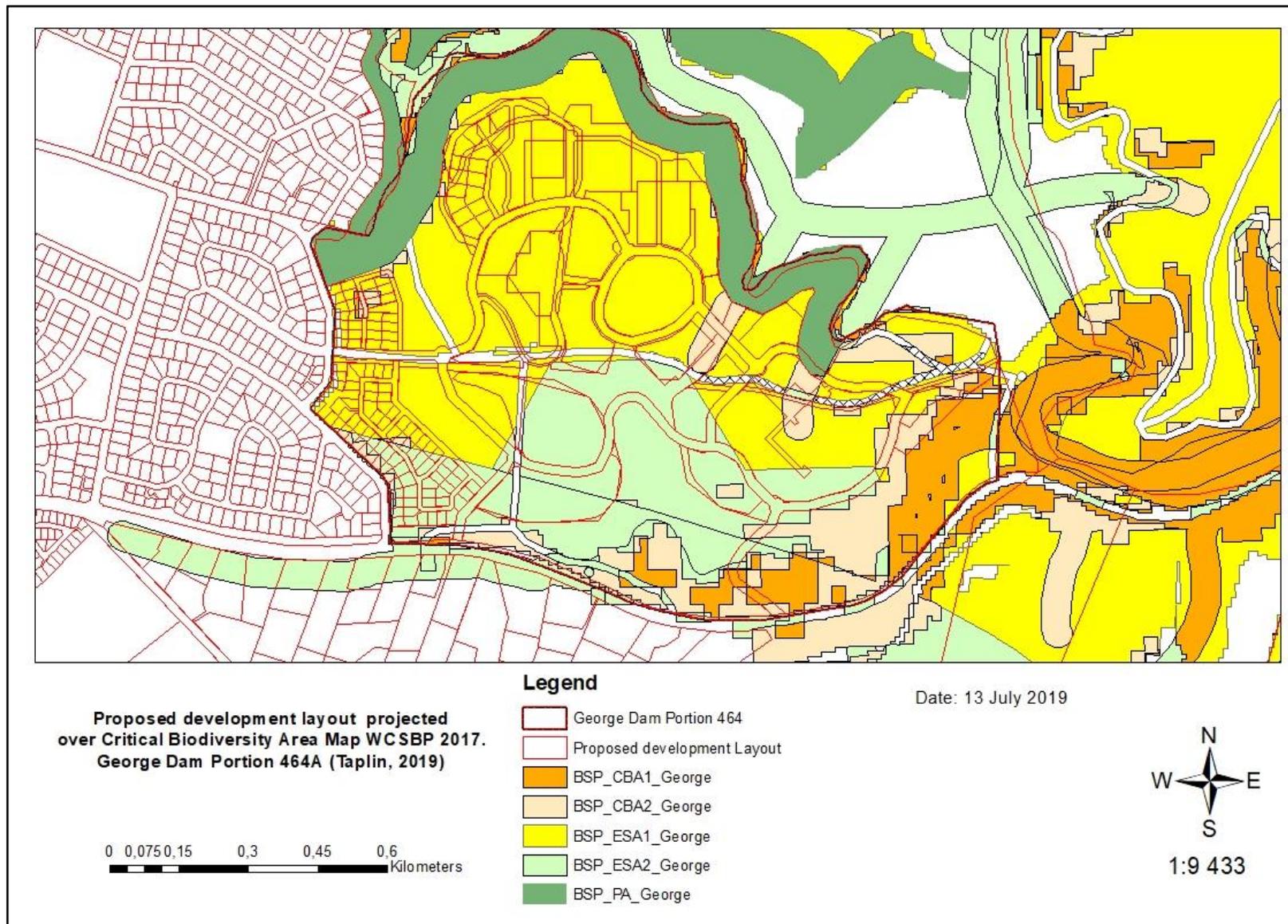


FIGURE 2.4: Proposed development layout projected over Critical Biodiversity Area Map (WCSBP, 2017). George Dam Portion 464A (Taplin,2019).

4. CONCLUSION AND RECOMMENDATIONS

The study site has been comprehensively evaluated for biodiversity sensitivity, initially by Coetzee in 2006 and 2012 and then again by Coetzee & Taplin in 2018. The biodiversity sensitivity assessments were undertaken over a period of thirteen years, which has allowed for consideration of site change over time.

Environmental biodiversity impacts that may result from the proposed development were identified, evaluated and mitigation recommendations were provided. In both the GRDDBSA (Coetzee 2012) and GRDDBSA (Coetzee & Taplin 2018) Conservation Management Services recognizes the development opportunity, however stipulate that the development should be aligned with transformed and disturbed areas. The reports further highlight the importance of ecological connectivity between the surrounding landscape and the study site. Fortunately, the proposed development allows for at least 44% of the total site area to be allocated to parks, natural assets or preservation areas.

If the consultant's recommendations are followed and the mitigation measures effectively implemented then the biodiversity impacts and the majority of associated risks are predicted to be low. One of the biggest ecological concerns on the property is that of alien invasive plants. They also present a high fire risk for development as well as the residential areas of George.

With the Western Cape and more specifically the George area experiencing a spiked increase in population growth over the last ten years it is presumed impacts on biodiversity are likely to increase. It is therefore critically important for responsible authorities to approve sustainable development only. It is the consultant's opinion that the Garden Route Dam Development site provides an opportunity for sustainable development while still accommodating biodiversity and ecological connectivity to the surrounding landscape.

SUMMARY OF RECOMMENDATIONS

In mitigation of the development's potential impact, it is recommended that:

1. The areas mapped as Sensitive Garden Route Granite Fynbos sensitive wetland habitat and sensitive forest thicket and represented in Figures 4 and 2.1 should, where practically possible, be retained intact. This is due to their sensitivity and their functionality as ecological corridors connecting the site to the surrounding landscape. However, where infrastructure such as roads and pipelines is required to transect these habitats to service the development, the following recommendations are made:
 - 1.1. Before and during construction
 - 1.1.1. A suitably qualified search-and-rescue team must search the identified area and translocate any sensitive plants or vertebrates found to a suitable location;
 - 1.1.2. A suitably qualified Environmental Control Officer (ECO) should be assigned to the development site during construction to ensure that environmental authorisation (EA) conditions are implemented and monitored;
 - 1.1.3. Suitably designed and constructed culvert bridges which will not affect the hydrology of the wetlands are recommended;
 - 1.2. After construction
 - 1.2.1. A suitably qualified restoration specialist must be appointed to ensure these sensitive areas are restored to their pre-disturbance condition;
2. The area mapped as sensitive fynbos restoration opportunity and represented in Figures 4 and 2.1 provides a restoration opportunity. It is suggested that the development layout be refined to maximize this ecological corridor opportunity where possible;
3. A buffer zone of at least 40-50m should be retained intact between the proposed development and habitats listed as sensitive. This relates to the proposed development layout in the following way (see Figure 2.1 and 2.2);

3.1. The proposed layout in the western portion of the development (single residential) which encroaches into the area listed as sensitive wetland should be removed and the necessary buffer provided;

3.2. The proposed layout in the eastern portion of the development (student housing) which encroaches into the area listed as sensitive forest thicket restoration opportunity should be removed and the necessary buffer provided;

4. Ecological corridor of undeveloped open space;

Figure 7 in the GRDDBSA 2018 report (page 42) illustrates the “*development opportunity*” areas highlighted in black cross hatch projected over the yellow area which is classified as “*low sensitivity disturbed former plantation area*”. Point 2.3 in Table 5 (page 40) in the “*opportunities and constraints for the study site*” section suggests that “*development considerations should include ecological process and connectivity areas from a site as well as regional scale*”.

In the GRDDBIA 2019 report, Section 3.3 (page 14), Conservation Management Services recommends that consideration can be given to additional open space in the centre of the development which may allow for improved fine-scale or site-specific ecological functioning. Recommendations include a minimum ecological corridor of undeveloped open space of approximately 100-150m wide. In addition, it is recommended that a “Y-shaped” open space corridor running through the centre of the site, connecting the sensitive habitats on the peripherals, makes the most sense from a functionality perspective.

As the “*low sensitivity disturbed former plantation area*” represented in yellow has been classified as an area of low sensitivity, it is suggested that this is the most suitable area for the proposed development (see Figure 7 in GRDDBSA 2018 and Figure 2.1, Section 3.2 in GRDDBIA 2019).

Conservation Management Services maintains that the shape, layout and placement of the development within the “*low sensitivity disturbed former plantation area*” is at the discretion of the developer, provided that the above-mentioned ecological corridor of open space is considered for inclusion and that the buffers between the sensitive vegetation and development are provisioned for as recommended in point three above.

5. Where practically possible, the roads and other infrastructure proposed within the sensitive southern portion of the site should be reconsidered and relocated. Should this not be possible, a suitably qualified search and rescue team must search the area and translocate any sensitive plants found. Where the proposed roads transect the sensitive wetland area, a suitably constructed culvert bridge which will not affect the hydrology of the wetland is required;
6. All invasive alien plants must be completely removed from the entire property, and the area kept completely clear of invasive alien plants once removal has taken place.
7. Human-wildlife conflict management (see Annexure 3).
8. Appropriate fire regime and fire management plan: An appropriate fire regime and fire management plan should must be applied to all the natural areas that require periodic fire for rejuvenation (see Annexure 4).
9. Only the necessary plant cover must be removed from site surfaces in preparation for construction and these areas should not be cleared long before the development of infrastructure on the site;
10. Environmental compliance and monitoring is required during and after the construction phase of the development.
11. A pre-construction “walk through” must be conducted with a suitably qualified botanist to identify any plant species of conservation concern located within the construction footprint and for which permits will be required prior to commencement of construction activities;
12. Search-and-rescue must be conducted for plants and an onsite nursery established. A suitably qualified person must be in charge of this nursery. Rescued plants need to be used in the landscape plan after development; and
13. Search-and-rescue must be conducted for all vertebrates and these vertebrates must be appropriately translocated to suitable identified sites prior to construction commencing.

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6. ENVIRONMENTAL IMPACT ASSESSMENT TABLES

The potential environmental impacts of the development are assessed in Tables 2.2 to 2.4.2.

Table 2.2: Assessment of the potential impacts of the development and associated infrastructure on the vertebrate fauna. The assessment considers potential impacts identified for the 2019 development against those identified for the 2012 proposed development layout.

Description of the impact	Assessment of the potential impacts of the development and associated infrastructure on the vertebrate fauna (2019 & 2012 development layout)							
	Amphibians 2019 Layout	Amphibians 2012 Layout	Reptiles 2019 Layout	Reptiles 2012 Layout	Mammals 2019 Layout	Mammals 2012 Layout	Birds 2019 Layout	Birds 2018 Layout
Nature of impact	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Determination extent (Scale)	Local	Local	Local	Local	Local	Local	Local	Local
Determination of duration	Long term	Long term	Long term	Long term	Long term	Long term	Long term	Long term
Determination of probability	Highly probable	Highly probable	Highly probable	Highly probable	Highly probable	Highly probable	Probable	Probable
Determination of reversibility	Barely reversible	Barely reversible	Partly reversible	Partly reversible	Partly reversible	Partly reversible	Partly reversible	Partly reversible
Determination of loss of resources	Marginal loss of resources	Marginal loss of resources	Marginal loss of resources	Marginal loss of resources	Significant loss of resources	Significant loss of resources	Significant loss of resources	Significant loss of resources
Determination to which an impact can be avoided	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Determination to which an impact can be managed	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Determination of cumulative impact	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

Determination of degree to which an impact can be mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated
Determination of significance (without mitigation)	High	High	Medium-High	Medium-High	Medium-High	Medium-High	Medium	Medium
Determination of significance (with mitigation)	Medium-low	Medium	Medium-low	Medium	Medium-low	Medium	Medium-low	Medium
Proposed mitigation measures	*Avoid development within the identified wetland area (western portion) & provide a minimum buffer of 20m		*To ensure that sufficient quality, quantity and connectivity of habitat is provided to accommodate the reptile population (ecological corridors)		*To ensure that sufficient quality, quantity and connectivity of habitat is provided to accommodate the mammal population (ecological corridors)		*To ensure that sufficient quality, quantity and connectivity of habitat is provided to accommodate the bird population (ecological corridors)	
	*Provide suitable culvert bridge (road & services) to ensure hydrology of water course and quality of water remain optimal		*Remove alien invasive plants and rehabilitate		*Remove alien invasive plants and rehabilitate		*Remove alien invasive plants and rehabilitate	
	*Remove alien invasive plants and rehabilitate area		*Protect reptiles from any harm during development		*Provision for speed limits on proposed roads		*Limit the amount of traffic within the developed area	
	*Limit the use and where possible avoid the application of nitrates (nitrogen-based fertilizers)		* Where possible translocate reptiles to an alternative site		*Develop a noise mitigation plan to reduce the potential noise impact		*Provision for speed limits on proposed roads	
	*Allow for habitat management and amphibian monitoring post development		*Allow for habitat management and reptile monitoring post development		*Allow for habitat management and mammal monitoring post development		*Allow for habitat management and bird monitoring post development	

Table 2.3.1: Assessment of the potential impacts of the development and associated infrastructure on the vegetation and habitat. The assessment considers potential impacts identified for the 2019 development against those identified for the 2012 proposed development layout.

Description of the impact	Assessment of the potential impacts of the development and associated infrastructure on the vegetation and habitat (2019 & 2012 development layout)					
	Pioneer Fynbos/ former plantation area 2019	Pioneer Fynbos/ former plantation area 2012	Pioneer Forest/ Thicket area 2019	Pioneer Forest/ Thicket area 2012	Highly disturbed/ transformed area 2019	Highly disturbed/ transformed area 2012
Nature of impact	Negative	Negative	Negative	Negative	Positive	Positive
Determination extent (scale):	Local	Local	Local	Local	Local	Local
Determination of duration	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent
Determination of probability	Probable	Probable	Probable	Probable	Probable	Probable
Determination of reversibility	Partly reversible	Partly reversible	Partly reversible	Partly reversible	Partly reversible	Partly reversible
Determination of loss of resources	Significant loss of resources	Marginal loss of resources	Marginal loss of resources	Marginal loss of resources	No loss of resources	No loss of resources
Determination to which an impact can be avoided	Medium	Medium	High	High	Medium	Medium
Determination to which an impact can be managed	Medium	Medium	High	High	Low	Low
Determination of cumulative impact	High	High	High	High	High	High
Determination of degree to which an impact can be mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated	Can be partly mitigated

Determination of significance (without mitigation)	Medium	Medium	Medium	Medium	Low	Low
Determination of significance (with mitigation)	Low	Low	Low	Low	Low	Low
Proposed mitigation measures	*Ensure sufficient quality, quantity and connectivity of habitat remains throughout the area of the property		*Ensure sufficient quality, quantity and connectivity of habitat remains throughout the area of the property		*Ensure sufficient quality, quantity and connectivity of habitat remains throughout the area of the property	
	*Remove alien invasive plants and rehabilitate		*Remove alien invasive plants and rehabilitate		*Remove alien invasive plants and rehabilitate	
	*Develop and implement fire management program		*Develop and implement fire management program		*Rehabilitate exposed soil surfaces	

Table 2.3.2: Assessment of the potential impacts of the development and associated infrastructure on the vegetation and habitat, continued (2019 & 2012 development layout).

Description of the impact	Assessment of the potential impacts of the development and associated infrastructure on the vegetation and habitat (2019 & 2012 development layout)			
	Wetland habitat 2019	Wetland habitat 2012	Sensitive Garden Route Granite Fynbos 2019	Sensitive Garden Route Granite Fynbos area 2012
Nature of impact	Negative	Negative	Negative	Negative
Determination extent (scale):	Local	Local	Local	Local
Determination of duration	Permanent	Permanent	Permanent	Permanent
Determination of probability	Probable	Probable	Probable	Probable
Determination of reversibility	Barely reversible	Barely reversible	Barely reversible	Irreversible
Determination of loss of resources	Significant loss of resources	Marginal loss of resources	Marginal loss of resources	Significant loss of resources
Determination to which an impact can be avoided	Medium	Medium	Medium	Unavoidable
Determination to which an impact can be managed	High	High	High	High
Determination of cumulative impact	Medium	Medium	Medium	Medium

Determination of degree to which an impact can be mitigated	Can be mitigated	Can be mitigated	Can be partly mitigated	Cannot be mitigated
Determination of significance (without mitigation)	High	High	High	Very High
Determination of significance (with mitigation)	Low	Low	Medium-low	Medium
Proposed mitigation measures	* Avoid development layout in area identified as sensitive wetland and allow buffer between development and wetland for functionality of wetland (see western portion of development)		*Do not consider the construction of a road through the identified area. Investigate an alternative less sensitive route	
	*Remove alien invasive plants and rehabilitate		*Make use of a search and rescue team to remove bulbs (such as <i>Gladiolus fourcadei</i>) prior to the development of the road and transplant them in adjacent areas listed as Sensitive Garden Route Fynbos.	
	*Provide suitable culvert bridge (road & services) to ensure hydrology of water course and quality of water remain optimal		*Remove alien invasive plants and rehabilitate	
	*Ensure sufficient quality, quantity and connectivity of habitat is available		*Ensure sufficient quality, quantity and connectivity of habitat is available	
	*Create emergency Standard Operating Procedure (SOP) in the event of a breakage in the bulk sewage line		*Develop and implement fire management program	

TABLE 2.4.1: Assessment of the potential impacts of the development and associated infrastructure on a landscape level. The assessment considers potential impacts identified for the 2019 development against those identified for the 2012 proposed development layout.

Description of the impact	Assessment of the potential impacts of the development and associated infrastructure on a landscape level (2019 & 2012 development layout)			
	Critical Biodiversity Areas (CBA) 1&2 2019	Critical Biodiversity Areas (CBA) 1&2 2012	Ecological Support Areas (ESA) 1&2 in Landscape connectivity 2019	Ecological Support Areas (ESA) 1&2 in Landscape connectivity 2012
Nature of impact	Negative	No impact	Negative	No impact
Determination extent (scale):	Local	Local	Local	Local
Determination of duration	Long term	Long term	Long term	Long term
Determination of probability	Probable	Improbable	Probable	Improbable
Determination of reversibility	Barely reversible	N/A	Barely reversible	N/A
Determination of loss of resources	Marginal loss of resources	N/A	Significant loss of resources	N/A
Determination to which an impact can be avoided	High	N/A	Low	N/A
Determination to which an impact can be managed	High	N/A	Medium	N/A
Determination of cumulative impact	Low	N/A	High	N/A

Determination of degree to which an impact can be mitigated	Can be mitigated	N/A	Can be partly mitigated	N/A
Determination of significance (without mitigation)	High	N/A	Medium-High	N/A
Determination of significance (with mitigation)	Medium	N/A	Medium	N/A
Proposed mitigation measures	*Western Cape Biodiversity Spatial Plan 2017 replaced previous Spatial Biodiversity layers. This is why the impacts are very different between 2012 & 2017. In 2012 the proposed development did not overlay with CBA 1 or 2 areas.		*Western Cape Biodiversity Spatial Plan 2017 replaced previous Spatial Biodiversity layers. This is why the impacts are very different between 2012 & 2017. In 2012 the proposed development did not overlay with ESA 1 or 2 areas.	
	* Adjust the footprint of development layout to avoid CBA 1&2 areas (western side)		*Ensure sufficient quality, quantity and connectivity of habitat is available between the proposed development	
	*Where possible the roads and services lines should be moved out of the CBA 1&2 areas and placed in a more suitable and less sensitive site		*Consideration can be given to reducing the complexity of the road network as this may improve landscape connectivity	
	* If moving of the roads and services is not possible, then a suitable search and rescue team should move any rare or endangered species prior to development to a suitable pre-identified area prior to development.		*Remove alien invasive plants and rehabilitate	
	*Provide suitable culvert bridge (road & services) to ensure hydrology of water course and quality of water remain optimal		*Rehabilitate exposed soil surfaces	

TABLE 2.4.2: Assessment of the potential impacts of the development and associated infrastructure on a landscape level, continued (2019 & 2012 development layout).

Description of the impact	Assessment of the potential impacts of the development and associated infrastructure on a landscape level (2019 and 2012 development layout).			
	Protected Environment (PE) 2019	Protected Environment (PE) 2012	Alien invasive plant removal 2019	Alien invasive plant removal 2012
Nature of impact	Negative	Negative	Positive	Positive
Determination extent (scale):	Local	Local	Local	Local
Determination of duration	Permanent	Permanent	Medium term	Medium term
Determination of probability	Definite	Definite	Definite	Definite
Determination of reversibility	Barely reversible	Barely reversible	Completely reversible	Completely reversible
Determination of loss of resources	Complete loss of resources	Complete loss of resources	No loss of resources	No loss of resources
Determination to which an impact can be avoided	Unavoidable	Unavoidable	Medium	Medium
Determination to which an impact can be managed	Low	Low	High	High
Determination of cumulative impact	High	High	High	High
Determination of degree to which an impact can be mitigated	Cannot be mitigated	Cannot be mitigated	Can be mitigated	Can be mitigated

Determination of significance (without mitigation)	High negative	High negative	High negative	High negative
Determination of significance (with mitigation)	High positive	High positive	High positive	High positive
Proposed mitigation measures	* The portion of road which cuts across the PE should be shifted into the adjacent area		*Draft an alien invasive monitoring, control and eradication plan	
	*Where possible, there should be a buffer between the PE and the development which is left undeveloped.		*Implement initial and follow-up alien invasive clearing and rehabilitate the area post clearing	
	*Remove alien invasive plants and rehabilitate			

ANNEXTURE: 1

TABLE 2.5: Specialist report requirements as set out in Appendix 6 of the EIA regulations, relevant for (GRDDBSA 2018 & GRDBIA 2019).

APPENDIX 6 OF THE EIA REGULATIONS		WHERE LOCATED IN THE REPORT (SECTION)	PAGE IN THE REPORT
a i)	Details of the specialists who prepared the report	Section 1.3 and cover page	3
a ii)	Expertise of the specialist to compile a specialist report (CV attached as Appendix)	Report 1: Section 1.3 Report 2: Appendix:1.10	Report 1: pg. 4 Report 2: N/A attached CV
b)	Declaration that the specialist is independent	Report 1: Section 1.2 Report 2: Appendix: 2.2	Report 1: pg. 3 Report 2: pg. 32
c)	An indication of the scope of and purpose for the report	Report 1: Section 1.1 Report 2: Section 1	Report 1: pg. 1-2 Report 2: pg. 1
(cA)	Indication of the quality and age of base data used for the report.	Report 1: Section 3 Report 2: Section 3	Report 1: pg. 22-27 Report 2: pg. 5-16

(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	Report 1: Section 3 Report 2 Section 3	Report 1: pg. 22-27 Report 2: pg. 5-16
d)	The date and season of the site investigation and relevance of season to the assessment	Report 1: Section 1.1 Report 2	Report 1: Pg. 2-3 Report 2:
e)	Description of the methodology used and the specific sensitivity of the site related to the activity and infrastructure	Report 1: Section 1.1 Report 2: Section 3	Report 1: pg. 2 Report 2: Pg. 5-15; pg. 19-29
g)	Identification of areas to be avoided including buffers	Report 1: Section 4 Report 2: Section 3,4&6	Report 1: pg. 38-40 Report 2: pg. 5-15, pg. 17-19
h)	A map superimposing the activity including infrastructure on the environmental sensitivities including no-go areas and buffers	Report 1: Section 3; figures 4&6 Report 2: Section 2; figure 2.1, Section 3; figure 2.4	Report 1: 29&37 Report 2: pg. 2&16
i)	Assumptions made, gaps in knowledge and uncertainties. A description of the findings and their implications on the impact of the activity, including alternatives	Report 1: Report 2: Section 3&6	Report 1: Report 2: pg. 2-15 & 20-28

k)	Mitigation measures to be included in the EMP	Report 1: Report 2: Section 3,4&6	Report 1: Report 2: pg. 2-15 & 17-19 & 20-28
l)	Conditions for inclusion in the authorisation	Report 1: Report 2: Section 4	Report 1: Report 2: pg. 17-19
m	Monitoring requirements for the EMP	Report 1: Report 2: Section 4(8)	Report 1: Report 2: pg. 18
n i. niA nii.	whether the activity, or portions of it should be authorised The acceptability of the proposed activity or activities If authorised, areas for avoidance, management and mitigation for inclusion in the EMPr.	Report 1: Report 2: Section 4	Report 1: Report 2: pg. 17
o)	Description of consultation processes undertaken		
p)	Summary of comments received during consultation		
q)	Other information requested by the competent authority		

ANNEXURE: 2

DECLARATION INDEPENDENT ENVIRONMENTAL SPECIALIST

I, Ken Coetzee, as the appointed independent Specialist hereby declare that I:

- act/ed as an independent Specialist in this application / EIA process;
- regard the information contained in this report to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, environmental assessment practitioner and/or competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 and 32 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist report will be distributed or made available to any interested and affected parties registered in the EIA process, administered by the appointed environmental assessment practitioner, with a reasonable opportunity to participate and to provide comments;
- have provided the environmental assessment practitioner / competent authority with access to all information at my disposal regarding the application / EIA process, whether such information is favourable to the applicant or not.
- am aware that a false declaration is an offence in terms of regulation 71 of GN. No. R. 543.

Note: The terms of reference must be attached.



Signature of the Specialist:

CONSERVATION MANAGEMENT SERVICES

Name of company: Conservation Management Services

16 July 2011

ANNEXURE: 3

Potential human-wildlife conflict

Given how the proposed development will transform the area, consideration and where necessary mitigation measures, will have to be implemented in terms of potential conflict between humans and wildlife.

Human-wildlife conflict occurs when the behavior or requirements of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact on the needs of wildlife. Management of human-wildlife conflict requires an integrated or holistic approach towards solving these challenges.

Although ecosystem-based connectivity approaches such as the development of ecological corridors (between natural areas) offer improved protection and movement for many wildlife species, they also present opportunities for interaction and conflict between local people and wildlife. The Kat River, which runs from the Outeniqua Reserve along the western edge of the dam, provides a connectivity opportunity for wildlife movement through the open space provisioned in the development. This opportunity for wildlife movement has the potential for human-wildlife conflict.

Baboon and vervet monkey activity in residential areas near the urban edge is the most common form of human-wildlife conflict encountered in the George, Sedgefield and Knysna urban settings. However, wildlife such as bushbuck, duiker, bushpig, porcupine and even otters have been known to trigger conflict along the urban edge.

One should consider a systematic approach when dealing with human-wildlife conflict. See Diagram 1, illustrating a systematic approach of best practice when approaching human-wildlife conflict (CapeNature).

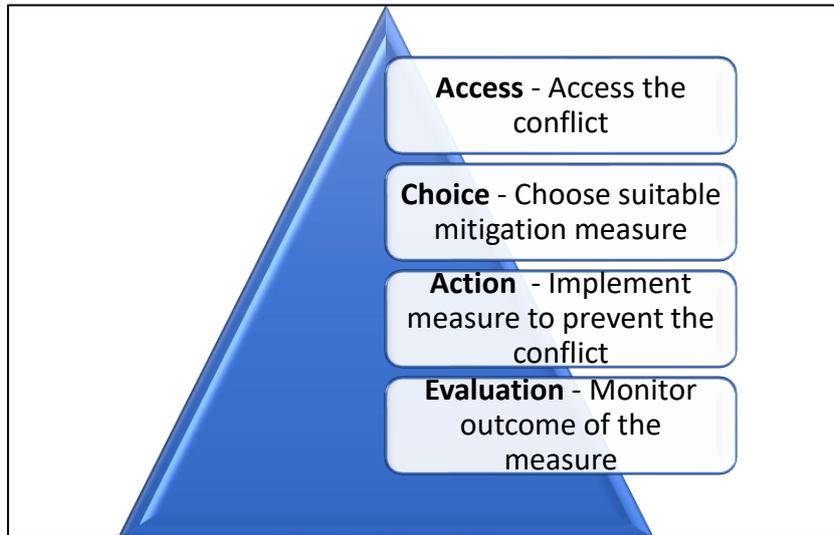


Diagram 1: Systematic approach when dealing with human-wildlife conflict.

Table 1: Potential human-wildlife conflict and proposed mitigating measures.

Species	Potential human-wildlife conflict	Mitigating measure
Baboons and vervet monkeys	Baboons / monkeys damaging gutters, down pipes, thatched rooves.	<ul style="list-style-type: none"> • Install electrical strand along roof edge, gutters and down pipes. • Electric fence around development / property. • Cover thatch in chicken mesh.
	Baboons / monkeys gaining access to house damaging possessions, eating food and defecating.	<ul style="list-style-type: none"> • Keep doors and windows closed if baboons are in the area. • Have baboon-proof burglar bars on windows so windows can remain open.
	Raiding of fruit trees, vegetable gardens, compost heaps.	<ul style="list-style-type: none"> • Cover compost heaps, erect netting over vegetables and fruit trees.
	Raiding of dustbins / wheelie bins.	<ul style="list-style-type: none"> • Only use baboon-proof wheelie bins with catches and keep wheelie-bin tied to a pole or in the garage. • Manage refuse responsibly

	Baboons that lose their fear of humans can become aggressive and can attack humans, causing injury.	<ul style="list-style-type: none"> Do not feed baboons or monkeys or encourage interaction. If human-wildlife conflict becomes unmanageable consider employing a baboon monitoring program
Bushbuck and duikers	Antelope browse growth points of young trees and other plants.	<ul style="list-style-type: none"> Suitable fence or electric strand around property or young trees or beds. Place Tubex tree guards around young saplings. LED lights and other deterrents.
Bushpigs	Raiding of refuse or wheelie bins.	<ul style="list-style-type: none"> Use wildlife proof dustbins and wheelie bins and manage refuse responsibly.
	Churning up of flower beds, sports fields and lawns.	<ul style="list-style-type: none"> Place electric strands around affected areas. LED lights and other deterrents. Do not feed wildlife.
Porcupine	Feeding on bulbs, tubers and roots.	<ul style="list-style-type: none"> Protect flower beds with electric strands and chicken mesh. Dig mesh in at least 300mm below ground.
	Gnawing on young bark of trees.	<ul style="list-style-type: none"> Place plastic piping around young trees
	Gnawing on PVC water pipes and electrical plastic-coated wires	<ul style="list-style-type: none"> Bury water piping and electrical cables at least 300mm below ground or elevate above ground by >500mm
Otters	Evidence of fish predation on fish located in ponds	<ul style="list-style-type: none"> Place netting over ponds

Reference:

CapeNature. Landowners's guide: Human-wildlife conflict. Sensible solutions to living with wildlife.

ANNEXURE: 4

Specialist opinion on a site-specific fire regime and practical fire management plan for the proposed Garden Route Dam Development footprint.

1 Introduction

As per request of the Environmental Assessment Practitioners (Betsy Ditcham of Sharples Environmental Services), the specialist hereby provides opinion on a suitable fire regime and practical fire management plan for the remaining natural vegetation on the property. References are made to both the Garden Route Dam Development Biodiversity Sensitivity Analysis (GRDDBSA, 2018) and the Garden Route Dam Development Biodiversity Impact Assessment (GRDDBIA, 2019). Where relevant, the procedures and principles outlined in the Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape (2nd edition, 2016) were followed.

Fire is a natural process that is essential for maintaining fynbos ecosystems in an ecologically sound condition. Fire in these systems stimulates re-sprouting, seedling recruitment and promotes maximum species richness. The core ecological aspects of fire management in fynbos are the frequency, seasonality intensity and size of fires. These aspects are collectively known as the fire regime. When applying a suitable fire regime for ecological reasons, one has to fully appreciate the danger fires present to lives, property and physical infrastructure.

The following site-specific considerations were used as a basis to provide opinion on a suitable fire regime and management plan:

1.1 Habitat type, condition, sensitivity and size

According to the national vegetation layer, the site consists of Garden Route Shale Fynbos (GRSF) and Garden Route Granite Fynbos (GRGF) (see Figure 2A in the GRDDBSA, 2018). According to the National Biodiversity Assessment (2018), GRSF is classified as a Vulnerable vegetation type which is poorly protected, while GRGF is classified as Critically Endangered and is Hardly Protected. Both GRSF and GRGF form part of the Cape Floristic Region which is largely a fire-dependent system and therefore, the natural fire regime must be

maintained and managed in the landscape.

GRSF covers the majority of the site (+-90 ha) while GRGF covers a small section on the southern border of the site (+- 28 ha).

The majority of the GRSF area is a former plantation area which has been transformed and no longer represents the original vegetation type. The specialist described the following fine-scale vegetation units and approximate areas within the GRSF and GRGF areas (Figure 2B and 4 in the GRDDBSA, 2018):

GRSF area (+- 90 ha)

Pioneer fynbos (+- 77 ha), Wetland Habitat (+- 2 ha), Pioneer Forest Thicket (+- 9 ha), Highly Disturbed / Transformed Habitat (+- 2 ha).

GRGF area (+- 28ha)

Sensitive Garden Route Granite Fynbos (7 ha), Wetland Habitat (+- 12 ha), Pioneer Forest Thicket (+- 9 ha).

1.2 Location and Infrastructure

The Saasveld Road runs along the full length of the southern boundary and the Garden Route Dam along the northern boundary. There is medium-density residential housing along the entire western boundary and low-density residential housing to the south of the Saasveld Road. The Kat River is situated on the northern portion of the property and extends west, while the Witfontein and Groeneweidebos Protected Areas are beyond the plantation area to the northwest and northeast respectively. The highest risk of wildfires derives from a northwesterly and northeasterly direction.

1.3 Potential Fire Risks

The most prominent risk of landscape level wildfires to the proposed development site comes from the Witfontein Nature Reserve managed by CapeNature in the northwest and the Garden Route National Park managed by South African National Parks in the northeast. The mountainous portions of these Protected Areas are considered wilderness areas which are largely unmanaged and considered to have natural fire regimes where little to no prescribed burning takes place. Under suitable conditions, wildfires can cover thousands of hectares and are extremely difficult to control. The plantations

which border the northern side of the dam increase this risk to the proposed development site.

From a localized site-specific risk perspective, the remaining natural vegetation (Open Space Zone 3) to the north and south of the development footprint also presents a moderate risk of fire.

2 Suitable fire regime within the fynbos vegetation and proposed approach for the GRDD

Due to the core of the proposed development area being a former plantation, it is transformed and has low biodiversity value. Although open space has been provisioned for within the core area in the form of a microcorridor for the purpose of faunal movement, the specialist is of the opinion that a burning programme should not be applied in this area. The high risk presented to human life and associated infrastructure and limited ecological gains in small fragmented areas make this area unsuitable for burning.

There is however an opportunity to initiate a small-scale prescribed burning programme for the remaining natural vegetation, as illustrated in Figure 1. The red polygons denote the suitable areas to the north (+-18 ha) and south (+- 30 ha) of the development. Although these are extremely small areas, suitably-timed small fires are still better than excluding fires from a fynbos ecosystem completely.

As illustrated in Figure 1, the Saasveld Road, internal roads and the development boundary can be used for the boundary of the burn area. A suitable fire break on the inside of this boundary will be required. Minimum requirements for a fire break in fynbos vegetation are 2.5 metres multiplied by the height of the vegetation (or a minimum of 5 metres). The vegetation within the fire break should be brush-cut and the vegetation should not be completely removed.

2.1 Size of fire

Calculating the ideal fire size, is an extremely complex exercise which is determined by many factors. The majority of land managers prefer burning over smaller areas because the fire is easier to manage, however this may not be ecologically desirable. Regardless of the size of the fire, it is important to maintain a mosaic of vegetation of different ages within any given tract of land, no matter how large or small it is. It is recommended that the areas illustrated in

Figure 1 be divided in two and burns undertaken at different intervals to ensure that a mosaic effect is created.

2.2 Fire frequency

Research indicates that under natural conditions, fynbos should be burn between 8 and 20 years after the last fire. In fynbos, prescribed burns should not occur more often than every seven years. If they do, it may result in loss of species that have not matured and produced seeds.

2.3 Fire season and intensity

Fire intensity is influenced by the moisture content of the vegetation and the fuel load relative to humidity and wind speed. Optimal fire season is vital to retain species richness, with late summer and autumn fires (December-March) giving the best recruitment results in the southwestern Cape.

2.4 Invasive Alien Plants

Burns in areas that are heavily invaded by woody invasive alien plants (IAP) (e.g. *Acacia* species) will also need special planning. Ideally the IAP's should be felled and chipped prior to initiating the burning programme and, where possible, the biomass removed to avoid hot, soil-sterilizing burns. However, where this is not possible the site may have to be burned under cool, moist conditions, after the soil has become wet enough to prevent the destruction of seeds and soil by the fire.

2.5 Managing risks

A fire risk assessment can assist with appropriated development layout and appropriately laid out burning programmes.

2.6 Involvement

- A burn permit is required from the Local Fire Chief office.
- Notification of your intention to burn is required by the Department of Agriculture and CapeNature.
- It is recommended that representation from the development join the Local Fire Protection Association (FPA) for legal and practical reasons.

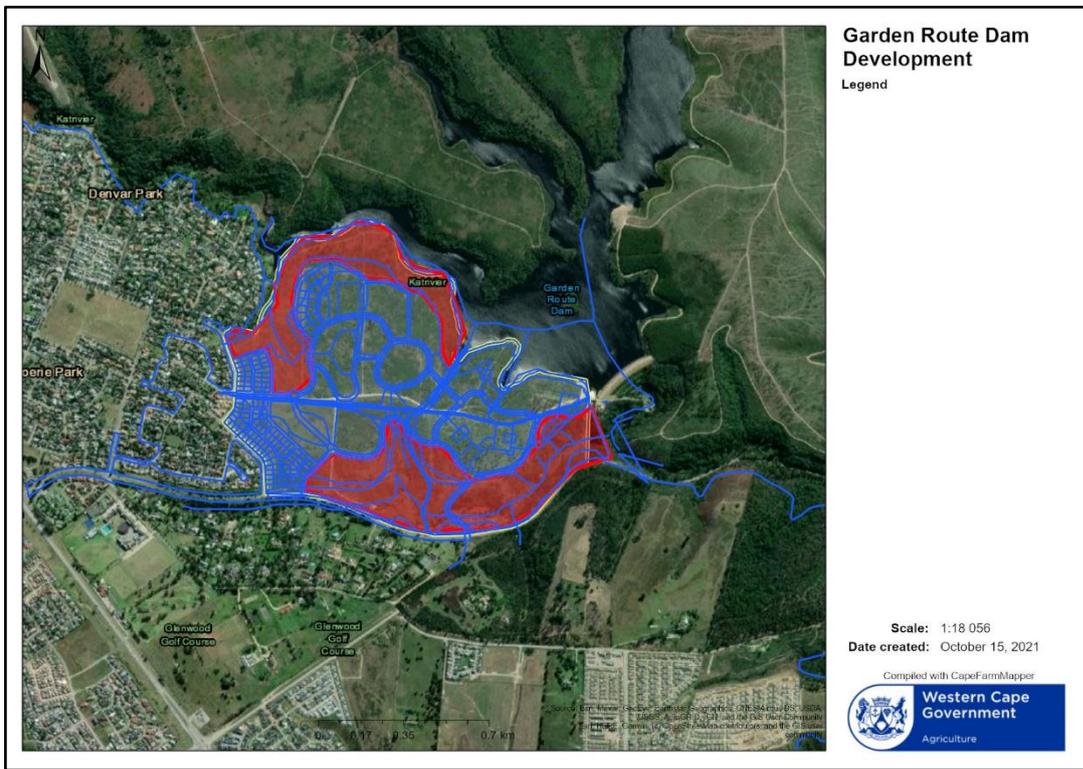


Figure 1: The blue lines indicate the proposed development footprint while the red polygons indicate the potential fire blocks that could be used for prescribed burns. Note how the roads and development boundary have been used as the boundaries for the potential fire blocks.

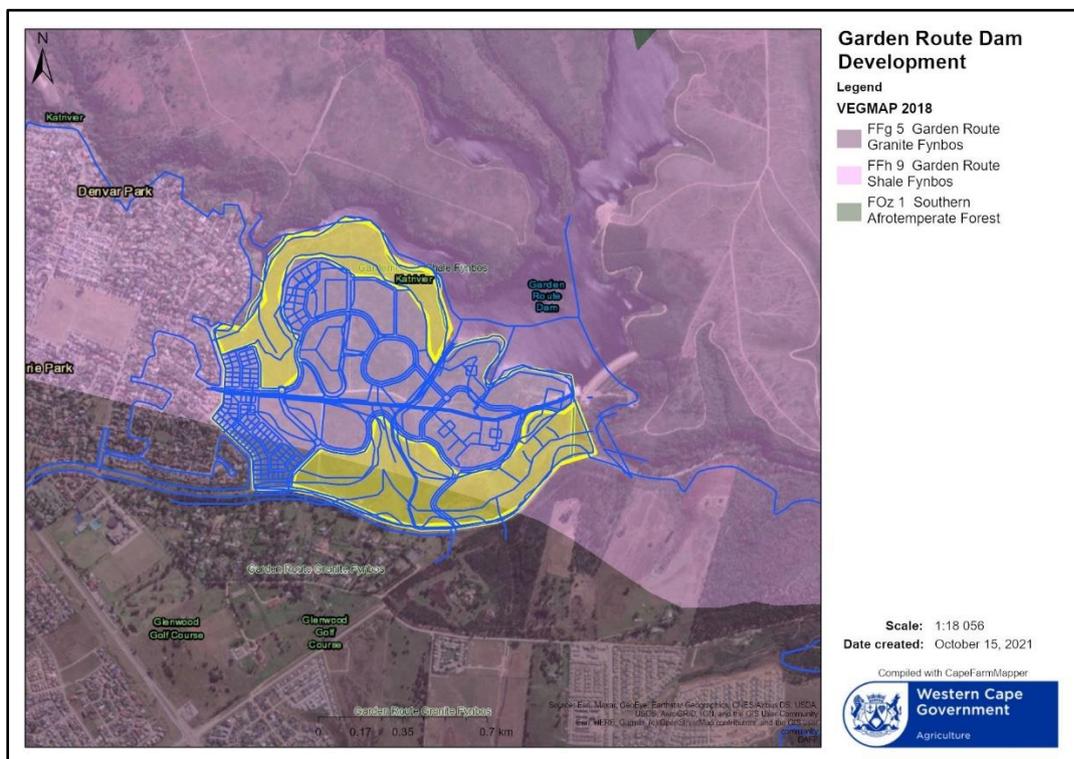


Figure 2: Illustrates how the potential fire blocks (yellow) are positioned in relation to the proposed development (blue lines) and the national vegetation types (Mucina & Rutherford, 2018).