ASSESSMENT OF THE PROPOSED MINE SITE ALTERNATIVES PROPOSED FOR A NEW DOLERITE MINE NEAR PIETERMARITZBURG, KWAZULU-NATAL IN RELATION TO THEIR IMPACT ON WETLANDS AND WATERCOURSES

March 2021

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SYNOPSIS

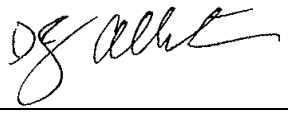
Comparison of the risks posed by two dolerite mine site options to the wetlands and watercourses in their vicinity. In addition to this, recommendations towards the management of the wetlands and watercourses in the vicinity of the project area have also been provided.

KEY WORDS:

Wetlands, Watercourses, Assessment, Management Recommendations.

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2015 which has been independently certified by DEKRA Certification.

Verification	Capacity	Name	Signature	Date
By Author	Wetland Ecologist	Jake Alletson		March 2021
Checked by	Hydrologist	Phillip Hull		March 2021
Authorised by:	Director	Jan Norris		March 2021

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1. INTRODUCTION

Greenmined Environmental is undertaking the various processes of application for environmental authorisation in relation to a new dolerite mine, located in the Mshwati Local Municipality, near Pietermaritzburg, KwaZulu-Natal. The applications are required in terms of the National Environmental Management Act (Act 107 of 1998) and Sections 21 (c) and 21 (i) of the National Water Act (Act 36 of 1998). Earlier specialist studies have been completed and submitted (Amanzi Aquatics, 2020) and, as a result, the Department of Water Affairs and Sanitation (DWS) has requested further information in relation to the impacts associated with the identified mine site alternatives on the aquatic environment both at the mine site and further downstream in the relevant catchment area. Of particular significance is the possibility of the Umgeni River being in some way affected or contaminated should the mine be approved and go into operation.

Terratest (Pty) Ltd was appointed by Greenmined (Pty) Ltd to undertake the necessary studies on the aquatic features (wetlands and watercourses) in the vicinity of the proposed mine and to answer the queries raised by the DWS. As a result, a report which examined the aquatic systems in the vicinity of the proposed mine, and which examined the associated risk levels posed, was produced (Terratest, 2021). This document takes the findings of that study as a basis but considers the risks posed by the alternative mine site option. Since the two mine options are close to one another, they have a considerable length of downstream watercourse in common. The information on that shared area is drawn from the existing Terratest document and so emphasis here is placed on comparison of the risks directly associated with the two mine site options.

2. LOCALITY AND ACCESS ROUTE

The site of the proposed mine is located approximately 10 km to the northeast of the Pietermaritzburg CBD, as presented in Figure *1*1. Access is along the Greytown Road (R33) off the Chota Motala Road out of the city centre. From the intersection at the Northdale Mall follow the road for some 10 km and then turn off to the right at the cross road. Proceed some 450 m and turn right opposite the brick sales shop. A track which is obscure in places leads from there to the mine sites. Permission to enter the property should be obtained beforehand.

3. TERMS OF REFERENCE

For each of the two (proposed) candidate mine sites, the following will be addressed in the following report:

- Assessment of the watercourses in the vicinity of the proposed mine with particular reference to potential impacts on the Umgeni River, and

- Assessment of the wetlands in the vicinity of the proposed mine with reference to compliance with the National Water Act (Act No. 36 of 1998)

4. STUDY AREA

In order to meet the Terms of Reference, the study area was set out with two objectives. These were as follows:

- To consider the characteristics of the various stream and river channels in the vicinity of the mine and between the mine and the Umgeni River; and
- To consider the possibility of the mine impacting on any wetlands which might be in its vicinity.

To meet these objectives, the definitions of the regulated areas of a watercourse and a wetland, as set out under the National Water Act (Act No. 36 of 1998), were referred to. The requirements below are relevant.

The "*General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21(c) and (i)",* Notice 509 of 2016, specifies that the "regulated area of a watercourse" is to mean:

(a) The outer edge of the 1 in 100 year flood line and / or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
(b) In the absence of a determined 1 in 100 year flood line or riparian area, the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
(c) A 500m radius from the delineated boundary (extent) of any wetland or pan.

The National Water Act defines wetlands and watercourses as follows:

"Wetland" means -

> Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils.

Figure 1*:* Locality of the proposed dolerite mine

"Watercourse" means –

a) a river or spring,
b) a natural channel in which water flows regularly or intermittently,
c) a wetland, lake or dam into which, or from which, water flows, and
d) any collection of water which the Minister may, by notice in the Gazette to declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

In order to meet these requirements, the study area for this investigation consists of a strip of land extending outwards 500 m from the given edges of each of the two proposed site alternatives. See Figure 2. However, since the two sites are so close to one another, and have the greater part of their downstream watercourse in common, each site will be considered separately and then the shared area which extends to the Umgeni River will be covered as a single entity.

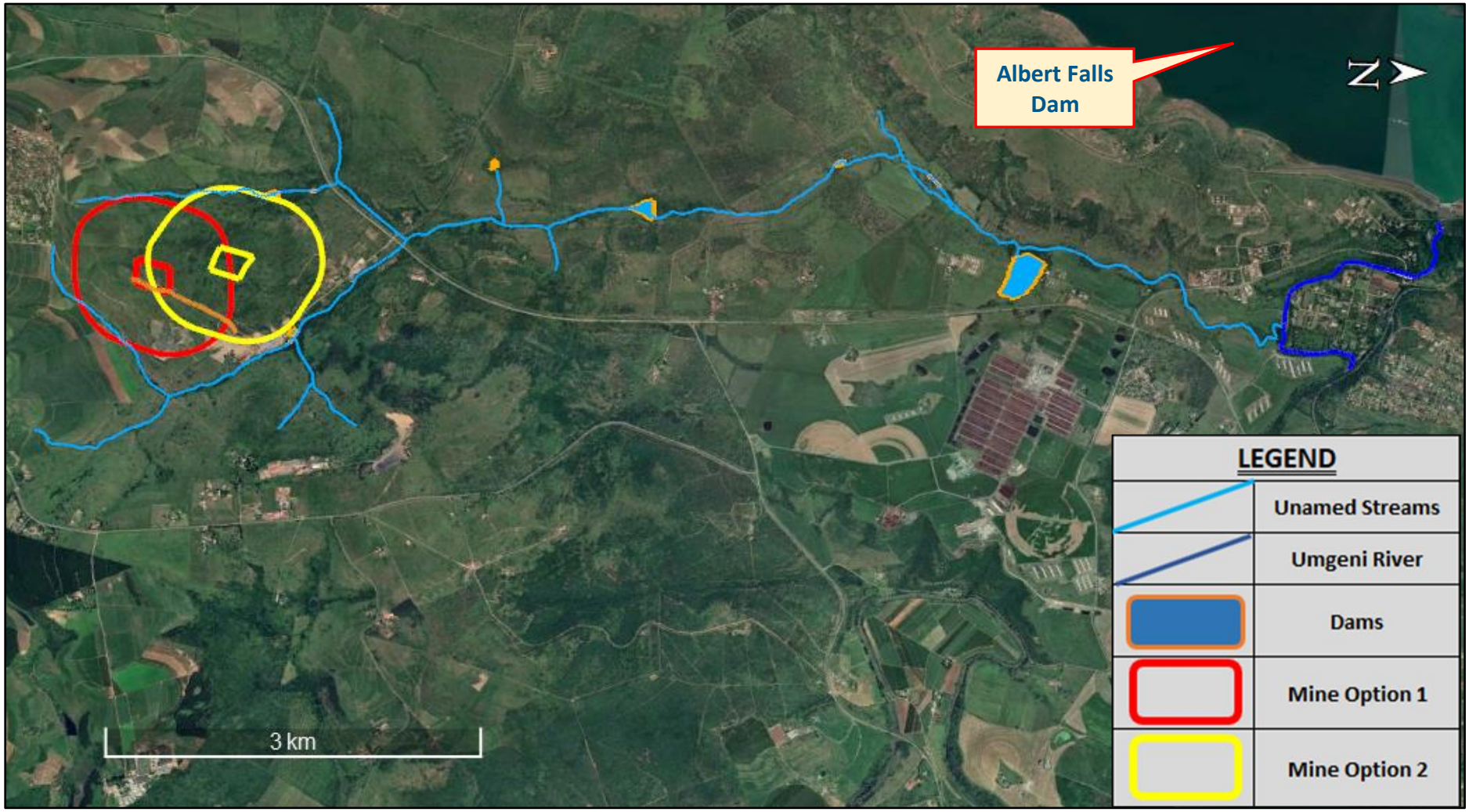


Figure 2: Project study area showing the two mine options and their 500 m wide surrounds

5. EXPERTISE OF THE SPECIALIST

In brief, Mr Alletson is a registered natural scientist with the South African Council of Natural Scientific Professions (Ecological Scientist No. 125697) and has a BSc degree in Biological Sciences from the University of Natal, Durban and a BSc Honours degree in Zoology from Rhodes University. He served as a freshwater ecologist and conservation planner for 21 years in the (then) Natal Parks Board and has a further 24 years of experience as a consulting aquatic and terrestrial ecologist. During that time, he has undertaken numerous wetland and biodiversity assessments for clients ranging from private landowners to state-owned entities such as Transnet and the South African National Roads Agency (SANRAL).

6. AIMS AND OBJECTIVES

The primary aim of the investigation was to identify and analyse of any possible impacts of the dolerite mine on the Umgeni River. Since the river is NFEPA listed and is a critical component of the social and economic well-being of the greater Pietermaritzburg – Durban Corridor, as well as being an important water source for a wider area, it is clear that any further degradation of the river system is undesirable. Since a mine can be a source of sediments and other contaminants, including hydrocarbons (fuels and oils) the possibility of impacts on the Umgeni River must be considered.

The key objectives in considering the risk of impacts on the Umgeni River are as follows:

- To determine the state of the intervening watercourses which link the mine and the Umgeni River;
- To determine the possibility and probability of any contaminants from the mine reaching the Umgeni river;
- To determine the possibility of the mine adversely impacting on aquatic biodiversity in the local rivers and streams; and
- To recommend means by which the possible contamination may be reduced or, preferably, eliminated.

A second aim of the study consists of investigating the possibility of any impacts on wetlands within 500 m of the mine, which might also lead to degradation of the Umgeni River. The possible risks of impacts are much the same for wetlands as for the watercourses and are as follows:

- To confirm the presence or absence of any wetlands within 500 m of the mine;
- To determine the state of any such wetlands;
- To determine the possibility and probability of any contaminants from the mine affecting the wetlands and their associated watercourses;
- To determine the possibility of the mine adversely impacting on aquatic biodiversity in the local aquatic systems; and
- To recommend means by which the possible contamination may be reduced or, preferably, eliminated.

7. METHODOLOGY

In order to meet the stated Aims and Objectives, the following actions were to be undertaken:

7.1 *Investigation of Watercourses*

- The presence of all watercourses in the mine area and flowing from it was to be determined and the channels were to be delineated. Publicly available datasets, including NFEPA and Surveyor General mapping, and Google Earth imagery, were to be used; and
- The characteristics of the watercourses, both those leaving the candidate mine sites, and the shared watercourse section, were to be determined.

7.2 *Investigation of Wetlands*

In order to meet the stated Aims and Objectives the following actions were to be undertaken:

- A search was to be made for any wetlands located within 500 m of the mine periphery. A desktop survey using NFEPA and Ezemvelo KZN Wildlife wetland mapping would be undertaken and a search for wetland traces in Google Earth imagery would be carried out;
- Wetlands which might be affected by the mine were to be delineated in accordance with the Department of Water and Forestry Guidelines of 2005; and

Delineated wetlands would have their Present Ecological State and their functionality determined by means of the WET-Health and WET-Ecoservices models.

Since an aquatic ecosystems report has been prepared (Terratest, 2021), much of the underlying information for the two tasks listed above will be drawn from that source. The only new information included here relates to that around the Option 2 mine site.

8. RESULTS

The earlier study (Terratest, 2021) undertaken on the aquatic systems relating to Mine Option 1 found that the operation would be No Risk to the systems providing that certain mitigatory measures were adhered to. The risks are summarised in Tables 2 and 3. The findings for Option 2 were derived by the same investigative procedures as used for Option 1 but they were only applied for the watercourse and wetland site upstream of the confluence with the stream coming from the Option 1 site. Thereafter is the shared watercourse section which flows some 9.5 km to the Umgeni River. See Figures 2 and 3.

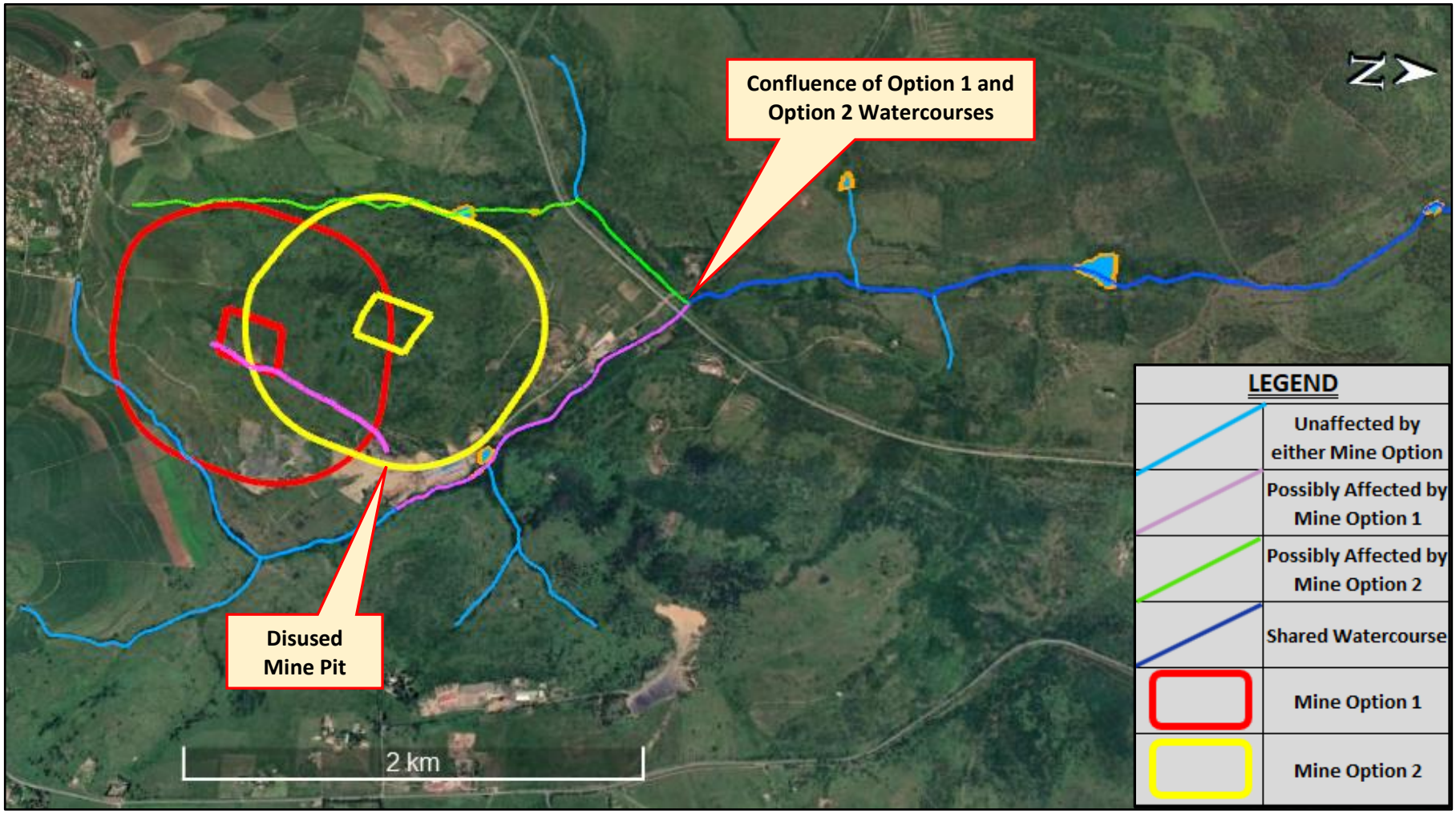


Figure 3: Watercourses in the vicinity of the dolerite mine

8.1 *Watercourses*

8.1.1 Mine Site Option 1

Mine Site Option 1 Is located at the base of a ridge which runs from south to north from the vicinity of the residential area of Copesville. It has a dry watercourse channel leading from it down toward a small stream which is unnamed. However, the earlier study found that the channel is dry at all times except after particularly heavy rainfall events. This channel has no hygrophilous vegetation in it and it no longer reached the other stream channel located to the east. Instead, its lower end was captured into a shale quarry which supplies a nearby brick factory. This quarry was opened in about 2006 and has expanded since. The actual date at which the diversion happened is unknown but, as the present brickworks was constructed in 2016 that organisation had no part in it.

Two small dam walls were raised in the channel of the watercourse but do not store any water. Their function is unknown but it is surmised that they may have been intended to prevent flood debris from reaching the quarry. The channel now ends in a disused pit in the quarry as is shown in Figure 3.

8.1.2 Mine Site Option 2

Mine Site Option 2 is located at a knoll which is the highest point of a ridge which runs from south to north from the vicinity of the residential area of Copesville. As it is at the highest point on the ridge the pit would sink down into the ground and would be almost entirely endorheic[1]. Thus, after the initial phase of ground clearing, no water will flow from it unless it is either by subterranean flow through jointing or other rock fissures, or by being pumped out. Thus, there is only very limited opportunity for surface flows to reach either of the watercourses which run along the base of the ridge. These watercourses are both non-perennial in terms of their flows with the one on the eastern side being dry almost all of the time. Thus, it was not assessed for its present Ecological State (PES). However, on the basis of professional opinion the channel on the west side of the ridge is considered to be a Category C/D system (Moderately to Largely Modified) on the basis of the agriculture in its catchment and the very heavy invasion of alien weed species along its channel. Further, there are two small dams which further lead to the lower reaches of the system being without water for prolonged periods. The eastern side of the Mine Option 2 site is some 330 m from a stream and the western side is 480 m from the stream. Thus the mine is well outside the Regulated Areas of both channels.

8.1.3 Shared watercourse channel

The watercourses from the two mine option sites converge at a point some 50 m downstream of Road R33 as shown in Figure 3. Downstream from the confluence, the channel is joined by

[1] "Endorheic." A drainage basin that has no outlet.

numerous tributaries and so is a third order system by the time it reaches the Umgeni River. Along its length it passes through two small farm dams which will be serving as sediment traps. The gradient is generally low and so much of the channel is very densely vegetated and wetland conditions appear in places, especially in the lower reaches. See Plate 1. These too will also be capable of trapping suspended solids and assimilating dissolved nutrients or toxicants.

Plate 1: View of the shared watercourse downstream of Road R33

The aquatic biodiversity in the area is not known to hold any species of conservation concern which might be affected by the mine. The Mocambique Tilapia (*Oreochromis mossambicus*) is present in the area, and is Red Data listed as a result of corruption of genetic integrity due to hybridisation with alien Nile Tilapia (*O. niloticus*), but will not be affected by the mine. Water quality is not likely to change in either the Umgeni River or the shared watercourse since the two watercourses which pass the mine option sites are commonly dry, and mitigatory measures may be taken for those times when there are flows.

The condition of the shared watercourse is probably stable now with there being no noticeable changes anticipated unless there is a significant change in catchment or climatic conditions.

8.1.4 Likelihood of sediment being transported into watercourse channels

The likelihood of either mine site introducing sediment into a watercourse is illustrated in Figure 4 below. The transects are drawn in an east - west direction through the mine sites and show the positions of the mines in relation to the watercourses. It is apparent that Option 1

is alongside a watercourse and so could be a source of sediment into the system. However, the channel is a dry one and no longer reaches to a channel where there are active flows. Option 2 is more remote from a watercourse but could be source of sediment toward both the western and eastern channels. The relative risks are summarised in Tables 2 and 3.

8.2 *Wetlands*

No field surveys have revealed any wetlands within the 500 m wide surrounding strip of either site option whose presence was not already known. The wetlands in the vicinity of the mine sites are shown in the NFEPA and Ezemvelo KZN Wildlife wetland databases, as indicated in Figure 5. In relation to Site 1, only one such wetland exists and it is located along the unnamed stream to the east of the mine area. It is on the extreme edge of the 500 m wide strip mandated for wetlands under the National Water Act (Section 4 above) and is shown in further detail in Figure 6. In accordance with Ollis *et al* (2013) it is a Channelled Valley Bottom Wetland and Terratest (2021) found it to be in PES Category C (Moderately Modified) as shown in Table 1.

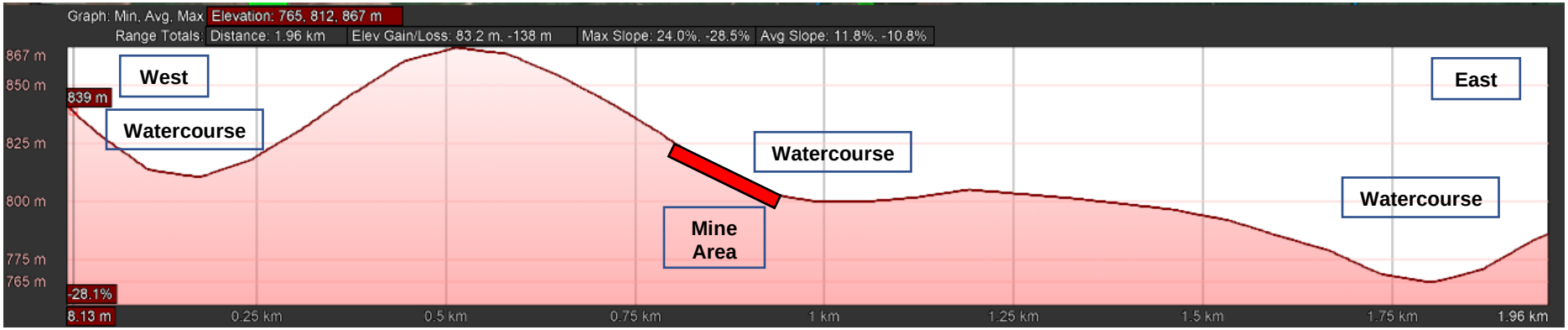
Table 1: Present Ecological State (PES) of the Channelled Valley Bottom wetland

HGM Unit	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
Channelled Valley Bottom	1.9	100	2.5	0	5.0	0	1,2	0
PES Category per driver			**C**	→	**D**	→	**B**	→
Overall PES Category of the site			**2.8 Category C (Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.)					

However, because the site is not in the same sub catchment as the proposed mine it was concluded that it would not be affected by the development.

In relation to Site Option 2, the NFEPA mapping shows a single wetland area. This site is a farm dam as shown in Plate 3. For this reason and because the locality is some 500 m from the mine site it is concluded that it could only be affected if sediment is transported down the feeder stream. However, again because of the remoteness of the channel from the mine site, the impact is most unlikely to happen.

MINE SITE OPTION 1



MINE SITE OPTION 2

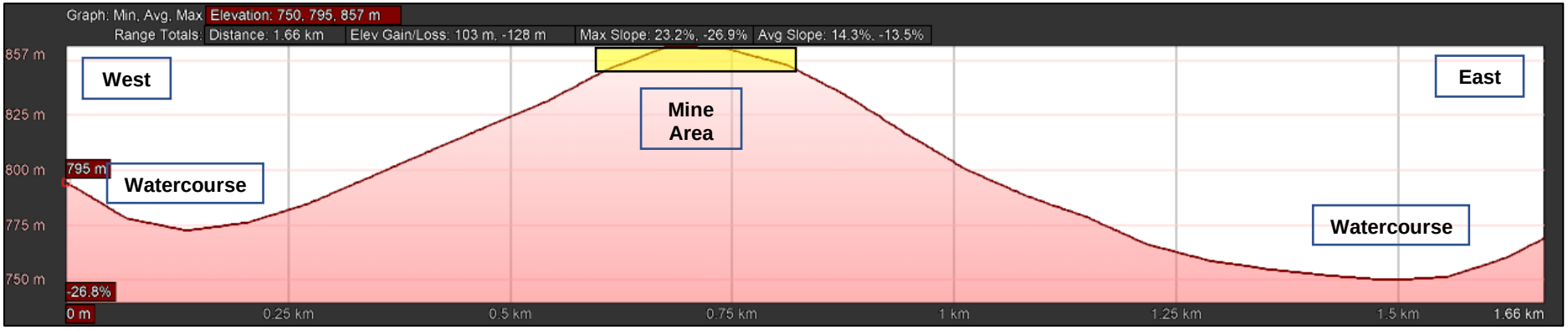


Figure 4: Mine sites in relation to watercourse

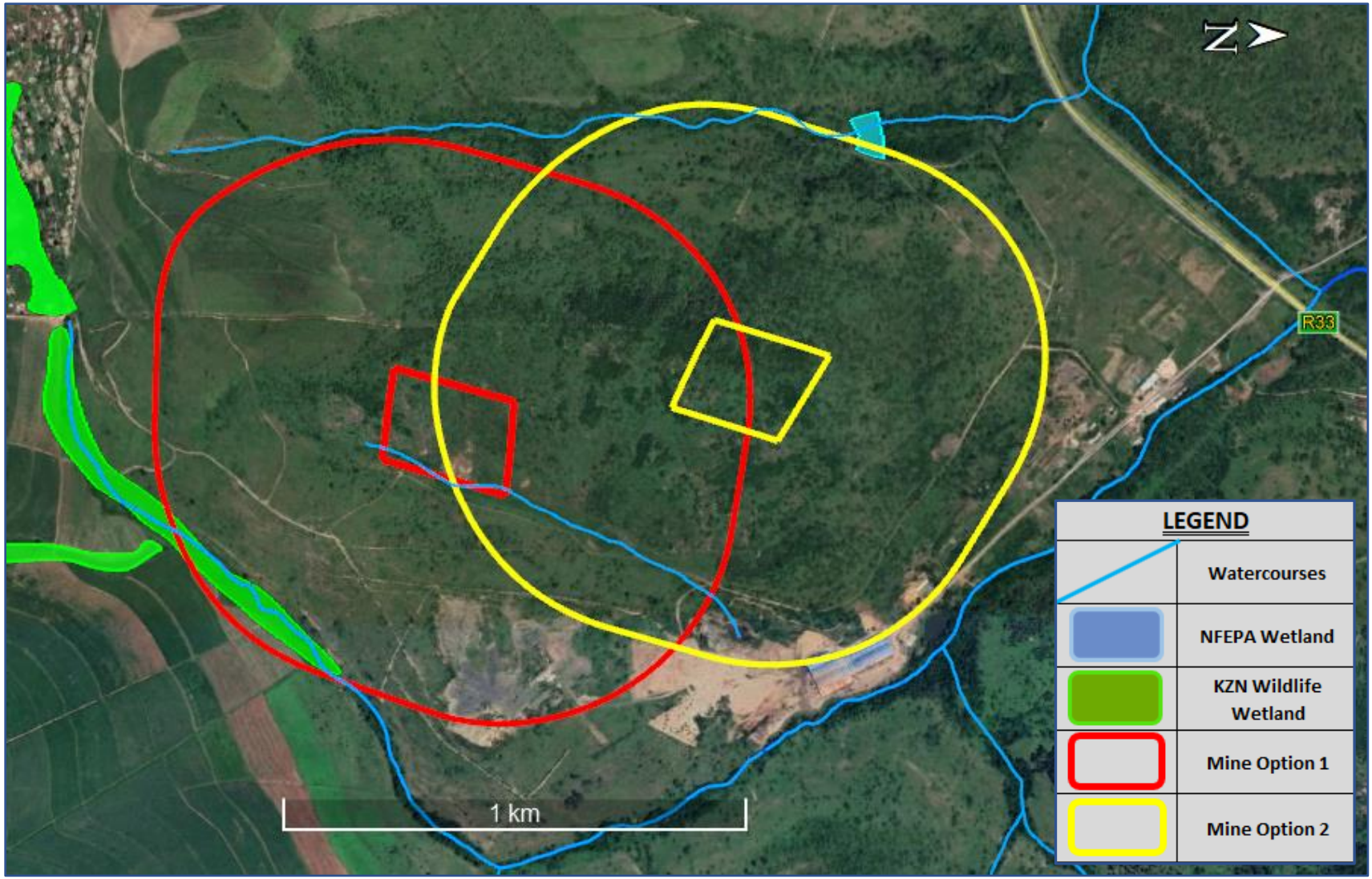


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Figure 5: Wetlands located in the vicinity of the two dolerite mine options

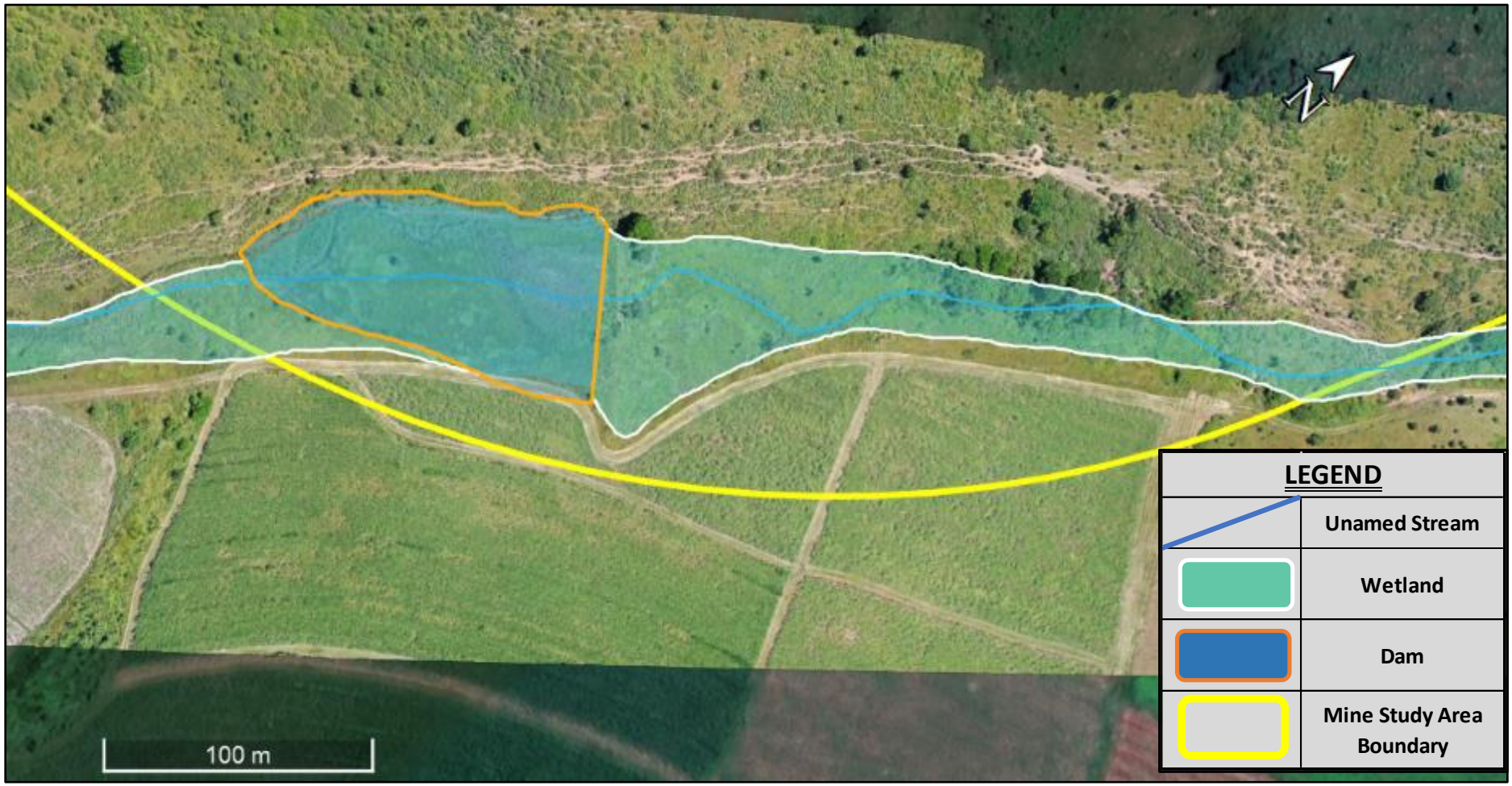

Figure 6: Portion of the wetland, including a dam, located within 500 m wide strip around the dolerite mine

Plate 2: View upstream over the unnamed stream wetland with the dam basin in the foreground

Plate 3: View of the farm dam which is shown as a NFEPA wetland

9. COMPARISON OF MINE SITE OPTIONS 1 AND 2

The anticipated impacts on wetlands and watercourses from the two mine site options are presented in Tables 2 and 3 below. The impacts include those listed in the earlier report which only considered the Option 1 site but with others now being added. The most important of these relate to the locality of Site 2. Because the site is located a little distance away from Site 1, it raises further issues which include the additional length of access road which will be required and the issue of biodiversity. The length of additional road which will be required is not known since no route has yet been proposed. However, because the site is at the crest of a hill, and not at the base, it may be anticipated that the road will have to climb up the hill at some point. This implies greater risk of surface erosion and runoff of soil toward one or both watercourse channels. The quantity of dust produced will also increase as the distance is extended.

In regard to biodiversity, the original report produced (Amanzi Aquatics, 2020) stated that the area in which Site 2 is located has higher biodiversity conservation value than the area at Site 1. Furthermore, the vegetation along the crest of the ridge is generally in better condition than that on the lower slopes. Since the condition of the aquatic biodiversity is commonly closely linked to terrestrial biodiversity, it follows that impacts on the crest of the ridge may well result in degradation of the adjoining streams and wetlands and so should be included in this study.

In the case of Site Option 1 the impacts are considered in relation to the eastern stream which flows directly to the confluence with the shared watercourse. The reason for basing the assessments on that stream, and not within the watercourse channel which leaves the mine site, is that the channel is dry almost throughout the year and that it does not now actually reach the stream directly. The latter condition was brought about by the opening of a shale quarry which eventually reached into its catchment and caused a diversion into an old mine pit. While the change started over 15 years ago, it is still of relevance at the present time.

In the tables, the Feasibility of Mitigation was determined with the mitigatory measures recommended in Terratest (2021) as the background yardstick. The measures were put forward with the intention that they be both practical to implement, and effective in controlling the associated impacts.

10. CONCLUSIONS

It is apparent that neither of the two mine site options pose any major threat to the aquatic systems in their vicinity and effectively none at all to the Umgeni River. The reasons for this situation are that the functional watercourses and wetlands in the area are all located at some distance from either mine site and that the systems are generally small and non-perennial. In the case of the channel which emanates from Site Option 1 there would be a considerable degree of threat but the system is dry at almost all times. In addition, it already has two small sediment retention walls within it and it no longer discharges directly into a normal watercourse. Only one wetland has any part of its area within 500 m of a candidate mine site and it is located in a sub catchment which is separate from the nearest mine site.

Despite the foregoing, the mine sites do pose some degree of threat to the aquatic systems. These threats are linked to indirect impacts and relate to the access roads and to the condition of biodiversity in the area. Mine Site Option 1 has an existing access road which approaches along a route which poses little threat to aquatic systems either in terms of sediment runoff, or from blown dust. Mine Site Option 2 has no road access at present and no route has been proposed. However, as the site is at the crest of a ridge it follows that the approach will have to be indirect in order to reduce the gradient, and so will be of some length. The risks of sediment runoff and blown dust are therefore greater than those from Mine Site Option 1.

Finally, Mine Site Option 2 is a greenfields site which is located in vegetation which is in better condition than that at Site 1. The loss of this vegetation would be of concern by itself but there are likely to be knock-on effects on the aquatic systems in terms of water quality, energy pathways, channel structure, and riparian vegetation. These impacts will penetrate for some distance downstream.

Thus, while there is little reason to determine between the two mine sites on the basis of direct impacts, it would seem that that Mine Site Option 1 will have fewer indirect impacts and so is the option supported by this study.

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Table 2: Comparison of impacts on watercourses by Mine Options 1 and 2

Impact	Mine Option 1			Mine Option 2		
	Probability of Occurrence	**Likely Severity**	**Feasibility of Mitigation**	**Probability of Occurrence**	**Likely Severity**	**Feasibility of Mitigation**
Impact on flow hydrology	Low	n/a	n/a	n/a	n/a	n/a
Risk of soil and sediment inputs	Moderate	Moderate	Moderate to High	Low	Low	Moderate to High
Risk of pollution by fuels and oils	Low	Moderate to Severe	High	Low	Moderate to Severe	High
Risk of pollution by solid wastes	Moderate	Low	High	Low	Low	High
Risk of pollution from blown dust entering the watercourse ecosystem	Moderate to High	Low	Moderate	Low	Low	Low
Risk of pollution by improperly treated waste water	Low	Low	Moderate to High	Low	Low	High
Risk of sediment and dust generation from the access route to the mine.	Low	Moderate	Low	Moderate	Moderate	Low
Risk of impacts on the aquatic biodiversity as a result of degradation of the local catchment area biodiversity	Low	Low	Low	Moderate	Moderate	Low

Table 3: Comparison of impacts on wetlands by Mine Options 1 and 2

Impact	Mine Option 1			Mine Option 2		
	Probability of Occurrence	Likely Severity	Feasibility of Mitigation	Probability of Occurrence	Likely Severity	Feasibility of Mitigation
Impact on flow hydrology	Low	n/a	n/a	n/a	n/a	n/a
Risk of soil and sediment inputs	Low	n/a	n/a	n/a	n/a	n/a
Risk of pollution by fuels and oils	Low	n/a	n/a	Very Low	n/a	n/a
Risk of pollution by solid wastes	Low	Low	High	Low	Low	High
Risk of pollution from blown dust entering the watercourse ecosystem	Low	n/a	n/a	Low	n/a	n/a
Risk of pollution by improperly treated waste water	Low	n/a	n/a	Low	n/a	n/a
Risk of sediment and dust generation from the route to the mine.	Low to Moderate	Moderate	Low	Moderate to High	Moderate	Low
Risk of impacts on the aquatic biodiversity as a result of degradation of the local catchment area biodiversity	Low	Low	Low	Moderate	Moderate	Low