ENVIRONMENTAL IMPACT REPORT:

THE CONSTRUCTION OF A NEW DAM AND ASSOCIATED INFRASTRUCTURE AS PART OF THE UPGRADING OF THE BULK WATER SUPPLY SCHEME TO AMSTERDAM, MPUMALANGA

Report prepared for: Gert Sibande District Municipality

Report dated: October 2017 (draft)

Report number: EIA 2017/01

DARDLEA Reference: 1/3/1/16/1 G-56

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PROJECT INFORMATION SUMMARY

PROJECT TITLE	Environmental Impact Report: Construction of a new dam and associated infrastructure as part of the upgrading of the bulk water supply scheme to Amsterdam, Mpumalanga

CLIENT	Gert Sibande District Municipality
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DARDLEA REFERENCE NO.	1/3/1/16/1 G-56
AdiE REFERENCE NO.	EIA 2017/01

REPORT VERSION	Environmental Impact Report – Draft
DATE	October 2017
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DATE	

This report should be cited as:
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UNDERTAKING BY EAP

as required in terms of Section 2(j) of Appendix 2 of the Environmental Impact Assessment Regulations, 2014.

I, ..., hereby confirm that:

- *the information provided in this Draft Environmental Impact Report is, to the best of my knowledge, correct as at the time of compilation thereof;*
- *comments and inputs obtained from stakeholders and interested and affected parties through the EIA phase have been included in this Draft Environmental Impact Report;*
- *information provided to interested and affected parties during the EIA phase has been included in this Draft Environmental Impact Report;*
- *responses provided to interested and affected parties during the EIA phase have been included in this Draft Environmental Impact Report.*

Signed at..... on this ..... day of..... of 2017.

Signature:.....

Company:.....

I, ..., hereby confirm that:

- *the information provided in this Draft Environmental Impact Report is, to the best of my knowledge, correct as at the time of compilation thereof;*
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Signed at..... on this ..... day of..... of 2017.

Signature:.....

Company:.....

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1. INTRODUCTION

Gert Sibande District Municipality intends to construct a new dam and abstraction facility in either the Gabosha River or the Thole River in order to improve the delivery of potable water to the Amsterdam and KwaThandeka communities.

Two possible dam sites were identified, namely Dam Site A and Dam Site B. Proposed Dam Site A is located in close proximity to KwaThandeka within the Thole River. Proposed Dam Site B is located upstream of Amsterdam (and the Amsterdam Water Treatment Works (WTW)) within the Gabosha River. Both sites are located on the Remainder of Portion 11 of the farm Amsterdam 408 IT.

As part of the project, a bulk water pipeline will be installed from the dam site to the existing Amsterdam WTW while a distribution pipeline will be installed from the WTW to Amsterdam/KwaThandeka. In addition, the Dorps Dam will be desilted and the Amsterdam WTW upgraded. The pipelines will also be located on the Remainder of Portion 11 of Amsterdam 408 IT and within the Amsterdam/KwaThandeka urban area.

Various alternatives in terms of this project were investigated as detailed in this report.

The Minister of Environmental and Water Affairs listed in terms of Sections 24(2), 24(5), 24D and 44, read with section 47A(1)(b) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), a number of activities that require an environmental impact assessment (either a Basic Assessment or a full Environmental Impact Assessment) before undertaking these activities.

The proposed development would involve the following listed activities as identified in terms of Section 24(2) and 24D of the National Environmental Management Act, 1998:

GN R983 – LISTING NOTICE 1 (REQUIRES A BASIC ASSESSMENT)	
Listed Activity	**Description**
9	The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water—(i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where—(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or (b) where such development will occur within an urban area.
12	The development of (i) canals exceeding 100 square metres in size; (ii) channels exceeding 100 square metres in size; (iii) bridges exceeding 100 square metres in size; (iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area, exceeds 100 square metres in size; (vi) bulk storm water outlet structures exceeding 100 square metres in size; (vii) marinas exceeding 100 square metres in size; (viii) jetties exceeding 100 square metres in size; (ix) slipways exceeding 100 square metres in size; (x) buildings exceeding 100 square metres in size; (xi) boardwalks exceeding 100 square metres in size; or (xii) infrastructure

GN R983 – LISTING NOTICE 1 (REQUIRES A BASIC ASSESSMENT)	
Listed Activity	**Description**
	or structures with a physical footprint of 100 square metres or more; where such development occurs (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a water course;- excluding (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads and road reserves.
19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from (i) a watercourse; (ii) the seashore; or (iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing, dredging, excavation, removal or moving – (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within ambit of activity 21 in this Notice, in which case that activity applies.
24	The development of—(i) a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) a road with a reserve wider than 13.5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding—(a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or (b) roads where the entire road falls within an urban area.
27	The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.

GN R984 – LISTING NOTICE 2 (REQUIRES A FULL EIA)	
Listed Activity	**Description**
15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for - (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.
16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the highwater mark of the dam covers an area of 10 hectares or more.

GN R985 – LISTING NOTICE 3 (REQUIRES A BASIC ASSESSMENT)	
Listed Activity	**Description**
Listing Notice No. 3 becomes applicable if the site is located within a specific geographical area (e.g. endangered ecosystems or critical biodiversity areas).	
4	The development of a road wider than 4 metres with a reserve less than 13.5 metres.
14	The development of - (i) canals exceeding 10 square metres in size; (ii) channels exceeding 10 square metres in size; (iii) bridges exceeding 10 square metres in size; (iv) dams, where the dam including infrastructure and water surface area exceeds 10 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size; (vi) bulk storm water outlet structures exceeding 10 square metres in size; (vii) marinas exceeding 10 square metres in size; (viii) jetties exceeding 10 square metres in size; (ix) slipways exceeding 10 square metres in size; (x) buildings exceeding 10 square metres in size; (xi) boardwalks exceeding 10 square metres in size; or (xii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs - (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.

In order to obtain environmental authorisation, a Scoping Report and an Environmental Impact Assessment Report must be compiled as described in Regulations 21 to 24 and Appendices 2, 3 and 4 of the Environmental Impact Assessment Regulations, 2014, promulgated in terms of Section 24(5), 24M and 44 of the National Environmental Management Act, 1998 (Act 107 of 1998).

According to Appendix 3 of the Regulations, the objective of the environmental impact assessment process is to, through a consultative process-

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;
(c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the-
i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
ii) degree to which these impacts-
(aa) can be reversed;
(bb) may cause irreplaceable loss of resources, and
(cc) can be avoided, managed or mitigated;
(e) identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;
(g) identify suitable measures to avoid, manage or mitigate identified impacts; and
(h) identify residual risks that need to be managed and monitored.

AdiEnvironmental cc was appointed as independent environmental consultant to conduct the required Scoping and Environmental Impact Assessment Process and compile the necessary documentation.

Subsequently, AdiEnvironmental cc compiled the following draft and final scoping report:

Title:	Scoping Report: Construction of a new dam and associated infrastructure as part of the upgrading of the bulk water supply scheme to Amsterdam, Mpumalanga.
Report prepared for:	Gert Sibande District Municipality
Report prepared by:	AdiEnvironmental cc
Report dated:	March 2017 (draft) and May 2017 (final)
Report number:	EIA 2017/01
DARDLEA ref. no:	1/3/1/16/1 G-56

The scoping report was submitted to the authorities (i.e. Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA), Department of Water and Sanitation, Mkhondo Local Municipality and Mpumalanga Tourism and Parks Agency) for evaluation. In addition, the draft scoping report was made available to interested and affected parties (I&APs) and stakeholders for comment as indicated in Section 4 of this document. Based on the findings of the scoping phase and the comments received from the authorities, stakeholders and I&APs (see Section 4 of this document), it was decided to commission the required specialist studies and continue with the full environmental impact assessment phase.

This Environmental Impact Report was compiled in accordance with Appendix 3 of the Environmental Impact Assessment Regulations, 2014 (as amended) and indicates the environmental outcomes, impacts and residual risks of the proposed activity.

Diagram 1 provides a schematic description of the Environmental Impact Assessment (EIA) process followed. This EIA process was conducted according to the above-mentioned Regulations. The aim of the process is to ensure that the environmental impacts are considered, the relevant I&APs are consulted and the decision making authorities are provided with sufficient information to make an informed decision.

In essence, this Environmental Impact Report provides the following information:

- details of the Environmental Assessment Practitioner and applicant (Section 2.1),
- undertaking by Environmental Assessment Practitioner (see front of report).
- an overview of the proposed project (Section 2.2),
- need and desirability of the proposed project (Section 2.3),

- supplementary information contained in the Scoping Report regarding the natural and social environments of the site to be affected by the proposed project (Section 5);
- outcome of the specialist studies conducted (Section 5);
- an overview of the alternatives investigated (Section 6),
- an indication of the interested and affected parties (I&APs) identified (Section 4),
- an indication of issues of concern/comments received from interested and affected parties (I&APs) to date (Section 4),
- an indication of potential environmental impacts that could take place as a result of the proposed project (Section 7),
- recommended mitigation measures to minimize the potential impact of the project on the environment (Section 8);
- an Environmental Management Programme (EMPr), which includes the recommended mitigation measures (Section 8);
- a summary of the findings and recommendations with regards to the approval of the proposed project (Section 9).

The decision making authority is the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA). This Department will decide whether to grant or refuse the approval of the project. On approval, an Environmental Authorisation and Record of Decision will be issued in the name of the project applicant.

The project applicant will be responsible for complying with the conditions set in the Environmental Authorisation and Record of Decision.

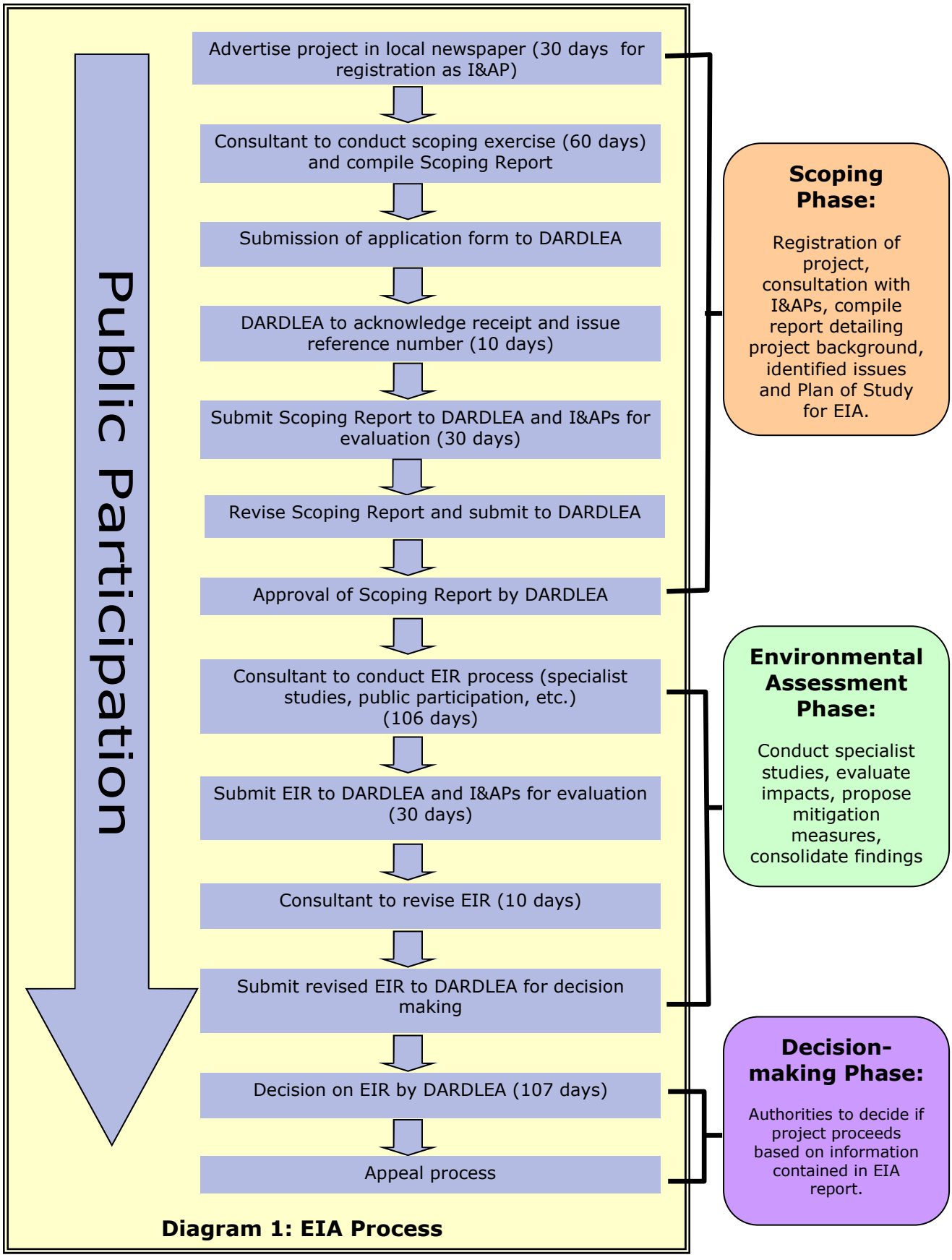


Diagram 1: EIA Process

2. DESCRIPTION OF THE ACTIVITY

2.1 Details of the project applicant and environmental consultant

Name and address of applicant:
Gert Sibande District Municipality P.O. Box 1748 Ermelo 2350
Contact person: Mike Dondo (Senior Manager: Water & Sanitation)
Telephone number: 017 – 801 7214
Cell number: 071 1446 793
e-mail address: Mike.Dondo@misa.gov.za

Afri Infra Group (Pty) Ltd. (on behalf of the Gert Sibande District Municipality) appointed AdiEnvironmental cc, an independent environmental consultancy, to undertake the Environmental Impact Assessment process for the proposed development in accordance with the Environmental Impact Assessment Regulations (EIA), 2014.

Name and address of environmental consultant:
AdiEnvironmental cc P.O. Box 647 Witbank (eMalahleni Central) 1035
Contact persons: Mrs. A. Erasmus *Pr. Sci. Nat.* Ms. R. Janse van Rensburg
Cell number: 083 271 8260
Telephone number: (013) 697 5021
Fax number: (013) 697 5021
e-mail address: adie@adienvironmental.co.za riana@adienvironmental.co.za

AdiEnvironmental cc has no vested interest (other than fair remuneration) in the approval of this project, and hereby declares its independence as required by the EIA Regulations, 2014.

A copy of the completed application form and the declaration of independence by the applicant and environmental consultant are provided in Appendix 1.

A copy of the Curriculum Vitae of both Mrs. A. Erasmus and Ms. R. Janse van Rensburg are provided in Appendix 2 together with a list of projects completed to date.

2.2 Description of development proposal

2.2.1 Proposed dam sites

Gert Sibande District Municipality intends to construct a new dam and abstraction facility in either the Gabosha River or the Thole River in order to improve the delivery of potable water to the Amsterdam and Kwathandeka communities as indicated in Section 2.3 of this EIA Report.

Two possible dam sites were identified, namely Dam Site A and Dam Site B. Proposed Dam Site A is located in close proximity to KwaThandeka within the Thole River (Figure 2.1). Proposed Dam Site B is located upstream of Amsterdam (and the Amsterdam Water Treatment Works (WTW)) within the Gabosha River (Figure 2.1). Both sites are located on the Remainder of Portion 11 of the farm Amsterdam 408 IT (Figure 2.1).

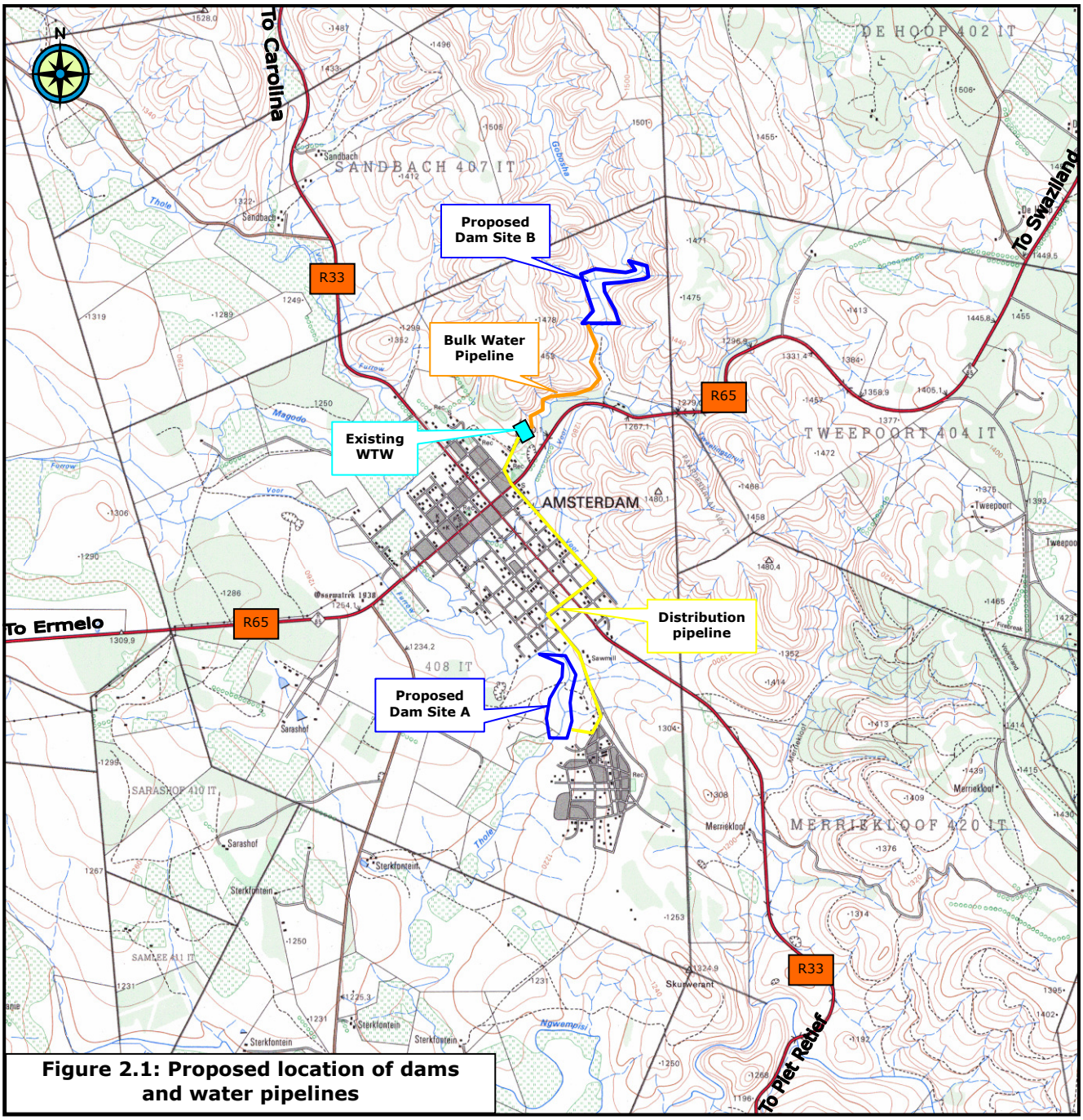


Figure 2.1: Proposed location of dams and water pipelines

As indicated in Section 5.10 of the Final Scoping Report, the following Dam Site alternatives were to be investigated in further detail during the EIA phase:

- 20 year silt/sediment dam at one of the following locations:
  - Dam Site A - located downstream of the confluence of the Thole and Gabosha Rivers in Thole River (Figure 2.1);
  - Dam Site B - located in the Gabosha River about 1.3 km north of the R65 road and upstream of the Dorps Dam (Figure 2.1).

From the desktop assessment conducted during the scoping phase, Dam Site B was indicated to have a much higher Ecological Sensitivity than Dam Site A in view of less impacts and the location away from the residential areas of Amsterdam and KwaThandeka. From an ecological point of view, Dam Site B was thus not preferable as indicated by Niemand and Venter (2017).

However, it was apparent that the proposed Dam Site A (located in the Thole River) would have a greater socio-economic impact on the local community than the proposed Dam Site B (located in the Gabosha River). The construction of the dam within the Thole River could also impact on the downstream users (e.g. irrigation farmers; etc.). In addition, in the long term the water quality could be impacted in view of its close proximity to residential areas, an existing landfill site, etc. This could ultimately impact on water treatment costs and the provision of potable water to the residents of Amsterdam. It was therefore felt that Dam Site A was not suitable for a long term water supply dam in view of the potential pollution risk.

Proposed Dam Site B would provide the more natural dam site in view of the topography of the site resulting in a reduced area being inundated by the proposed dam and thus a reduced impact on the natural environment. In view of the lack of activities taking place in the upstream area, the said site would be less prone to sedimentation and potential impacts on water quality in the long term. The downstream area has already been impacted in terms of the existing Dorps Dam, existing abstraction from the Dorps Dam and the residential area of Amsterdam and is thus not pristine. In addition, a much shorter raw water pipeline (approximately 2175m in length) to the existing Amsterdam Water Treatment Works would be required thus reducing overall costs. An alternative is to release water directly into the Gabosha River downstream of Dam Site B and to abstract water at the existing Dorps Dam abstraction point.

In view of the above-mentioned and from a water resource management perspective, the proposed Dam Site B was indicated as more preferable and required further investigation as part of the EIA phase. Dam Site B was thus investigated in further detail and will be discussed in this EIA Report.

2.2.2 Bulk water pipelines

As indicated in Section 5.10 of the Final Scoping Report, the following pipeline alternatives were to be investigated in further detail during the EIA phase:

- Pipeline from the existing Amsterdam Water Treatment Works (WTWs) to the proposed Dam Site A i.e. a pump line or gravity line (yellow line; Figure 2.1);
- Pipeline from the proposed Dam Site B to the existing Amsterdam WTWs i.e. bulk water supply pipeline (orange line; Figure 2.1).
- No pipeline from the proposed Dam Site B to the existing Amsterdam WTWs: water to be released directly into the Gabosha River

downstream of the Dam Site B and abstracted at the existing Dorps Dam abstraction point.

2.2.3 Desilting of the Dorps Dam

The Dorps Dam, the current abstraction point for Amsterdam, will be desilted (accumulated silt in the dam to be removed) in order to increase the capacity of the dam in terms of the storage of water. This activity was to be assessed as part of the EIA phase.

2.2.4 Upgrading of the Amsterdam WTW

The upgrading/refurbishment of the Amsterdam WTW (Figure 2.1) will form part of the overall project but does not require an Environmental Authorisation in terms of the Environmental Impact Assessment Regulations, 2014 (see Section 4.7.2.3 and Section 6.2.1 of this EIA Report for more details in this regard). The upgrading/refurbishment will therefore not be discussed in this EIA Report.

2.3 Reason for project (need and desirability)

According to Afri Infra (2016), the objective of this project is to upgrade and refurbish the Bulk Water Supply Infrastructure to Amsterdam, situated in the jurisdiction area of the Mkhondo Local Municipality (MLM).

The Amsterdam Regional Water Supply Scheme currently serves a population of approximately 14 500 people who reside within the boundaries of the scheme. These residents are reliant on the scheme to provide a sustainable water supply.

The scheme currently abstracts water from a single location within the catchment of the Gabosha River and is not connected to any National Bulk Water Infrastructure.

The project aims to:

- Eradicate Backlogs (access to basic infrastructure);
- Serve housing and settlement infrastructure;
- Support and stimulate economic growth and development;
- Improve water service quality:
  - drinking water quality (WTW); and
  - consider Operation & Maintenance (O&M) challenges (limited finances, ownership, lack of adequate skilled staff, lack of management, poor asset management);
- Improve supply interruptions (reliability of supply);
- Optimize cost/appropriate technology;
- Support integrated resource planning and management;
- Promote cooperation between authorities with regards to sharing of resources, responsibilities and risks; and
- Increase sustainability (Afri Infra, 2016).

2.4 Phases of development

2.4.1 Estimated start and completion dates of construction

Construction will only commence once the relevant approvals have been obtained.

2.4.2 Construction phase

This would involve the construction of the following infrastructure:

- Dam (either at Dam Site A or Dam Site B; Figure 2.1);
- Bulk water pipeline (Figure 2.1);
- Distribution pipeline (Figure 2.1).

2.4.3 Operational phase

This would involve the utilization of the following infrastructure:

- Dam (either at Dam Site A or Dam Site B; Figure 2.1);
- Bulk water pipeline (Figure 2.1);
- Distribution pipeline (Figure 2.1).

2.4.4 Decommissioning phase

If the situation of decommissioning in terms of the overall project does arise, an Environmental Management Plan (EMP) will need to be compiled in order to manage the activities associated with the decommissioning of the site.

2.5 Applicable legislation, policies and/or guidelines

Table 2.1 provides an indication of legislation, policies and/or guidelines applicable to the said project.

TABLE 2.1: APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

Title of legislation, policy or guideline:	Administering authority:	Aim of legislation, policy or guideline
The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996)	Department of Justice and Constitutional Development	To establish a Constitution with a Bill of Rights for the RSA. It sets out of a number of fundamental environmental rights (Section 24).
Spatial and Land Use Management Act (Act 16 of 2013)	Local Authority	To provide a framework for spatial planning and land use management in the Republic.
Environment Conservation Act, 1989 (Act 73 of 1989) and amendments	Department of Agriculture, Rural Development, Land and Environmental Affairs	To control environmental conservation.
National Environmental Management Act, 1998 (Act 107 0f 1998) and amendments	Department of Agriculture, Rural Development, Land and Environmental Affairs	To provide for the integrated management of the environment.
National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004) and amendments	Department of Agriculture, Rural Development, Land and Environmental Affairs	To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incidental thereto.
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) and amendments	Department of Agriculture, Rural Development, Land and Environmental Affairs	To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment

TABLE 2.1: APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES		
Title of legislation, policy or guideline:	**Administering authority:**	**Aim of legislation, policy or guideline**
		and functions of a South African Biodiversity Institute; and for matters connected therewith.
National Environmental Management: Waste Act, 2008 (Act 59 of 2008) and amendments	Department of Agriculture, Rural Development, Land and Environmental Affairs	To reform the law regulating waste management in order to protect health and the environment by providing for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) and amendments	Department of Environmental Affairs	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
Environmental Impact Assessment Regulations, 2014 (Government Gazette No. 33306 of 18 June 2010) and amendments	Department of Agriculture, Rural Development, Land and Environmental Affairs	Regulations pertaining to environmental impact assessments.
National Water Act, 1998 (Act 36 of 1998) and amendments	Department of Water and Sanitation	To control water management aspects.
National Veld and Forest Fire Act, 1998 (Act 101 of 1998) and amendments	Department of Agriculture, Forestry and Fisheries	To prevent and combat veld, forest and mountain fires throughout South Africa.
National Heritage Resources Act, 1999 (Act 25 of 1999) and amendments	South African Heritage Resources Agency	This legislation aims to promote good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed to future generations.
Protection of Personal Information Act, 2013 (Act 4 of 2013)	Department of Justice and Constitutional Development	The purpose of this act is to give effect to the constitutional right to privacy by safeguarding personal information and to regulate the manner in which personal information may be processed.
Promotion of Access to Information Act, 2000 (Act 2 of 2000) and amendments	Department of Justice and Constitutional Development	To give effect to the constitutional right of access to any information held by the State and any information that is held by another person and that is required for the exercise or protection of any rights; and to provide for matters connected therewith.
Promotion of Administrative Justice Act, 2000 (Act 3 of 2000) and amendments	Department of Justice and Constitutional Development	The Act aims to make the administration (e.g. Government and Parastatals) effective and accountable to people for its actions.
Conservation of the Agricultural Resources Act, 1983 (Act 43 of 1989) and amendments	Department of Agriculture, Forestry and Fisheries	To provide control over the utilization of the natural resources of the Republic in order to promote the conservation of soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.
Occupational Health and Safety Act, 1993 (Act 85 of 1993) and amendments	Department of Labour	To provide for the health and safety of persons at work and for the health and safety of persons in connection with the activities of persons at work and to establish an advisory council for occupational health and safety.

TABLE 2.1: APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES		
Title of legislation, policy or guideline:	**Administering authority:**	**Aim of legislation, policy or guideline**
Health Act, 1977 (Act 63 of 1977) and amendments	Department of Health	To promote public health.
Mpumalanga Nature Conservation Act, 1998 (Act 10 of 1998) and amendments	Mpumalanga Tourism and Parks Agency	To control nature conservation.
Various by-laws of the Mkhondo Local Municipality.	Mkhondo Local Municipality	To regulate land use within the Mkhondo Local Municipal area.
Integrated Development Plan for the Mkhondo Local Municipality	Mkhondo Local Municipality	Broad spatial framework guidelines for the Mkhondo Local Municipality.
Various by-laws of the Gert Sibande District Municipality.	Gert Sibande District Municipality	To regulate land use within the Gert Sibande District Municipal area.
Spatial Development Framework for the Gert Sibande District Municipality	Gert Sibande District Municipality	Spatially based policy guidelines whereby changes, needs and growth in the region can be managed to benefit the whole community.
Water Services Development Plan for the Gert Sibande District Municipality	Gert Sibande District Municipality	Long term planning in terms of the provision of water supply and sanitation services to local communities and addressing socio-economic, technical, financial, management and environmental aspects thereof.
Integrated Environmental Management Guideline Series (Guideline 5 – 10 October 2012) – Companion to the Environmental Impact Assessment Regulations, 2010	Department of Economic Development, Environment and Tourism	To provide clarity on the processes to be followed when applying for an environmental authorisation in terms of the EIA Regulations and gives a comprehensive interpretation of the listed activities.
National Biodiversity Framework (NBF, 2008)	Department of Environmental Affairs	To co-ordinate and align the efforts of the organisations and individuals involved in conserving and managing South Africa's biodiversity
Convention on Biological Diversity (29 December 1993)	Party to International Convention	Develop strategies, plans or programs for conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plant or programs which shall reflect, inter alia, the measures set out in this Convention.
Tripartite Interim Agreement between the Republic of Mozambique and the Republic of South African and the Kingdom of Swaziland for co-operation on the protection and sustainable utilisation of the water resources of the Incomati and Maputo Water Resources (Interim IncoMaputo Agreement, 2002).	Republic of Mozambique, Republic of South Africa and the Kingdom of Swaziland	Deals with the co-operation between the 3 countries on the protection and sustainable utilisation of the water resources of the Incomati and Maputo Water Resources.

3. FINDINGS OF THE SCOPING PHASE

This section provides:
- A summary of the findings of the scoping phase (Section 3.1);
- An indication of additional studies required (Section 3.2);
- An indication of additional public participation required (Section 3.3).

3.1 Findings of the scoping phase

Dam Site A versus Dam Site B
As indicated in Section 5.10 of the Final Scoping Report, the following Dam Site alternatives were to be investigated in further detail during the EIA phase:

- 20 year silt/sediment dam at one of the following locations:
  - Dam Site A - located downstream of the confluence of the Thole and Gabosha Rivers in Thole River;
  - Dam Site B - located in the Gabosha River about 1.3 km north of the R65 road and upstream of the Dorps Dam.

From the desktop assessment (Section 6.2 of the Final Scoping Report), Dam Site B was indicated to have a much higher Ecological Sensitivity than Dam Site A in view of less impacts and the location away from the residential areas of Amsterdam and KwaThandeka. From an ecological point of view, Dam Site B was thus not preferable as indicated by Niemand and Venter (2017).

However, it was apparent that the proposed Dam Site A (located in the Thole River) would have a greater socio-economic impact on the local community than the proposed Dam Site B (located in the Gabosha River). The construction of the dam within the Thole River could also impact on the downstream users (e.g. irrigation farmers; etc.). In addition, in the long term the water quality could be impacted in view of its close proximity to residential areas, an existing landfill site, etc. This could ultimately impact on water treatment costs and the provision of potable water to the residents of Amsterdam. **It was therefore felt that Dam Site A was not suitable for a long term water supply dam in view of the potential pollution risk.**

Proposed Dam Site B would provide the more natural dam site in view of the topography of the site resulting in a reduced area being inundated by the proposed dam and thus a reduced impact on the natural environment. In view of the lack of activities taking place in the upstream area, the said site would be less prone to sedimentation and potential impacts on water quality in the long term. The downstream area has already been impacted in terms of the existing Dorps Dam, existing abstraction from the Dorps Dam and the residential area of Amsterdam and is thus not pristine. In addition, a much shorter raw water pipeline (approximately 2175m in length) to the existing Amsterdam Water Treatment Works would be required thus reducing overall costs. An alternative is to release water directly into the Gabosha River downstream of Dam Site B and to abstract water at the existing Dorps Dam abstraction point.

In view of the above-mentioned and from a water resource management perspective, the proposed Dam Site B was indicated as more preferable and required further investigation. It was indicated that a detailed Environmental Impact Assessment (with specialist studies)

was required in order to determine the overall impact of the dam in view of the ecological sensitivity of the site and to ensure that the Ecological Water Requirements (EWR) and cross border flows (i.e. to Swaziland) of the overall system could be maintained (a requirement in terms of the National Water Act, 1998).

Pipelines

As indicated in Section 5.10 of the Final Scoping Report, the following pipeline alternatives were to be investigated in further detail during the EIA phase:

- Pipeline alternatives:
    - Pipeline from the existing Amsterdam Water Treatment Works (WTWs) to the proposed Dam Site A i.e. a pump line or gravity line;
    - Pipeline from the proposed Dam Site B to the existing Amsterdam WTWs i.e. bulk water supply pipeline.
    - No pipeline from the proposed Dam Site B to the existing Amsterdam WTWs: water to be released directly into the Gabosha River downstream of the Dam Site B and abstracted at the existing Dorps Dam abstraction point.

If Dam Site A is not developed and Dam Site B is developed, then the pipeline from the existing Amsterdam WTWs to the proposed Dam A site would become a distribution pipeline providing potable water from the existing Amsterdam WTWs to the residential areas of Amsterdam and KwaThandeka. In this case, the said pipeline would be a gravity pipeline and was to be assessed as part of the EIA phase.

The proposed pipeline from the proposed Dam Site B to the existing Amsterdam WTWs would extend through an area of High Ecological Sensitivity and is thus not a preferred option but was to be assessed as part of the EIA phase.

The alternative of releasing water directly into the Gabosha River downstream of the Dam Site B and abstracting at the existing Dorps Dam abstraction point would impact on the aquatic environment associated with the Gabosha River in terms of increased flows, etc. The Gabosha River is indicated as Critical Biodiversity Areas: Rivers and the surrounding areas Ecological Support Areas (ESAs): Important subcatchments in the freshwater assessment of Mpumalanga Biodiversity Sector Plan (2013). The Gabosha River is a tributary draining into sub-quaternary reach W53C-1679 and is anticipated to have a much higher PES (Category A or B) than the Thole River in view of less impacts. It is thus seen as important from an aquatic point of view and was to be assessed as part of the EIA phase.

Issues raised through the public participation process

In summary, the following issues of concern were recorded through the scoping phase (Section 6.4 of the Final Scoping Report) and need to be addressed during the EIA phase:

- Requirements in terms of the Interim IncoMaputo Agreement (i.e. agreement between South Africa, Swaziland and Mozambique regarding water resource management);
- Potential impact on local resident residing in Vincent Street, Amsterdam;
- Potential impact on downstream water users in terms of water availability for irrigation;
- Water use licence application required;

- Water resource situation analysis and availability (water demand and balance) study required;
- Ecological assessment of all wetlands to be conducted;
- Dam design studies required;
- Dam registration with the Department of Water and Sanitation: Dam Safety Office required.

3.2 Additional studies required

Through the scoping phase, it was evident that various issues require further investigation before the proposed development can be approved.

The following specialist studies were thus commissioned as part of the EIA phase:

- Heritage Impact Assessment;
- Palaeontological Impact Assessment;
- Vegetation and plant species assessment;
- Faunal (animal life) assessment;
- Wetland assessment;
- Aquatic assessment;
- Geotechnical study;
- Water resource situation and availability analysis.

3.2.1 Heritage Impact Assessment

A Heritage Impact Assessment as required in terms of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) was commissioned in order to determine whether any sites of archaeological and/or cultural interest are located at or near the proposed dam sites and/or pipeline routes. Dr. Anton van Vollenhoven, an accredited archaeologist, was appointed to conduct the required assessment.

The scope of work entailed the following:

- Identify objects, sites, occurrences and structures of an archaeological or historical nature (cultural heritage sites) located on the property.
- Study background information on the area to be developed.
- Assess the significance of the cultural resources in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value.
- Describe the possible impact of the proposed development on these cultural remains, according to a standard set of conventions.
- Recommend suitable mitigation measures to minimize possible negative impacts on the cultural resources by the proposed development.
- Review applicable legislative requirements.
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Heritage Impact Assessment.

3.2.2 Palaeontological Impact Assessment

A Palaeontological Impact Assessment as required in terms of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) was commissioned. Dr. Heidi Fourie, an accredited palaeontologist, was appointed to conduct the required assessment.

The scope of work entailed the following:

- Document palaeontological resources in the area to be developed by utilizing geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps;
- Provide an assessment of observed or inferred palaeontological heritage within the proposed development site;
- Make recommendations (if any) for protection, mitigation or monitoring of palaeontological resources identified;
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Palaeontological Impact Assessment.

3.2.3 Vegetation and plant species assessment

A vegetation and plant species assessment was commissioned in order to determine the status of the vegetation of the proposed dam sites and along the proposed pipeline routes. Ina Venter of Kyllinga Consulting was appointed to conduct the required assessment.

The scope of work entailed the following:

- Identification of plant communities/habitat types;
- Compilation of species lists of the plant communities identified;
- Determining if the vegetation is primary or secondary and identifying disturbances;
- Compilation of a list of medicinal and invasive plant species;
- Searching for Red Data plant species and species of conservation importance;
- Determining the sensitivity and conservation importance of the vegetation;
- Impact assessment and proposed mitigation measures;
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Vegetation and Plant Species Assessment.

3.2.4 Fauna (animal life) assessment

A fauna (animal life) assessment was commissioned in order to determine the status of the fauna (animal life) at the proposed dam sites and along the proposed pipelines routes. Lukas Niemand of Pachnoda Consulting, working in association with Ina Venter of Kyllinga Consulting, was appointed to conduct the required assessment.

The scope of work entailed the following:

- An avifaunal (bird) study based on random transect walks and point counts (to estimate dominance and associations);
- A mammal study based on random transect walks and visual indicators such as spoor, burrows, tracks and scats (excluding trapping due to the possibility of theft and vandalism);
- An overview of the herpetofauna based on active searching and vocalisations (for amphibians);
- A dragonfly assessment (at suitable habitat) based on point counts and the estimation of an DBI (dragonfly biotic index) for the area (excluding detailed sampling methods);

- Verification of the occurrence or potential occurrence of threatened, near-threatened, endemic or rare bird, mammal, herpetofauna or invertebrate species;
- A sensitivity and habitat map (including buffer zones if applicable);
- Recommendations and mitigation measures where applicable;
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Faunal (Animal Life) Assessment.

3.2.5 Wetland assessment

A wetland assessment was commissioned to determine the status and importance of wetlands within the proposed dam sites and along the proposed pipeline routes. Ina Venter of Kyllinga Consulting was appointed to do the required assessment.

The scope of work entailed the following:

- Field delineation of the wetlands within the dam site and along the pipeline routes according to the Department of Water Affairs (DWA) delineation guidelines;
- Desktop delineation of the wetlands within 500m thereof on aerial photographs;
- Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) assessments;
- Diatom assessment;
- Buffer zone recommendations;
- Impact assessment and proposed mitigation measures;
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Wetland Assessment.

3.2.6 Aquatic assessment

A specialist aquatic assessment was commissioned with regards to the potential impact of the proposed dam sites and pipeline routes on the aquatic environment. This specialist aquatic assessment was conducted by Dr. Pieter Kotze and his team from Clean Stream Biological Services (Pty) Ltd.

The scope of work entailed the following:

- Baseline assessment of the present status of the aquatic fauna (fish and macroinvertebrates) and their relevant habitats of the lotic ecosystems (streams/rivers).
- An impact assessment to identify the potential impact of the proposed project on the aquatic fauna and its relevant habitats.
- Recommendations regarding possible mitigation strategies that may reduce or prevent the identified risks.
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Aquatic Assessment.

3.2.7 Geotechnical study

A geotechnical study was commissioned with regards to the suitability of the sites for dam construction. This study was undertaken by Engeolab cc.

The scope of work entailed the following:

- Determine the site soils and depth to bedrock where possible;
- Evaluate the engineering properties of the site soils;
- Assess the groundwater conditions;
- Evaluate the workability of the site soils with regards to their excavatability and compactability;
- Determine the overburden soil properties such as permeability, dispersiveness, grading and plasticity;
- Determine the characteristics and distribution of site soils;
- Determine the suitability of on-site materials for use as dam construction materials;
- Determine the availability of the required materials;
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Geotechnical Study.

3.2.8 Water situation and availability analysis

Steven Mallory of IWR Water Resources (Pty) Ltd was appointed to conduct the water situation and availability analysis with regards to the said project.

The scope of work entailed the following:

- Review of the hydrology and water resource assessment studies previously undertaken with regards to the project;
- Determine the yield at the proposed dam sites and whether the future water requirement of Amsterdam can be met taking into account the Ecological Water Requirements (EWR) and the minimum cross border flows;
- Determine the potential impact on downstream water users especially irrigation farmers;
- Determine whether or not the requirements in terms of the Interim IncoMaputo Agreement (i.e. agreement between South Africa, Swaziland and Mozambique regarding water resource management) can be met;
- An overall assessment of the water availability and whether or not the project can proceed;
- Addressing comments received through the public participation process.

Section 5 of this EIA Report provides feedback in terms of the findings of the Water Situation and Availability Analysis.

3.3 Additional public participation

The following additional public participation was recommended in the Plan of Study for EIA (Section 7 of the Scoping Report):

7.1 Evaluation of the Scoping Report

The draft Scoping Report (dated: March 2017) will be submitted to the Department of Agriculture, Rural Development, Land and Environmental Affairs for evaluation purposes. A hard copy of the document will also be forwarded to the following authorities for evaluation (30-day period):

- Inkomati Usuthu Catchment Management Agency;
- Department of Water and Sanitation;

- Mpumalanga Tourism and Parks Agency;
- Mkhondo Local Municipality.

An electronic copy of the draft Scoping Report will be made available during the above-mentioned period to the interested and affected parties and stakeholders consulted and/or registered as part of the scoping process (see Section 4 of this report).

The various departments, stakeholders and interested and affected parties will be requested to forward any comments on the report to the consultant within the 30 day period provided. A register will be kept of all comments received in terms of the evaluation of the report. These comments will then be included and addressed in a final Scoping Report.

A hard copy of the draft Scoping Report will be left at the Amsterdam Public Library. An electronic version will be made available on the company website (www.adienvironmental.co.za) and on cd (on request).

An advertisement in this regard will also be placed in the local newspapers – Hoëvelder and Excelsior - in order to inform I&APs of availability of the draft Scoping Report for evaluation purposes.

The final Scoping Report (including the comments received) will be submitted to the Department of Agriculture, Rural Development, Land and Environmental Affairs for decision making.

The Environmental Impact Report will be compiled once the final Scoping Report has been approved by the Department of Agriculture, Rural Development, Land and Environmental Affairs.

7.2 Additional public participation during EIA phase

As indicated in Table 4.2 and Figure 4.2, large portions of the surrounding properties belong to the provincial and national government. However, many private landowners also own property in the area. These private landowners were identified and will be consulted as part of the EIA phase as indicated in Table 4.2.

Additional stakeholders/government departments (e.g. Department of Water and Sanitation: Dam Safety) will also be identified and consulted as part of the EIA phase as indicated in the preceding sections.

In summary, the following issues of concern were recorded through the scoping phase and will be investigated and addressed during the EIA phase:

- Requirements in terms of the Interim IncoMaputo Agreement (i.e. agreement between South Africa, Swaziland and Mozambique regarding water resource management);
- Potential impact on local resident residing in Vincent Street, Amsterdam;
- Potential impact on downstream water users in terms of water availability for irrigation;
- Water use licence application required;
- Water resources situation analysis and availability (water demand and balance) study required;
- Ecological assessment of all wetlands to be conducted;

- Dam design studies required;
- Dam registration with the Department of Water and Sanitation: Dam Safety Office required.

Section 4 of this EIA Report provides feedback in terms of the above-mentioned public participation process.

4. DESCRIPTION OF PUBLIC PARTICIPATION PROCESS

This section of the report provides the following:
- Details regarding the advertising of the project (Section 4.1);
- Comment received during the scoping phase of the project (i.e. in response to advertising, distribution of Background Information Document, comment on Draft and Final Scoping Reports) (Sections 4.2 to 4.8);
- Additional comment received during the EIA phase of the project (Section 4.9);
- A list of registered interested and affected parties (Section 4.7);
- A map indicating directly affected and adjacent landowners (Figure 4.2);
- **A response to the issues raised during the scoping and EIA phases (Table 4.4).**

4.1 Advertising of the project

4.1.1 Press advertising

A block advert (150mm x 95mm), according to the Environmental Impact Assessment Regulations, 2014, was placed in the Hoëvelder, on Friday, 24 February 2017. A copy of the advert is provided in Appendix 4.

4.1.2 On-site advertising

Notices according to the Environmental Impact Assessment Regulations, 2014, were placed at the following locations:
- On fence at existing Amsterdam Water Treatment (Purification) Works (A1; Photo 4.1 and Figure 4.1);
- Entrance to gravel road extending off the R65 provincial road providing access to the proposed Dam Site B (A1; Photo 4.2 and Figure 4.1);
- In Vincent Street in close proximity to where the distribution pipeline would extend across the Gabosha River (A1; Photo 4.3 and Figure 4.1);
- Adjacent to tar road between Amsterdam and KwaThandeka i.e. proposed Dam Site A (A1; Photos 4.4; Figure 4.1).
- At the offices of the Mkhondo Local Municipality (A3; Photo 4.5 and Figure 4.1);
- On the noticeboard at the Amsterdam Public Library (A3; Photo 4.6 and Figure 4.1).

A copy of the notice was also loaded onto the company website: www.adienvironmental.co.za.

These notices were displayed from Friday, 24 February 2017, for the duration of the scoping phase. A copy of the notice is provided in Appendix 4.

4.1.3 Informing I&APs via the internet

Interested and affected parties were also informed via the above-mentioned adverts and notices that a copy of the following documentation could be downloaded from the AdiEnvironmental cc website (www.adienvironmental.co.za) from Friday, 24 February 2017:
- Copy of the notice;
- Background Information Document (Appendix 5).

This information was available on the website for the duration of the scoping phase. A copy of the webpage printouts is provided in Appendix 4.

Photo 4.1: On fence at existing Amsterdam Water Treatment (Purification) Works.

Photo 4.2: Entrance to gravel road extending off the R65 provincial road providing access to the proposed Dam Site B.

Photo 4.3: In Vincent Street in close proximity to where the distribution pipeline would extend across the Gabosha River.

Photo 4.4: Adjacent to tar road between Amsterdam and KwaThandeka i.e. proposed Dam Site A.

Photo 4.5: On noticeboard at the offices of the Mkhondo Local Municipality.

Photo 4.6: On the noticeboard at the Amsterdam Public Library.

Figure 4.1: Location of notices.

4.1.4 Feedback from advertising process

Only one person registered as interested and affected party in terms of the advertising process (site and newspaper advertising) within the 30 day registration period provided as indicated in Table 4.1.

Table 4.1: Registration of I&APs in terms of the advertising process

Name	Date	Comment
Robert Smith	20 March 2017	Lives opposite Amsterdam Primary School (81 Vincent Street). Just bought the property and wants to renovate. Wanted to know if dam will impact on him? An email (dated: 20 March 2017; Appendix 6) with Background Information Document was forwarded.

4.1.5 Public meeting

As indicated in Section 4.1.4, only one interested and affected party registered in terms of the above-mentioned advertising process. A public meeting was therefore not required as part of the scoping phase of this project.

4.2 Directly affected landowners/users

Mkhondo Local Municipality
Dam Site A, the distribution line, the proposed bulk water pipeline and Dam Site B are all located on the Remaining Extent of Portion 11 of the farm Amsterdam 408 IT. This property belongs to the Mkhondo Local Municipality. A copy of the Windeed printout is provided in Appendix 1.

The Mkhondo Local Municipality was consulted as indicated in Section 4.5.3.

4.3 Surrounding landowners/users

Figure 4.2 provides an indication of the landowners/users in the immediate area surrounding the proposed Dam Site A and Dam Site B.

In order to determine the registered owners of the various properties, a Deeds Search was conducted via the WinDeed system of the Deeds Office of South Africa. The Deeds Search Template provides information pertaining to land ownership, size and land value of each of the properties.

As indicated in Table 4.2 and Figure 4.2, large portions of the surrounding properties belong to the provincial and national government. However, many private landowners also own property in the area.

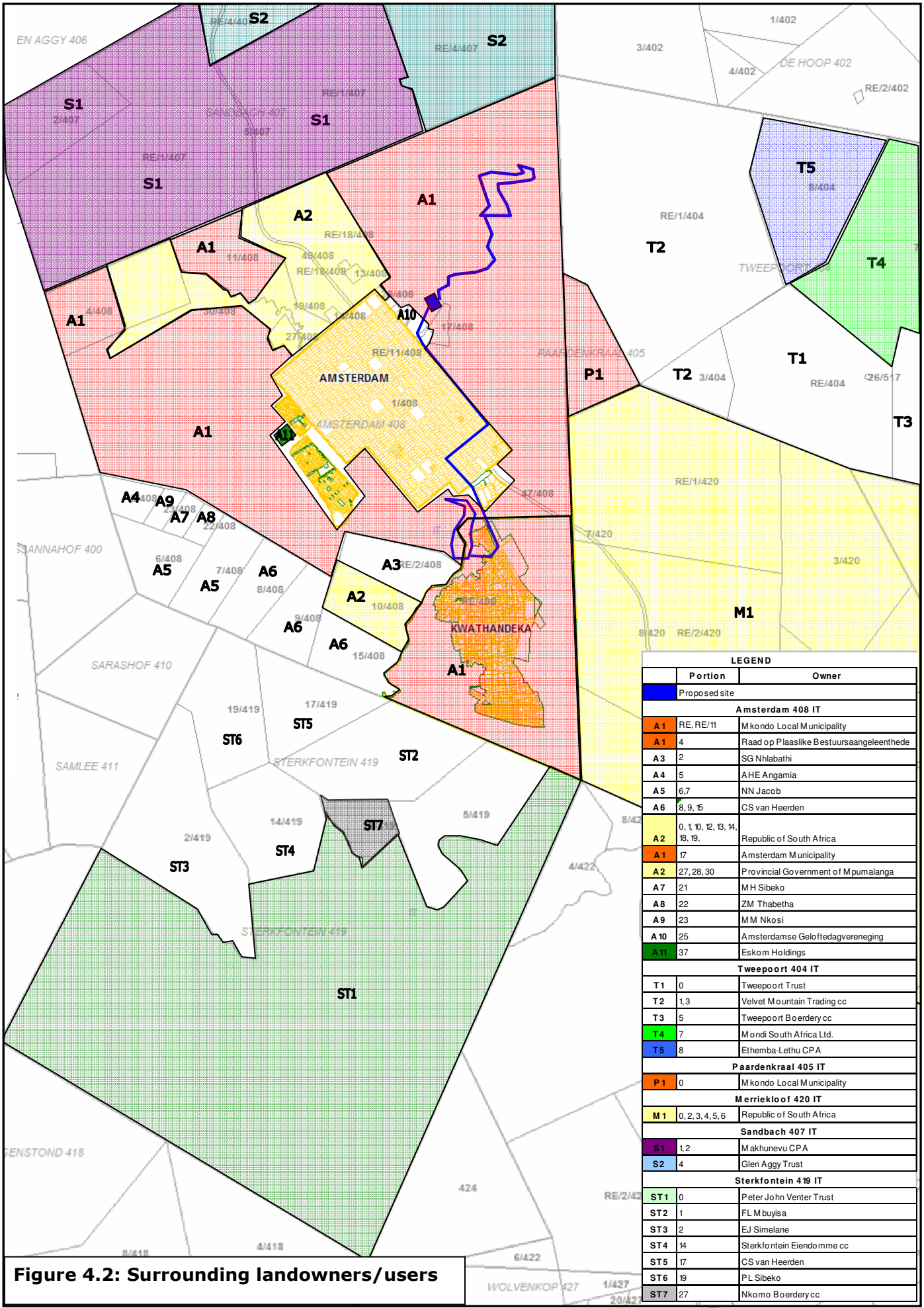
An e-mail and Background Information Document (BID) were forwarded to the landowners who could be traced during the scoping exercise, informing them of the proposed project.

Table 4.2 provides an indication of landowners identified to date, as well as comments received.

Table 4.2: Identified adjacent land owners/users who received BIDs

PROPERTY (FIGURE 4.2)	LANDOWNER/ CONTACT PERSON	CORRESPONDENCE	COMMENTS
AMSTERDAM 408 IT			
4 (A1)	Raad op Plaaslike Bestuursaangeleenthede	The property now falls under the jurisdiction of local government (i.e. Mkhondo Local Municipality).	See Section 4.5.3.
2 (A3)	SG Nhlabathi	Contact details to be obtained.	To be consulted during EIA phase.
5 (A4)	AHE Angamia	Contact details to be obtained.	To be consulted during EIA phase.
6, 7 (A5)	NN Jacob	Contact details to be obtained.	To be consulted during EIA phase.
8, 9, 15 (A6)	CS van Heerden	Contact details to be obtained.	To be consulted during EIA phase.
0, 1, 10, 12, 13, 14, 18, 19 (A2)	Republic of South Africa (National Department of Public Works - G Masuku)	E-mail with BID forwarded (dated: 14 March 2017; Appendix 6)	No.
17 (A1)	Amsterdam Municipality	Falls under Mkhondo Local Municipality.	See Section 4.5.3.
27, 28, 30 (A2)	Provincial Government of Mpumalanga	Contact details to be obtained.	To be consulted during EIA phase.
21 (A7)	MH Sibeko	Contact details to be obtained.	To be consulted

PROPERTY (FIGURE 4.2)	LANDOWNER/ CONTACT PERSON	CORRESPONDENCE	COMMENTS
			during EIA phase.
22 (A8)	ZM Thabetha	Contact details to be obtained.	To be consulted during EIA phase.
23 (A9)	MM Nkosi	Contact details to be obtained.	To be consulted during EIA phase.
25 (A10)	Amsterdamse Geloftedagvereneging	Contact details to be obtained.	To be consulted during EIA phase.
37 (A11)	Eskom Holdings - T Ludere	BID e-mailed (27 February 2017; Appendix 6)	No
TWEEPOORT 404 IT			
0 (T1)	Tweepoort Trust	Contact details to be obtained.	To be consulted during EIA phase.
1, 3 (T2)	Velvet Mountain Trading cc	Contact details to be obtained.	To be consulted during EIA phase.
5 (T3)	Tweepoort Boerdery cc	Contact details to be obtained.	To be consulted during EIA phase.
7 (T4)	Mondi South Africa Ltd.	Contact details to be obtained.	To be consulted during EIA phase.
8 (T5)	Ethemba-Lethu CPA	Contact details to be obtained.	To be consulted during EIA phase.
PAARDENKRAAL 405 IT			
0 (P1)	Mkhondo Local Municipality	BID e-mailed (28 February 2017; Appendix 6)	See Section 4.5.3.
SANDBACH 407 IT			
1, 2 (S1)	Makhunevu CPA	Contact details to be obtained.	
4 (S2)	Glenn Aggy Trust - A Grobbelaar	E-mail with BID forwarded (dated: 14 March 2017; Appendix 6)	No
MERRIEKLOOF 420 IT			
0, 2, 3, 4, 5, 6 (M1)	Republic of South Africa (National Department of Public Works - G Masuku)	E-mail with BID forwarded (dated: 14 March 2017; Appendix 6)	No.
STERKFONTEIN 419 IT			
0 (ST1)	Peter Johan Venter Trust - Peter Venter	E-mail with BID forwarded (dated: 14 March 2017; Appendix 6)	No.
1 (ST2)	FL Mbuyisa	Contact details to be obtained.	To be consulted during EIA phase.
2 (ST3)	EJ Simelane	Contact details to be obtained.	To be consulted during EIA phase.
14 (ST4)	Sterkfontein Eiendomme cc	Contact details to be obtained.	To be consulted during EIA phase.
17 (ST5)	CS van Heerden	Contact details to be obtained.	To be consulted during EIA phase.
19 (ST6)	PL Sibeko	Contact details to be obtained.	To be consulted during EIA phase.
27 (ST7)	Nkomo Boerdery cc - L Botha	E-mail forwarded (16 March 2017; Appendix 7)	Yes. Section 4.3.1.



LEGEND		
	Portion	Owner
	Proposed site	
	Amsterdam 408 IT	
A1	RE, RE/11	Mkondo Local Municipality
A1	4	Raad op Plaaslike Bestuursaangeleenthede
A3	2	SG Nhlabathi
A4	5	AHE Angamia
A5	6,7	NN Jacob
A6	8, 9, 15	CS van Heerden
A2	0, 1, 10, 12, 13, 14, 18, 19,	Republic of South Africa
A1	17	Amsterdam Municipality
A2	27, 28, 30	Provincial Government of Mpumalanga
A7	21	MH Sibeko
A8	22	ZM Thabetha
A9	23	MM Nkosi
A10	25	Amsterdamse Geloftedagvereneging
A11	37	Eskom Holdings
	Tweepoort 404 IT	
T1	0	Tweepoort Trust
T2	1,3	Velvet Mountain Trading cc
T3	5	Tweepoort Boerdery cc
T4	7	Mondi South Africa Ltd.
T5	8	Ethemba-Lethu CPA
	Paardenkraal 405 IT	
P1	0	Mkondo Local Municipality
	Merriekloof 420 IT	
M1	0, 2, 3, 4, 5, 6	Republic of South Africa
	Sandbach 407 IT	
S1	1,2	Makhunevu CPA
S2	4	Glen Aggy Trust
	Sterkfontein 419 IT	
ST1	0	Peter John Venter Trust
ST2	1	FL Mbuyisa
ST3	2	EJ Simelane
ST4	14	Sterkfontein Eiendomme cc
ST5	17	CS van Heerden
ST6	19	PL Sibeko
ST7	27	Nkomo Boerdery cc

Figure 4.2: Surrounding landowners/users

4.3.1 Nkomo Boerdery cc - L. Botha (ST7, Figure 4.2)

A completed comment sheet (dated: 15 March 2017; Appendix 7) was received from Mr. L. Botha of Nkomo Boerdery cc. The following was indicated:

'Nkomo Boerdery has water rights registered in the Thole River and we do irrigate from the river. The proposed dam could have an impact on the availability of irrigation water downstream.'

4.4 Downstream water users

4.4.1 Swaziland and Mozambique

The proposed Dam Site A would be located within the Thole River and the proposed Dam Site B would be located within the Gabosha River (Figure 3.1).

The Thole and Gabosha Rivers are tributaries of the Ngwempisi River (W53 catchments), which is a tributary of the Usutu River (Figure 3.12). The Usutu River has its headwaters in South Africa and flows into Swaziland after which it joins the Pongola River to form the Maputo River just before the South Africa/Mozambique border. The catchment is thus an international water course, forming part of the Maputo River Basin (Mallory and Jacobs, 2014).

The Tripartite Agreement between the Republic of Mozambique, the Republic of South Africa and the Kingdom of Swaziland (referred to as the Interim IncoMaputo Agreement (2002), Appendix 3) specifies the minimum amount of water that must be released into Swaziland (Table 3.3).

The requirements in terms of the Interim IncoMaputo Agreement (2002) will be reviewed during the EIA phase and the applicability thereof on this project determined. In addition, the relevant parties with regards to this Agreement will also be determined and consulted.

4.4.2 Downstream farmers

The downstream farmers on the farms Amsterdam 408 It and Sterkfontein 419 IT were identified (Table 4.2; Figure 4.2) and will be consulted as part of the EIA process.

4.5 Identified local authorities/government departments and stakeholders

Table 4.3 provides an indication to which local authorities/government departments and stakeholders Background Information Documents (BIDs; Appendix 5) were forwarded in order to inform them of the proposed project and to obtain their issues of concern.

Table 4.3: Identified local authorities/government departments and stakeholders who received BIDs

AUTHORITY/ STAKEHOLDER	CONTACT PERSON	CORRESPONDENCE SENT	COMMENTS
Department of Agriculture, Forestry and Fisheries (DAFF)	F. Mashabela	BID e-mailed (27 February 2017; Appendix 6)	No
Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) - Directorate: Land	J. Venter	BID e-mailed (27 February 2017; Appendix 6)	No

AUTHORITY/ STAKEHOLDER	CONTACT PERSON	CORRESPONDENCE SENT	COMMENTS
Use and Soil Management – Ermelo			
Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) - Directorate: Environmental Management – Ermelo	S. Mbuyane; S. Marebane	BID e-mailed (27 & 28 February 2017; Appendix 6)	No
Department of Co-operative Governance and Traditional Affairs (COGTA)	M. Loock	BID e-mailed (27 & 28 February 2017; Appendix 6)	No
Department of Mineral Resources	S. Mathavela	BID e-mailed (27 & 28 February 2017; Appendix 6)	No
Department of Public Works, Roads and Transport	B. Viljoen	BID e-mailed (27 & 28 February 2017; Appendix 6)	Yes. Section 4.5.1.
Department of Rural Development and Land Reform (Commission on Restitution of Land Rights)	N.D. Nkambule	Claim enquiry (28 February 2017; Appendix 6)	No
Inkomati Usuthu Catchment Management Agency (IUCMA)	S. Shabangu	BID e-mailed (28 February 2017; Appendix 6)	Yes. Section 4.5.2.
Mkhondo Local Municipality (Water and Sanitation Manager)	A. Mazibuko	BID e-mailed (28 February 2017; Appendix 6)	Yes. See Section 4.5.3
Mkhondo Local Municipality (Senior Manager: Amsterdam)	N Ndlovu	BID e-mailed (28 February 2017; Appendix 6)	No
Mkhondo Local Municipality (Amsterdam Library)	R Nkambule	BID e-mailed (28 February 2017; Appendix 6)	No
Gert Sibande District Municipality (Senior Manager: Water and Sanitation)	M. Dondo	BID e-mailed (28 February 2017; Appendix 6)	Yes. Section 4.5.4.
Eskom Distribution (Land & Rights)	T. Ludere	BID e-mailed (27 February 2017; Appendix 6)	No
Eskom Transmission	L. Motsisi	BID e-mailed (12 February 2016; Appendix 6)	No
Mpumalanga Tourism and Parks Agency	K. Narasoo	BID e-mailed (27 February 2017; Appendix 6)	No
Mpumalanga Wetland Forum	H. Marais	BID e-mailed (27 February 2017; Appendix 6)	No
South African Heritage Resources Agency (SAHRA)	SAHRA website	BID loaded onto website (28 February 2017; Appendix 6)	No
Telkom	J. Smit	BID e-mailed (27 February 2017; Appendix 6)	No
Transvaalse Landbou Unie	D. du Plessis	BID e-mailed (27 February 2017; Appendix 6)	No
Piet Retief Agricultural Union	H. Kusel	BID e-mailed (27 February 2017; Appendix 6)	No
Ward 19 Community Development	S. Sukazi	BID e-mailed (27 February 2017; Appendix 6)	No
Ward Councillor (Ward 19)	D.L. Ngobeza	BID faxed (27 February 2017; Appendix 6)	No
Wildlife and Environment Society of South Africa	L. Betha; J. Wesson	BID e-mailed (27 February 2017; Appendix 6)	No
Birdlife	D. Marnewick	BID e-mailed (27 February 2017; Appendix 6)	No

4.5.1 Department of Public Works, Roads and Transport

An e-mail (dated: 28 February and 1 March 2017; Appendix 7) was received from Mr. B. Viljoen indicating that the Department of Public Works, Roads and Transport (DPWRT) (Ermelo) should be consulted. Contact details were

provided. To date, the Ermelo office could not be reached. The Department will thus be consulted during the EIA phase.

4.5.2 Inkomati Usuthu Catchment Management Agency (IUCMA)

An email (dated: 1 March 2017; Appendix 7) was received from the IUCMA (Mr. S. Shabangu) in which the following was indicated:

- *The IUCMA is an interested stakeholder on the said project and will be responsible for processing of the water use authorization.*
- *Please note the following:*
  - *All documentation related to the project shall be received by the IUCMA for commenting.*
  - *The said activities of the project triggers some water uses like the storing of water in a form of a dam, the taking of water to supply the community, the desilting of the Dorps Dam, the planting of bulk pipeline across water courses.*
  - *Hence authorization shall be obtained prior commencement of the project.*
- *Moreover, the following specialist studies ought to be done to support the water use authorization application:*
  - *Water resources situation analysis and availability (water demand and balance);*
  - *Ecological assessment of all wetlands to be impacted by the project development footprint including the bulk pipeline infrastructure routes and alternatives;*
  - *The Dam design studies and registration with Department of Water and Sanitation Dam Safety Office;*
  - *The method statement for each river crossing.*

4.5.3 Mkhondo Local Municipality

An e-mail (dated: 2 March 2017; Appendix 7) was received from the Mkhondo Local Municipality (Ms. A. Mazibuko) in which the following was indicated:

'I will look into it and respond'.

4.5.4 Gert Sibande District Municipality

An email (dated: 2 March 2017; Appendix 7) was received from the Gert Sibande District Municipality (Mr. M. Dondo) in which the following was indicated:

'Thank you for the email. Let me go through the document and if I have comments/queries I will revert back to you. I have also forwarded it to three of my Colleagues who are working in our Water and Sanitation Section'.

4.6 Department of Agriculture, Rural Development, Land and Environmental Affairs

Letters (dated: 14 December 2016; Appendix 8) were submitted to the Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) regarding the applicability of the Environmental Impact Assessment Regulations (2014) in terms of the following:

- The upgrading/refurbishment of the Amsterdam Water Treatment Works and upgrading of existing bulk water supply infrastructure;
- The installation of a new bulk water pipeline from the Amsterdam Water Treatment Works to the proposed new pumpstation.

A site meeting was held with an official from the Department (Ms. S. Mbuyane) on 2 February 2017 regarding the said letters. In addition, the overall Amsterdam project as detailed in this Scoping Report was discussed and the location of Dam Site A, Dam Site B and the proposed bulk water pipeline route visited.

Subsequently, a letter (dated: 14 March 2017; Appendix 8) was received from the Department indicating that an Environmental Impact Assessment must be conducted for the installation of the proposed bulk water pipeline since the following listed activities would be triggered:

- Listed Activities 12 and 19 of Listing Notice 1;
- Listed Activity 6 of Listing Notice 2;
- Listed Activity 12 of Listing Notice 3.

A letter (dated: 28 March 2017; Appendix 8) from AdiEnvironmental cc was forwarded to the Department indicating that the company disagrees with the Department's conclusion that an Environmental Impact Assessment is required for the entire pipeline. This is in view of the fact that the pipeline is smaller than the specifications indicated in Listing Notice 1 and is mostly located within a road reserve. A Basic Assessment must only be conducted where the pipeline crosses the Gabosha River.

4.7 Evaluation of draft Scoping Report

4.7.1 Availability of Draft Scoping Report for review

The Draft Scoping Report (dated: March 2017) was couriered to the Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) on 5 April 2017 (letter dated: 5 April 2017; Appendix 9).

The Draft Scoping Report was also provided to the following authorities for evaluation purposes:

- Inkomati Usuthu Catchment Management Agency (IUCMA) – couriered 5 April 2017 (letter dated: 5 April 2017; Appendix 9);
- Mpumalanga Tourism and Parks Agency – couriered 5 April 2017 (letter dated: 5 April 2017; Appendix 9);
- Mkhondo Local Municipality – couriered 11 April 2017 (letter dated: 5 April 2017; Appendix 9).

The other government departments, stakeholders and interested and affected parties were informed that the document was available for evaluation purposes by means of e-mail, facsimile and phone calls. An example of the e-mails forwarded (dated: 6 April 2017) is provided in Appendix 9.

A hard copy of the Draft Scoping Report was made available from 7 April 2017 to 10 May 2017 at the Amsterdam Public Library. A copy of the notice displayed at the library and the register is provided in Appendix 9.

In addition, a copy of the document was provided on the AdiEnvironmental cc website (www.adienvironmental.co.za) for download and evaluation purposes. A copy of the webpage printouts are provided in Appendix 9.

The availability of the Draft Scoping Report for evaluation purposes was advertised in the Hoëvelder and the Excelsior News on Friday, 7 April 2017 (Appendix 9).

4.7.2 Comments received

4.7.2.1 Interested and Affected Parties

No comment was received on the Draft Scoping Report from any of the adjacent landowners or other interested and affected parties.

4.7.2.2 Government Departments/relevant authorities/stakeholders

South African Heritage Resources Agency

A letter (dated: 31 March 2017; Appendix 9) was received from the South African Heritage Resources Agency indicating the following:

Your application, received by SAHRA, provides no indication that an assessment of heritage resources including palaeontological resources was conducted. As such SAHRA requires a Heritage Impact Assessment and a Palaeontological Impact Assessment for the proposed development to be conducted and submitted to SAHRA for comments. These specialists' studies can only be conducted by suitably qualified Archaeologist and Palaeontologist for the respective assessments. If you are unaware of any archaeologists and palaeontologists a list of them working within Heritage Resources Management field are provided in the following websites: (see www.asapa.org.za) and (see www.palaeontologicalsociety.co.za).

If the property is heavily disturbed from previous developments then a letter of exemption from further heritage study may be submitted. This letter should be written by either an archaeologist and/or palaeontologist depending on the specific specialist studies being exempted from further assessment that is being motivated for, and the letter must be submitted to SAHRA for commenting.

SAHRA will comment further on this proposed development once the requested reports are submitted to the case.

Inkomati Usuthu Catchment Management Agency (IUCMA)

A letter from the IUCMA (dated: 26 April 2017; Ref: 14/1/3/4/1/X53C; Appendix 9) was received indicating that *'the Inkomati-Usuthu Catchment Management Agency has no objection to the proposed development and amenities. Lest, the development trigger any section 21 water uses, as provided by the National Water Act, Act 36 of 1998, please apply for the relevant water use prior to the commencement of the activity'.*

1. *The Act specify a regulated area, as follows,*
   - *1.1 When the activity is 1:100-year flood line or the riparian areas of a watercourse, whichever is the greatest, additionally a 500 meters from a wetland.*
2. *The following water uses are, as ascribed on section 21 of the National Water Act, Act 36 of 1998 (the Act), will be triggered:*
   - *2.1 Taking water from a water resource: The report indicates that Gert Sibande District Municipality intends to construct a new dam and abstraction facility in either the Gabosha River or the Thole River, this activity its holds a potential to trigger water use section 21(a) such an activity is a water use in terms of the National Water Act, Act 36 of 1998, as described in paragraph 2.1 which requires authorisation prior to the commencement of the activity.*

2.2 Storing of water: The report indicates that Gert Sibande District Municipality intends to construct a new dam and abstraction facility in either the Gabosha River or the Thole River and the desilting of the existing Dorps Dam, this activity it holds a potential to trigger water use section 21(b) such an activity is a water use in terms of the National Water Act, Act 36 of 1998, as described in paragraph 2.2 which requires authorisation prior to the commencement of the activity, should the development occur in the vicinity of the regulated area.

2.3 Impeding or diverting the flow of water in a watercourse: The report indicates that the project entails the construction of a pipeline which at some point it will be crossing the water courses i.e. Gabosha River, it holds a potential to trigger water use section 21(c) such an activity is a water use in terms of the National Water Act, Act 36 of 1998, as described in paragraph 2.3 which requires authorisation prior to the commencement of the activity.

2.2 Altering the bed, banks, course or characteristics of a water course: The report indicates that the project entails the construction of a pipeline which at some point it will be crossing the water courses i.e. Gabosha River, it holds a potential to trigger water use section 21(i) such an activity is a water use in terms of the National Water Act, Act 36 of 1998, as described in paragraph 2.3 which requires authorisation prior to the commencement of the activity.

Eskom

An email (dated: 6 April 2017; Appendix 9) was received from Eskom requesting that the coordinates of the area be forwarded.

Subsequently, a letter from Eskom (dated: 19 April 2017; Ref: LD-INV/E/TT/011/2017; Appendix 9) was received indicating that *Eskom Distribution services are not affected by this application'.*

OpenServe (previously Telkom)

A letter from OpenServe (dated: 4 April 2017; Ref: TK17/32; Appendix 9) was received indicating that *'this Company has no objections regarding this proposal. The above proposal is approved in terms of section 22 of the Electronic Communication Act; act no. 36 of 2005, subject to the stipulations as indicated within this letter being met'.*

4.7.2.3 Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA)

Submission of application form/registration of project

A letter from DARDLEA (dated: 12 April 2017; Ref: 1/3/1/16/1 G-56; Appendix 9) was received acknowledging receipt of the application form for Environmental Authorisation on 10 April 2017.

The following was also indicated:

The application has been assigned a reference number 1/3/1/16/1 G-56. Kindly quote this reference number in any future correspondence in respect of the application. The responsible officer is Mbunyane Sindisiwe and all correspondence must be directed to: The Deputy Director, Environmental Impact Management, Gert Sibande District Office, marked for the attention of the responsible officer. Please note that you must, within 44 days from the submission date, submit to this office a Scoping Report which has been

already subjected to the public participation process, and was provided to interested and affected parties for a period of 30 days for comments, and which reflects the incorporation of any comments received, including any comments from this office.

Take note in terms of the provisions of Regulation 45, the application will lapse if you fail to submit a Scoping Report within the timeframe specified above, unless extension has been granted in terms of regulation 3(7).

Please draw the applicant's attention to the fact that the activity may not commence prior to an environmental authorisation being granted by the Department.

Enquiry: Proposed upgrading/refurbishment of the Amsterdam Water Treatment Works and Upgrading of the existing bulk water supply infrastructure

A letter from DARDLEA (dated: 15 February 2017; Ref: 1/3/1/16/3 G-86; Appendix 9) was received indicating the following:

1. *'…….the proposed activity does not require an Environmental Authorisation in terms of the Environmental Impact Assessment Regulations, 2014'.*
2. *The Department's conclusion is based on the fact that the upgrading or refurbishment, forms part of maintenance plan. However you are requested to submit a Maintenance Management Plan or Environmental Management Programme to the Department prior to the proposed activity taking place.*
3. *The applicant is responsible for compliance with Section 28 of the National Environmental Management Act, 1998 (Act 107 of 1998), which relates to the duty of care and remediation of environmental damage.*
4. *Kindly note that this does not exempt the applicant from complying with any other statutory requirements that may be applicable to the undertaking of the screening.*

Enquiry: The applicability of environmental authorisation regarding the new water pipeline from the Amsterdam Water Treatment Works to the proposed new pumpstation

A letter from DARDLEA (dated: 4 April 2017; Ref: 1/3/1/16/3 G-85; Appendix 9) was received indicating the following:

1. *After due consideration of the information furnished in the letter and the site visit conducted on 02 February 2017, the Department has made the following findings:*
    a. *From point A to point C, point D to point L an Environmental Authorisation is not required in terms of Environmental Impact Assessment Regulations, 2014;*
    b. *From point C and point D an Environmental Authorisation is required.*
2. *The Department's conclusion is based on the fact that the pipeline from point C to point D passes through a watercourse. The activities associated with the excavations are deemed to meet the thresholds for listed activities in Listing Notice 1, activities, 12 and 19.*
3. *In case where activities associated with non-listed activities commence, the applicant must comply with Section 28 of the National*

Environmental Management Act, 1998 (Act 107 of 1998), which relates to the duty of care and remediation of environmental damage.

4. *Kindly note that this does not exempt the applicant from complying with any other statutory requirements that may be applicable to the undertaking of the screening.*

4.8 Comments received on Final Scoping Report

The Final Scoping Report (dated: May 2017) was couriered (17 May 2017; Appendix 10) to the Department of Agriculture, Rural Development, Land and Environmental Affairs (letter dated: 16 May 2017; Appendix 10) and delivered to the Department on 19 May 2017 (Appendix 10).

Subsequently, a letter from DARDLEA (dated: 29 May 2017; Ref: 1/3/1/16/1G-56; Appendix 10) was received acknowledging receipt of the Final Scoping Report. A letter from DARDLEA (dated: 3 July 2017; Ref: 1/3/1/16/1G-56; Appendix 10) was received (received: 11 July 2017) indicating the following:

1. *The Department is satisfied with the information furnished and hereby accepts the report. There are no further comments at this stage.*
2. *Please note that in terms of the provisions of Regulation 45, this application will lapse if the applicant fails for a period of 106 days to submit EIAR and Environmental Management Programme as required by the EIA Regulations, 2014, or if reasons for failure to comply are not communicated in writing to and accepted by this Department.*

4.9 Public participation during EIA phase

4.9.1 Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA)

An email (dated: 4 September 2017; Appendix 10) was forwarded to DARDLEA with regards to requesting an extension of time in terms of the Amsterdam project.

Subsequently, an email (dated: 11 October 2017; Appendix 10) and letter (dated: 11 October 2017; Appendix 10) requesting an extension of time was forwarded to DARDLEA.

Extension of time (50 days) was granted by DARDLEA as indicated in the letter (dated: 16 October 2017; Appendix 10).

4.9.2 Additional consultation with landowners

4.9.2.1 The farm Tweepoort 404 IT (Figure 4.2)

Mondi South Africa Limited (T4, Figure 4.2)

Portion 7 of the farm Tweepoort 404 IT (Figure 4.2) belongs to Mondi South Africa Limited. An email with BID (dated: 31 May 2017; Appendix 11) was forwarded to Ms. Miranda Sikhakane (Mondi Environmental Specialist) in order to obtain any issues of concern. To date, no comment has been received.

Ethemba-Lethu Community Property Association (T5, Figure 4.2)
The Ethemba Lethu CPA owns Portion 8 of the farm Tweepoort 405 IT (Table 4.2; Figure 4.2).

An email with BID (dated: 31 May 2017; Appendix 11) was forwarded to Mr. Mlomo (Operations Manager: Gert Sibande District (Restitution)) and Mr. Lukhele (Deputy Director: Gert Sibande District (REID)) of the Department of Rural Development and Land Reform requesting contact details for the Ethemba- Lethu CPA that owns land in close proximity to the proposed dam site.

Subsequently, an email (dated: 31 May 2017; Appendix 11) was received from Mr. S. Mjali indicating that the *'contact details for the Ethemba-Lethu CPA can be provided by Land Reform, as they did not receive land through restitution'.*

Mr. P. Lukhele indicated in an email (dated: 31 May 2017; Appendix 11) that Ms. Shezi could assist with providing the contact details for the Ethemba-Lethu CPA. An email (dated: 1 June 2017; Appendix 11) was forwarded to Ms. Shezi for her assistance in this regard. To date, no feedback has been received.

Velvet Mountain Trading cc (T2; Figure 4.2)
Mr. J. Naude (Velvet Mountain Trading cc) was contacted telephonically in order to inform him of the proposed project. Mr. Naude could however, not be reached and messages were left on his cellphone. To date, Mr. Naude has not contacted AdiEnvironmental cc.

As indicated in Figure 4.2, Portions 1 and 3 of Tweepoort 404 IT are located to the east of Dam Site B and will not be impacted by any of the activities.

Other landowners
Using the internet, the Windeed System of the Deeds Office, the local telephone directories, etc., the contact details of the following landowners could not be obtained and therefore the said landowners could not be consulted as part of the EIA phase. However, the following should be noted with regards to these landowners:

PROPERTY (FIGURE 4.2)	LANDOWNER/ CONTACT PERSON	COMMENTS
TWEEPOORT 404 IT		
0 (T1)	Tweepoort Trust	As indicated in Figure 4.2, these properties are located to the east of Dam Site B and will not be impacted by any of the activities.
5 (T3)	Tweepoort Boerdery cc	

4.9.2.2 The farm Sandbach 407 IT (Figure 4.2)

Makhuneva Community Property Association (S1; Figure 4.2)
An email with BID (dated: 31 May 2017; Appendix 11) was forwarded to Mr. Mlomo (Operations Manager: Gert Sibande District (Restitution)) and Mr. Lukhele (Deputy Director: Gert Sibande District (REID)) of the Department of Rural Development and Land Reform requesting contact details for the Makhuneva CPA that owns Portion 1 and 2 of the farm Sandbach 407 IT (Table 4.2; Figure 4.2) in close proximity to the proposed dam site.

Subsequently, an email (dated: 31 May 2017; Appendix 11) was received from Mr. S. Mjali providing the contact details for the Makhuneva CPA.

An email with BID (dated: 2 June 2017; Appendix 11) was forwarded to Mr. Mabuza and Mr. Makhathini of the said CPA. An acknowledgement of receipt (email dated: 2 June 2017; Appendix 11) was received from Mr. Mabuza.

An email (dated: 2 June 2017; Appendix 11) was forwarded to Mr. Mabuza and Mr. Makhathini regarding the draft Scoping Report that was available for comment.

Subsequently, an email (dated: 2 June 2017; Appendix 11) was received indicating the following:
'I notice that the closing submission date for our concerns was the 10 May 2017 which has already passed and the other issue is, we need to schedule a meeting of Makhuneva CPA members to get their views concerning the proposed project.

We find it difficult to schedule a meeting at short notice as some of the members are not staying around and the issue of resources coming to the meeting, is forcing us to schedule our meeting towards month end.

We will discuss this issue with my chairman John Makahathini and see if that would be possible or not for next week'.

A response (email dated: 3 June 2017; Appendix 11) to this email was forwarded indicating the following:
'In view of the fact that we only obtained your contact details during the course of this week, we are providing you with documentation that we have to date provided to other Interested and Affected Parties and have therefore not changed the deadline dates.

We would appreciate it if you could provide us with comment by the first week of July – so that we can include your comment in the next round of documentation to be completed by the end of July'.

Subsequently, an email (dated: 13 June 2017; Appendix 11) was received indicating the following: *'Could you please how much of our land is going to be used for this project.'*

The following response was provided (email dated: 13 June 2017; Appendix 11): *'No infrastructure (dam, pipelines, etc.) will be built on your land. The dam will also not impact on your land and your water since your land is located upstream of the said site'.*

To date, no comments have been received from the Makhuneva CPA.

4.9.3 Private landowners/downstream water users

As indicated in Section 4.4.2, the downstream farmers on the farms Amsterdam 408 It and Sterkfontein 419 IT were identified (Table 4.2; Figure 4.2) and were to be consulted as part of the EIA process.

4.9.3.1 The farm Amsterdam 408 IT

Land belonging to government (A2; Figure 4.2)
As indicated in Table 4.2 and Figure 4.2, large portions of the surrounding properties belong to the national and provincial governments. As indicated in Table 4.2, the relevant authorities/departments were informed of the proposed project and also provided with an opportunity to evaluate the draft Scoping Report (see Section 4.7.1). To date, no formal comment has been received from these authorities.

Provincial Government of Mpumalanga (A2; Figure 4.2)
The proposed project will not impact directly on land owned by the Provincial Government of Mpumalanga i.e. Portions 27, 28 and 30 of the farm Amsterdam 408 IT (Table 4.2; Figure 4.2).

However, an email with BID (dated: 31 May 2017; Appendix 11) was forwarded to Mr. M. de Kock (contact person for Provincial State Land) of the Department of Rural Development and Land Reform in order to notify the Department of the said project and also to obtain any issues of concern. To date, no comment has been received.

Land in private ownership
Using the internet, the Windeed System of the Deeds Office, the local telephone directories, etc., the contact details of the following landowners could not be obtained and therefore the said landowners could not be consulted as part of the EIA phase. However, the following should be noted with regards to these landowners:

PROPERTY (FIGURE 4.2)	LANDOWNER/ CONTACT PERSON	COMMENTS
AMSTERDAM 408 IT		
2 (A3)	SG Nhlabathi	Propery downstream of Dam Site A (Figure 4.2) – will not be impacted by any of the activities. No irrigation from the river taking place.
5 (A4)	AHE Angamia	Property located to the west of Dam Site A (Figure 4.2) – will not be impacted by any of the activities. No irrigation from the river taking place.
6, 7 (A5)	NN Jacob	
8, 9, 15 (A6)	CS van Heerden	Propery downstream of Dam Site A (Figure 4.2) – will not be impacted by any of the activities. No irrigation from the river taking place.
21 (A7)	MH Sibeko	Property located to the west of Dam Site A (Figure 4.2) – will not be impacted by any of the activities. No irrigation from the river taking place.
22 (A8)	ZM Thabetha	
23 (A9)	MM Nkosi	
25 (A10)	Amsterdamse Geloftedagvereneging	Property located within Amsterdam in close proximity to where distribution pipeline will be installed (Figure 4.2). The distribution pipeline will however, be installed within the road reserve and the property will not be impacted by the construction of Dam B.

4.9.3.2 The farm Sterkfontein 419 IT
As indicated in Table 4.2, only two landowners could be informed of the proposed project namely:

- Peter Venter (Peter Johan Venter Trust; owner of Portion 1 of the farm Sterkfontein 419 IT (Figure 4.2)) – to date, no comment has been received (Table 4.2);
- L. Botha (Nkomo Boerdery cc; owner of Portion 27 of the farm Sterkfontein 419 IT (Figure 4.2)) – comment was received as indicated in Section 4.3.1. No further comments was received.

Using the internet, the Windeed System of the Deeds Office, the local telephone directories, etc., the contact details of the following landowners could not be obtained and therefore the said landowners could not be consulted as part of the EIA phase:

PROPERTY (FIGURE 4.2)	LANDOWNER/ CONTACT PERSON	COMMENTS
STERKFONTEIN 419 IT		
1 (ST2)	FL Mbuyisa	Propery downstream of Dam Site A (Figure 4.2) – will not be impacted by any of the activities. No irrigation from the river taking place.
2 (ST3)	EJ Simelane	
14 (ST4)	Sterkfontein Eiendomme cc	Propery downstream of Dam Site A (Figure 4.2). Possible abstraction of water from the river for irrigation purposes.
17 (ST5)	CS van Heerden	Propery downstream of Dam Site A (Figure 4.2) – will not be impacted by any of the activities. No irrigation from the river taking place.
19 (ST6)	PL Sibeko	Property is not located next to the river and will not be impacted by the construction of either Dam A or Dam B (Figure 4.2).

4.9.3.3 Swaziland and Mozambique

As indicated in Section 4.4.1, the requirements in terms of the Interim IncoMaputo Agreement (2002) was to be reviewed as part of this EIA and the applicability thereof on this project determined.

The following specialist study - *Hydrology and water resource assessment towards augmenting the water supply to Amsterdam, Mpumalanga* - was undertaken by IWR Water Resources (Pty) Ltd. As part of this specialist study, the above-mentioned requirements were determined and taken into account. Please refer to Section 6.8 and Appendix 17 for further details in this regard.

The Department of Water and Sanitation: National Water Resources Planning Office (N. van Wyk) was informed of the availability of the Scoping Report for evaluation purposes (email dated: 6 April 2017; Appendix 9). To date, no comment has been received.

A copy of this EIA Report and the Water Use Licence Application will be forwarded to the Department of Water and Sanitation: National Water Resources Planning Office for evaluation and input.

4.9.4 Other stakeholders/government departments

4.9.4.1 Department of Water and Sanitation: Dam Safety Office

A copy of the following documentation was obtained from the Department of Water and Sanitation website: *Summary of legal requirements for prospective and existing dam owners in South Africa* in order to determine the requirements in terms of the Department of Water and Sanitation.

According to this information, there are three legal requirements that must be met before a person may construct a new dam, namely dam safety, entitlement to water use and environmental legislation.

The following must be noted as indicated in the above-mentioned document:

1. DAM SAFETY LEGISLATION

The dam safety legislation *is covered by chapter 12 of the National Water Act, 1998 (Act 36 of 1998)* ***[NWA]*** *and by dam safety regulations, published in Government Notice R. 139 of 24 February 2012. Only dams with a safety risk (that is dams with a maximum wall height exceeding 5,0 m* ***and*** *with a storage capacity exceeding 50 000 m^3, or any other dam declared by the Minister as a dam with a safety risk) are subject to these Regulations. These Regulations are administered by the Dam Safety Office within the Department of Water Affairs (hereafter Department). The requirements of the dam safety regulations are summarised below:*

1.1 New dams, enlargement, alteration or repair of existing dams

- *The first step is to confirm the entitlement to water use at the relevant Regional Office (to prevent fruitless expenditure) – see section 2 below.*
- *The next step is to apply for classification of the dam on form DW 692E. The Department will then inform the applicant of the classification of the dam and of further procedures.*
  - *If the dam is classified as a category I dam, apply for a licence to construct on form DW 694E and submit a design report and engineering drawings as specified in regulations 4 to 8.* ***Construction may only commence after the licence to construct has been issued.***
  - *If the dam is classified as a category II or III dam, the services of an approved professional person (****APP****) must first be obtained. The APP must apply for a licence to construct on behalf of the dam owner (this involves the submission of an application form, design report, engineering drawings and project specifications as specified in regulations 10 to 21).* ***Construction may only commence after the licence to construct has been issued.*** *The APP must also ensure that an adequate quality control programme is in place during the construction period. Before starting with storage of water, the APP must apply for a licence to impound water (this involves the submission of an operation & maintenance manual and emergency preparedness plan together with an application form DW 696E and construction progress report). After completion of all construction work, the APP must submit a completion report, completion drawings and a completion certificate stating that the work has been completed according to his/her specifications.*

2. ENTITLEMENT TO WATER USE *(administered by the Regional Offices of the Department)*

- *Any new water use as defined in section 21 of the NWA is subject to licensing. Just "storing water" is also defined as a water use! There is no guarantee that a licence will be issued as it is subject to availability of water and a number of conditions and constraints in the NWA.*
- ***Before construction** of **any** new dam or enlargement/alteration/repair of an existing dam may start, a water use licence or written authorisation/confirmation must be obtained from the Regional Director of the relevant region of the Department.*

3. ***ENVIRONMENTAL LEGISLATION (Administered by relevant provincial department)***
   - *The provisions and regulations of Government Notices Nos. R. 543 to R. 547, dated 18 June 2010, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) regarding control over activities which may have a detrimental effect on the environment, must be complied with. Normally it will be required that an environmental impact assessment (EIA) must be carried out **before** construction of a new dam or enlargement/repair of an existing dam will be authorised. Written authorisation must be obtained from the relevant provincial government department before commencing with the project.*

The above-mentioned must be adhered to by the project applicant before commencing with the construction of the new dam.

A copy of this EIA Report together with the relevant applications and design reports will be submitted to the Department of Water and Sanitation: National Water Resources Planning Office for evaluation and input.

4.9.4.2 South African Heritage Resources Agency

As indicated in Section 4.7.2.2, the Heritage Impact Assessment and Palaeontological study were loaded onto the SAHRIS website. Subsequently, a letter (dated: 20 October 2017; Appendix 11) was received from the South African Heritage Resources Agency providing the following feedback regarding the said studies:

Heritage Impact Assessment

'*The author undertook a field assessment of the proposed development and identified two historical buildings that are located within the KwaThandeka township of the town of Amsterdam. The buildings will not be impacted by the proposed pipeline as it will be constructed within the road servitude'.*

Palaeontological Impact Assessment: Desktop Study

'The proposed area for dam site B and the majority of dam site A are underlain by the unfossiliferous igneous rocks of the Amsterdam Formation of very low palaeontological significance. A small portion of the proposed dam site A are underlain by the Suite Thole and Dwyka Groups. The latter group is of moderate sensitivity. The author proposes dam site B as the preferred site as it has no negative impact on palaeonotological resources. If Dam site A is chosen as the preferred site, the author recommends the monitoring of the overburden and interburden consisting of Dwyka rocks for fossiliferous shale rocks. The Fossil Chance Finds procedure in the report must be included in the EMPr for implementation'.

Interim Comment

'SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit will comment on the project once the EIA report and its appendices is submitted to the case during the public review period'.

4.9.4.3 Department of Public Works, Roads and Transport

As indicated in Section 4.5.1, Mr. B. Viljoen indicated that the Department of Public Works, Roads and Transport (DPWRT) (Ermelo) should be consulted. Contact details were provided. To date, the Ermelo office could not be reached after numerous attempts.

4.9.5 Other interested and affected parties

4.9.5.1 H. Singh

An email (dated: 24 July 2017; Appendix 11) was received from Mr. H. Singh, who requested the following:

- *I would like to register as an I&AP for the above-mentioned project.*
- *Kindly forward me all the current information going forward throughout the EIA process.*

Subsequently, an email (dated: 25 July 2017) was forwarded to Mr. Singh indicating that he was registered as an I&AP as requested. A BID was also forwarded together with the link to the company website where he could download a copy of the draft Scoping Report.

As indicated in the said email, Mr. Singh was requested to provide feedback in terms of his interest in the said project and whether or not he was a resident of Amsterdam and surrounding area. Mr Singh was also requested to forward his telephone number for future reference purposes. To date, no further feedback or comment has been received.

4.10 Summary of issues

Table 4.4 provides a summary of all the issues of concern and/or objections received through this public participation process. The way in which the said issues of concern and/or objections were addressed are also indicated in Table 4.4.

In summary, the following issues of concern were recorded:

- Requirements in terms of the Interim IncoMaputo Agreement (i.e. agreement between South Africa, Swaziland and Mozambique regarding water resource management);
- Potential impact on local resident residing in Vincent Street, Amsterdam;
- Potential impact on Makhuneva CPA property;
- Potential impact on heritage and palaeontological resources;
- Potential impact on telephone line infrastructure;
- Potential impact on downstream water users in terms of water availability for irrigation;
- Water use licence application required;
- Water resources situation analysis and availability (water demand and balance) study required;
- Ecological assessment of all wetlands to be conducted;
- Dam design studies required;
- Dam registration with the Department of Water and Sanitation: Dam Safety Office required.

4.11 Evaluation of Draft and Final Environmental Impact Report

The Draft Environment Impact Report (dated: October 2017) will be made available to interested and affected parties, stakeholders and authorities for comment. Interested and affected parties will be notified by means of facsimile, email and phone of the availability of the report for comment.

An electronic copy of the Draft Environmental Impact Report will be available on the company website (www.adienvironmental.co.za) and on cd (on request). In addition, a hard copy of the document will be made available at the Amsterdam Public Library.

The availability of the Draft Environmental Impact Report for evaluation purposes will be advertised in the Hoëvelder and the Excelsior News on Friday, 3 November 2017.

Interested and affected parties will be requested to forward any comments on the report to AdiEnvironmental cc within 30 days.

Comments received on the Draft Environmental Impact Report will be addressed and included as part of the Final Environmental Impact Report, which will be submitted to the Department of Agriculture, Rural Development, Land and Environmental Affairs for decision making.

5. BIOPHYSICAL DESCRIPTION OF THE PROPOSED SITES

5.1 Location of the sites

Two possible dam sites were identified, namely Dam Site A and Dam Site B. Proposed Dam Site A is located in close proximity to KwaThandeka within the Thole River (Figure 2.1). Proposed Dam Site B is located upstream of Amsterdam (and the Amsterdam Water Treatment Works (WTW)) within the Gabosha River (Figure 2.1). Both sites are located on the Remainder of Portion 11 of the farm Amsterdam 408 IT (Figure 2.1).

The dam wall would be 20 metres in height and the footprint of the dam approximately 20 hectares. The co-ordinates of the proposed dam sites are:

	Latitude (S):			**Longitude (E):**		
• Dam Site A	26°	38′	30.81″	30°	40′	23.08″
• Dam Site B	26°	36′	07.55″	30°	40′	41.03″

As part of the project, a bulk water pipeline will be installed from the dam site to the existing Amsterdam WTW (orange line; Figure 2.1) while a distribution pipeline will be installed from the WTW to Amsterdam/KwaThandeka (yellow line; Figure 2.1). In addition, the Dorps Dam will be desilted and the Amsterdam WTW (Figure 2.1) upgraded. The pipelines will also be located on the Remainder of Portion 11 of Amsterdam 408 IT and within the Amsterdam/Kwathandeka urban area.

The co-ordinates of the distribution pipeline crossing at the Gabosha River is:

	Latitude (S):			**Longitude (E):**		
• Crossing	26°	37′	20.01″	30°	40′	11.37″

There is only one Surveyor-General 21 digit site reference number for this project as the sites all occur on the same property namely:

T	0	I	T	0	0	0	0	0	0	0	0	0	4	0	8	0	0	0	1	1

The said property falls under the jurisdiction of the Mkhondo Local Municipality (MP301) and the Gert Sibande District Municipality.

5.2 Climate

Amsterdam is located within the Escarpment Physiographic Region where the altitude ranges between 600 to 1500 m above mean sea level (mamsl), with the average being 1210 mamsl (Beuster and Clarke, 2008).

Table 5.1 provides an indication of the climate associated with the Escarpment Physiographic Region and therefore the Amsterdam area (i.e. the project area).

Table 5.1: Climate associated with the Escarpment Physiographic Region and therefore the Amsterdam area (taken from Beuster and Clarke, 2008)

Mean Annual Temperature	17°C
Mean Annual Temperature (December)	20°C
Mean Annual Temperature (June)	12°C
Mean Annual Precipitation	800 – 1000 mm
Mean Annual Evaporation (S-Pan)	1500 mm/year
Start of rainy season	Early summer (December)
Driest year in 5	600 – 800 mm/year
Wettest year in 5	1000 – 1200 mm/year

5.3 Geology/geotechnical issues

5.3.1 Geology of the area

According to the 1:250 000 geology map (2630 Mbabane), the proposed Dam Site A, Dam Site B, Distribution Pipeline and Bulk Water Pipeline routes are underlain by pyroclastic rocks and ash-flow tuff of the Gobasha Member, Amsterdam Formation (Rag; Figure 5.1a). The southern portion of Dam Site A is underlain by ultrabasic rocks, pyroxenite and norite of the Suite Thole (Rt; Figure 5.1a). These rocks are of Randian Age and thus very old. Dykes might be present in areas (Figure 5.1a).

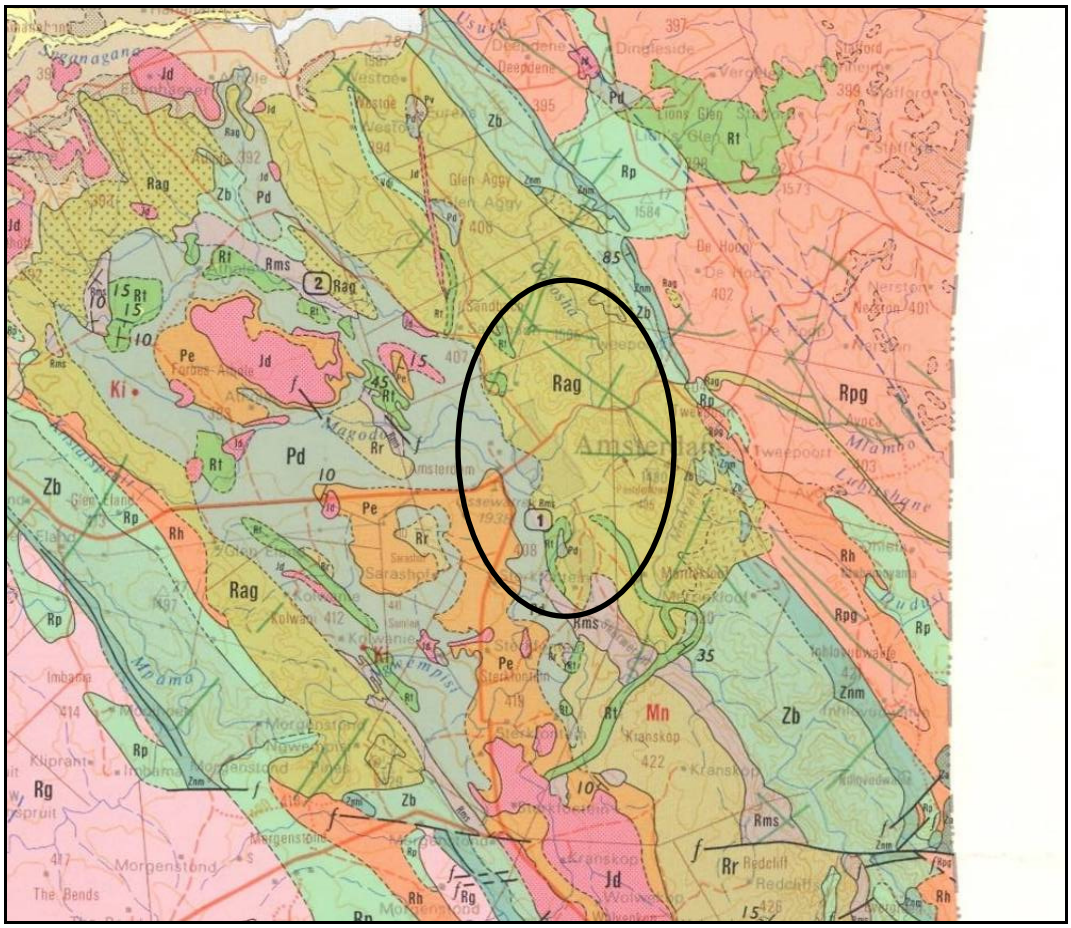


Figure 5.1a: Geology of Amsterdam area (taken from 1:250 000 geology map, 2630 Mbabane).

5.3.2 Dam Site A

A geotechnical investigation was conducted by M. Meyer of Engeolab cc in order to determine the geotechnical suitability of Dam Site A for dam construction. A copy of the geotechnical report (referred to as Meyer, 2016) is provided in Appendix 12. This report should be consulted with regards to methodology used and the tests carried out on the samples collected.

Meyer (2016) confirmed that Dam Site A is underlain by Randian Age ultrabasic rocks including pyroxenite and norite of the Tholeite Group, which is overlain by Dwyka tillite in places (Figure 5.1b). According to Meyer (2016), an outcrop of Amsterdam Formation volcanics is visible on the proposed centre-line, east of the Thole River.

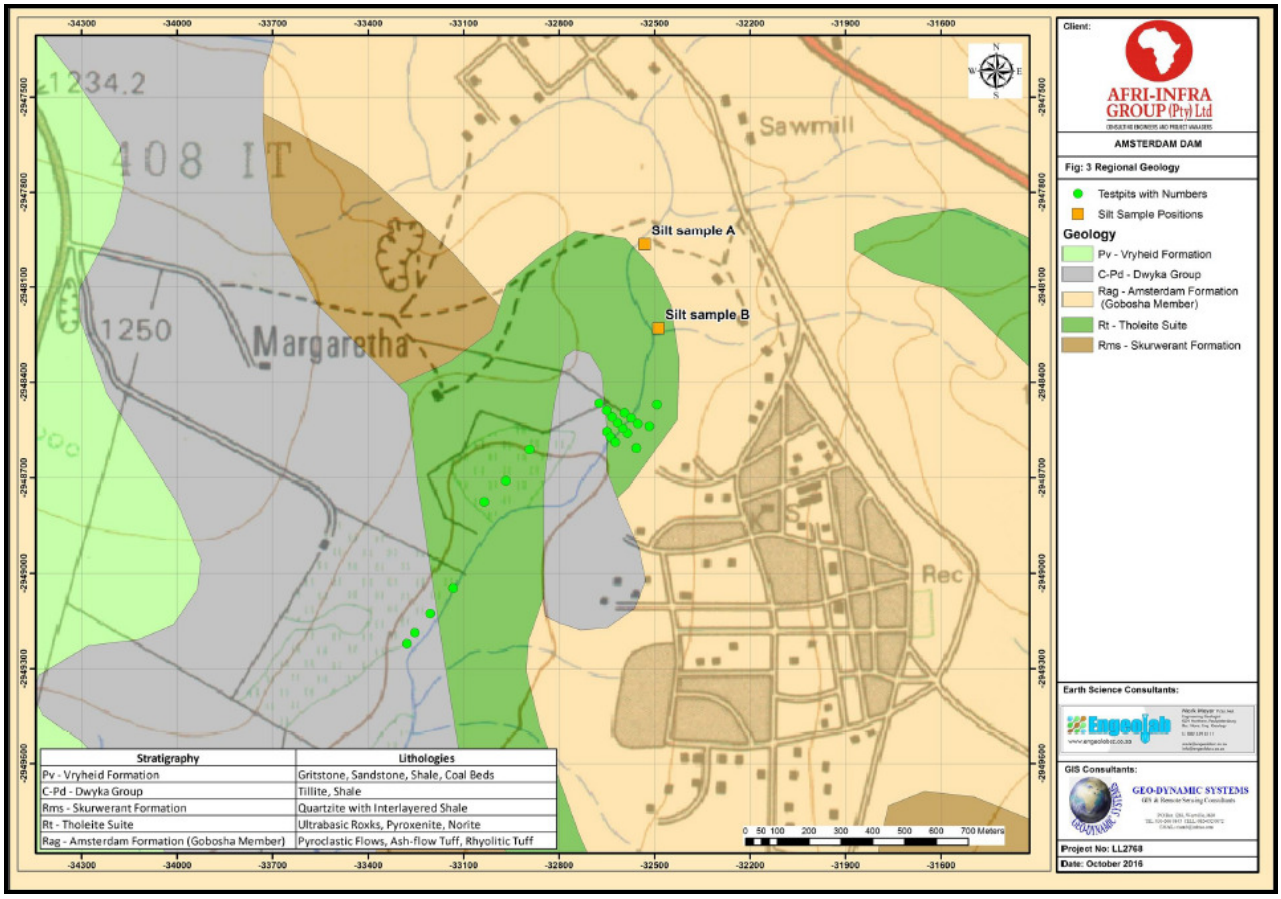


Figure 5.1b: Geology of Dam Site A (taken from Meyer, 2016)

According to Meyer (2016), the basin of Dam Site A is blanketed by younger unconsolidated Quaternary alluvium consisting of transported sands, silts and clays derived from upstream weathered bedrock. A layer of gravelly Talus of mixed origin covers the hillside.

The main mode of weathering of bedrock is by means of chemical decomposition as the said area has a climatic N-value of about 2.0 (Weinert, 1980). Meyer (2016) indicated that the depth of weathering is generally controlled by the topography, with the flat, poorly drained areas generally comprising deeper soils with superficial pedocretes and steeper areas having thin residual and cover soils. Alluvial clays and sands occur within and along the banks.

According to Meyer (2016), 21 test pits (in total) were excavated to the maximum reach of the backhoe (i.e. some 3.0m below surface or to shallower refusal). The said test pits were excavated at the following locations as indicated in Figure 5.1c:

- 7 along the proposed dam centre line (Figure 5.1c);
- 5 upstream of the proposed dam centre line (Figure 5.1c);
- 3 downstream (Figure 5.1c);
- 7 in surrounding area in search of potential borrow material for the clay core (Figure 5.1c).

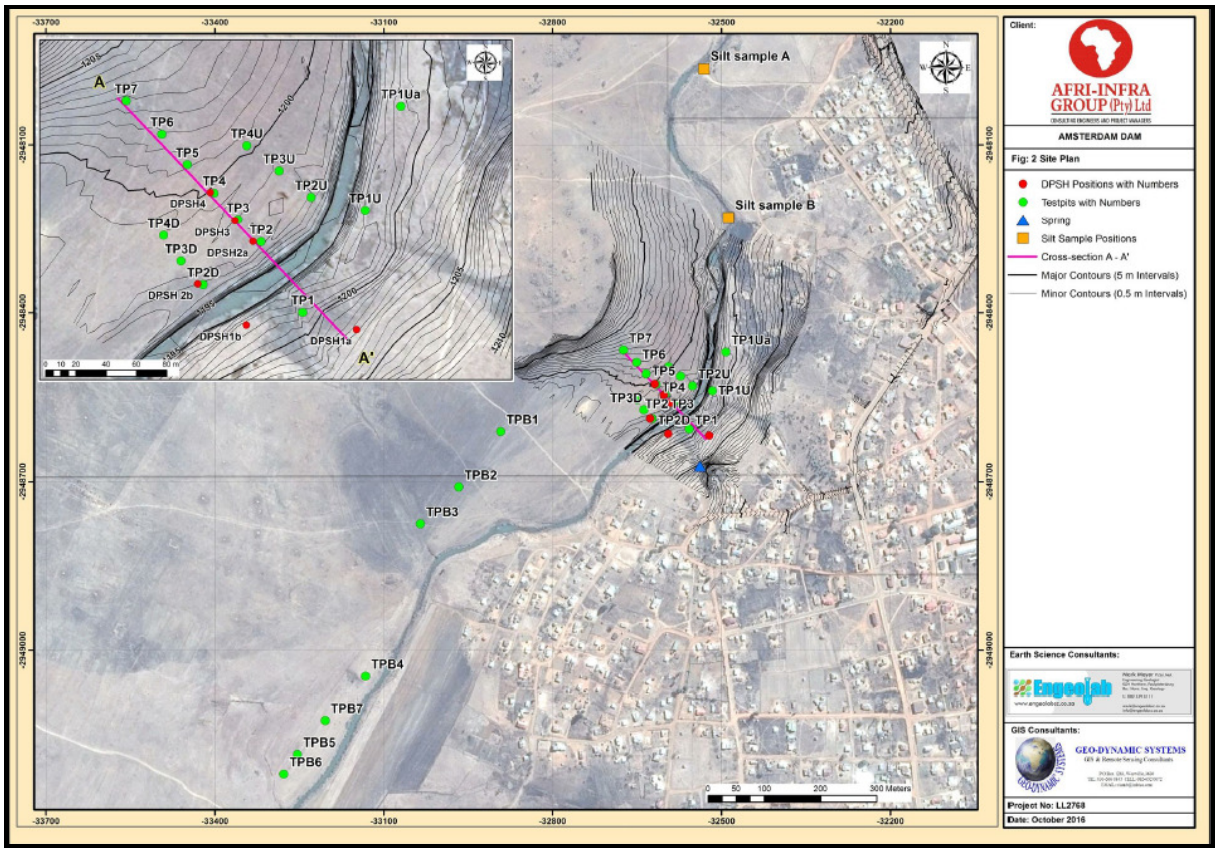


Figure 5.1c: Location of test pits at Dam Site A (taken from Meyer, 2016)

Meyer (2016) indicated that test pits on the eastern flank refused at shallow depth on hardpan ferricrete while refusal was experienced on medium hard rock weathered norite bedrock (TP 5 – TP7; Figure 5.1c) in the vicinity of the proposed spillway. Table 5.2 provides a summary of the test pit results.

Table 5.2: Summary of the test pit results (taken from Meyer, 2016)

AREA	NUMBER OF TEST PITS	TEST PIT NUMBERS	DEPTH RANGE (m)
Eastern flank	3	TP1, 1U, 1Ua	1.0-1.5
Western flank	9	TP2, 2U, 2D TP3, 3U, 3D TP4, 4U, 4D	2.4-3.0
Potential clay borrow areas	7	TPB1-TPB7	1.5-2.5
Spillway	2	TP5-TP7	2.0-2.8

In the area of the proposed spillway, shallow refusal of the TLB was encountered, i.e. where soft to medium hard rock occurred. According to Meyer (2016), this rock is not believed to be resistant to weathering/stream erosion (i.e. could be easily scraped by geological hammer).

No seepage was noted in any of the test pits. Only the DPSH tests performed adjacent to the stream encountered water as expected (Meyer, 2016).

A relatively strong spring was noted on the eastern flank of the river, almost on the proposed dam wall axis (Figure 5.1c). The presence of this spring could affect the stability of the proposed embankment dam. This water should either be diverted or the alignment of the axis changed.

5.3.3 Dam Site B

A geotechnical investigation was conducted by M. Meyer of Engeolab cc in order to determine the geotechnical suitability of Dam Site B. A copy of the geotechnical report (referred to as Meyer, 2017a) is provided in Appendix 12. This report should be consulted with regards to methodology used and the tests carried out on the samples collected.

Meyer (2017a) confirmed that Dam Site B is underlain by pyroclastic rocks and ash-flow tuff (Dacite lava) of the Gobasha Member, Amsterdam Formation of Randian Age (Rag; Figure 5.2a). These rocks have been intruded by a number of diabase dykes (Meyer, 2017b). A north-west south-east trending dyke cuts across Dam Site B (Figure 5.2a).

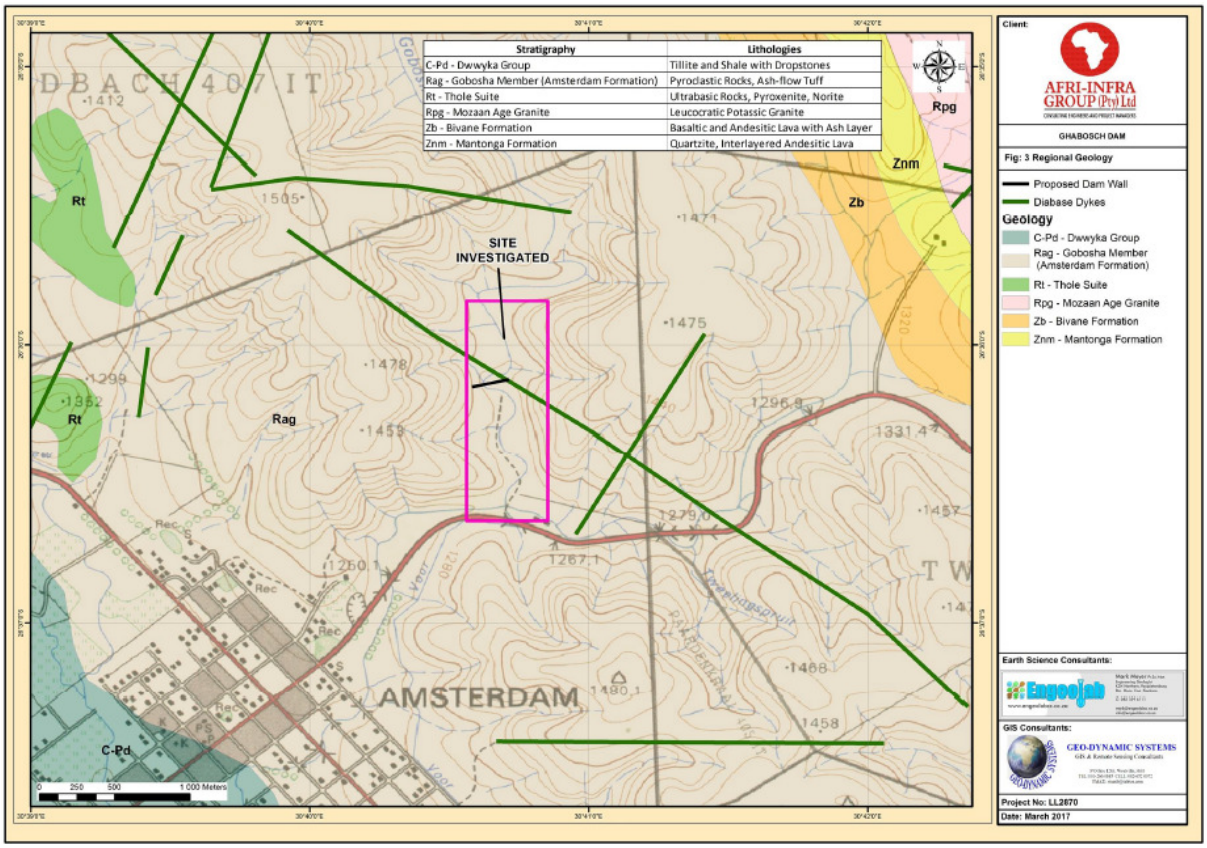


Figure 5.2a: Geology of Dam Site B (taken from Meyer, 2017a)

According to Meyer (2017a), the basin of Dam Site B is blanketed by younger unconsolidated Quaternary alluvium consisting of transported sandy, silty and gravelly soils derived from upstream weathered bedrock.

Clays are mostly absent in the streambed due to the generally high-energy depositional environment and are only present in the matrix within the alluvial gravel (Meyer, 2017a).

The hillslopes on both sides of the stream are covered with a layer of gravelly Talus of mixed origin (Meyer, 2017a).

The main mode of weathering of bedrock is by means of chemical decomposition as the said area has a climatic N-value of about 2.0 (Weinert, 1980). Refusal of the TLB occurred in most text pits at relatively shallow depth (<2m) on alluvial boulders/bedrock.

Geotechnical investigation

According to Meyer (2017a), nineteen test pits in total were excavated, all refusing at depths of less than 3.0m, mostly on alluvial gravel/boulders. The said test pits were excavated at the following locations as indicated in Figure 5.2b:

- 4 along the proposed dam wall centre line;
- 5 upstream of the proposed wall centre line (Option 1);
- 1 downstream of the proposed dam wall centre line;
- 9 scattered in the surrounding area (i.e. in search of potential borrow material for the clay core/rockfill material).

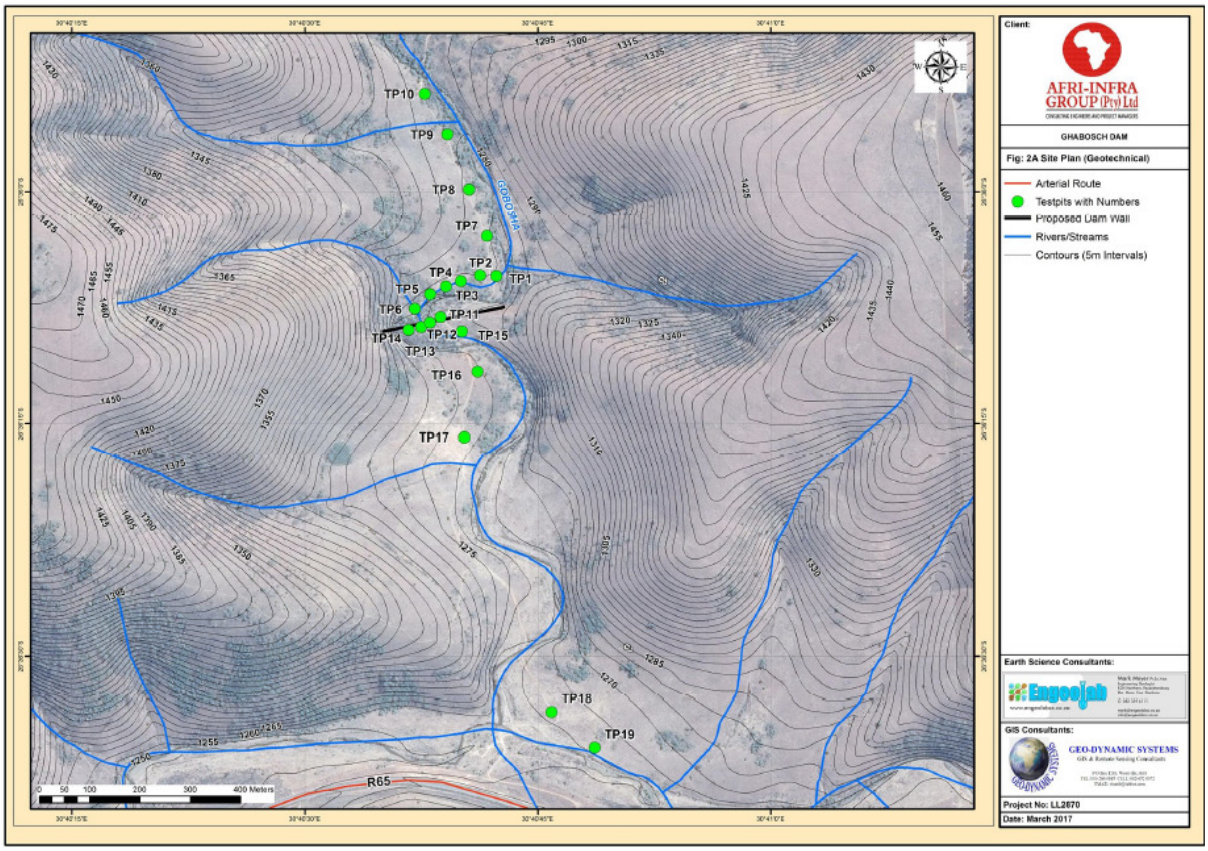


Figure 5.2b: Location of test pits at Dam Site B (taken from Meyer, 2017a).

No seepage was noted in any of the nineteen testpits (Figure 5.2b) excavated (Meyer, 2017a).

Meyer (2017a) indicated that roughly half of the dam wall is underlain by outcrop/sub-outcrop while test pits excavated towards the west revealed abundant alluvial gravel/boulders. Gravelly alluvial material was noted in most test pits.

Meyer (2017a) indicated that shallow good quality diabase exists on the eastern flank of the proposed dam for a potential side spillway. Early indications are that the material is very competent. The quality of this material should however, be assessed during the second phase investigation (i.e. drilling phase).

Geophysical investigation

Seismic refraction surveys were conducted by Engineering and Exploration Geophysical Services cc. A copy of the seismic refraction report is provided in Appendix D of Appendix 12.

The geophysical investigation comprised of two resistivity traverses and eight seismic traverses as indicated in Figure 5.2c. Seismic refraction traverse Line 1 and Line 2 (Figure 5.2c) were conducted in the vicinity of the proposed spillway on the eastern flank of the river. Line 3, 4, & 7 (Figure 5.2c) were completed towards the centre of the proposed damwall while Line 6 and 8 (Figure 5.2c) were done north and south of the proposed damwall respectively. Line 5 (Figure 5.2c) was completed at the proposed rockfill/concrete aggregate quarry.

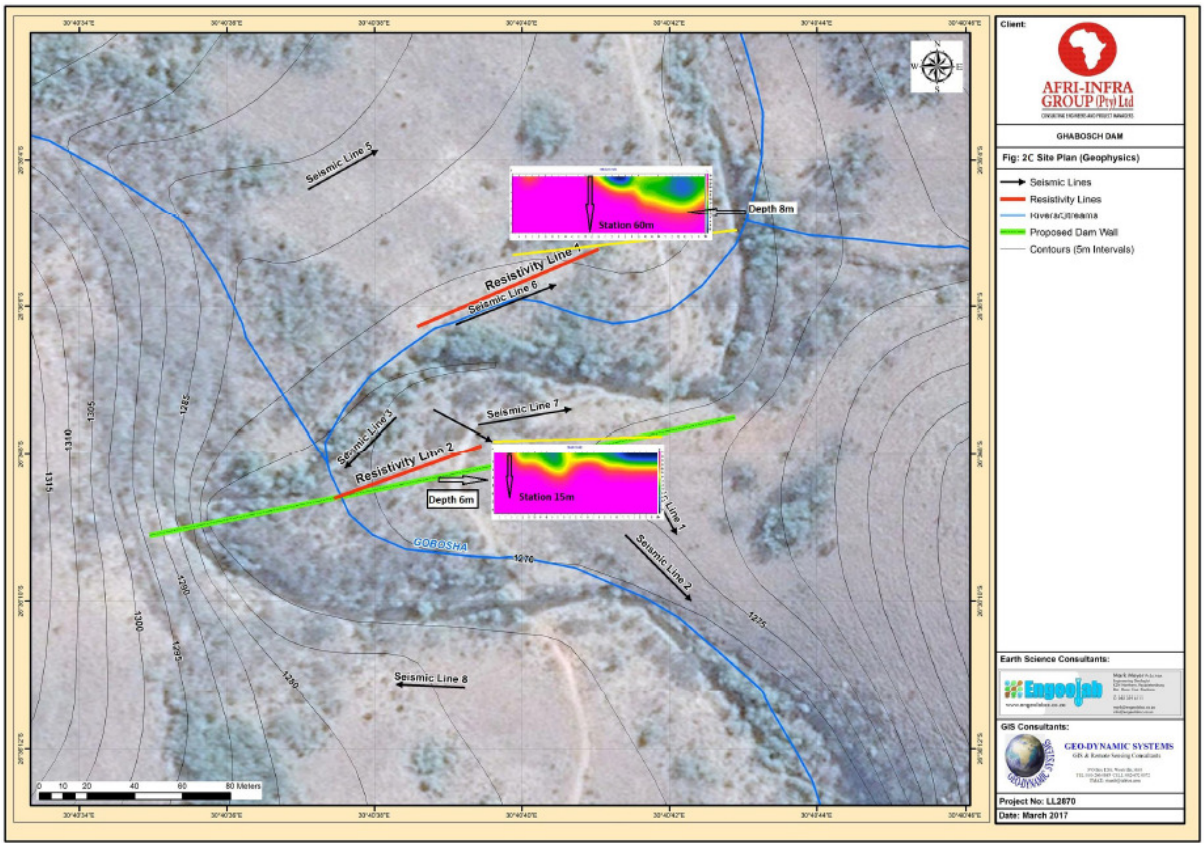


Figure 5.2c: Seismic and resistivity lines at Dam Site B (taken from Meyer, 2017a)

According to Meyer (2017a; 2017b), the seismic data indicated mostly shallow (<5m) depths to competent bedrock with the deepest weathering zones observed in the area north of the stream in GBS 5 and 6 (Figure 5.2c). The results of the resistivity surveys (Figure 5.2c) indicated weathered material/alluvium to depths of between 6-8m (i.e. palaeo-currents) underlain by solid bedrock.

Geotechnical mapping

Meyer (2017b) indicated that geotechnical mapping was carried out on site at selected locations where jointed rock structures were visible on outcrops of the dacite bedrock. The purpose of this mapping was to obtain information on the in-situ orientation and physical characteristics of the joint/defect systems. Figure 5.2d indicates the joint survey positions at Dam Site B.

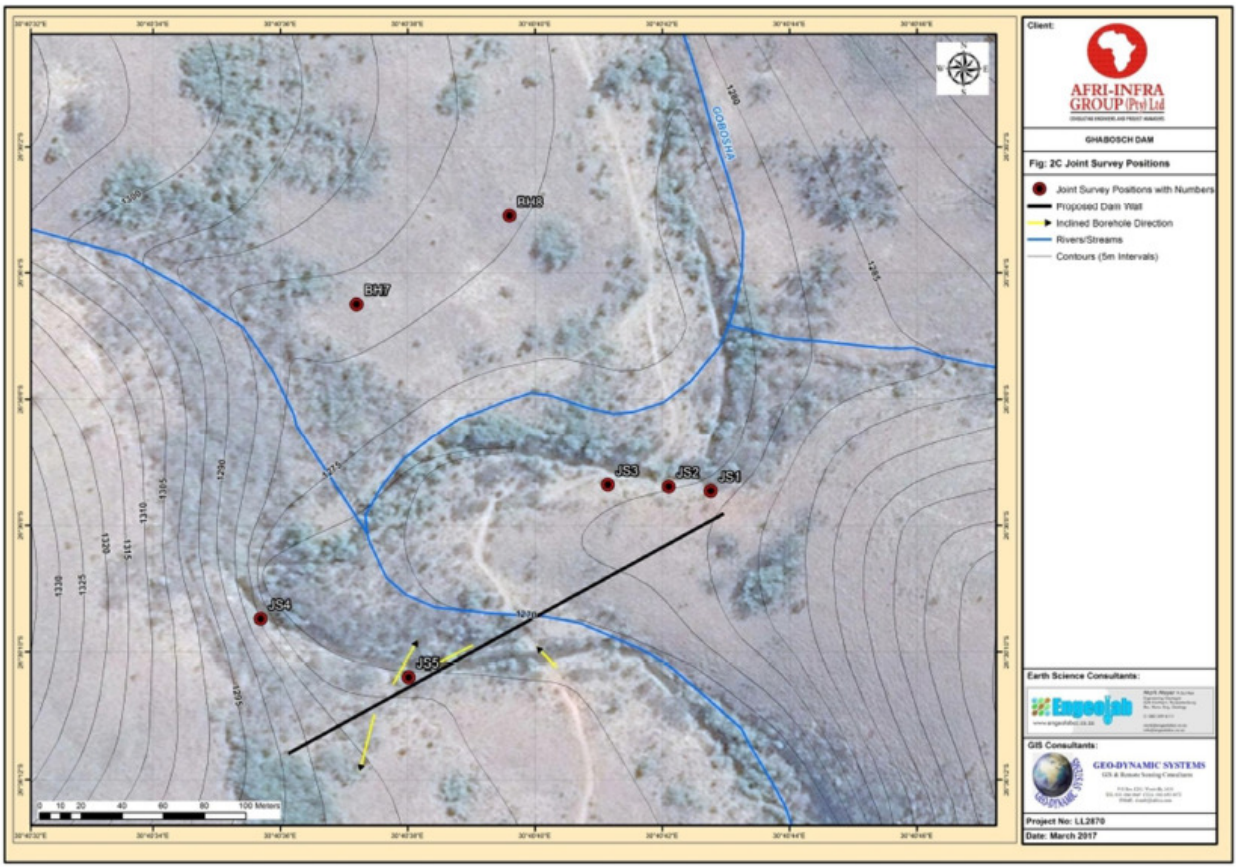


Figure 5.2d: Joint survey positions at Dam Site B (taken from Meyer, 2017b)

Drilling phase

Meyer (2017a) indicated that determining depth to bedrock or the presence of paleo-channels would be inconclusive if done by means of DPSH testing. A second phase investigation comprising of diamond drilling (i.e. five to ten boreholes to depths of around 10-30m) was recommended in order to confirm the presence of paleo-channels.

Figure 5.2e indicates the location and direction of the boreholes drilled. Boreholes BH1-5 were drilled along the centreline of the proposed dam wall, BH6 was drilled at the proposed stilling basin and BH7-8 was drilled at the proposed borrowpit/quarry for fill and aggregate material.

Four boreholes (BH1, BH2, BH3 & BH6) were drilled at an angle of approximately 60 degrees to an inclined depth of between 12-18m. The bottom of the inclined boreholes was marked using a "spear" device to allow for the measurement of dip and dip direction of geological structures that might influence the stability of the excavation.

Three inclined boreholes were oriented to intersect the most prominent geological structures identified during the geophysics exercise, while borehole BH1 was drilled into the hillside to determine the depth to competent material. BH4, BH5, BH7 and BH8 were drilled vertically. Figure 5.2f provides the cross-sections obtained from the borehole data.

Figure 5.2e: Borehole positions at Dam Site B (taken from Meyer, 2017b)

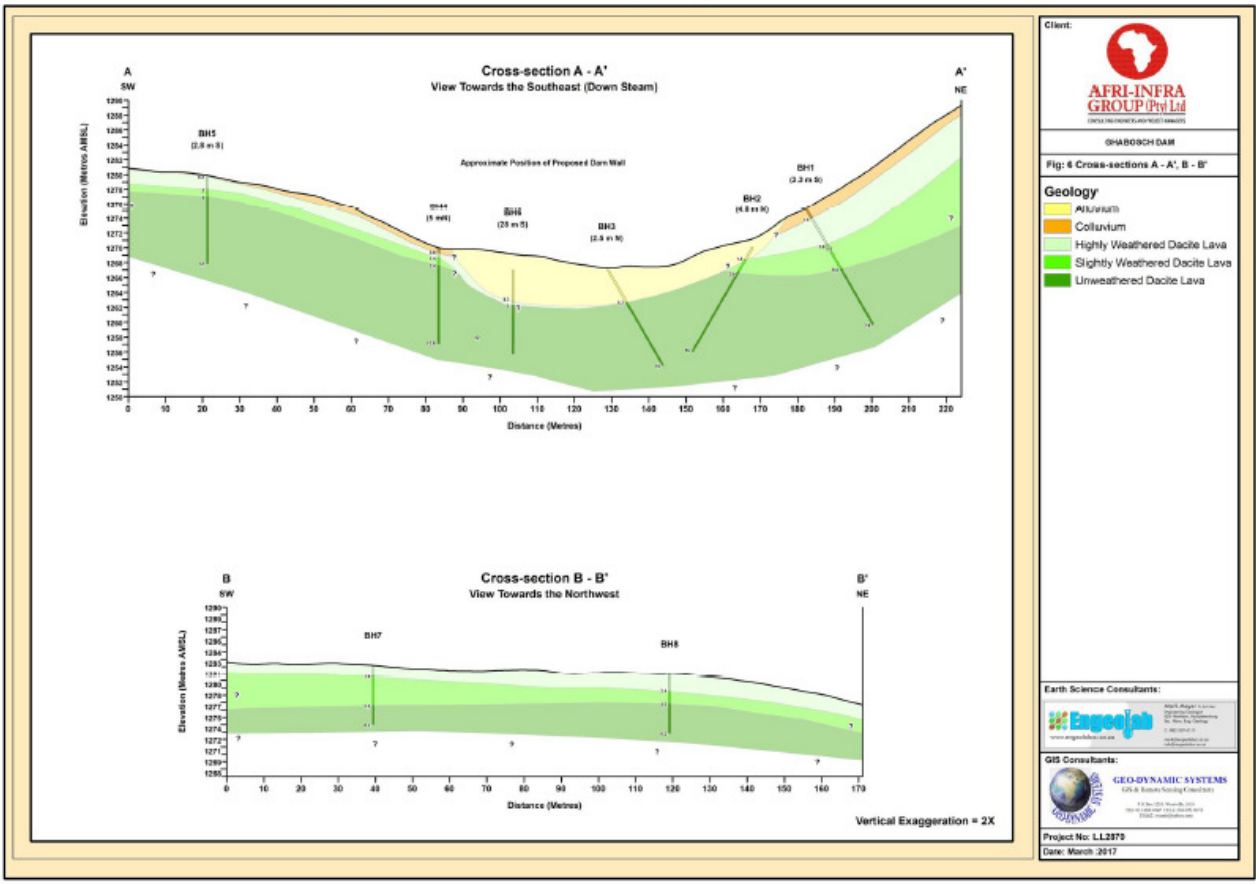


Figure 5.2f: Cross-sections at Dam Site B (taken from Meyer, 2017b)

The borehole logs and resultant cross sections (Figure 5.2f) indicate the depth to solid unweathered material on which the dam should be founded. The overburden material (colluvium on the slopes and alluvium adjacent to and below the stream) as well as residual highly weathered dacite bedrock was classed as '*Soft*' excavatable. The slightly to moderately weathered highly jointed dacite rock was classed as *'Intermediate'* excavatable. The excavatability of the unweathered dacite bedrock is expected to be '*Hard*'.

Structural measurements (boreholes and outcrop)

Meyer (2017b) indicated that an overall assessment of the rock mass quality was carried out by assessing the rock mass characteristics (i.e. lithology & alteration; rock strength and weathering; defect spacing, equivalent "RQD" and hence blockiness (Structure Rating – SR); effect surface characteristics (Surface Condition Rating - SCR); and geological strength index (GSI) and/or Rock Mass rating).

Meyer (2017b) indicated the following based on the results obtained:

- a main joint trending in a NE-SW direction which is perpendicular to the dam axis (Meyer, 2017b). This main joint will require grouting. Grout holes will need to take this into account.
- The site measurements were all recorded as joints, planar and slightly rough.
- No distinction was made on persistence or magnitude so a small joint has the same weighting as a major joint.
- No faults or large fissures were recorded, although the right flank is clearly formed by a significant structure.

5.4 Topography

Dam Site A:
Dam Site A would be located within the Thole River (Figure 2.1) with the dam wall located at approximately 1200m above mean sea level (Figure 2.1).

The dam would be located within a valley between low hills rising to a height of 1220 mamsl on the western side and 1304 mamsl on the eastern side (Figure 2.1). According to the AGIS Comprehensive Map drafted by the Department of Agriculture, Forestry and Fisheries, the terrain type of the proposed Dam Site A is indicated as Level Plains with some relief (Figure 5.3).

The topography of the surrounding area has been impacted in terms of the development of the residential areas of Amsterdam and KwaThandeka, agricultural activities (cultivated lands), excavations, roads, etc.

Distribution Pipeline:
The proposed Distribution Pipeline from the existing Amsterdam WTWs to the proposed Dam Site A would extend through an area previously indicated as Level Plains with some relief (Figure 5.3). Today, this area is built-up and represents the residential area of Amsterdam. The topography of this area has thus already been impacted upon.

Dam Site B:
Dam Site B would be located within the Gabosha River (Figure 2.1) with the dam wall located at approximately 1280m above mean sea level (Figure 2.1).

The proposed dam would be located within a narrow valley surrounded by very rugged topography (steep hills on either side, Figure 2.1) that extends to approximately 1480mamsl on both sides. According to the AGIS Comprehensive Map drafted by the Department of Agriculture, Forestry and Fisheries, the terrain type of the proposed Dam Site B is indicated as Open High Hills or Ridges (Figure 5.3).

Very little, if any, impact on topography has taken place within the proposed Dam Site B area due to the ruggedness of the topography.

Bulk Water Pipeline:
The proposed Bulk Water Pipeline from the proposed Dam Site B to the existing Amsterdam WTWs would extend mostly through Open High Hills or Ridges as indicated in Figure 5.3.

No impact on topography has taken place along the proposed pipeline route. However, the topography of the surrounding area has been impacted in terms of the provincial R65 road, gravel roads, excavations (sand), etc.

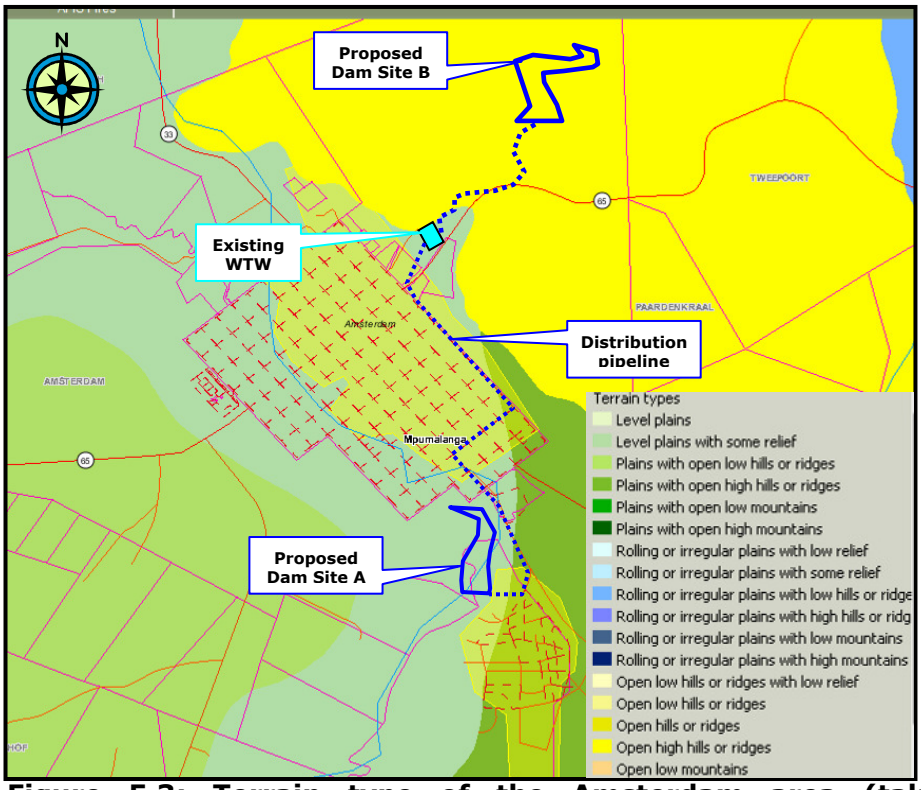


Figure 5.3: Terrain type of the Amsterdam area (taken from Department of Agriculture, Forestry and Fisheries).

5.5 Soils/land capability/agricultural potential

Dam Site A:
According to the AGIS Comprehensive Map drafted by the Department of Agriculture, Forestry and Fisheries, red and yellow soils with low to medium base status (Figure 5.4) would be associated with the proposed Dam Site A.

Dam Site A occurs within land type Ac (Figure 5.5) described as follows: *Red-yellow apedal, freely drained soils (red and yellow, dystrophic and/or mesotrophic). Dominantly (> 40%) red and yellow, freely drained, apedal (= structureless) soils. Normally associated with high rainfall areas, where soils are subjected to moderate (= mesotrophic) to intense (= dystrophic) leaching of nutrients from the soil profile. Soils are thus mostly low in base elements (K, Ca, Mg, Na). A broad range of textures may occur.*

According to Meyer (2016), the basin of Dam Site A is blanketed by younger unconsolidated Quaternary alluvium consisting of transported sands, silts and clays derived from upstream weathered bedrock. The flat, poorly drained areas generally comprise deeper soils with superficial pedocretes. Alluvial clays and sands occur within and along the banks (Mayer, 2016). The steeper areas (surrounding hillside) are covered by thin residual and cover soils consisting of a layer of gravelly Talus of mixed origin (Meyer, 2016).

Dam Site A is indicated as Moderate potential arable land (Figure 5.6) with a grazing potential of less than 4ha/animal unit (Figure 5.7). The area is used for grazing purposes by local residents. Small cultivated areas (fenced vegetable gardens) are present on the eastern side of the proposed Dam Site A.

Distribution Pipeline:
Red and yellow soils with low to medium base status would be present along the proposed Distribution Pipeline from the existing Amsterdam WTWs to the proposed Dam Site A (Figure 5.4). The soil along this route has already been impacted in terms of the development of the Amsterdam residential area. Wetland soils would be associated with areas where the pipeline extends across the Gabosha River and other tributaries.

The Distribution Pipeline would extend through land type Ac (Figure 5.5) described as follows: *Red-yellow apedal, freely drained soils (red and yellow, dystrophic and/or mesotrophic). Dominantly (> 40%) red and yellow, freely drained, apedal (= structureless) soils. Normally associated with high rainfall areas, where soils are subjected to moderate (= mesotrophic) to intense (= dystrophic) leaching of nutrients from the soil profile. Soils are thus mostly low in base elements (K, Ca, Mg, Na). A broad range of textures may occur.*

The Distribution Pipeline would extend through an area indicated as Moderate potential arable land (Figure 5.6) with a grazing potential of less than 4ha/animal unit (Figure 5.7). However, the majority of the proposed pipeline route would extend through a built up area (i.e. residential area of Amsterdam) where the land capability and grazing potential have already been impacted upon.

Dam Site B:
According to the AGIS Comprehensive Map drafted by the Department of Agriculture, Forestry and Fisheries, the soils of Dam Site B (Figure 5.4) can be described as: '*Soils with minimal development, usually shallow on hard or weathering rock with or without intermittent diverse soils. Lime rare or absent in the landscape'.*

According to Meyer (2017a), the basin of Dam Site B is blanketed by younger unconsolidated Quaternary alluvium consisting of transported sandy, silty and gravelly soils derived from upstream weathered bedrock. Clays are mostly absent in the streambed due to the generally high-energy depositional environment and are only present in the matrix within the alluvial gravel (Meyer, 2017a). The hillslopes on both sides of the stream are covered with a layer of gravelly Talus of mixed origin (Meyer, 2017a).

Dam Site B occurs within land type Fa (Figure 5.5) described as follows: *Glenrosa and/or Mispah soil forms (other soils may occur); lime rare or absent in the entire landscape. Generally shallow soils consisting of a topsoil directly underlain by weathered rock (Glenrosa form) or hard rock (Mispah form), sometimes with surface rock and steep slopes. Found in moister areas or areas with acidic parent materials, where little lime exists. Lime rare or absent in the entire landscape.*

Dam Site B is indicated as Non-arable with low to moderate potential grazing land (Figure 5.6). The grazing potential is indicated as less than 4ha/animal unit (Figure 5.7). No cultivation was noted within the proposed Dam Site B

area (Figure 2.1) due to the rocky nature of the area. The said area may however be used for grazing purposes.

Bulk Water Pipeline:
According to the AGIS Comprehensive Map drafted by the Department of Agriculture, Forestry and Fisheries, the soils along the Bulk Water Pipeline (Figure 5.3) can be described as: '*Soils with minimal development, usually shallow on hard or weathering rock with or without intermittent diverse soils. Lime rare or absent in the landscape'.*

The Bulk Water Pipeline would extend through land type Fa (Figure 5.4) described as follows: *Glenrosa and/or Mispah soil forms (other soils may occur); lime rare or absent in the entire landscape. Generally shallow soils consisting of a topsoil directly underlain by weathered rock (Glenrosa form) or hard rock (Mispah form), sometimes with surface rock and steep slopes. Found in moister areas or areas with acidic parent materials, where little lime exists. Lime rare or absent in the entire landscape.*

The Bulk Water Pipeline would extend through an area indicated as Non-arable with low to moderate potential grazing land (Figure 5.5). The grazing potential is indicated as less than 4ha/animal unit (Figure 5.6). No cultivation was noted along the proposed pipeline route due to the rocky nature of the area. The said area may be used for grazing purposes.

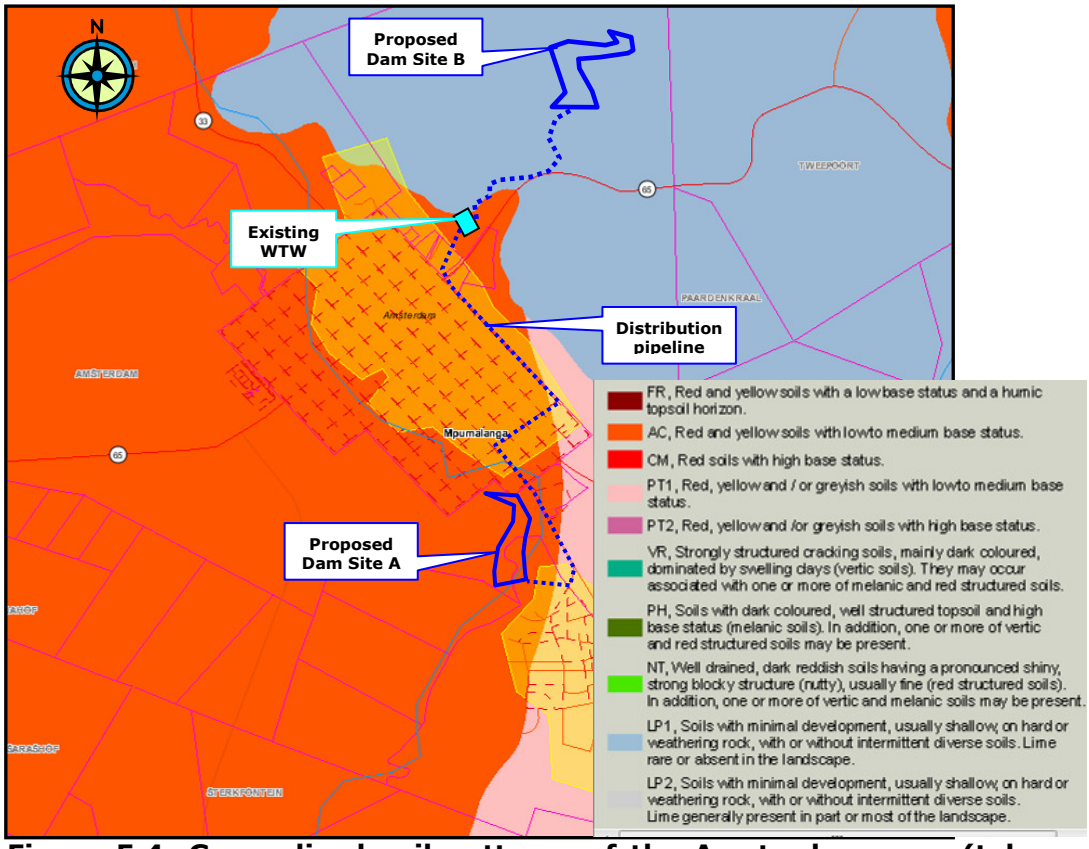


Figure 5.4: Generalised soil patterns of the Amsterdam area (taken from Department of Agriculture, Forestry and Fisheries).

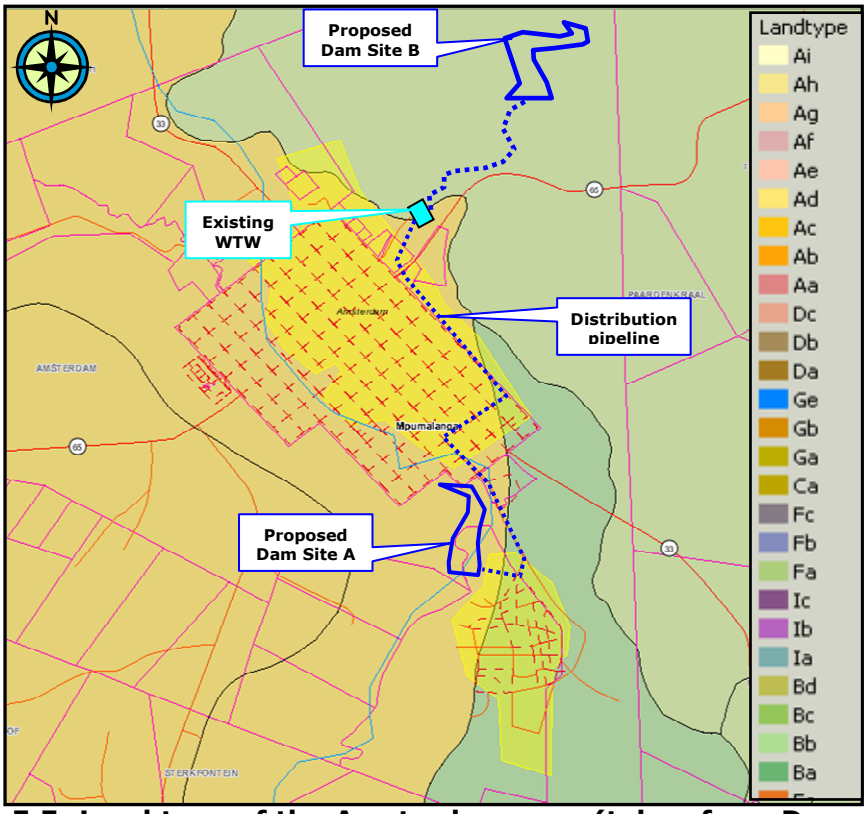


Figure 5.5: Land type of the Amsterdam area (taken from Department of Agriculture, Forestry and Fisheries).

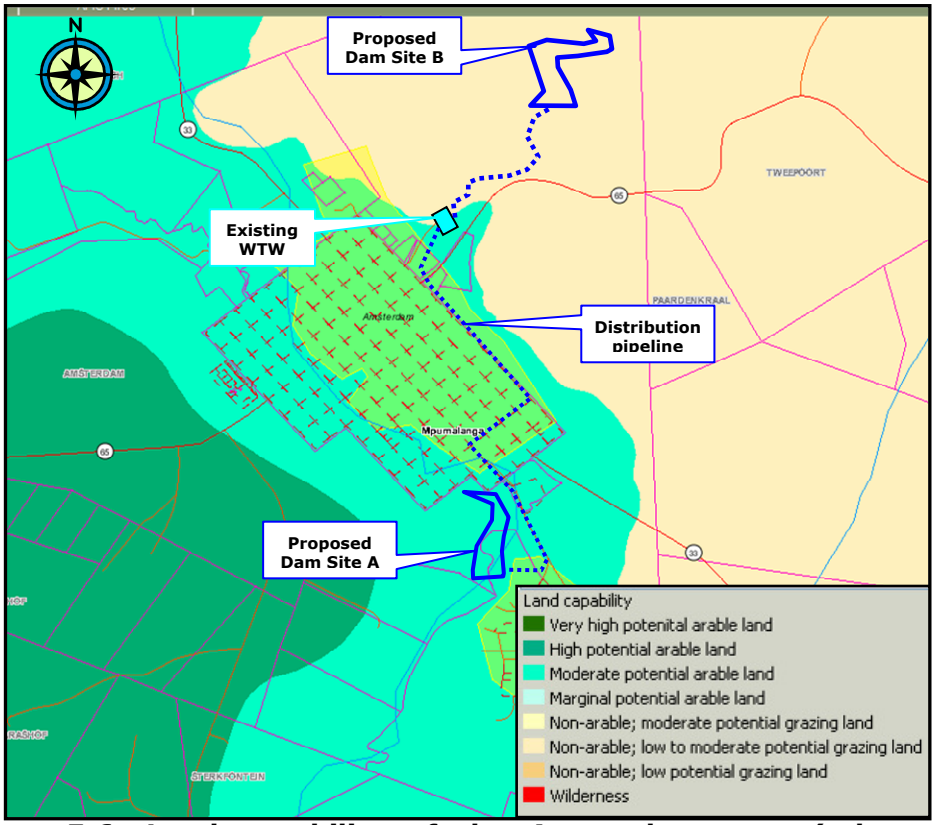


Figure 5.6: Land capability of the Amsterdam area (taken from Department of Agriculture, Forestry and Fisheries).

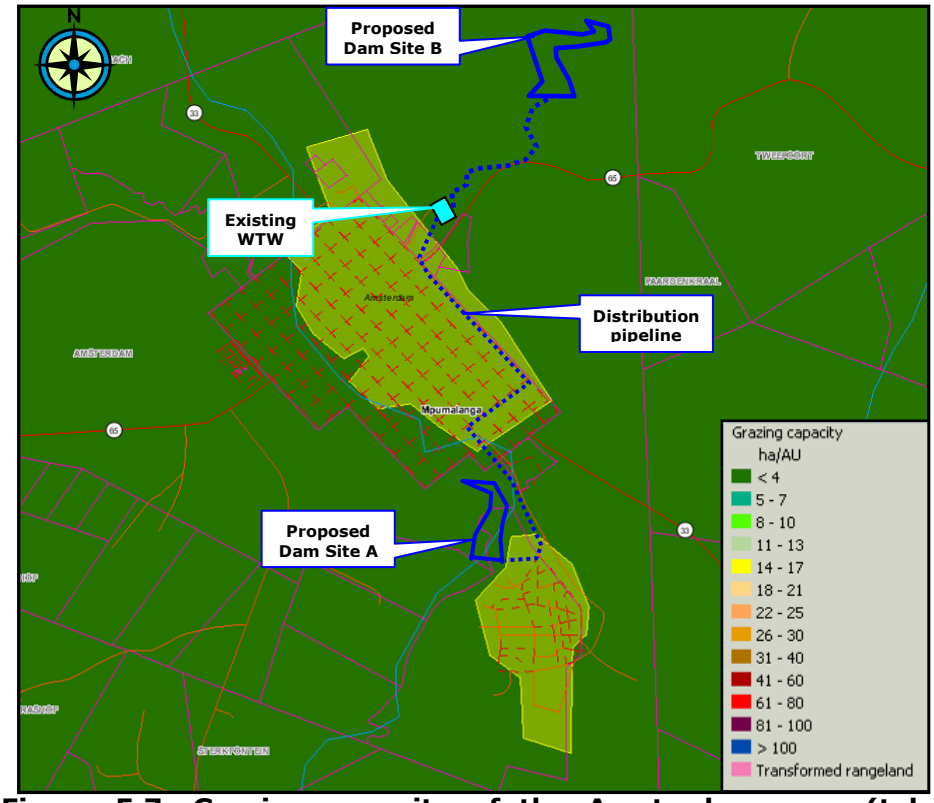


Figure 5.7: Grazing capacity of the Amsterdam area (taken from Department of Agriculture, Forestry and Fisheries).

5.6 Land use

5.6.1 Zoning of the site

Dam Site A:
Dam Site A is zoned as 'Agriculture' as it does not form part of the existing residential areas of Amsterdam and KwaThandeka.

Distribution Pipeline:
The Distribution Pipeline would extend through the residential area of Amsterdam (Figure 5.9) which is zoned for residential purposes.

Dam Site B:
Dam Site B is zoned as 'Agriculture' and does not form part of the residential area of Amsterdam.

Bulk Water Pipeline:
The Bulk Water Pipeline route is zoned as 'Agriculture' as it does not form part of the residential area of Amsterdam.

5.6.2 Land ownership

Dam Site A, the Distribution Pipeline, the proposed Bulk Water Pipeline and Dam Site B are all located on the Remaining Extent of Portion 11 of the farm Amsterdam 408 IT. This property belongs to the Mkhondo Local Municipality. A copy of the Windeed printout is provided in Appendix 1.

5.6.3 Servitudes

Dam Site A:
No servitudes are known to be associated within the proposed Dam Site. An outfall sewer line is known to extend along the eastern side of the proposed dam site and a servitude might be associated with this line.

Distribution Pipeline:
The Distribution Pipeline would extend through the residential area of Amsterdam (Figure 5.9) which is zoned for residential purposes. The proposed Distribution Pipeline would be located within the road reserve.

Dam Site B:
No servitudes are known to be associated within the proposed Dam Site B.

Bulk Water Pipeline:
No servitudes are known to be associated with the proposed Bulk Water Pipeline route.

5.6.4 Major existing infrastructure

Dam Site A:
From an aerial view (Figure 5.8a), it is evident that no infrastructure is present within the proposed Dam Site A. An outfall sewer line is known to extend along the eastern side of the proposed dam site.

Distribution pipeline:
The Distribution Pipeline would extend through the residential area of Amsterdam (Figure 5.8a) and thus existing infrastructure (e.g. roads, houses, etc.) is present adjacent to the proposed route.

Dam Site B:
From an aerial view (Figure 5.8b), no infrastructure is present within the proposed Dam Site B.

Bulk Water Pipeline:
From an aerial view (Figure 5.8b), no infrastructure is present along the proposed Bulk Water Pipeline route.

5.6.5 Surrounding land uses

Dam Site A:
As indicated in Figure 5.8a, the residential areas of Amsterdam and KwaThandeka occur in the immediate surrounding area of proposed Dam Site A (i.e. along the eastern side). Informal settlements and smallholdings are also present in this area. Old lands and areas of cultivation are also indicated to be present (Figure 5.9).

The unrehabilitated Amsterdam Waste Disposal Site is located on the western side of the proposed Dam Site A (Figure 5.8a) while the Amsterdam Waste Water Treatment Works (WWTW) is located approximately 1.8km downstream.

Distribution Pipeline:
The Distribution Pipeline would extend through the residential area of Amsterdam (Figure 5.8a and Figure 9).

Figure 5.8a: Aerial view of Dam Site A and Distribution Pipeline.

Figure 5.8b: Aerial view of Dam Site B and Bulk Water Pipeline.

Dam Site B:

As indicated in Figure 5.8b and Figure 5.9, no cultivation, afforestation, old lands or mining takes place within the immediate area surrounding the proposed Dam Site B. Afforestation is however present to the east of the dam site in the adjacent catchment area.

Bulk Water Pipeline:
As indicated in Figure 5.8b and Figure 5.9, no cultivation, afforestation, old lands or mining takes place within the immediate surrounding area of the proposed Bulk Water Pipeline route. The provincial R65 road is however present to the south of the proposed route as indicated in Figure 5.8b.

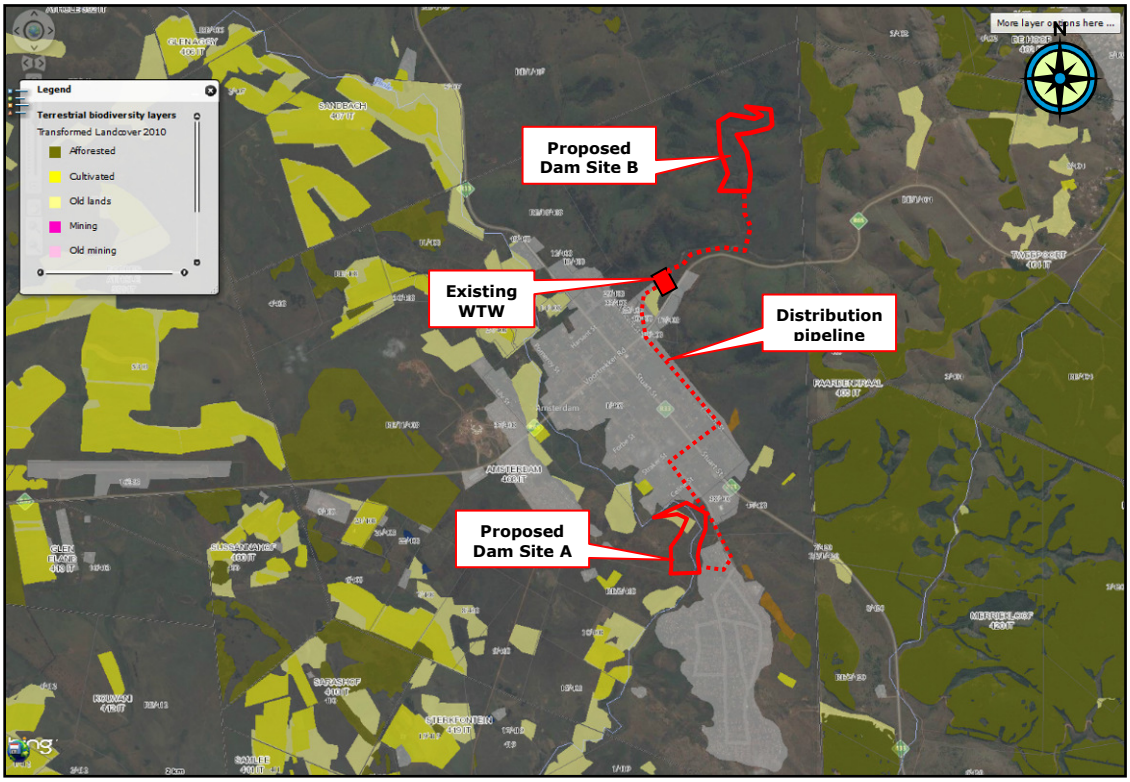


Figure 5.9: Landcover map of the Amsterdam area (Mpumalanga Biodiversity Sector Plan, 2013).

5.7 Natural vegetation

5.7.1 General description

According to 'The vegetation of South Africa, Lesotho and Swaziland', the study area falls within the Mesic Highveld Grassland Bioregion, specifically the **KaNgwane Montane Grassland** (veld type Gm16; Figure 5.10) (Mucina & Rutherford, 2006). The vegetation type was previously referred to by Low and Rebelo (1998) as North-eastern Mountain Grassland (43) and by Acocks (1953) as Piet Retief Sourveld veld Grassland (64).

This grassland occurs along the gentle slopes of the Escarpment, from the Phongolo Valley in the south, northwards to the Usutu Valley and to the uppermost Lomati Valley near Carolina, including the western grassland areas of Swaziland.

It occurs at an altitude of 880 – 1740m (Mucina & Rutherford, 2006) and is present on the undulating hills and plains that occur on the eastern edge of the Escarpment (Mucina & Rutherford, 2006).

This vegetation unit is transitional between the Highveld and Escarpment and contains elements of both. The vegetation structure is comprised of a short closed grassland layer with many forbs, and a few scattered shrubs on the

rocky outcrops (Mucina & Rutherford, 2006).

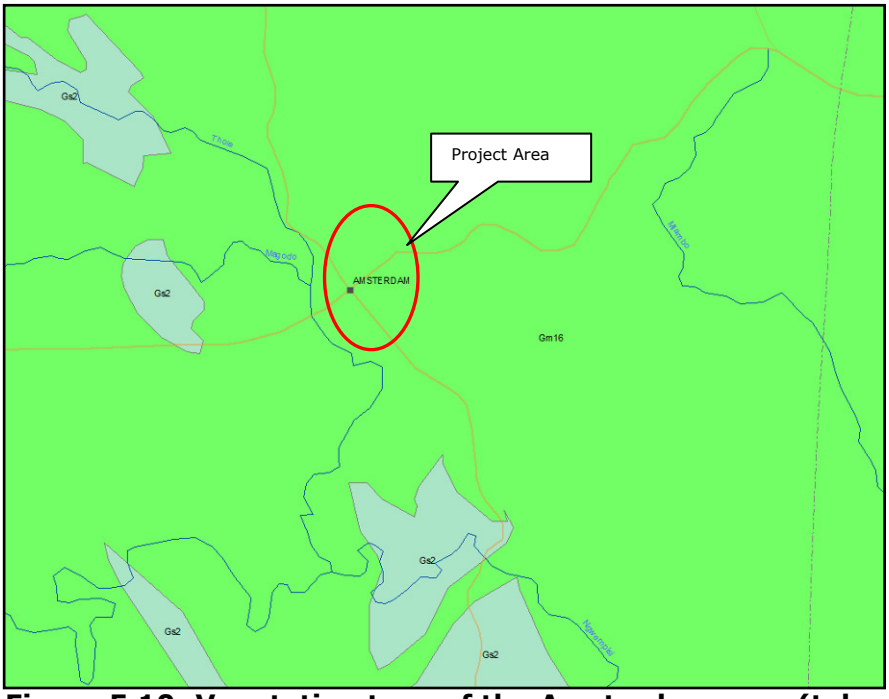


Figure 5.10: Vegetation type of the Amsterdam area (taken from Mucina and Rutherford, 2006).

5.7.2 Centre of Endemism

The KaNgwane Montane Grassland occurs on the southern edge of the Barberton Centre of Endemism (Van Wyk and Smith, 2001). According to Mucina & Rutherford (2006), the following biogeographically important taxa are associated with this vegetation type.

SPECIES	TYPE	ENDEMIC
Hemizygia modesta	Herb	Barberton endemic
Hemizygia thorncroftii	Herb	
Selago stewartii	Herb	
Watsonia watsonioides	Geophytic herb	Northern sourveld endemic
Kleinia galpinii	Succulent herg	
Hemizygia albiflora	Low shrub	

Endemic taxa include the following:

SPECIES	TYPE
Lotononis difformis	Herb
Lotononis spicata	Herb
Streptocarpus occultis	Herb
Syncolostemon comptonii	Low shrub

5.7.3 Conservation status

According to Mucina & Rutherford (2006), the conservation status of this vegetation type is Vulnerable. The conservation target is 27% but only 0.4% is formally protected within formally proclaimed nature reserves (Malalotja, Nooitgedacht Dam, Songimvelo). Approximately 30% of this vegetation type has already been converted to plantations (alien trees) with approximately 6% under cultivation.

The National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists this vegetation type as **Vulnerable**.

> **Vulnerable (VU) ecosystems -** being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems.

The stated purpose of listing 'threatened ecosystems' is primarily to reduce the rate of ecosystem degradation and species extinction.

5.7.3.1 Mpumalanga Biodiversity Conservation Plan, 2006

The proposed Dam Site A, Dam Site B, the Distribution Pipeline and the Bulk Water Pipeline are indicated to occur within areas classified as **'Irreplaceable'** and **'Highly Significant'** (Figure 5.11a) in terms of the terrestrial biodiversity assessment of the Mpumalanga Biodiversity Conservation Plan (2006).

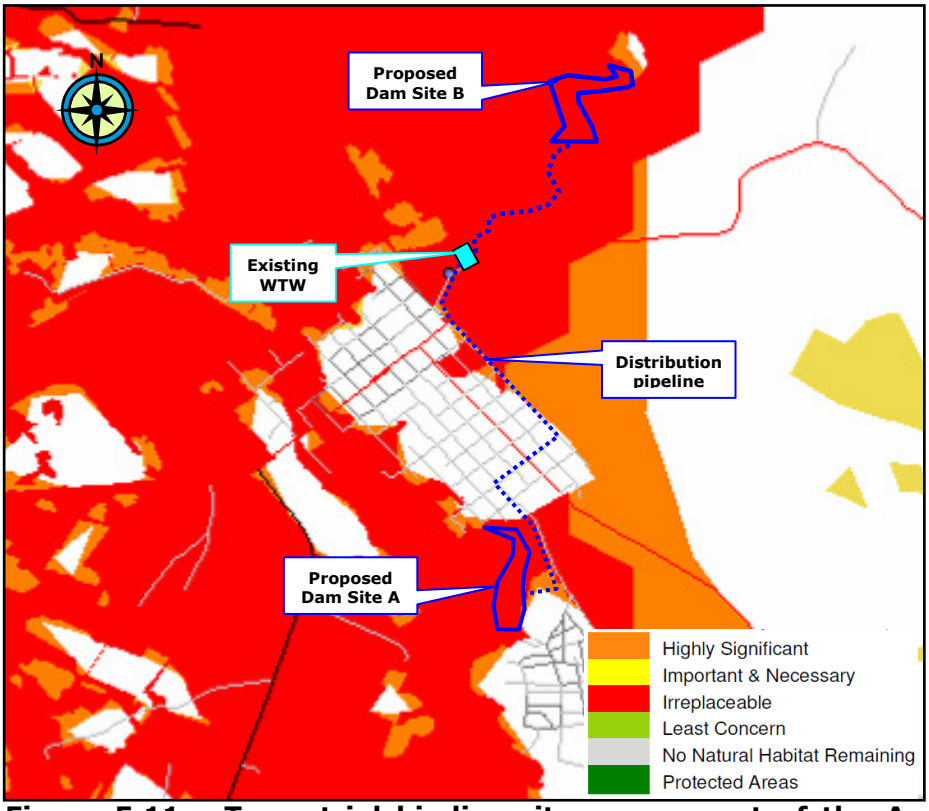


Figure 5.11a: Terrestrial biodiversity assessment of the Amsterdam area (taken from the Mpumalanga Biodiversity Conservation Plan, 2006).

5.7.3.2 Mpumalanga Biodiversity Sector Plan, 2013

The Mpumalanga Biodiversity Sector Plan (MBSP, 2013) is a biodiversity planning tool that provides the most recent spatial biodiversity information to inform land-use and development planning (Lotter *et al.*, 2014). The main mapping categories used in the MBSP (in descending order of importance in terms of meeting conservation targets), are:

- Protected Areas;
- Critical Biodiversity Areas (Irreplaceable and Optimal);

- Ecological Support Areas;
- Other Natural Areas;
- Modified (Heavily Modified and Moderately Modified-old lands).

According to the Mpumalanga Biodiversity Sector Plan (MBSP, 2013), the proposed Dam Site B and the Bulk Water Pipeline would be located within areas identified as Critical Biodiversity Area (CBA) Optimal (Figure 5.11b). The proposed Dam Site A is mostly located in an area classified as Critical Biodiversity Area (CBA) Optimal, while a significant portion is classified as Other Natural Areas (Figure 5.11b). Only a small portion of the proposed Dam Site A is located in a Heavily Modified Area (Figure 11b).

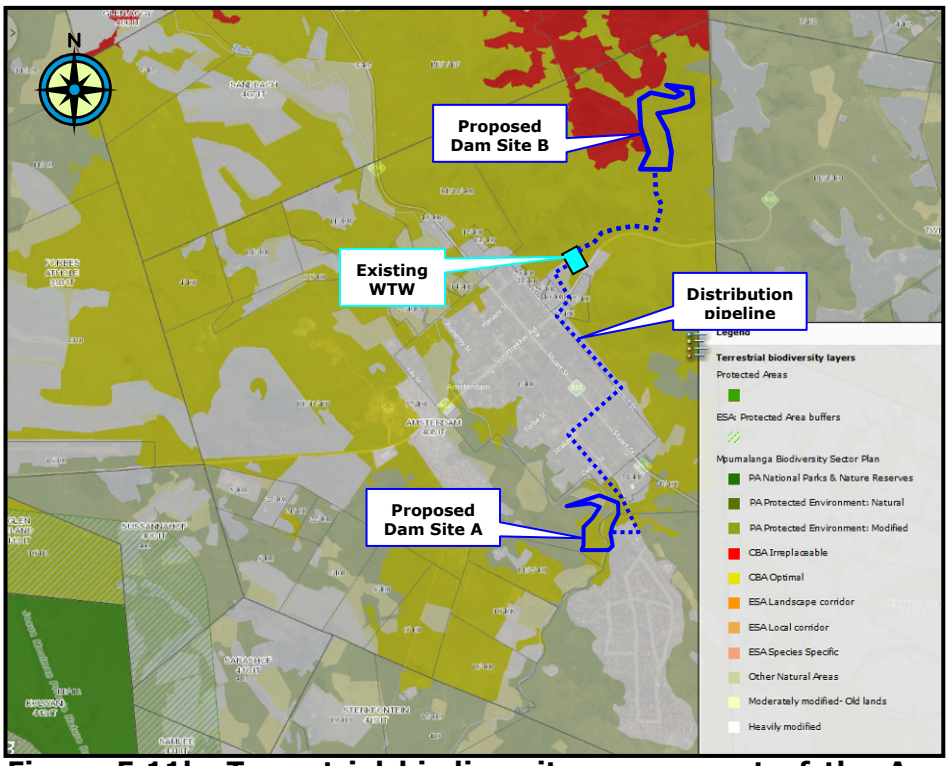


Figure 5.11b: Terrestrial biodiversity assessment of the Amsterdam area (taken from the Mpumalanga Biodiversity Sector Plan, 2013).

The Distribution Pipeline would extend through the residential area of Amsterdam indicated as **'Heavily Modified'** (Figure 5.11b).

5.7.4 Vegetation on site

A vegetation survey was undertaken by I. Venter of Kyllinga Consulting (hereafter referred to as Venter and Niemand, 2017b) as part of the overall ecological assessment. A copy of the report is provided in Appendix 13 and should be consulted with regards to methodology used.

Table 5.3 provides a summary of the vegetation and habitat units identified.

Table 5.3: Vegetation and habitat units identified (taken from Venter and Niemand, 2017b)

VEGETATION UNIT	VEGETATION SUB-UNIT	SENSITIVITY	DAM SITE A		DAM SITE B		DISTRIBUTION LINE		BULK WATER PIPELINE	
			HECTARE (ha)	%	HECTARE (ha)	%	HECTARE (ha)	%	HECTARE (ha)	%
Woody	Indigenous	High			5.08	13.5	0.69	0.6	6.80	17.0
	Invasive	Low			12.55	33.3	0.62	0.5	6.26	15.7
Grassland	Montane	High	13.90	39.6	8.44	22.4	14.56	11.8	21.81	54.6
	Modified	Moderate	7.64	21.8			16.64	13.4		
	Weedy	Moderate	0.26	0.7	5.55	14.7	4.07	3.3	3.54	8.9
	Wet	Moderate					1.34	1.1		
Watercourse	CVB	High	2.33	6.6			1.82	1.5		
	Drainage line	High			1.17	3.1			0.90	2.2
	River	High	3.63	10.3	4.87	12.9	2.46	2.0	0.65	1.6
	Seep	High	3.72	10.6			1.79	1.4		
Artificial watercourse	Artificial seep	Moderate					0.69	0.6		
	Dam	Moderate					1.46	1.2		
Development	Development	Low	3.61	10.3			77.61	62.7		
TOTAL:			**35.09**	**100**	**37.66**	**100**	**123.75**	**100**	**39.96**	**100**

Legend: CVB: Channelled Valley Bottom Wetland

5.7.4.1 Woody vegetation unit (Table 5.3)

Venter and Niemand (2017b) identified two units of woody vegetation namely:

- Indigenous woody vegetation – Dam Site B, Distribution Pipeline and Bulk Water Pipeline (Table 5.3);
- Invasive woody vegetation – Dam Site B, Distribution Pipeline and Bulk Water Pipeline (Table 5.3).

Woody vegetation was not recorded at Dam Site A (Table 5.3).

Photo 5.1: View of indigenous woody vegetation and invasive woody vegetation (taken from Venter and Niemand, 2017b)

5.7.4.2 Grassland vegetation unit (Table 5.3)

Venter and Niemand (2017b) identified the following grassland units within the overall project area:

- Montane Grassland – Dam Site A, along the Distribution Pipeline route, Dam Site B, along the Bulk Water Pipeline route (Table 5.3);
- Modified Grassland – Dam Site A and along the Distribution Pipeline Route (Table 5.3);
- Wet Grassland – along Distribution Pipeline route (Table 5.3);
- Weedy vegetation – Dam Site A, along the Distribution Pipeline route, Dam Site B, along the Bulk Water Pipeline route (Table 5.3).

Montane Grassland

The majority of the grassland vegetation present on site is primary grassland of the KaNgwane Montane Grassland vegetation type (Venter and Niemand, 2017b). The montane grassland has a high diversity of grass and forb species, with only a few woody species present.

Dominant species include *Themeda triandra, Eragrostis chloromelas, Cymbopogon caesius, Diospyros lycioides, Helichrysum oreophilum, Geranium incanum, Alepidea setifera, Vernonia natalensis, Hypoxis longifolia, Indigophera sanguinea* and numerous other indigenous species.

The soil is generally fairly shallow and the grassland is a rocky grassland, with several rocks exposed at or above the surface. This provides additional habitat for several additional plant species. Most of the plant species of conservation importance are expected to occur in this vegetation type, mostly in the rocky portions.

Modified Grassland

Venter and Niemand (2017b) indicated that the Modified Grassland vegetation unit can still be classified as KaNgwane Montane Grassland, but has a lower diversity of indigenous forb species, likely as a result of high

grazing pressure. Even though the grassland is modified, it has not been transformed completely and may recover to a better condition with long term veld management to this effect.

Wet grassland
Although a few species of this grassland vegetation unit may indicate that temporary wetness is present, the occurrence of these species may also be the result of disturbances.

Weedy grassland
Venter and Niemand (2017b) recorded several patches of weedy vegetation or invasive vegetation within the grassland vegetation unit. Although a few indigenous species are present in this unit, the indigenous species are pioneer or weedy species, such as *Hyparrhenia hirta, Melinis repens* and *Chloris gayana.* The majority of the species are however alien and invasive species, including *Pennisetum clandestinum, Paspalum dilatatum, Paspalum distichum, Xanthium strumarium, Datura stramonium, Chenopodium alba* and *Verbena bonariense.*

5.7.4.3 Watercourses
Venter and Niemand (2017b) identified the following watercourses (Table 5.3) within the project area:
- River – Dam Site A; along the Distribution Line route; Dam Site B; along the Bulk Water Pipeline route (Table 5.3);
- Drainage lines – Dam Site B; along the Bulk Water Pipeline route (Table 5.3);
- Wetlands:
  - Seep wetland – Dam Site A; along the Distribution Line route (Table 5.3):
  - Channelled Valley Bottom (CVB) wetland – Dam Site A; along the Distribution Pipeline route (Table 5.3):
- Artificial wetlands:
  - Dam – along the Distribution Pipeline route (Table 5.3);
  - Artificial seep – along the Distribution Pipeline route (Table 5.3).

As indicated in Table 5.3, the vegetation of the identified watercourses (i.e. river, drainage lines, seep wetland and channelled valley bottom wetland) all have a High Sensitivity while the vegetation of the artificial wetlands (dam, artificial seep) have Moderate Sensitivity (Table 5.3). Further details regarding the vegetation of the above-mentioned watercourses are provided in Section 5.9.8 of this report.

5.7.5 Dam Site A
Venter and Niemand (2017b) identified the following vegetation units at Dam Site A (Table 5.3 and Figure 5.12):
- Grassland:
  - Montane Grassland;
  - Modified Grassland;
  - Weedy Grassland;
- Watercourse:
  - River;
  - Channelled Valley Bottom (CVB);
  - Seep wetland.

The above-mentioned vegetation units have been impacted to varying degrees due to the close proximity of the residential area of Amsterdam and

KwaThandeka and the use of the area for agricultural purposes (e.g. grazing, cultivation, etc.).

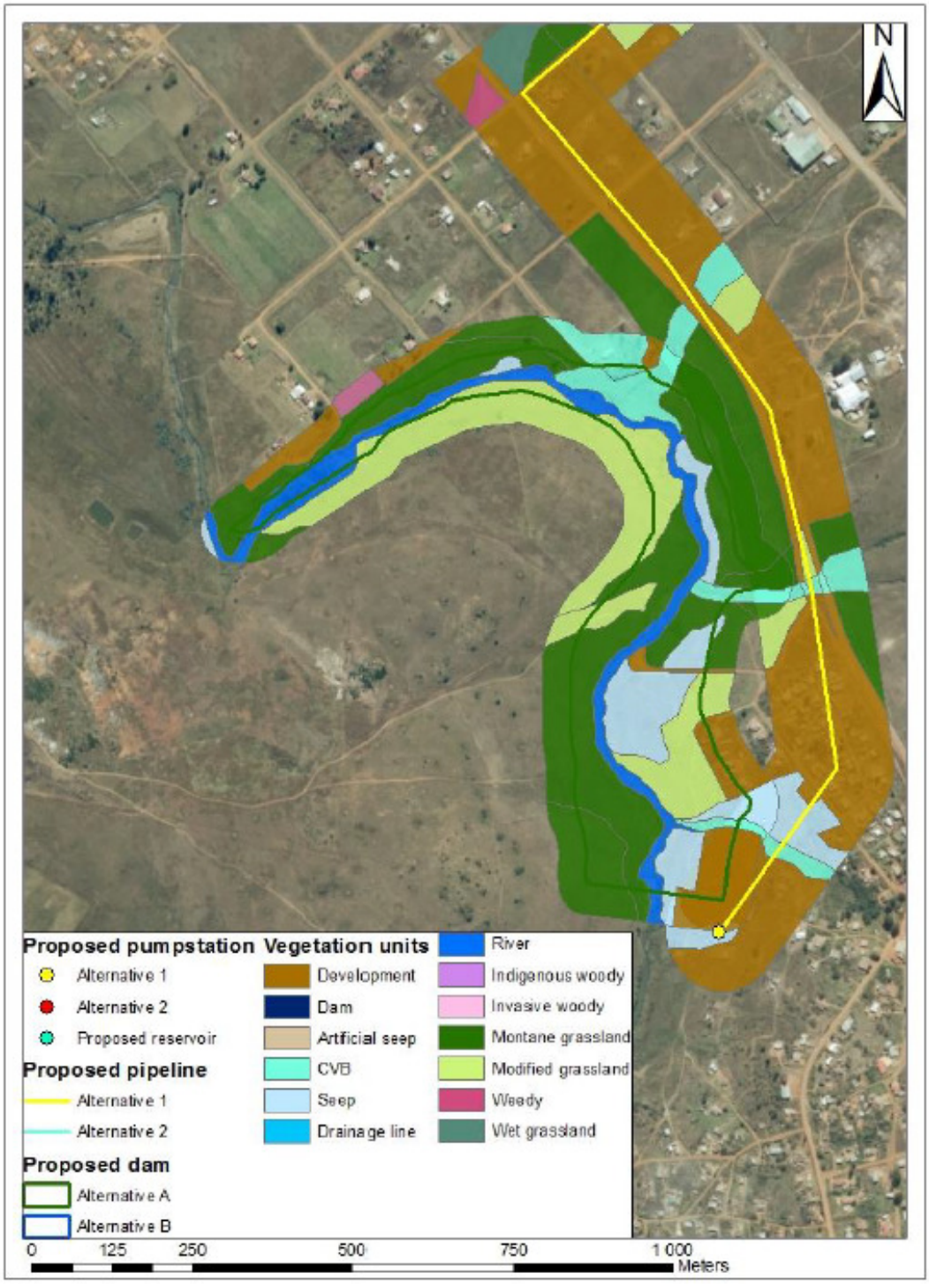


Figure 5.12: Vegetation units identified at Dam Site A and along a portion of the Distribution Pipeline route (taken from Venter and Niemand, 2017b)

Montane Grassland (Figure 5.12)

The Montane Grassland vegetation unit is present along several portions of Dam Site A (Figure 5.12) and covers an area of 13.9 ha (Table 5.3). The vegetation in this area is subjected to grazing, but few disturbances are

present and the species diversity is still fairly high. Species include *Eragrostis chloromelas, Cymbopogon caesius, Geranium invanum, Digitaria* species, *Watsonia* species and *Dicoma zeyheri.* The grassland in this area is slightly more disturbed than the Montane Grassland to the north of Amsterdam, but the grassland still falls within the same unit.

Modified Grassland (Figure 5.12)
An area of 7.64 ha (Table 5.3) of Modified Grassland is present at Dam Site A (Photo 5.2) within areas of deeper soils and appears to be heavily grazed. Dominant species include *Eragrostis chloromelas, Aristida congesta, Cymbopogon caesius, Hypoxis longifolia, Helichrysum rugulosum* and *Ledebouria ovatifolia.*

Photo 5.2: View of Modified Grassland at Dam Site A (taken from Niemand and Venter, 2017b).

Weedy Grassland (Figure 5.12)
A patch of Weedy Grassland (0.26 ha) is present in the upper portion of Dam Site A (Figure 5.12), next to development on small holdings. This vegetation is dominated by *Tagetus minuta, Amaranthus hybridus, Pennisetum clandestinum, Melia azedarach* and *Solanum mauritianum.*

Watercourse vegetation (Figure 5.12)
The following watercourse vegetation units – River, Wetlands (Seep Wetland, Channelled Valley Bottom (CVB); Table 5.3) - were also identified at Dam Site A (Figure 5.12). As indicated in Table 5.3, the vegetation of the identified watercourses (i.e. river, seep wetland and channelled valley bottom wetland) all have a High Sensitivity. Further details regarding the vegetation of the above-mentioned watercourses are provided in Section 5.9.8 of this report.

5.7.6 Distribution Pipeline

The majority of the Distribution Pipeline would be located within the road reserve associated with the roads extending through the residential area of Amsterdam. The vegetation of the road reserve area would be seen as Transformed.

Venter and Niemand (2017b) identified the following vegetation units along the Distribution Pipeline route and assessed buffer zone (Table 5.3):

- Woody:
  - Indigenous Woody;
  - Invasive Woody;
- Grassland:
  - Montane Grassland;

  - Modified Grassland;
  - Weedy Grassland;
  - Wet Grassland;
- Watercourse:
  - River;
  - Channelled Valley Bottom (CVB);
  - Seep wetland;
- Artificial watercourse:
  - Dam;
  - Artificial seep.

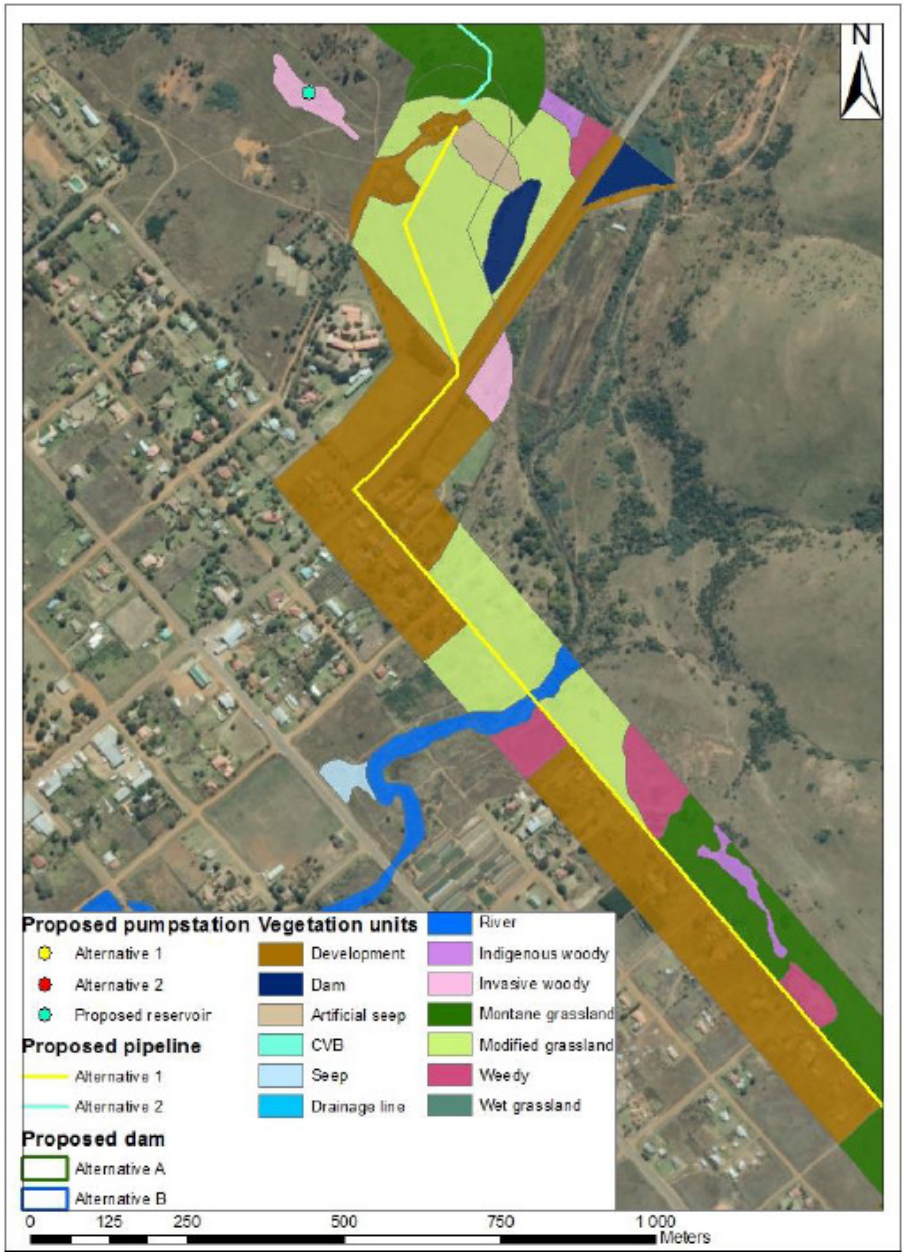


Figure 5.13a: Vegetation units identified along the Distribution Pipeline Route (taken from Venter and Niemand, 2017b).

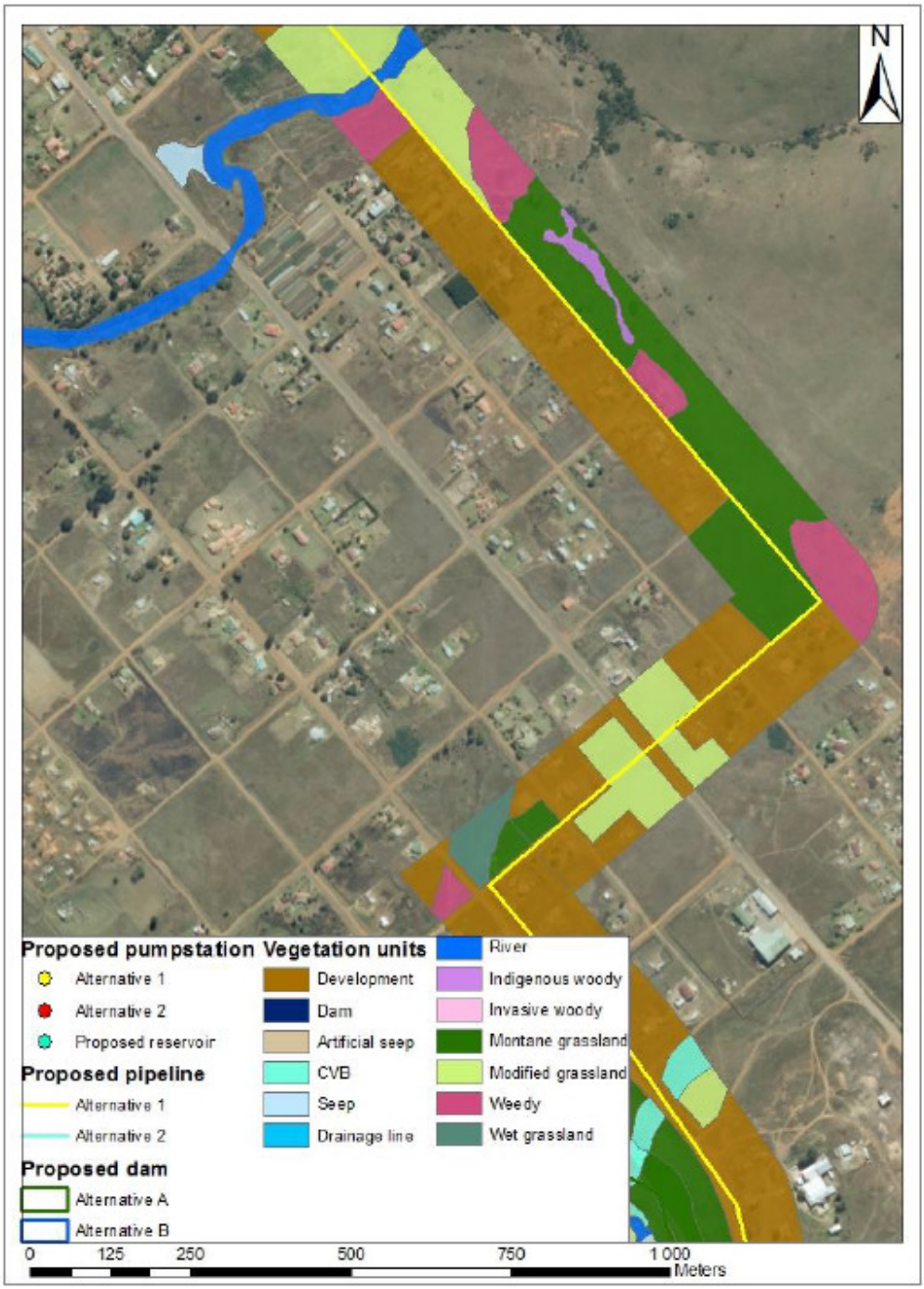


Figure 5.13b: Vegetation units identified along the Distribution Pipeline Route (taken from Venter and Niemand, 2017b).

Woody Indigenous vegetation (Figure 5.13a)

A small patch (0.7 ha; Table 5.3) of Indigenous Woody vegetation is present to the north of the Distribution Pipeline route, north of Amsterdam (Figure 5.13a). The vegetation is unlikely to be affected by the pipeline.

Invasive Woody vegetation (Figure 5.13a)

A few patches of invasive woody vegetation (0.62 ha; Table 5.3) are present along the Distribution Pipeline route and its assessed 50m buffer area (Figure 5.13a).

Montane Grassland (Figure 5.13a & 5.13b)
Approximately 14.56 ha (Table 5.3) of Montane Grassland vegetation is present in the 50m buffer adjacent to the Distribution Pipeline route (Figure 5.13a & 5.13b). Although the vegetation unit has a slightly higher diversity in the northern portion of the pipeline route than the southern portion, the site is in good condition. Species include *Eragrostis chloromelas, Aristida meridionalis, Cymbopogon caesius, Ledebouria revoluta* and *Hypoxis longifolia.*

Modified Grassland (Figure 5.13a & 5.13b)
The 50m buffer zone around the Distribution Pipeline route includes 16.64 ha (Table 5.3) of Modified Grassland (Figure 5.13a & 5.13b). Modified Grassland is present within the 50 m buffer zone around the Distribution Pipeline at the proposed river crossing (Figure 5.13a). The grassland is modified due to the various disturbances associated with development in Amsterdam and poor veld management, resulting in a loss of species diversity. Species include *Eragrostis chloromelas, Aristida congesta, Aristida transvaalensis* and *Cymbopogon caesius.*

Wet Grassland (Figure 5.13b)
This small (1.34 ha; Table 5.3) portion of Wet Grassland is fairly disturbed, since it is located inside Amsterdam along the Distribution line route (Figure 5.13b). Although few species, which may indicate temporary wetness is present, the occurrence of these species may also be the result of disturbances. No signs of wetness were observed in the soil profile and no signs of wetness were observed upslope or downslope of the grassland. A house and garden, as well as weedy and alien species are present downslope of the grassland portion.

The Wet Grassland vegetation unit is dominated by *Eragrostis plana*, with a number of other grass species and weedy species present. The floristic species diversity is low.

Weedy Grassland (Figure 5.13a & 5.13b)
A patch of Weedy Grassland is present within the 50 m buffer zone around the Distribution Pipeline at the proposed river crossing (Figure 5.13a). The following species were recorded within this vegetation unit e.g. *Hyparrhenia hirta, Pennisetum clandestinum, Melinis repens, Ricardia braziliense, Verbena rigida, Tagetus minuta* and *Bidens pilosa.*

Watercourse vegetation (Figure 5.13a & 5.13b)
As indicated in Table 5.3, the vegetation of the identified watercourses (i.e. river, seep wetland and channelled valley bottom wetland; Figure 5.13a & 5.13b) all have a High Sensitivity while the vegetation of the artificial wetlands (dam, artificial seep) have Moderate Sensitivity (Table 5.3). Further details regarding the vegetation of the above-mentioned watercourses are provided in Section 5.9.8 of this report.

5.7.7 Dam Site B

Venter and Niemand (2017b) identified the following vegetation units at Dam Site B (Figure 5.14):

- Woody:
  - Indigenous Woody;
  - Invasive Woody;
- Grassland:
  - Montane Grassland;

  - Modified Grassland;
  - Weedy Grassland;
- Watercourse:
  - River;
  - Drainage lines.

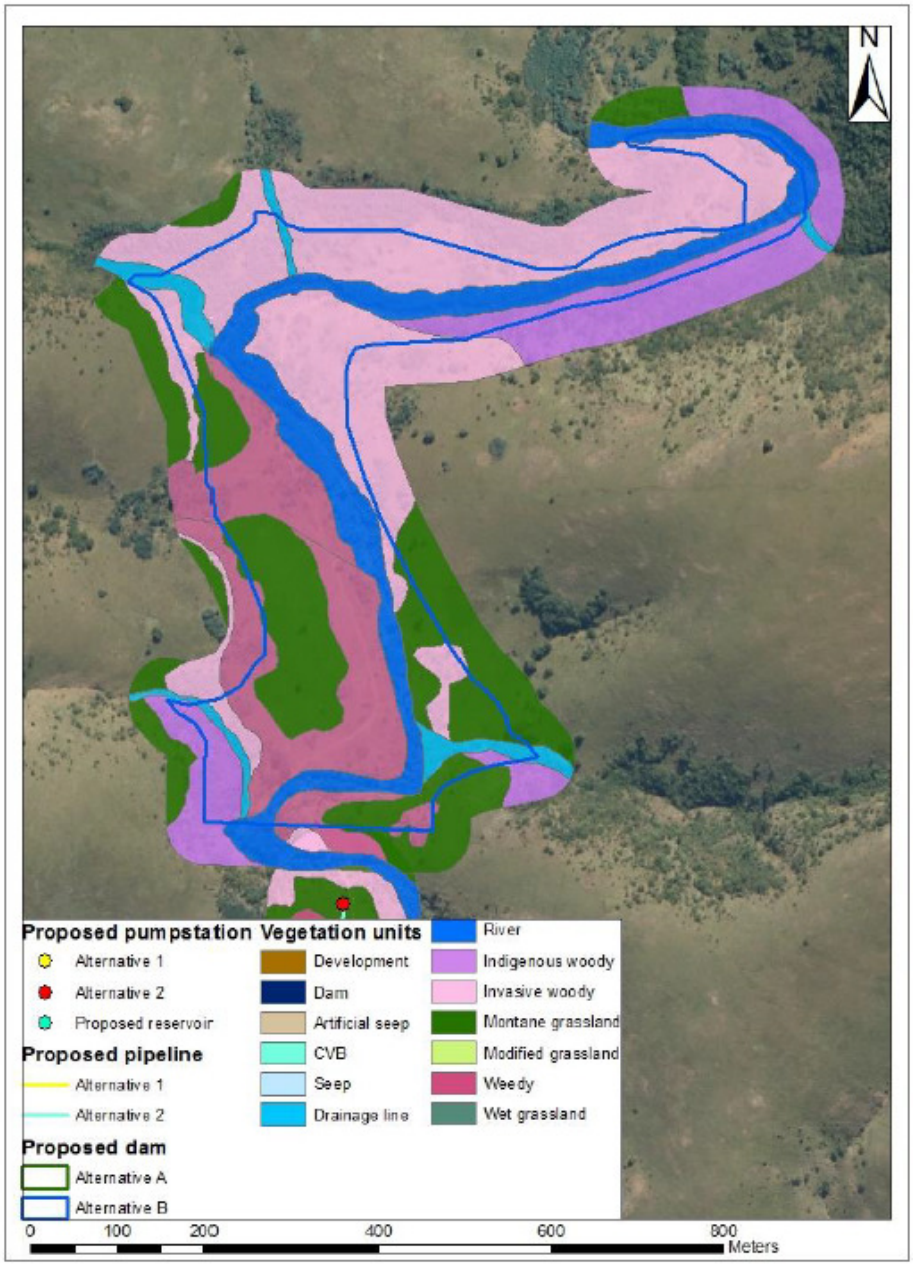


Figure 5.14: Vegetation units identified at Dam Site B (taken from Venter and Niemand, 2017b).

Indigenous Woody vegetation (Figure 5.14)

Indigenous Woody vegetation (5.08ha; Table 5.3) is present on the hillslopes surrounding Dam Site B (Figure 5.14) and is confined to the slopes surrounding the proposed dam site and to the west of the proposed dam site (Figure 5.14). The vegetation is fairly dense and has a high floristic species diversity (Photo 5.3). The same woody vegetation is also present in the drainage lines and the two units are mostly distinguished by the topography of the site. Species typical to the vegetation unit include *Ziziphus mucronata,*

Streptocarpus pentherianus, Agapanthus inapertus, Senegalia caffra, *Aspidoglossum interruptum, Clematis brachiata* and *Diospyros lycioides*.

Invasive Woody vegetation (Figure 5.14)
Patches of invasive woody vegetation is present in the valley bed and slopes at Dam Site B (12.55 ha; Table 5.3). The dam will therefore flood large portions affected by invasive vegetation establishment. The invasive vegetation invades several of the grassland areas and may significantly impact on the status of the grassland unit if left unchecked. Most of the plant species observed in this unit are alien or pioneer species and include *Acacia dealbata, Acacia decurrens, Tagetus minuta, Bidens pilosa, Verbena bonariense, Lantana camara, Melia azedarach* and *Ipomoea purpurea*.

Montane Grassland (Figure 5.14)
Patches of the Montane Grassland (8.44 ha; Table 5.3) is interspersed with Weedy grassland, Indigenous woody vegetation and Invasive woody vegetation at Dam Site B (Figure 5.14), with the River vegetation unit passing approximately through the centre of the site (Figure 5.14). The grassland in this area is very similar to the grassland present at Dam Site A. Several typical grassland species are present, including *Cymbopogon caesius, Eragrostis chloromelas, Eragrostis capensis, Dicoma zeyheri, Helichrysum oreophilum, Heteropogon contortis* and *Ledebouria revoluta*.

Photo 5.3: View of Montane Grassland at Dam Site B (taken from Venter and Niemand, 2017b).

Weedy Grassland (Figure 5.14)
Several portions of Dam Site B are dominated by Weedy Grassland (5.55 ha; Table 5.3), which mostly occur interspersed, with invasive woody species and montane grassland (Figure 5.14). Although some indigenous species, including *Hyparrhenia hirta, Melinis repens* and *Chloris gayana* are present, the vegetation is dominated by alien and invasive grass and forb species. The alien and invasive species include *Verbena bonariense, Verbena rigida, Pennisetum clandestinum, Paspalum distichum, Tagetus minuta* and *Bidens pilosa.*

Watercourse vegetation (Figure 5.14)
The following watercourse vegetation units – River and Drainage lines (Figure 5.14; Table 5.3) were identified at Dam Site. As indicated in Table 5.3, the vegetation of the identified watercourses (i.e. river, drainage lines) all have a High Sensitivity. Further details regarding the vegetation of the above-mentioned watercourses are provided in Section 5.9.8 of this report.

5.7.8 Bulk Water Pipeline:

Venter and Niemand (2017b) identified the following vegetation units along the Bulk Water Pipeline route and assessed buffer zone (Figure 5.15):

- Woody:
  - Indigenous Woody;
  - Invasive Woody;
- Grassland:
  - Montane Grassland;
  - Weedy Grassland;
- Watercourse:
  - River;
  - Drainage lines.

Indigenous Woody vegetation (Figure 5.15)

Woody vegetation is present on the slopes crossed by the Bulk Water Pipeline route (Figure 5.15) and covers an area of 6.8 ha (including buffer area; Table 5.3). The vegetation is fairly dense and has a high floristic species diversity. The same woody vegetation is also present in the drainage lines and the two units are mostly distinguished by the topography of the site. Species typical to the vegetation unit include *Ziziphus mucronata, Streptocarpus pentherianus, Agapanthus inapertus, Senegalia caffra*, *Aspidoglossum interruptum, Clematis brachiata* and *Diospyros lycioides*.

Invasive Woody vegetation (Figure 5.15)

Patches of invasive woody vegetation are present on portions of the slopes crossed by the Bulk Water Pipeline route (6.26 ha; Table 5.3). The invasive vegetation invades several of the grassland areas and may significantly impact on the status of the grassland unit if left unchecked. Most of the plant species observed in this unit are alien or pioneer species and include *Acacia dealbata, Acacia decurrens, Tagetus minuta, Bidens pilosa, Verbena bonariense, Lantana camara, Melia azedarach* and *Ipomoea purpurea*.

Montane Grassland vegetation (Figure 5.15)

Approximately 21.81 ha (Table 5.e) of the Montane Grassland is present in the 50m buffer adjacent to the Bulk Water Pipeline route (Figure 5.15). A high diversity of plant species is present and includes grass species such as *Eragrostis chloromelas, Eragrostis capensis, Aristida meridionalis* and *Cymbopogon caesius,* forbs such as *Alepidea setifera, Hypoxis obtuse, Indigophera sanguinea, Rhynchosia monophyla* and *Triumfetta welwitschii* and the shrub *Diospyros lycioides.*

Weedy Grassland (Figure 5.15)

The Weedy Grassland unit (3.54 ha; Table 5.3) is confined to the north-eastern portion of the Bulk Water Pipeline route, adjacent to Dam Site B (Figure 5.15). This vegetation is dominated by alien and invasive grass and forb species, with the invasive shrub species *Xanthium strumarium* and *Datura stramonium* also present in significant densities. Other species include *Pennisetum clandestinum, Paspalum distichum, Paspalum dilatatum, Sporobolus africana, Verbena rigida* and *Solanum sisymbrifolium.*

Watercourse vegetation (Figure 5.15)

The following watercourse vegetation units – River and Drainage lines (Table 5.3) - were also identified along the Bulk Water Pipeline route (Figure 5.15). As indicated in Table 5.3, the vegetation of the identified watercourses (i.e. river, drainage lines) all have a High Sensitivity. Further details regarding the

vegetation of the above-mentioned watercourses are provided in Section 5.9.8 of this report.

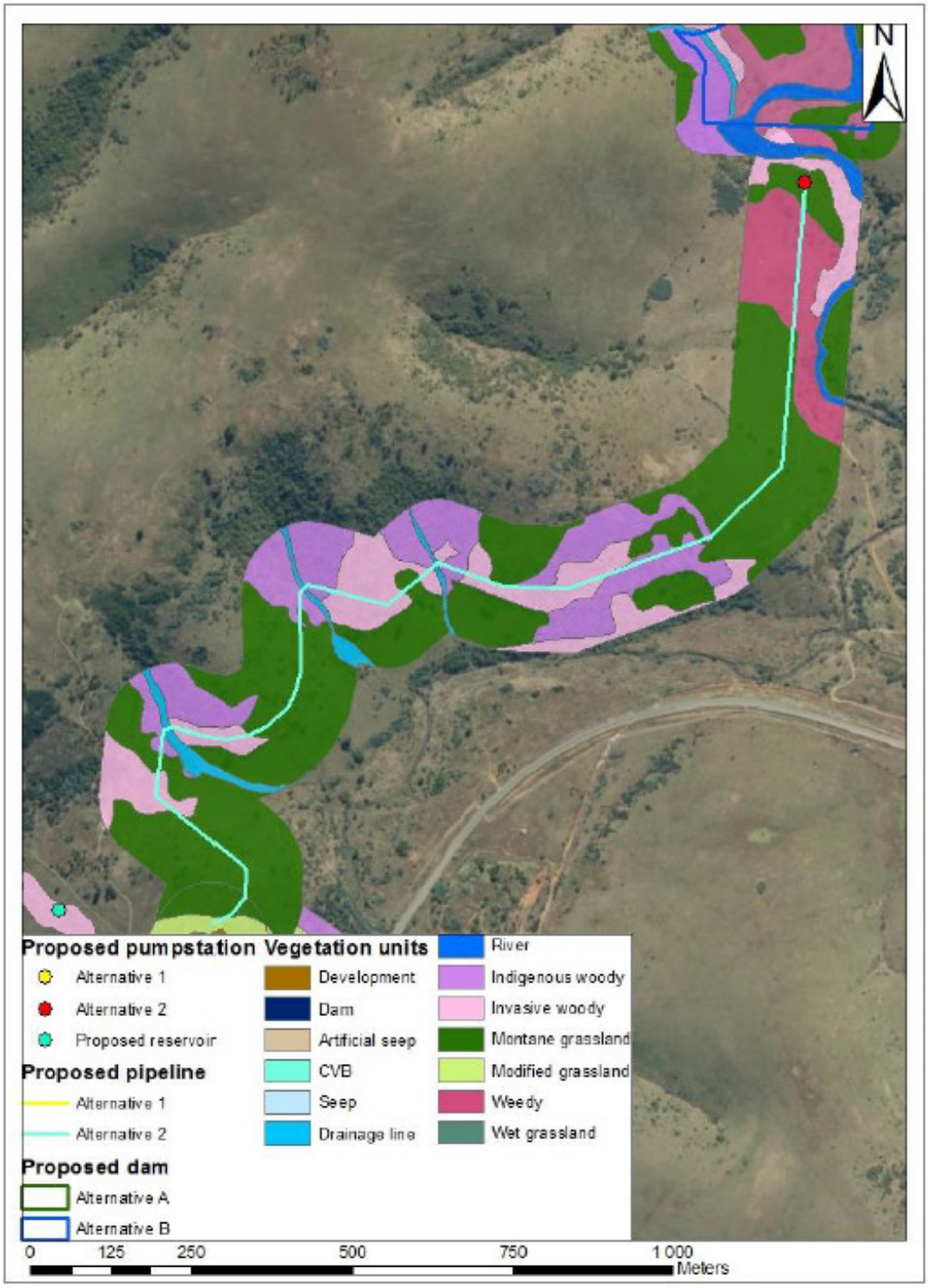


Figure 5.15: Vegetation units identified along the Bulk Water Pipeline route (taken from Venter and Niemand, 2017b).

5.7.9 Red Data species

Table 5.4 provides an indication of Species of Conservation Importance possibly occurring in the area.

Table 5.4: Species of Conservation Importance possibly occurring in the area (taken from Venter and Niemand, 2017b).

Species name	Habitat	Status	MTPA	Habitat available on site
Aloe kniphofioides	Montane grassland.	Vulnerable	Vulnerable	Only in the Montane Grassland vegetation unit (Dam Site B; Bulk Water Pipeline)
Eugenia pusilla	Montane grassland. Last collected in 1920, and never seen again despite numerous searches. The area where it was last seen has been transformed to wattle plantations.	Extinct	Extinct	Only in the Montane Grassland vegetation unit (Dam Site B; Bulk Water Pipeline). Since the species is listed as extinct it is highly unlikely that the species will be present.
Eucomis montana	Rocky montane grassland.	Declining	Declining	Only in the Montane Grassland vegetation unit. In the western, rocky area, mostly affected by the Bulk Water Pipeline.
Watsonia latifolia	Open montane grassland. Rocky soil or the bases of granite outcrops.	Least Concern	Rare	Only in the Montane Grassland vegetation unit (Dam Site B; Bulk Water Pipeline).
Selago abietina	Terrestrial	Data Deficient	Data Deficient	Habitat data is insufficient. The species may therefore be present.
Cassipourea swaziensis	Exposed quartzite rock ridges.	Least Concern	Rare	The species may be present in the Indigenous Woody vegetation unit (Dam Site B; mostly Bulk Water Pipeline).

Venter and Niemand (2017b) indicated that all of the Species of Conservation Importance are present in either the Montane Grassland or the Indigenous Woody vegetation units (Table 5.4). The project activity most likely to affect these units is the proposed Bulk Water Pipeline from the proposed Dam Site B dam to the Amsterdam Water Treatment Works. The construction of the dam at Dam Site B will also affect portions of these vegetation units, but none of the individuals were observed on site during the site visit.

5.7.10 Invasive species

A list of alien and invasive species has been published in the Government Gazette of 1 August 2014 in the Alien and Invasive Species Regulations (AIS) under the National Environmental Management Biodiversity Act (Act 10 of 2004). Venter and Niemand (2017b) recorded a total of 26 invasive species during the site visit (Table 5.5). It is the responsibility of the landowner to control these species on site. These species are also the most likely to invade recently disturbed areas.

Table 5.5: Invasive species recorded during the site visit (taken from Niemand and Venter, 2017b).

Species	Growth form	Invasive species class
Acacia dealbata	Tree	Class 2
Acacia decurrens	Tree	Class 2
Acacia mearnsii	Tree	Class 2
Agave sisalana	Succulent	Class 2
Agrimonia procera	Forb	Class 1b
Cirsium vulgare	Forb	Class 1b
Cuscuta campestris	Climber	Class 1b
Datura stramonium	Shrub	Class 1b
Ipomoea purpurea	Climber	Class 1b
Lantana camara	Shrub	Class 1b
Melia azedarach	Tree	Class 1b
Mirabilis jalapa	Shrub	Class 1b
Morus alba	Tree	Class 3
Opuntia ficus-indica	Succulent	Class 1b
Populus x canescens	Tree	Class 2
Pyracantha angustifolia	Shrub	Class 1b
Robinia pseudoacacia	Tree	Class 1b
Rubus species	Shrub	Class 1b or 2
Sesbania punicea	Shrub	Class 1b
Solanum mauritianum	Shrub	Class 1b
Solanum sisymbriifolium	Forb	Class 1b
Verbena bonariense	Forb	Class 1b
Verbena braziliense	Forb	Class 1b
Verbena rigida	Forb	Class 1b
Xanthium spinosum	Shrub	Class 1b
Xanthium strumarium	Shrub	Class 1b

Legend: Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited; Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form of trade or planting is strictly prohibited; Category 2: Invasive species, or species deemed to be potentially invasive, in that a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees. Plants in riparian areas are Category 1b; Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is however prohibited; Plants in riparian areas are Category 1b.

5.8 Animal life/Fauna

A faunal survey was undertaken by Lukas Niemand of Pachnoda Consulting (hereafter referred to as Venter and Niemand, 2017b) as part of the overall ecological assessment. A copy of the report is provided in Appendix 13 and should be consulted with regards to methology used.

5.8.1 Mammals

5.8.1.1 Overview and taxonomic diversity

The study site, based on its spatial habitat heterogeneity, is expected to host a high mammal richness, with 66 mammal species expected to be sympatric

to the study area (excluding introduced game and/or escapees) (Addendum H of Appendix 13).

Forty-seven (47) of the expected mammalian species have a high probability of occurrence (71%), while 14 have moderate probability of occurrence (21%). In addition, five species have a low probability of occurrence since they either share distribution ranges peripheral to the study site or ecological information on their life histories are scant, thereby rendering their presence on the study area as uncertain or questionable (8%).

Of the 66 species expected to be present, only 13 species (20%) were confirmed during the site visit (Table 5.6; Figure 21 of Appendix 13). The confirmed taxa include one primate, one leporid (hare), four rodents, one mustelid (otters), two herpestids (mongoose), one hyaenid and three ungulates.

The high expected mammalian richness is best explained by the high habitat heterogeneity and altitudinal gradient on the study area. The high habitat heterogeneity includes both perennial rivers, seasonal drainage lines in combination with two wetlands types which occur in the southern section of the study area (Dam Site A, Figure 5.12; Distribution Pipeline, Figure 5.13a & 13b). In addition, the northern section (Dam Site B, Figure 5.14; Bulk Water Pipeline, Figure 5.15) has extensive Montane Grassland. However, most of these species are probably present on the northern section of the study area (Dam Site B; Bulk Water Pipeline) as opposed to the south.

The northern section (Dam Site B and Bulk Water Pipeline) hosts a low frequency of anthropogenic activities in the area and low grazing intensity by livestock owing to the remoteness of the area. Due to the rural nature and extensive area of natural grassland surrounding Dam Site B, it is likely that this area will support large-bodied meta-carnivores and a higher proportion of threatened mammal species.

Apart from the high diversity of expected mammal species, the following three species are worth mentioning due to their specific habitat preference and life histories:

- the endangered Mountain Reedbuck (*Redunca fulvorufula*),
- the endangered Oribi (*Ourebia ourebi*),
- the vulnerable Spotted-necked Otter (*Hydrictis maculicollis*).

The Spotted-necked Otter is most likely to be affected by the proposed development since it is especially sensitive to current water management regimes. Any siltation (discolouration of the associated rivers) and reduction in prey sources (especially fish) will affect the species ability to hunt, thereby resulting in the displacement of this species from the area downstream of the dam wall of Dam Site B.

According to reporting rates extracted from MammalMap, the dominant taxa in the region include the Oribi (*Ourebia ourebi*), Aardvark (*Orycteropus afer*), Eastern Rock Sengi (*Elephantulus myurus*), Four-striped Grass Mouse (*Rhabdomys pumilio*) and the Natal Multimammate Mouse (*Mastomys cf. natalensis*).

Table 5.6: An inventory of mammalian taxa observed in the study area (taken from Venter and Niemand, 2017b)

SCIENTIFIC NAME	VERNACULAR NAME	OBSERVATION INDICATORS	OBSERVED HABITAT
Aonyx capensis	Cape Clawless Otter	Scats	A very common species recorded from several instances along both the Thole (Dam Site A) and Gabosha Rivers (Dam Site B).
Atilax paludinosus	Marsh Mongoose	Spoor	Widespread along the Thole (Dam Site A) and Gabosha Rivers (Dam Site B).
Cercopithecus pygerythrus	Vervet Monkey	Visual sightings	Restricted to the northern parts (Dam Site B and Bulk Water Pipeline) of the study site and observed from invasive and indigenous woody vegetation along the Gabosha River.
Cryptomys hottentotus	African Mole-rat.	Soil heaps	Widespread.
Cynictis penicillata	Yellow Mongoose	Visual sightings	Widespread.
Gerbilliscus (Tatera) cf. brantsii	Highveld Gerbil	Burrow systems	Localised in the south (Dam Site A and Bulk Water Pipeline) corresponding to modified grassland on sandy soils.
Hystrix africaeaustralis	Cape Porcupine	Scats and diggings	Widespread, nearly all habitat types.
Lepus saxatilis/macrotis	Scrub/Savanna Hare	Visual sightings and droppings	Widespread.
Micaelamys namaquensis	Namaqua Rock Mouse	Dens among rock fissures	Localised, restricted to surface outcrops among woody vegetation on the northern section (Dam Site B) of the study area.
Parahyaena brunnea	Brown Hyaena	Tracks	Localised, recorded from the extreme northern section (northern portion of Dam Site B) of the study area along the Gabosha River.
Raphicerus campestris	Steenbok	Visual sightings	Confined to the slopes above the inundation zone of the proposed Dam Site B, mainly montane grassland.
Raphicerus campestris	Steenbok	Visual sightings & spoor.	Localised, restricted to low-lying grassland in close proximity to the proposed pump stations.
Sylvicapra grimmia	Common Duiker	Spoor, droppings & visual sightings	Widespread, mainly confined to grassland habitat types.

5.8.1.2 Mammal taxa of conservation concern

The study area, according to habitat availability and structure, provides habitat for a high diversity of nationally threatened and near threatened species, of which 14 species could be present. Nine of these are near threatened, three species are vulnerable and two are endangered.

Eleven (11) of these species have a moderate-high probability of occurrence (with three confirmed during the site visit; Table 5.7) and one with a low probability of occurrence (Table 5.7).

The remaining two species (Table 5.7) could occur based on the presence of suitable habitat and historical records, but data are scant regarding their extant distribution ranges and occurrence on the study area (*sensu* Child *et al*., 2016):

Table 5.7: Mammal taxa of conservation concern (taken from Venter and Niemand, 2017b)

VERNACULAR NAME	SCIENTIFIC NAME	STATUS	PROBABILITY OF OCCURRENCE	HABITAT
Vlei Rat	*Otomys auratus*	Nationally Near Threatened	Moderate-high	Moist and wet grassland bordering Channel Valley Bottom Wetlands, Seeps (Dam Site A, Distribution Pipeline)
Swamp Shrew	*Crocicidura mariquensis*	Nationally Near Threatened	Moderate-high	Channel Valley Bottom Wetlands, Seeps, Rivers (Dam Site A, Distribution Pipeline, Dam Site B, Bulk Water Pipeline)
Serval	*Leptailurus serval*	Nationally Near Threatened	Moderate-high	Moist and wet grassland bordering Channel Valley Bottom Wetlands, Seeps, Rivers (Dam Site A, Distribution Pipeline, Dam Site B, Bulk Water Pipeline)
Brown Hyaena	*Parahyaena brunnea*	Globally and Nationally Near Threatened	Moderate-High	Invasive Woody vegetation along Gabosha River (Dam Site B). Any habitat as long as it is not persecuted.
Cape Clawless Otter	*Aonyx capensis*	Nationally Near Threatened	Confirmed – Thole and Gabosha Rivers	A very common species recorded from several instances along both the Thole (Dam Site A) and Gabosha Rivers (Dam Site B).
Spotted-necked Otter	Hydrictis maculicollis	Nationally Vulnerable	Moderate-high	Thole and Gabosha Rivers
Mountain Reedbuck	Redunca fulvorufula	Nationally Endangered	Confirmed – Dam Site B	Montane Grassland – Dam Site B; Bulk Water Pipeline
Grey Rhebok	Pelea caprelus	National Near Threatened	Moderate-high	Montane Grassland – Dam Site B; Bulk Water Pipeline
Oribi	Ourebia ourebi	Nationally Endangered	Moderate-high	Montane Grassland – Dam Site B; Bulk Water Pipeline
White-tailed Rat	Mystromys albicaudatus	Nationally Vulnerable	Moderate-high	Montane Grassland – Dam Site B; Bulk Water Pipeline. Rocky grassland near Thole River (Dam Site A).
African March Rat	Dasymys incomtus	Nationally Near Threatened	Moderate-high	Channel Valley Bottom Wetlands, Seeps, Rivers (Dam Site A, Distribution Pipeline, Dam Site B, Bulk Water Pipeline)
Highveld Golden Mole	Amblysomus septentrionalis	Nationally Near Threatened	Low	Southern area along the Thole River (Dam Site A)
Leopard	Panthera pardus	Nationally Vulnerable	Uncertain	Dam Site B, Bulk Water Pipeline
African Striped Weasel	Poecilogale albinucha	Nationally Near Threatened	Uncertain	Grassland

5.8.2 Amphibians

Eleven (11) frog species are known to be sympatric to the study region (according to QDC 2630DA; Table 5.8). All of these species have a high probability of occurrence based on their widespread distribution ranges (albeit in the eastern Mpumalanga grasslands) and their ability to breed in temporary rain-filled depressions and along the permanently inundated valley bottom wetland and seep.

Of these, five species were confirmed (Table 5.8), which include Common Caco (*Cacosternum boettgeri*), Delalande's River Frog (*Amietia delalandii*), Guttural Toad (*Sclerophrys gutturalis*), Common Platanna (*Xenopus laevis*) and Clicking Stream Frog (*Strongylopus grayii*).

According to Minter *et al*. (2004), the amphibian richness on the study area is moderate (c. 11-20 species) with a very low prevalence of endemic species (c. 1 species, *Amietia delalandii*). Therefore, the study site is not considered as an important amphibian diversity hotspot.

Table 5.8: A list of amphibian/frog species known from recent observations (sensu FrogMap) and historical distributional records for the study region (2630DA) (taken from Venter and Niemand, 2017b).

Family	Genus	Species	Common name
Brevicipitidae	*Breviceps*	*mossambicus*	Mozambique Rain Frog
Bufonidae	*Sclerophrys*	*gutturalis*	Guttural Toad
Hyperoliidae	*Hyperolius*	*marmoratus*	Painted Reed Frog
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina
Hyperoliidae	*Semnodactylus*	*wealii*	Rattling Frog
Phrynobatrachidae	*Phrynobatrachus*	*natalensis*	Snoring Puddle Frog
Pipidae	*Xenopus*	*laevis*	Common Platanna
Pyxicephalidae	*Amietia*	*delalandii*	Delalande's River Frog
Pyxicephalidae	*Cacosternum*	*boettgeri*	Common Caco
Pyxicephalidae	*Strongylopus*	*grayii*	Clicking Stream Frog
Pyxicephalidae	*Tomopterna*	*natalensis*	Natal Sand Frog

None of the frog species present or expected to occur are threatened or near threatened (Measey, 2010).

5.8.3 Reptiles

A total of 23 reptile taxa are known to be sympatric to the study region (according to QDC 2630DA) of which four species are endemic to South Africa (Table 5.9).

According to the habitat types present, the reptile diversity is considered moderately high (Bates *et al.,* 2014). However, the observed reptile richness during the site visit was low with only five species observed (Table 5.9) namely the Rainbow Skink (*Trachylepus margaritifer*), Speckled Rock Skink (*T. punctatissima*), Yellow-throated Plated Lizard (*Gerrhosaurus flavigularis*), Water Monitor (*Varanus niloticus*) and Distant's Ground Agama (*Agama aculeata distanti*).

Table 5.9: A list of reptile species known from recent observations (sensu ReptileMap) and historical distributional records for the study region (2630DA) (taken from Venter and Niemand, 2017b).

Family	Genus	Species	Subspecies	Common name	Endemic
Agamidae	*Agama*	*aculeata*	*distanti*	Distant's Ground Agama	X
Elapidae	*Elapsoidea*	*boulengeri*		Boulenger's Garter Snake	
Elapidae	*Elapsoidea*	*sundevallii*	*sundevallii*	Sundevall's Garter Snake	
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	
Gekkonidae	*Lygodactylus*	*ocellatus*		Spotted Dwarf Gecko	X
Gekkonidae	*Pachydactylus*	*maculatus*		Spotted Gecko	
Gekkonidae	*Pachydactylus*	*vansoni*		Van Son's Gecko	
Gerrhosauridae	*Gerrhosaurus*	*flavigularis*		Yellow-throated Plated Lizard	
Lacertidae	*Nucras*	*lalandii*		Delalande's Sandveld Lizard	X
Lamprophiidae	*Aparallactus*	*capensis*		Black-headed Centipede-eater	
Lamprophiidae	*Boaedon*	*capensis*		Brown House Snake	
Lamprophiidae	*Lamprophis*	*guttatus*		Spotted House Snake	
Lamprophiidae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	
Lamprophiidae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	
Lamprophiidae	*Pseudaspis*	*cana*		Mole Snake	
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*conjunctus*	Eastern Thread Snake	
Scincidae	*Panaspis*	*wahlbergii*		Wahlberg's Snake-eyed Skink	
Scincidae	*Scelotes*	*mirus*		Montane Dwarf Burrowing Skink	X
Scincidae	*Trachylepis*	*margaritifer*		Rainbow Skink	
Scincidae	*Trachylepis*	*punctatissima*		Speckled Rock Skink	
Scincidae	*Trachylepis*	*varia*		Variable Skink	
Varanidae	*Varanus*	*niloticus*		Water Monitor	
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	

The rocky grassland (part of the montane grassland units) and outcrops along the Gabosha River (Figure 5.15) provide essential habitat for rupicolous species (coinciding with Dam Site B, Figure 5.14). Some sections of grassland contain termitaria, which provide habitat for fossorial snake taxa such as the Black-headed Centipede-eater (*Aparallactus capensis*), including snake taxa which occur naturally in low densities such as the Boulenger's Garter Snake (*Elapsoidea boulengeri*) and Sundevall's Garter Snake (*E. sundevallii*).

None of the reptile species present or expected to occur are threatened or near threatened (Bates et al., 2014).

5.8.4 Odonata (dragonflies and damselflies)

According to OdonataMap, only seven Odonata taxa have been observed in the study area representing QDS 2630DA4 (Table 5.10). Three of these taxa are damselflies (Zygoptera) while the remaining four belong to the dragonfly sub-order (Anisoptera). Four of these species are habitat generalists and could occur along lotic as well as lentic systems, while another four of the species are partial to flowing streams and rivers. However, the generalist species are widespread with a preference for static surface water habitat, although they are also present along streams and rivers, especially where the construction of culverts has created in-stream pools or dams within the river/streams.

Table 5.10: A list of expected Odonata taxa likely to be present on the study area (sensu OdonataMap) (taken from Venter and Niemand, 2017b).

Family	Genus	Species	Common name	Habitat preference
Coenagrionidae	*Pseudagrion*	*hageni*	Painted Sprite	Lotic
Coenagrionidae	*Pseudagrion*	*salisburyense*	Slate Sprite	Variable, mainly lotic
Gomphidae	*Paragomphus*	*cognatus*	Rock Hooktail	Lotic
Libellulidae	*Crocothemis*	*sanguinolenta*	Little Scarlet	Variable
Libellulidae	*Trithemis*	*furva*	Navy Dropwing	Variable, often lotic
Libellulidae	*Trithemis*	*kirbyi*	Orange-winged Dropwing	Variable
Platycnemididae	*Elattoneura*	*glauca*	Common Threadtail	Lotic

According to reporting rates, the dominant species includes *Pseudagrion salisburyense.*

Venter and Niemand (2017b) recorded a total of 22 Odonata species and 212 individuals were observed at 14 sampling sites (Table 15 and Addendum I of Appendix 13). However, 19 of the observed species were not previously recorded from the study area (*sensu* OdonataMap). Six families (Aeshnidae, Chlorocyphidae, Coenagrionidae, Gomphidae, Lestidae and Libellulidae) were recorded, of which the Libellulidae was prominent. Dominant taxa were represented by *Trithemis cf. dorsalis, Pseudagrion spernatum* and *Platycypha caligata*.

Nine of the species (41%) are restricted to lotic or flowing streams and rivers, while two of the species are confined to static or lentic systems (c.

Africallagma glaucum & *Palpopleura jucunda*). The remaining species have undifferentiated preferences, and could occur at both lotic or lentic systems, but are invariable recorded from lotic systems.

5.8.5 Avifauna (birds)

5.8.5.1 Species richness and composition

Approximately 229 bird species could ("expected richness") occur in the study are (Addendum K & Table 17 of Appendix 13). The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2) (Harrison et al., 1997; www.sabap2.org) and the presence of suitable habitat in the study area. The expected richness is also strongly correlated with favourable environmental conditions (e.g. when seep zones and wetlands are inundated). Waterbird and wading bird taxa are anticipated to temporarily colonise the area. This equates to 24 % of the approximate 9737 species listed for the southern African subregion (and approximately 27 % of the 8509 species recorded within South Africa). However, the SABAP2 database (www.sabap2.adu.org.za) for the two pentad grids corresponding to the study area was lower (c. 59- 69 species/pentad prior to the current survey), which emphasises the poor atlas coverage of the area. According to personal observations, the average number of species observed per pentad is approximately 90 species, with 93 species observed (see Addendum K of Appendix 13) during the site visit. On a national scale, the species richness per pentad on the study area is considered low-moderate (Figure 36 of Appendix 13).

Venter and Niemand (2017b) indicated that the study area provides habitat for a high richness of bird species, including a moderate richness of biome-restricted (pertaining mainly to species restricted to the Afrotropical Highlands), near-endemic and endemic bird taxa. It also provides habitat for two restricted-range species (c. Bush Blackcap *Lioptilus nigricapillus* and Chorister Robin-chat *Cossypha dichroa*).

5.8.5.2 Dominance and general composition

An analysis of bird data generated from the point counts showed that the dominant composition is extremely diverse and include species that are typically widespread and abundant on the eastern Highveld grasslands, while it also contains species that are particularly common along the Drakensberg escarpment (c. Drakensberg Prinia *Prinia hypoxantha*) and forested or wooded areas (Bar-throated Apalis *Apalis thoracica*). The dominance is best explained by the occurrence of a diverse suit of habitat types in the study area, which differ significantly from each other in floristic structure and altitude (e.g. wooded vegetation, montane grassland, perennial streams). However, most of the dominant composition consists in part of obligatory insectivores and facultative granivores (Table 5.11).

Table 5.11: The dominant bird species recorded on the study site (taken from Venter and Niemand, 2017b).

SPECIES	AVERAGE ABUNDANCE	CONSISTENCY	% CONTRIBUTION
Dark-capped Bulbul	1.52	1.04	46.81
Southern Fiscal	0.45	0.45	8.36
Cape Canary	0.76	0.76	5.53
Willow Warbler	0.52	0.52	5.52
Common Waxbill	0.93	0.30	5.31

SPECIES	AVERAGE ABUNDANCE	CONSISTENCY	% CONTRIBUTION
Tawny-flanked Prinia	0.55	0.22	3.84
Southern Masked Weaver	1.14	0.23	3.10
Levaillant's Cisticola	0.45	0.20	2.08
Cape White-eye	0.41	0.18	1.70
Southern Red Bishop	2.00	0.15	0.65
Black-throated Canary	0.52	0.15	1.52
Drakensberg Prinia	0.41	0.15	1.36
Bar-throated Apalis	0.34	0.15	1.17
Bronze Mannikin	0.28	0.1	1.1
Cape Turtle Dove	0.21	0.15	1.07

5.8.5.3 Important Bird and Biodiversity Areas (IBAs)

The study site does not overlap with any Important Bird and Biodiversity Area as defined by Marnewick et al. (2015). It does however provide habitat for a number of biome-restricted species with high affinities to the Afrotropical Highlands. These include Bush Blackcap (*Lioptilus nigricapillus*), Chorister Robin-chat (*Cossypha dichroa*) and Olive Bush-shrike (*Chlorophoneus olivaceus)*, with the majority confined to the densely wooded kloofs corresponding to the Bulk Water Pipeline route.

5.8.5.4 Bird species of conservation concern

Table 5.12 provides an overview of bird species of 'conservation concern' recorded in the study area, as well as those previously recorded in the area based on their known distribution range and the presence of suitable habitat. According to Table 5.12, 21 threatened and near-threatened species are known to occur according to recent (SABAP2) or historical distribution records.

Table 5.12: Threatened and near threatened bird species that could utilise the study area based on their known distribution range and the presence of suitable habitat. Red list categories according to IUCN (2017)* and Taylor et al. (2015). (taken from Venter and Niemand, 2017b)**

Species	Global Conservation Status*	National Conservation Status**	SABAP1 reporting rate (n=90)	SABAP2 reporting rate (n=4 full protocol)	Preferred Habitat	Potential Likelihood of Occurrence	Probability to be affected by proposed activity
Anthropoides paradiseus (Blue Crane)	Vulnerable	Near-threatened	22	50	Prefers open grasslands. Also forages in wetlands, pastures and agricultural land.	Could be present, although at low densities.	High
Alcedo semitorquata (Half-collared Kingfisher)	-	Near-threatened	17	No	Prefers clear fast-flowing streams with overhanging vegetation earth banks that provide breeding habitat.	Predicted to be resident along the perennial Thole and Gobosha Rivers.	High
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	10		High reporting rates owing to nearby habitat consisting of mountains and exposed cliff faces.	Rare to vagrant owing to sub-optimal habitat suitability.	Low
Balearica	Endangered	Endangered	37	Yes	Upland grassland	Could be	Moderate

Species	Global Conservation Status*	National Conservation Status**	SABAP1 reporting rate (n=90)	SABAP2 reporting rate (n=4 full protocol)	Preferred Habitat	Potential Likelihood of Occurrence	Probability to be affected by proposed activity
regulorum (Grey Crowned Crane)					in close association to wetland systems.	present, although at low densities.	
Bugeranus carunculatus (Wattled Crane)	Vulnerable	Critically Endangered	1	No	Restricted to large upland wetlands and sponges dominated by short Cyperaceae, especially *Eleocharis* spp.	Probably absent or highly irregular.	Low
Bucorvus leadbeateri (Southern Ground Hornbill)	Vulnerable	Endangered	7	No	Confined to open woodland and hilly grassland.	Probably absent at Dam Site A but the surrounding hilly grassland at Dam Site B provides suitable foraging habitat.	Moderate
Calidris ferruginea (Curlew Sandpiper)	Near-threatened	-	2	No	Generally confined to muddy fringes of inland pans and impoundments, lagoons and estuaries.	Probably absent.	Low
Circus ranivorus (African Marsh Harrier)	-	Endangered	1	Yes	Restricted to permanent wetlands with extensive reedbeds.	Probably an irregular foraging visitor to the wetland feeding into the Thole River system.	Moderate-low
Ciconia abdimii (Abdim's Stork)	-	Near-threatened	1	No	A non-breeding summer visitor to open grassland and recently tilled agricultural land.	An uncommon summer foraging visitor.	Low
Eupodotis senegalensis (White-bellied Korhaan)	-	Vulnerable	18	No	Prefers transitional habitat between grassland and savanna (e.g. Bankenveld).	Probably resident along the hilly grassland bordering Dam Site B. Historically occurred on the open grassland of Dam Site A but displaced by intense grazing and human activities.	Moderate
Eupodotis caerulescens (Blue Korhaan)	Near-threatened	(delisted)	1	Yes	Prefers extensive open short grassland and cultivated land.	An uncommon resident in the area.	Low
Falco biarmicus (Lanner Falcon)	-	Vulnerable	1	No	Varied, but prefers to breed in mountainous areas.	An occasional foraging visitor to the study area, although regarded to be more frequent at Dam Site B.	Moderate

Species	Global Conservation Status*	National Conservation Status**	SABAP1 reporting rate (n=90)	SABAP2 reporting rate (n=4 full protocol)	Preferred Habitat	Potential Likelihood of Occurrence	Probability to be affected by proposed activity
Geronticus calvus (Southern Bald Ibis)	Vulnerable	Vulnerable	60	100	A species restricted to montane grassland (especially when burned) and breed/nest on steep cliffs.	A regular foraging visitor.	High
Gyps coprotheres (Cape Vulture)	Endangered	Endangered	2	No	Varied but breeds on steep south or east facing cliffs.	Irregular foraging visitor (mainly soaring overhead).	Low
Lioptilus nigricapillus (Bush Blackcap)	Near-threatened	Vulnerable	3	Yes	Afromontane forest and wattle plantations.	Could occur in the dense woodland stands along the proposed bulk water pipeline route.	High
Neotis denhami (Denham's Bustard)	Near-threatened	Vulnerable	12	No	Primary upland grassland, particularly on hilly terrain.	Unlikely to be present at A, but could be present on the hilly grassland surrounding Alternative B.	Moderate
Oxyura maccoa (Maccoa Duck)	Near-threatened	Near-threatened	1	Yes	Large saline pans and shallow impoundments.	Probably absent.	Low
Phoenicopterus ruber (Greater Flamingo)	-	Near-threatened	1	Yes	Restricted to large saline pans and other inland water bodies.	Absent.	Low
Polemaetus bellicosus (Martial Eagle)	Vulnerable	Endangered	3	Yes	Varied, from open karroid shrub to lowland savanna.	Uncommon foraging visitor.	Lo
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	24	No	Prefers open grassland or lightly wooded habitat.	Considered to be a regular foraging visitor on open grassland sites (both Alternative A and B).	High
Tyto capensis (African Grass-owl)	-	Vulnerable	4	Yes	Prefers rank moist grassland that borders drainage lines or wetlands.	A rare or uncommon resident.	High

Of the 21 species of concern, the following four species:

- Blue Crane (*Anthropoides paradise)* – national Near Threatened;
- Half-collared Kingfisher (*Alcedo semitorquata)* – national Near Threatened,
- Southern Bald Ibis (*Geronticus calvus)* – national Vulnerable;
- Secretarybird (*Sagittarius serpentarius*) – national Vulnerable;

are expected to be affected by the proposed development (*c*. loss of habitat or displacement due to disturbances caused by construction activities) since their preferred breeding and foraging habitat coincide with the proposed inundation zone of the dam or pipeline alignments.

Another species, the Bush Blackcap (*Lioptilus nigricapillus*; national Vulnerable) could also be present in the dense wooded kloofs along the Bulk Water Pipeline route.

However, the following four large terrestrial species could be present on the hilly and montane grasslands surrounding Dam Site B:

- Denham's Bustard (*Neotis denhami)* – national Vulnerable;
- White-bellied Korhaan (*Eupodotis senegalensis)* – national Vulnerable;
- Blue Korhaan (*E. caerulescens)* – global Near Threatened;
- Southern Ground Hornbill *Bucorvus leadbeateri*) – national Endangered;

These species could become displaced during the construction phase.

5.8.6 Aquatic fauna

Dr. P. Kotze and team of Clean Stream Biological Services (Pty) Ltd. (hereafter referred to as Kotze, 2017) were appointed to conduct an aquatic biota baseline assessment with regards to the Gabosha River and the Thole River. A copy of the report is provided in Appendix 14. This report should be consulted regarding the methodology used.

5.8.6.1 Ecological status of study area

The study area lies within the Level II EcoRegion 11.04 (Upper Highveld) (Kleynhans *et al*., 2005).

The proposed Dam Site A and Dam Site B fall within drainage region W (Mhlatuze/Usutu River System) and specifically within the secondary catchment W53. The sub-quaternary reach of concern of the Thole River is W53C-1679. The Gabosha River is a tributary of the Thole River and was not classified on sub-quaternary reach level. The Thole River flows into the Ngwempisi River (SQ Reach W53D-1801) which later flows into the Usuthu River.

For sub-quaternary reach W53C – 1679 of the Thole River in which the proposed Dam Site A would be located, the following is applicable:

- Present Ecological Status (PES) is estimated as moderately modified (Category C),
- Ecological Importance is High;
- Ecological Sensitivity is Very High (Kotze, 2017).

A recent assessment of the Usuthu-Lusutfu catchment (MTPA, 2016) also indicated that the Instream Ecostatus (Ecological Status) of the Thole River to be in a category C, with macro-invertebrates (MIRAI) to be in a category C/D and fish (FRAI) in a C (based on survey results for W5THOL-ATHOL, approximately 10km upstream of Amsterdam).

The Gabosha River is a tributary draining into sub-quaternary reach W53C-1679. Unfortunately this river was not included as a separate sub-quaternary reach in the DWS/SANBI process. It was therefore not assessed on desktop level and the PES, EI and ES information is currently not available. Based on the fact that this reach is less impacted it is anticipated that the PES could be much higher (e.g. Category A or B).

The Thole and Gabosha Rivers are indicated as Critical Biodiversity Areas: Rivers (Figure 5.16) and the surrounding areas Ecological Support Areas

(ESAs): Important subcatchments (Figure 5.16) in the freshwater assessment of Mpumalanga Biodiversity Sector Plan (2013).

Critical Biodiversity Areas (CBAs) *are areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; areas of high biodiversity value that must be maintained in a natural state. Rivers, with a 100 m buffer, that need to be maintained in a good ecological condition in order to meet biodiversity targets for freshwater ecosystems. This category includes FEPA rivers and all FEPA free-flowing rivers. The FEPA rivers include those required to meet biodiversity targets for threatened fish species.*

Ecological Support Areas (ESA) *are areas that are not essential for meeting targets, but that play an important role in supporting the functioning of CBAs and that deliver important ecosystem services. The Gabosha and Thole River catchments are furthermore indicated as Fish Support Areas, which indicates that they harbour fish populations of conservation concern, based on FEPA data augmented with regional data sets.*

It should be noted that the MBSP freshwater assessment includes information obtained from the National Freshwater Ecosystem Priority Areas (NFEPA) and threatened freshwater ecosystems databases (National Biodiversity Assessment 2011).

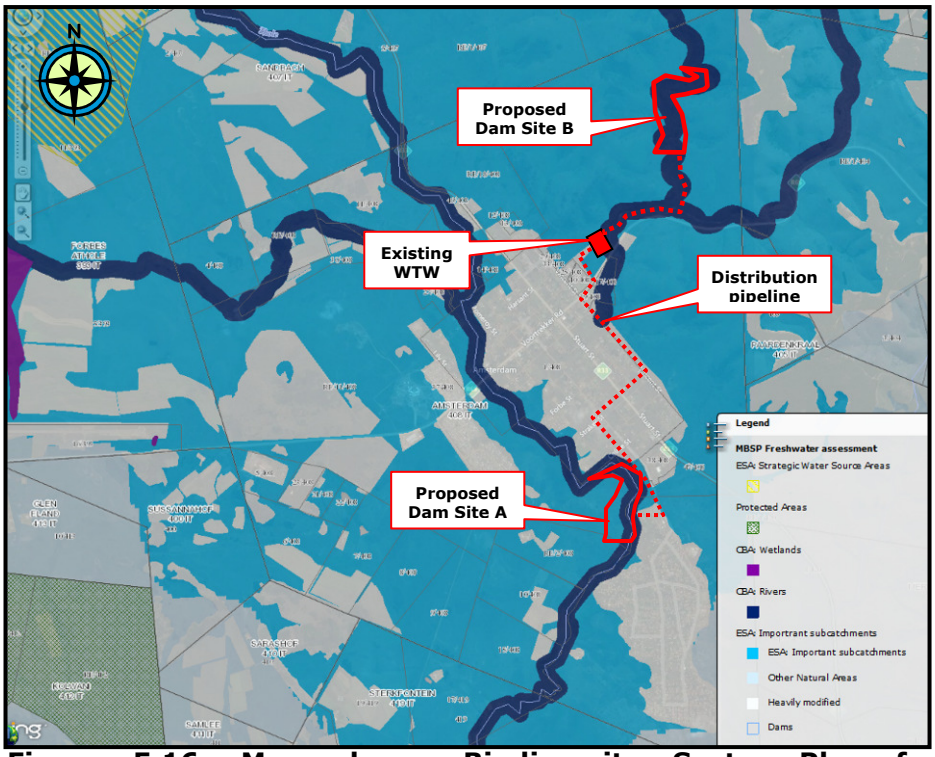


Figure 5.16: Mpumalanga Biodiversity Sector Plan freshwater assessment of the Amsterdam area (taken from MBSP, 2013).

The Thole River (SQ reach W53C-1679) is indicated to be a NFEPA River 'National Freshwater Ecosystem Priority Area' (NFEPA) according to the Atlas of Freshwater Ecosystem Priority Areas in South Africa (SANBI, 2017). The fish species of concern in this reach was indicated as *Amphilius natalensis*.

The Gabosha River reach was not assessed as part of the NFEPA process (done on sub-quaternary reach level; Kotze, 2017).

Both the Thole and Gabosha catchment areas are thus seen as important from an aquatic point of view.

A Strategic Water Source Area also straddles the upper reaches of the Gabosha River catchment (Kotze, 2017).

5.8.6.2 Site selection

Kotze (2017) selected four (4) aquatic survey sites within the Gabosha River and two (2) aquatic survey sites within the Thole River for sampling purposes. Table 5.13 provides a description of the sampling sites and Figure 5.17 indicates the location of the sites in relation to the proposed sewer line.

Table 5.13: Description of the sampling sites (taken from Kotze, 2017)

Site (Figure 5.17)	Location and Description
GB1	**Gabosha River – upstream of inundation (upstream of all proposed activities):** Site GB1 was selected in the Gabosha River upstream of the area of inundation of proposed Dam Site B. This site provides an indication of the conditions of the river before it will be impacted by the proposed dam. This site will not be directly impacted by inundation or other construction activities related to the dam. The only expected impact at this site is the impact on fish due to the downstream migration barrier to be created. Should any water transfers be made into the upper Gabosha River to provide water to the dam this site will also be impacted by flow modification. This site may however be a valuable upstream (control) site to monitor the potential impact of the dam (especially construction phase related impacts).
GB2	**Gabosha River within dam basin area (to be inundated by Dam B):** Site GB2 was selected approximately 2km downstream of site GB1 in the Gabosha River (Figure 5.17). This site falls within the basin area of proposed Dam Site B. This site will be completely inundated by the proposed dam and will be completely transformed from its current state. This site provides an indication of the river section to be completely altered as a result of the proposed dam.
GB3	**Gabosha downstream of dam B wall (downstream of all proposed dam activities).** Site GB3 is situated in the lower Gabosha River downstream of the dam wall of the proposed Dam Site B. This site is directly downstream of the proposed dam site B and will reflect all impacts (construction and operational) of this proposed development. This site will be a valuable long-term monitoring site to measure the impact of the dam on the Gabosha River aquatic ecology.
PLC-1	**Pipeline crossing (Gabosha River):** Site PLC1 was selected in the Gabosha River where it flows into the town of Amsterdam at the site where the proposed pipeline will cross the river. This site will be directly impacted by construction activities associated with the pipeline. The proposed upgrade of the existing water treatment works, as well as the desilting of the Dorps Dam will also impact on the ecology of this site.
TR-US	**Thole River upstream of Gabosha River confluence (upstream of all proposed activities):** Site TR-US was selected in the Thole River upstream of the confluence with the Gabosha River. This site is upstream of all proposed activities and impacts related to this study and provides a control site for present and future monitoring purposes to determine the aggregate impact of the development on the Thole River.
TR-DS	**Thole River downstream of all proposed impacts (Dam A or B, pump station, treatment works, pipeline crossings):** Upstream of existing water treatment works effluent. Site TR-DS was selected in the Thole River downstream of all proposed activities (impacts) related to current study. This site will reflect the aggregate impact of proposed Dam Sites A and B, the entire pipeline, Dorps Dam desilting, Water treatment facility upgrade and new pump station. This site is located upstream of the waste water treatment works in an attempt to exclude the potential impact of effluent releases from these works. This site is however largely impacted by the various impacts associated with the Amsterdam Town.
Visual observation sites	
Existing dam and abstraction facility	Dorps Dam and existing abstraction facility; existing water treatment facility
PLC 2	Pipeline crossings over seasonal tributaries or drainage lines flowing towards the Thole River.
PLC 3	

Figure 5.17: Aerial view of study area indicating location of proposed activities and aquatic sampling sites (taken from Kotze, 2017).

5.8.6.3 Site description and Instream Habitat Integrity (IHI)

Site GB1 (Figure 5.17)
Kotze (2017) indicated that the site based IHI of **Site GB1** (upstream of proposed Dam Site B) is currently in a very good condition, being classified in a category A/B (Largely natural/slightly modified) (Photo 5.4a & 5.4b). The riparian habitat integrity of this site was also in a very good condition being classified in a category A (Largely natural).

Photo 5.4a: Upstream view of site GB1 (taken from Kotze, 2017).

Photo 5.4b: Downstream view of site GB1.

Site GB1 is situated on a private farm and the surrounding area is primarily used for cattle grazing. The only notable impact at the site was from livestock farming (slight bank erosion due to cattle trampling) and an informal river crossing. Very little alien vegetation (Wattle trees) was noted. The flows are also modified by irregular releases upstream of the site from a water transfer scheme (based on land owner, requires verification) into the upper Gabosha River. These releases can result in scouring of bed substrates, increased bank erosion and also lead to unnatural cues for fish migration. The habitat integrity of this site is not expected to be impacted by any activities related to the proposed development.

Site GB2 (Figure 5.17)
Kotze (2017) indicated the instream habitat integrity of **Site GB2** also to be in a very good condition (category A/B), while there was a notable deterioration in the riparian zone condition (Category C) (Photo 5.5).

This site is situated on municipal/communal land and will be inundated by the proposed Dam Site B.

Photo 5.5a: Downstream view of site GB2.

Photo 5.5b: View of site GB2.

The instream impacts at this site are similar to those observed at Site GB1, and aggravated by extensive growth of alien invader trees (Black/Silver wattle). These trees will reduce flows and have a notable impact on flows (flow modification) during dry seasons and especially during droughts. The alien trees were also the most significant impact on the riparian zone, replacing natural vegetation and increasing bank erosion. The wattle (and potentially also indigenous) trees are being removed actively (using chain saws) by the local community and various donkey carts were observed on the day crossing the river at Site GB2 and transporting people, equipment and wood (Photo 5.5b). These continuous crossings of the river also contributed slightly to a localised increase in sedimentation and embeddedness of bottom substrates.

The habitat of this site will be completely transformed by the proposed Dam Site B as this area will fall within the basin and be completely inundated.

Site GB3 (Figure 5.17)

Kotze (2017) indicated that the habitat integrity was very similar at **Site GB3** than at Site GB2. Instream impacts were similar (category A/B) while the riparian zone improved slightly towards a category B/C (Photo 5.6a & 5.6b). This was primarily attributed to lower infestation of alien invader trees (potentially due to higher removal rate by locals as it is closer to main road and hence more accessible).

Photo 5.6a: Upstream view of site GB3.

Photo 5.6b: Downstream view of site GB3.

The habitat integrity of this site can be expected to be impacted by the proposed development (Dam Site B and Bulk Water Pipeline) during construction phase (physical removal of vegetation for access road and pipeline, increased sedimentation) as well as operational phase (Dam B) due to flow modification.

Site PLC1 (Figure 5.17)

Kotze (2017) indicated that the habitat integrity deteriorated notably downstream in the Gabosha River towards **Site PLC1** (proposed Distribution Pipeline crossing), where the instream habitat integrity fell in a category C (moderately modified) and the riparian habitat integrity in a category E (seriously modified) (Photo 5.7). This site is situated in close proximity of the town of Amsterdam. The Dorps Dam (and associated infrastructure such as pump station and water treatment facility) is also present upstream of this site and impact notably on the flows and bottom substrates.

The riparian zone at this site is in a very poor condition due to agricultural activities, grazing, erosion, alien trees and an informal river crossing (Photo 5.7a & 5.7b).

Photo 5.7a: Upstream view of site PLC1.

Photo 5.7b: Downstream view of site PLC1.

The habitat at this site is already in a poor condition and can be expected to be impacted by the proposed pipeline crossing. Secondary impacts can also be expected at this site due to flow modification by the proposed Dam Site B, desilting of the Dorps Dam and upgrading of the water purification works.

Site TR-US (Figure 5.17)

Kotze (2017) indicated that the habitat integrity of both the instream and riparian zones of **site TR-US** in the Thole River were classified in a category C (Moderately modified) (Photo 5.8a & 5.8b).

Photo 5.8a: Upstream view of site TR-US.

Photo 5.8b: Downstream view of site TR -US.

This site is located within the town of Amsterdam and hence directly impacted by the various urban related activities. Notable impacts observed at the site included:

- sedimentation of bottom substrates,
- rubbish dumping,
- bank erosion,
- some alien vegetation (Poplar trees).

This site is situated upstream of the Gabosha River confluence and should not be directly impacted by the proposed development.

Site TR-DS (Figure 5.17)

Kotze (2017) indicated that the habitat integrity remained very similar between sites TR-US and **TR-DS**, with the instream and riparian zones of the downstream site also being classified in a category C (Photo 5.9a & 5.9b).

Photo 5.9a: Upstream view of site TR-DS.

Photo 5.9b: Downstream view of site TR-DS.

The habitat integrity at this site is impacted by the aggregate impacts of Amsterdam town as well as the Gabosha and upper Thole River catchment. The most notable impacts include:

- water abstraction and flow modification (Dorps Dam, agriculture, livestock watering),
- bed modification (sedimentation),
- channel modification (trampling, erosion);
- water quality modification (especially urban runoff);
- some alien vegetation encroachment (Sesbania).

5.8.6.4 *In-situ* water quality

Kotze (2017) conducted some on-site water measurements (March 2017) in order to assist in the interpretation of the biological data. Table 5.14 provides a summary of the water quality results.

Table 5.14: In-situ water quality variables measured at the time of sampling at the selected sampling sites (March 2017 survey) (taken from Kotze, 2017).

Monitoring site	EC (mS/m)	pH	Oxygen saturation (%)	Dissolved oxygen (mg/l)	Water temp (ºC)	Turbidity (visual)	Flow (visual)	Time
GB1	6.0	*7.5*	109.0	8.62	24.2	Clear	Moderate	15H00
GB2	6.1	*7.6*	110.0	9.31	20.3	Slight	Moderate	09H00
GB3	6.2	*7.5*	110.6	9.07	22.8	Slight	Moderate	11H00
PLC 1	7.1	*7.6*	107.3	8.42	26.4	Slight	Moderate	12H00
TR-US	7.7	7.8	106.4	8.76	22.5	Slight	Moderate	09H15
TR-DS	8.1	*7.4*	111.0	8.65	25.3	Slight	Moderate	14H45

Kotze (2017) indicated that the electrical conductivity (EC) of the sites was very low, ranging between 6.0 mS/m and 8.1 mS/m (Table 5.14). The EC level in the Gabosha River remained very similar between sites GB1 to GB3, and then increased slightly towards site PLC1 after the Dorps Dam and associated activities. The EC was also slightly higher in the Thole River than in the Gabosha River, and increased slightly downstream between site TR-US and TR-DS due to the various human activities in this reach (Amsterdam Town). The overall low EC values indicate that salinity levels are currently low in the study area and should not be limiting to the aquatic biota. No notable impacts in salinity is expected as a result of the proposed activities.

The pH was circum-neutral at all sites, ranging from 7.4 to 7.8 during the March 2017 baseline survey (Table 5.14). No notable spatial deterioration was detected at the time of sampling. These levels fell within the target for fish health of between 6.5 and 9.0 as it is expected that most species will tolerate and reproduce successfully within this pH range (DWAF, 1996). Minor impacts on pH can be expected downstream of the proposed dams but it is not expected to have a significant impact on the overall status of the aquatic fauna.

Dissolved oxygen and oxygen saturation levels were very high at all sites (Table 5.14) falling above the guideline levels of >5mg/l (Kempster *et al*., 1982) and should therefore not be limiting to the ecological integrity of these sites. Significant changes in dissolved oxygen can be expected as a result of the proposed development, especially downstream of the dams. Proposed

desilting of the Dorps dam may also impact on the oxygen levels in the downstream river section.

The turbidity/clarity of the water ranged between clear to slightly discoloured. It can be assumed that the turbidity will increase during high flows and floods as a result of the sediment in the catchment. Turbidity will especially be impacted by the proposed development (construction phase of dam, pipeline crossings, desilting of Dorps Dam).

Based on these limited measurements and visual observations, it appears that the overall water quality of the Gabosha River in the vicinity of proposed Dam B is currently very good, while the quality may be moderate to good in the Thole River at the proposed Dam Site A (Kotze, 2017).

5.8.6.5 Icthyofauna (fish)

Fish habitat assessment
According to Kotze (2017), the Habitat Cover Ratings (HCRs) indicated that the diversity of habitats for fish was high at all sites, with all four velocity-depth classes (i.e. slow-deep, slow-shallow, fast-deep, fast-shallow) being present.

The upper Gabosha River sites (GB1 to GB3; Figure 5.17) were dominated by fast habitats, while slower habitats dominated site PLC1 (Figure 5.17) after the gradient decreased towards Amsterdam town. Differences in fish diversity between sites GB1 to GB3 and PLC1 can therefore be expected based on the habitat composition at the sites (Kotze, 2017).

The upstream Thole River site (TR-US; Figure 5.17) lacked fast-deep habitats, while the habitat diversity was very good at the downstream site. Habitat differences may therefore also play a role in fish diversity variation between these two sites (Kotze, 2017).

The primary feature available for fish at the sites was generally in the form of overhanging vegetation and rocky substrate. The substrate condition was generally good at sites GB1 to GB3 within the Gabosha River (Figure 5.17), with some deterioration at the rest of the sites due to sedimentation. The habitat composition at a site plays an important role in determining the expected fish species assemblage of the site, which is furthermore influenced by the prevailing water quality.

Fish species composition (pre-disturbance/reference and present)
During March 2017, Kotze (2017) sampled five (5) fish species in the Gabosha River and nine (9) in the Thole River (Table 5.15). Based on all available information, it is estimated that eleven (11) (possibly 12) indigenous fish species may occur (or have occurred under pre-disturbed conditions) in the river to be potentially impacted by the proposed developments.

Table 5.15: Indigenous fish species (CPUE: number of individuals/hour) sampled during March 2017 in the study area.

SCIENTIFIC NAME	Gabosha River				Thole River	
	GB1	GB2	GB3	PLC1	TR-US	TR-DS
AMPHILIUS cf. NATALENSIS	0.0	7.8	12.0	0.0	0.0	0.0
AMPHILIUS URANOSCOPUS	2.2	39.1	0.0	0.0	0.0	3.5
ENTEROMIUS (BARBUS) CROCODILENSIS	11.1	62.6	21.0	3.5	0.0	0.0
LABEOBARBUS MAREQUENSIS	0.0	0.0	0.0	0.0	0.0	17.6
LABEOBARBUS POLYLEPIS	0.0	0.0	0.0	0.0	0.0	14.1
CHILOGLANIS ANOTERUS	40.0	15.7	15.0	0.0	5.2	21.2
CLARIAS GARIEPINUS	0.0	0.0	0.0	0.0	0.0	17.6
PSEUDOCRENILABRUS PHILANDER	0.0	0.0	0.0	0.0	2.6	21.2
TILAPIA SPARRMANII	0.0	0.0	0.0	3.5	0.0	14.1
TOTAL	**53.3**	**125.2**	**48.0**	**7.1**	**7.8**	**109.4**

Kotze (2017) indicated that many of the expected and observed species are rheophilic species (i.e. requiring flowing habitats during all life stages and therefore has a requirement and preference for fast-shallow and fast-deep habitats (*A. uranoscopus, C. anoterus, E. crocodilensis*). It is therefore essential that the current proposed activity should not allow cessation of flow downstream of the weir at any stage, since it will lead to the loss of these species. It is also of cardinal importance that the ecological flow requirements of the affected rivers should be determined through a reserve determination process. These species also have a preference and requirement for rocky substrates of good quality, and therefore all precautions should be taken not to impact on the substrate quality. Sedimentation and excessive algal growth due to nutrient enrichment may be especially detrimental to these species.

E. anoplus, P. philander and *T. sparrmanii* prefer slow-shallow and slow-deep habitats with overhanging vegetation, aquatic macrophytes or undercut banks and water column as cover features. It is therefore essential that habitat diversity (fast and slow velocity depth categories) as well as different cover features should be maintained in the study area to ensure the protection of aquatic biodiversity (Kotze, 2017).

Conservation status

Kotze (2017) indicated that none of the fish species expected or observed in the study area are classified as threatened based on international criteria (IUCN) with all falling in the 'least concern' IUCN category (Table 5.16).

Table 5.16: Conservation status of expected and observed fish species (taken from Kotze, 2017)

SPECIES	COMMON NAME	CONSERVATION STATUS
Anguilla mossambica (adults)	Longfin eel	**Rare**
Amphilius cf. natalensis	Natal mountain catfish	IUCN: Least concern. RSA/Provincial: **Uncertain**
Amphilius uranoscopus	Stargazer (mountain catfish)	Common
Barbus anoplus (adults)	Chubbyhead barb	Widespread and common

SPECIES	COMMON NAME	CONSERVATION STATUS
Barbus argenteus	Rosefin barb	Common
Chiloglanis anoterus	Pennant-tail rock catlet	Common
Chiloglanis emarginatus	Pongola rock catlet	**Near Threatened (Skelton 2003). (IUCN, least concern)**
Clarias gariepinus	Sharptooth catfish	Widespread and common
Labeobarbus marequensis	Largescale yellowfish	Common
Labeobarbus polylepis	Smallscale yellowfish	**RSA Endemic. Becoming rare in Mpumalanga.**
Pseudocrenilabrus philander	Southern mouthbrooder	Common
Tilapia sparrmanii	Banded tilapia	Common

Chiloglanis emarginatus is however classified as near threatened (RSA red list, Skelton, 2003). This species is threatened by water abstraction, river regulation and sedimentation (Skelton, 2003).

Kotze (2017) indicated that it is unlikely that this species is present in the Gabosha River with a low probability that it occurs in the Thole River. This species may well be present in the downstream receiving rivers (Ngwempisi) and should therefore be considered important when setting flows through a reserve determination process.

The conservation status of *Amphilius cf. natalensis* also requires further verification in future (outside scope of current study).

Although the two yellowfish species are classified as "least concern" by Wolhuter & Impson (2007), as for most yellowfish in South Africa, their natural distribution range is shrinking, but they are however still widely distributed and relatively abundant in many rivers (Roux, F: in Wolhuter & Impson, 2007). *Labeobarbus polylepis* is especially becoming rare in Mpumalanga province.

Alien fish species

Kotze (2017) indicated that no alien fish species were sampled in the Gabosha and Thole Rivers. Largemouth bass (*Micropterus salmoides*) might however be present.

Biotic integrity based on fish

Kotze (2017) indicated that the Present Ecological Status (PES), based on fish, of the Gabosha River reach of concern (GB1 to PLC1; Figure 5.17) was calculated to fall in an ecological category B (largely natural to slightly modified), with a Fish Response Assessment Index (FRAI) score of 86.5% calculated. The primary impacts are associated with:

- sedimentation of rocky bottom substrate,
- flow modification (water transfers),
- bank erosion,
- alien vegetation encroachment,
- presence of Dorps Dam.

Kotze (2017) indicated that there is a gradual downstream deterioration with increasing levels of impacts.

Kotze (2017) estimated the PES of the Thole River reach of concern to fall in a category C (i.e. Moderately modified), with a FRAI score of 86.5%. Kotze (2017) indicated that this corresponds well with the category C calculated for fish in the Thole River (MTPA, 2016). The primary impacts are associated with:

- sedimentation of rocky bottom substrate,
- water quality deterioration (especially Amsterdam town and associated infrastructure as well as agriculture and livestock farming);
- alien vegetation encroachment,
- vegetation removal,
- erosion,
- flow modification (water transfers and Dorps Dam).

Kotze (2017) indicated that there is a gradual downstream deterioration with increasing levels of impacts.

5.8.6.6 Aquatic macro-invertebrate diversity

Taxa richness and relative intolerance to water quality alterations
Kotze (2017) sampled 34 aquatic invertebrate taxa (family level) at the sampling points (Figure 5.17).

Four taxa (or indicator groups) with a high requirement for unmodified water quality, namely Perlidae, Heptageniidae >2spp. Baetidae and >2spp. Hydropsychidae, were sampled in the study area. These are the most valuable indicator taxa to be used to monitor potential deterioration associated with the proposed or other activities in the catchment, especially in terms of water quality and flow modification as well as increased sedimentation due to their preference for substrate habitats.

Five taxa (15% of all taxa sampled) with a moderate requirement for unmodified water quality were also sampled in the study area. These taxa can also be expected to react to water quality deterioration and could also be used as potential indicator taxa of water quality deterioration during a future biomonitoring programme.

Eighteen taxa (53% of all taxa sample) observed in the study area have a low requirement for unmodified water quality while seven of the observed invertebrate taxa (21% of all taxa sampled) have a very low requirement for unmodified water quality.

Habitat preferences
The invertebrates of the study area require a diversity of habitats to ensure the maintenance of the present ecological integrity. Some taxa observed prefer slow or very slow habitat and may be negatively influenced by unnatural increase in flows, such as through unnaturally high return flows and water transfer schemes.

Some taxa again prefer moderately fast to fast (>0.3m/s) and may be negatively influenced by a reduction of flow, through activities such as dam and weir construction, water abstraction, etc.

In terms of substrate and cover requirements, the highest proportion of the invertebrate taxa prefer cobbles, while some prefer vegetation, gravel-sand-mud or water column. It is therefore important to especially maintain good quality cobble (substrate) habitats, while a diversity of cover features will be essential to maintain the diversity of invertebrates.

The substrate habitat features can be impacted by aspects such as erosion, resulting in sedimentation and clogging of interstitial spaces between rocks, excessive algal growth, often associated with nutrient enrichment.

Biotic integrity based on aquatic macro-invertebrates

Gabosha River
SASS5 scores calculated during March 2017 for the Gabosha River sites ranged between 142 (site GB3) and 105 (site PLC1), while the ASPT scores ranged between 6.45 (site GB3) to 6.18 (site PLC1) (Table 5.17).

Based on the SASS5 interpretation guidelines (Dallas, 2007) the upper reaches of the Gabosha River within the study area (GB1 to GB3) was in a very good ecological state (category B to B/C), which deteriorated downstream (after the Dorps Dam and associated Amsterdam town influences) to a category C.

Overall the Gabosha River reach of concern (site GB1 to PLC1) can be classified in a category B/C based on macroinvertebrates. Habitat suitability and availability was very good at all sites within the Gabosha River (Table 5.17). The good habitat was also confirmed by relatively high (>80%) Integrated Habitat Assessment System (IHAS) scores for the Gabosha River sites (Appendix 2 of Appendix 14).

Thole River
The SASS5 and ASPT scores calculated for the Thole River ranged between 98 and 5.44 respectively at site TR-US to 85 and 6.07 at site TR-DS (Table 5.17).

Based on the SASS interpretation guidelines (Dallas, 2007), site TR-US can be classified in a category D (largely modified) while site TR-DS falls in a category C (moderately modified).

Overall the Thole River reach of concern can therefore be placed in a category C/D, which corresponds to the calculations from a recent study by MTPA that also indicated the Thole River to fall within a category C/D based on the application of the MIRAI macro-invertebrate index (MTPA, 2016).

Although the SASS5 score decreased slightly between site TR-US and TR-DS, the ASPT and EC indicated the opposite trend (Table 5.17). It therefore indicated that after the inflow of the Gabosha River into the Thole River, and after the Amsterdam town impacts, there was no notable downstream change in the macro-invertebrate assemblage.

Habitat suitability and availability was slightly lower in the Thole River than the Gabosha River due to the increased level of human activities along the Thole River reach (Table 5.17, Appendix 2 of Appendix 14).

Table 5.17: SASS5 results of sites within the Gabosha and Thole River reaches of concern (March 2017 survey) (taken from Kotze, 2017)

Monitoring site	SASS5 score	ASPT	EC*	SASS5-score per biotope			Biotope availability and suitability (Scores)			
				SASS Stones	SASS Vegetation	SASS GSM	Stones	Vegetation	GSM	Combined
GB1	128	6.40	B	90	70	17	6	6	2	14
GB2	132	6.29	B/C	70	47	42	9	4	3	16
GB3	142	6.45	B	93	67	33	7	6	4	17
PLC1	105	6.18	C	68	45	30	5	7	6	18
TR-US	98	5.44	D	54	43	14	4	5	3	12
TR-DS	85	6.07	C	61	24	13	4	6	3	13

*EC: Ecological Category based on SASS5 interpretation guidelines (Dallas, 2007)

5.9 Surface water

5.9.1 Catchment

The proposed Dam Site A would be located within the Thole River and the proposed Dam Site B would be located within the Gabosha River (Figure 2.1).

The Thole and Gabosha Rivers are tributaries of the Ngwempisi River (W53 catchments), which is a tributary of the Usutu River. The Usutu River has its headwaters in South Africa and flows into Swaziland after which it joins the Pongola River to form the Maputo River just before the South Africa/Mozambique border. The catchment is thus an international water course, forming part of the Maputo River Basin (Mallory and Jacobs, 2014).

Cross-border flows

The Tripartite Agreement between the Republic of Mozambique, the Republic of South Africa and the Kingdom of Swaziland (Interim IncoMaputo Agreement, 2002; Appendix 3) specifies the minimum amount of water that must be released into Swaziland. Table 5.18 provides an indication of the minimum cross-border flows into Swaziland as per the Interim IncoMaputo Agreement (IIMA).

Table 5.18: Minimum cross-border flows according to the Interim IncoMaputo Agreement (taken from Mallory and Jacobs, 2014).

RIVER	KEY POINT	INTERIM TARGET INSTREAM FLOW	
		MEAN (million m^3/a)	MINIMUM (m^3/s)
Ngwempisi	GS21	30	0.1
Usuthu	GS23	20	0.1
	Big Bend (GS16)	520	1.7

The Ngwepisi River catchment up to the Swaziland border consists of 4 quaternary catchments and a third of the W53E quaternary catchment (Figure 5.18) with a total area of about 1 540 km^2 (Mallory, 2017).

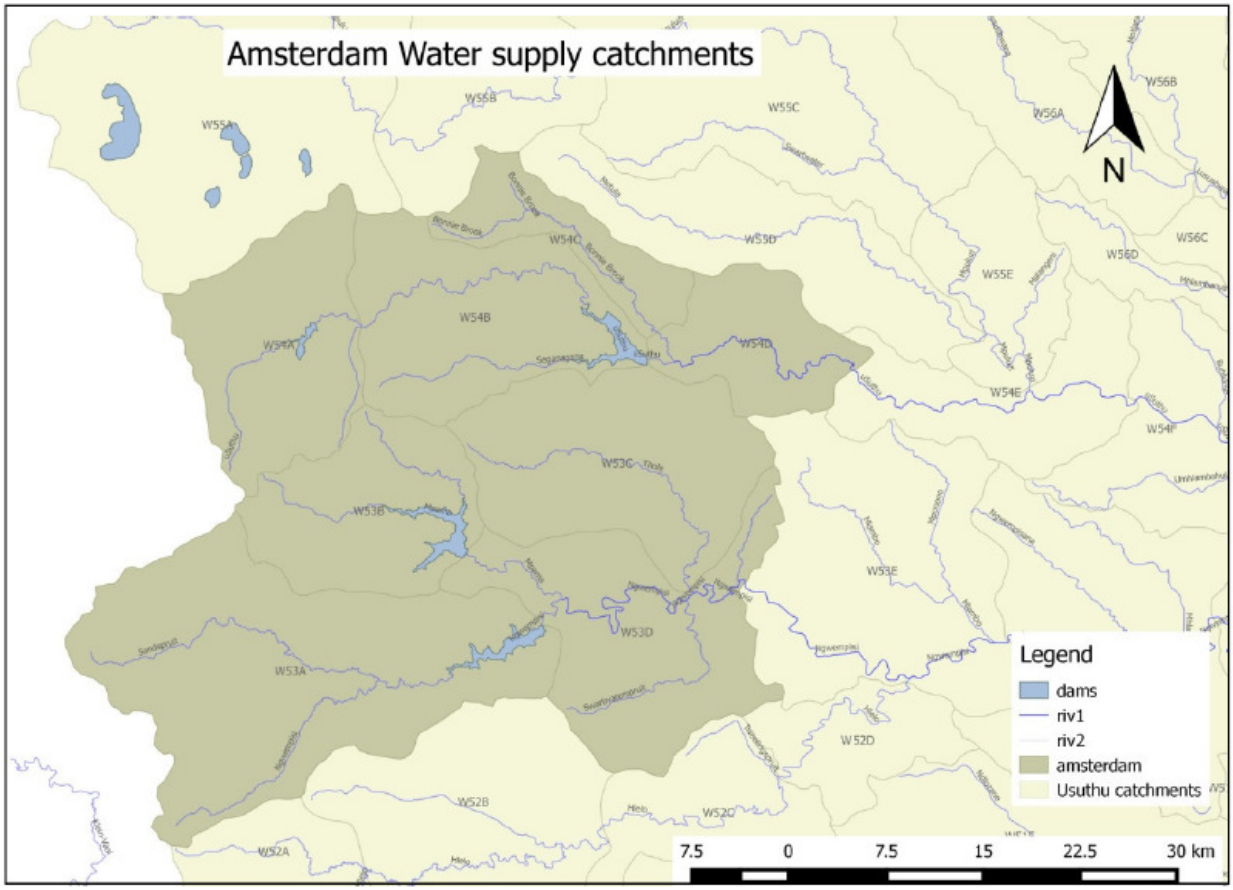


Figure 5.18: Catchments of the Amsterdam water supply area (taken from Mallory and Jacobs, 2014).

Table 5.19 provides hydrological and catchment information for the Usuthu and Ngwempisi catchments.

Table 5.19: Hydrology and catchment information for the Usuthu and Ngwempisi catchments (taken from Mallory and Jacobs, 2014).

QUATERNARY CATCHMENT	GROSS CATCHMENT AREA (km^2)	MEAN ANNUAL		
		EVAPORATION (mm)	PRECIPITATION (mm)	RUNOFF (million m^3/a)
NGWEMPISI RIVER				
W53A	548	1400	825	50.01
W53B	219	1400	857	19.17
W53C*	**316**	**1400**	**913**	**37.45**
W53D	315	1400	867	31.69
USUTHU RIVER				
W54A	251	1400	783	16.87
W54B	282	1400	846	24.4
W54C	107	1400	867	9.43
W54D	139	1400	896	20.17

*Legend: *: Proposed Dam Site A, Dam Site B, distribution pipeline and bulk water pipeline located in this catchment.*

Mallory and Jacobs (2014) indicated that Amsterdam falls within the W53C catchment that only contributes 19% of the runoff at the border with Swaziland. The remaining 81% is derived from the W53A, B and D catchments.

5.9.2 Water transfer scheme

The Usuthu River Government Water Scheme is located within the Ngwempisi/Usutu sub-catchment area transferring water from the upper Ngwempisi catchment to the Olifants catchment for power generation (i.e. for cooling purposes in Eskom power stations).

Table 5.20 provides an indication of water being transferred between the catchments as part of the Usuthu River Government Water Scheme.

Table 5.20: Details of the Usuthu River Government Water Scheme (taken from Mallory and Jacobs, 2014)

USUTHU RIVER GOVERNMENT WATER SCHEME: TRANSFERS OUT						
DAM	**CATCHEMNT & RIVER**	**GROSS CAPACITY (10^6m^3)**	**SURFACE AREA (ha)**	**TRANSFER TO**	**TRANSFER VOLUME (10^6m^3/year)**	
Churchill weir	W54C;			Westoe Dam	0.5	70 (71 allocation)
Westoe Dam	W54B; Usuthu	61.90	733.3	Jericho Dam		
Morgenstond Dam	W53A; Ngwempisi	100.77	977.2	Jericho Dam		
Jericho Dam	W53B; Mpama	59.50	982.5	Olifants WMA		

The Jericho and Morgenstond dams (Table 5.20) are located west of Amsterdam and have a major impact on the flow in the Ngwempisi River, which is a major tributary of the Usuthu River which flows into Swaziland (Mallory, 2017).

The Sandcliff Dam is also located on the Usuthu River within quaternary catchment W54A and has a surface area of 144 ha and an estimated gross capacity of 0.156 x 10^6 m^3 (Mallory and Jacobs, 2014).

5.9.3 Water use in the overall catchment area

Mallory and Jacobs (2014) indicated that the only significant land use in the Upper Usuthu catchment is forestry and irrigation (agriculture).

Domestic water use

A weir (known as Dorps Dam) in the Gabosha River is the current abstraction point for Amsterdam. This weir has a gross capacity of 220 000m^3 but is currently silted up. Amsterdam is reliant on run-of-river (Mallory and Jacobs, 2014).

Other than water usage by Amsterdam, there is very limited abstractions for domestic use from run-of-river in the Ngwempisi catchment (Mallory and Jacobs, 2014).

Irrigation

Table 5.21 provides an indication of areas of registered irrigation water use and irrigation requirements for the Usuthu and Ngwempisi catchments.

Table 5.21: Areas of registered irrigation and irrigation requirements for the Usuthu and Ngwempisi catchments (taken from Mallory and Jacobs, 2014).

QUATERNARY CATCHMENT & AREA (km^2)	CROPS (km^2)				IRRIGATION	
	VEGETABLES	PASTURES	OTHER	MAIZE	AREA (km^2)	REQUIREMENT (million m3/a)
NGWEMPISI RIVER						
W53A; 548	0.5	0.3	-	1.4	2.2	0.702
W53B; 219	0.45	-	-	-	0.45	0.191
W53C*; 316	**1.6**	**0.8**	**0.07**	**-**	**2.5**	**0.905**
W53D; 315	-	0.98	0.37	-	1.35	0.507
USUTHU RIVER						
W54A; 251	-	0.17	1.20	1.30	2.67	1.26
W54B; 282	-	-	-	-	-	-
W54C; 107	0.08	0.15	0.06	-	0.27	0.112
W54D; 139	-	-	-	-	-	-

*Legend: *: Proposed Dam Site A, Dam Site B, distribution pipeline and bulk water pipeline located in this catchment.*

Mallory (2017) indicated that there is an area of approximately 30 ha of irrigation (Figure 5.19a) on the Thole River downstream of the proposed dam sites. Pivot irrigation is also evident further downstream as indicated in Figure 5.19b.

Figure 5.19a: Irrigation downstream of Amsterdam on the Thole River (taken from Mallory, 2017)

Figure 5.19b: Pivot irrigation downstream of Amsterdam on the Thole River visible on Google aerial view

Forestry

Table 5.22 provides an indication of areas of forestry in the Usuthu and Ngwempisi catchments as obtained from the WARMS database.

Table 5.22: Areas of forestry in the Usuthu and Ngwempisi catchments (taken from Mallory and Jacobs, 2014).

QUATERNARY CATCHMENT	CATCHMENT AREA (km^2)	WARMS (km^2)
NGWEMPISI RIVER		
W53A	548	164.96
W53B	219	34.45
W53C*	**316**	**56.95**
W53D	315	157.96
TOTAL:	**1398**	**414.32**
USUTHU RIVER		
W54A	251	25.41
W54B	282	78.07
W54C	107	46.45
W54D9	139	49.77
TOTAL:	**779**	**199.70**

*Legend: *: Proposed Dam Site A, Dam Site B, distribution pipeline and bulk water pipeline located in this catchment.*

Invasive alien plants

Table 5.23 provides an indication of the total areas covered by invasive alien plants (i.e. landscape and riparia) in the Usuthu and Ngwempisi catchments as obtained from the National Invasive Alien Plant Survey (NIAPS) project (Mallory and Jacobs, 2014).

Table 5.23: Areas covered by invasive alien plants in the Usuthu and Ngwempisi catchments (taken from Mallory and Jacobs, 2014).

QUATERNARY CATCHMENT	CATCHMENT AREA (km^2)	NIAPS (km^2)
NGWEMPISI RIVER		
W53A	548	0.7
W53B	219	1.9
W53C*	**316**	**4.2**
W53D	315	20.9
TOTAL:	**1398**	**27.70**
USUTHU RIVER		
W54A	251	0.7
W54B	282	82.2
W54C	107	0.0
W54D9	139	0.0
TOTAL:	**779**	**82.90**

*Legend: *: Proposed Dam Site A, Dam Site B, distribution pipeline and bulk water pipeline located in this catchment.*

Streamflow reduction due to forestry and invasive alien plants

Table 5.24 provides an indication of streamflow reduction due to forestry and invasive alien plants in the Usuthu and Ngwempisi catchments. The impact of forestry and alien vegetation on streamflow is very significant and will definitely impact on the yield of the system (Mallory and Jacobs, 2014).

Table 5.24: Streamflow reduction due to forestry and invasive alien plants in the Usuthu and Ngwempisi catchments (taken from Mallory and Jacobs, 2014).

QUATERNARY CATCHMENT	CATCHMENT AREA (km^2)	NATURAL MEAN ANNUAL RUNOFF (million m^3/a)	STREAMFLOW REDUCTION DUE TO	
			FORESTRY (million m^3/a)	ALIEN VEGETATION (million m^3/a)
NGWEMPISI RIVER				
W53A	548	39.63	7.78	0.06
W53B	219	58.8	1.36	0.21
W53C*	**316**	**19.75**	**2.11**	**1.77**
W53D	315	36.48	6.43	1.41
W53 TOTAL:	**1398**	**154.66**	**17.68**	**3.44**
USUTHU RIVER				
W54A	251	17.43	0.76	0.03
W54B	282	30.8	3.15	4.41
W54C	107	9.22	2.27	0.00
W54D	139	21.73	5.97	0.01
W54 TOTAL:	**779**	**79.18**	**12.15**	**4.45**
TOTAL:	**2177**	**233.84**	**29.83**	**7.89**

*Legend: *: Proposed Dam Site A, Dam Site B, distribution pipeline and bulk water pipeline located in this catchment.*

5.9.4 W53C catchment, Thole and Gabosha Rivers

Table 5.25 provides catchment information with regards to W53C, the Thole and Gabosha Rivers.

Table 5.25: Catchment information with regards to W53C, the Thole and Gabosha Rivers (taken from Mallory and Jacobs, 2015)

Catchment	Catchment Area (km^2) (incremental)	Mean Annual Evaporation (mm)	Mean Annual Precipitation (mm)	Mean Annual Runoff (million m^3/a) (1950 to 1993)	
				Natural (cumulative)	Present Day (present day)
W53C	316	1400	913	30.28	27.84
Thole	199.84			122.1	19.74
Gabosche	70.2			6.61	6.005

Source: WR2005 (Middleton and Bailey, 2008)

According to Mallory and Jacobs (2015) and Mallory (2017), there is limited water use in the Thole and Gabosha River catchments. Afforestation however, reduces runoff (Table 5.26).

Table 5.26: Water use in the Thole and Gabosha catchments (taken from Mallory and Jacobs, 2015; Mallory, 2017)

QUATERNARY CATCHMENT	WATER USE (million m^3/annum)		Streamflow reduction (million m^3/annum)	
	Domestic	Irrigation	Forestry	Invasive alien plants
W53C	0.6	0.905	2.11	1.8
Thole		0.905	1.33	0.77
Gabosha 1		0.000	0.47	0.19
Amsterdam Weir		0.905	1.80	0.96
Gabosha 2	0.6	0.000	0.47	0.19

Irrigation is an important water use in the Thole catchment with forestry and invasive alien plants contributing to streamflow reduction (Table 5.26).

In the Gabosha catchment, no irrigation takes place (Table 5.26) with very little streamflow reduction due to forestry and alien invasive plants.

Mallory (2017) indicated that the domestic use of 0.6 million m^3/annum (Table 5.26) is the current estimated water requirement of Amsterdam. Water is abstracted from the Dorps Dam located in the Gabosha River (Afri-Infra, 2016). The yield of the river at this abstraction point is estimated at 0.33 Mm^3/a (WSDP, 2010). Raw water is treated at the existing Amsterdam Water Treatment Works (WTWs) with a capacity of approximately 7 Ml/day. Clean water is then distributed to the storage facilities of Amsterdam and KwaThandeka.

5.9.5 Ecological water requirements

It is a requirement in terms of South Africa's National Water Act to allow some water to remain in the river to sustain the ecological functioning of the river. This water is referred to as the Ecological Reserve or Ecological Water Requirement (EWR).

The EWR for the W53C catchment was estimated for a C ecological category using the Hughes Desktop model (Hughes and Hannart, 2003). Table 5.27 provides a summary of the Ecological Reserve or Ecological Water Requirement (EWR).

Table 5.27: Summary of Ecological Reserve in terms of MAR (WR2005 hydrology) (taken from Mallory, 2017)

Catchment	MAR (natural)	EWR	
	million m^3/annum	million m^3/annum	% of MAR
W53C	30.3	8.03	26.5
Thole	22.1	5.86	26.5
Gabosche1	6.6	1.75	26.5
Amsterdam Weir	27.9	7.39	26.5
Gabosche 2	4.8	1.27	26.5

5.9.6 Thole River catchment

The proposed Dam Site A would be located within the Thole River catchment (Figure 2.1). Although the distribution pipeline would extend through the residential area of Amsterdam, it would extend across a tributary of the Thole River and the Gabosha River (Figure 2.1).

The Thole River originates on the farm Athole 392 IT, also in close proximity to the Westoe Dam (Figure 2.1). It then flows in a southeasterly direction across the farms Athole 392 IT, Forbes Athole 393 IT, Glenaggy 406 IT, Sandbach 407 IT, Amsterdam 408 IT and Sterkfontein 419 IT where it joins the Ngwempisi River ±6 km downstream of the proposed Dam Site A (Figure 2.1).

From the topographical map and Google aerial view, it is evident that cultivation and some afforestation affects the upper catchment area located on the farms Athole 392 IT, Forbes Athole 393 IT, Glenaggy 406 IT and Sandbach 407 IT (Figure 2.1). In close proximity of Amsterdam and proposed Dam Site A, cultivation, afforestation and urban development impacts on the Thole catchment (Figure 2.1). Downstream of Amsterdam, cultivation and agricultural activities (e.g. irrigation) impact on the Thole River catchment (Figure 2.1).

For a distance of approximately 11.2km upstream of the proposed Dam Site A, there are no physical barriers in the river system (i.e. weirs, dams, etc.) (Kotze, 2016). At 11.2km upstream of the dam site, it appears that a small weir is present. No other physical barriers are present in the remainder of the upstream Thole River reach (Kotze, 2016).

There appears to be no weirs/dams downstream (approximately 7.8km) of the proposed Dam Site A (Kotze, 2016). The Amsterdam Waste Water Treatment Works is located approximately 1.8km downstream of the proposed Dam Site A. Effluent from this WWTW could impact on the water quality of the Thole River and cause a chemical migration barrier to fish from time to time depending on how the WWTWs is managed (Kotze, 2016).

No large physical barriers (weirs/dams) are located in the downstream reaches of the Ngwempisi/Mhlatuze and Usuthu Rivers (Kotze, 2016).

5.9.7 Gabosha River catchment

The proposed Dam Site B and the bulk water pipeline would be located within the Gabosha River catchment (Figure 2.1) with numerous tributaries flowing into the Gabosha River (Figure 2.1).

The Gabosha River originates on the farm Westoe 394 IT, in close proximity to the Westoe Dam which is located on the Usutu River (Figure 2.1). It then flows in a southeasterly direction across the farms Westoe 394 IT, Glenaggy 406 IT, Sandbach 407 IT and Amsterdam 408 IT (Figure 2.1). It joins the Thole River just below the residential area of Amsterdam (Figure 2.1).

From the topographical map and Google aerial view, it is evident that afforestation occurs mostly on the farm Westoe 394 IT, in close proximity to the Westoe Dam (Figure 2.1). Limited cultivation takes place on the farm Westoe 394 IT and Glenaggy 406 IT, i.e. within the catchment area of the Gabosha River (Figure 2.1). Two small farm dams are located on the farm Westoe 394 IT (Figure 2.1) and one small farm dam on the farm Glenaggy 406 IT (Figure 2.1).

No cultivation or afforestation takes place on the farm Sandbach 407 IT, i.e. within the catchment area of the Gabosha River (Figure 2.1). No dams are present on this farm (Figure 2.1).

No cultivation or afforestation takes place within the proposed Dam Site B (Figure 2.1). No dams are present within this area (Figure 2.1).

The Tweelingspruit joins the Gabosha River in close proximity of the provincial R65 road (Figure 2.1).

Downstream of the proposed Dam Site B, the catchment is impacted in terms of afforestation, road building, residential development, roads, etc. (i.e. the built up area of Amsterdam; Figure 2.1). The Dorps Dam, the water abstraction point for Amsterdam, is located in the Gabosha River upstream of Amsterdam (Figure 2.1).

5.9.8 Wetlands associated with the Thole and Gabosha Rivers

The Thole and Gabosha Rivers are indicated as Critical Biodiversity Areas: Rivers (Figure 5.16) and the surrounding areas Ecological Support Areas (ESAs): Important subcatchments (Figure 5.16) in the freshwater assessment of Mpumalanga Biodiversity Sector Plan (2013).

Venter and Niemand (2017b) indicated the following:

- **Dam Site A:** mostly located in a Critical Biodiversity Area, very small portions are located in a Heavily Modified Area or Ecological Support Area (Figure 5.16);
- **Distribution Pipeline:** majority of pipeline located in an Ecological Support Area with a portion in a Critical Biodiversity Area (Figure 5.16);
- **Dam Site B:** majority of site is located within a Critical Biodiversity Area, with a small portion in an Ecological Support Area (Figure 5.16);
- **Bulk Water Pipeline:** mostly in a Heavily Modified Area (Figure 5.16).

It should be noted that the MBSP freshwater assessment includes information obtained from the National Freshwater Ecosystem Priority Areas (NFEPA) and threatened freshwater ecosystems databases (National Biodiversity Assessment 2011).

Venter and Niemand (2017b) however, indicated that no wetland units are indicated on site in the NFEPA database. This is not unusual, since the NFEPA database mostly only contains permanent wetland units. The only river

included in the NFEPA database is the Thole River, in which the proposed Dam Site A is located. According to this database, the Present Ecological Status (PES) class of the river is AB.

According to the Department of Water Affairs (DWS) Resource Quality Information System (RQIS) for the region W5, the Present Ecological State (PES) of the site is class C, which is Moderately Modified, the Ecological Importance (EI) is High and the Ecological State (ES) is Very High. This PES class is expected to be more accurate than the estimated NFEPA PES class.

Both the Thole and Gabosha catchment areas are thus seen as important from an aquatic point of view.

For sub-quaternary reach W53C – 1679 of the Thole River in which the proposed Dam Site A would be located, the following is applicable:

- Present Ecological Status (PES) is estimated as moderately modified (Category C),
- Ecological Importance is High;
- Ecological Sensitivity is Very High (Kotze, 2016).

The Gabosha River is a tributary draining into sub-quaternary reach W53C-1679. Unfortunately this river was not included as a separate sub-quaternary reach in the DWS/SANBI process. It was therefore not assessed on desktop level and the PES, EI and ES information is currently not available. Based on the fact that this reach is less impacted it is anticipated that the PES could be much higher (e.g. Category A or B).

5.9.8.1 Wetland delineation study

A wetland delineation study was undertaken by Ina Venter of Kyllinga Consulting as part of the overall ecological assessment (hereafter referred to as Venter and Niemand, 2017b). A copy of the said report is provided in Appendix 13 and should be consulted with regards to methodology used.

Watercourses identified

Venter and Niemand (2017b) identified a number of watercourses within the overall study area that would be affected by the proposed project as indicated in Table 5.28.

Table 5.28: Watercourses identified within project area (taken from Venter and Niemand, 2017b)

VEGETATION UNIT	VEGETATION SUB-UNIT	SENSITIVITY	DAM SITE A		DAM SITE B		DISTRIBUTION PIPELINE		BULK WATER PIPELINE	
			ha	%	ha	%	ha	%	ha	%
Watercourse	CVB	High	2.33	6.6			1.82	1.5		
	Drainage line	High			1.17	3.1			0.90	2.2
	River	High	3.63	10.3	4.87	12.9	2.46	2.0	0.65	1.6
	Seep	High	3.72	10.6			1.79	1.4		
Artificial watercourse	Artificial seep	Moderate					0.69	0.6		
	Dam	Moderate					1.46	1.2		
TOTAL:			**9.68**		**6.04**		**8.22**		**1.55**	

Dam Site A (Figure 5.12):

The following watercourses were identified – River (Thole River); Channelled Valley Bottom Wetland (CVB); Seep Wetland - within the proposed Dam Site A (Figure 5.12). No drainage lines or artificial wetlands were identified (Table 5.28).

River

Dam Site A is located within the Thole River (Figure 5.12). At this location, the river banks are mostly dominated by grass species, with a number of woody, forb and sedge species also present (Photo 5.10).

Photo 5.10: The Thole River at Dam Site A (taken from Venter and Niemand, 2017b)

Dominant species include *Agrostis continua, Buddleja* species, *Combretum erythrophyllum, Cymbopogon caesius, Cynodon dactylon, Eragrostis plana* and *Panicum maximum.* Several signs of disturbance are present and development takes place close to the river, but the vegetation is still dominated by indigenous species. A total of 3.64 ha of this vegetation unit falls within Dam Site A and its 50m buffer (Table 5.28).

Wetlands

Venter and Niemand (2017) indicated that the lower portions of four Channelled Valley Bottom (CVB) wetland units are present at the proposed Dam Site A (Figure 5.12) as well as a seep (Seep 2; Figure 5.12) which is located adjacent to the Thole River (Figure 5.12). The seep is located adjacent to the Thole River and may occasionally be flooded if the Thole River overtops the banks, but the wetland can more correctly be classified as a seep wetland. The size of the channelled valley bottom wetlands affected by Dam Site A is 2.33 ha while the seep area is 3.72 ha (Table 5.28).

The wetland units are mostly dominated by indigenous grass and sedge species, but are being invaded by invasive species, including *Sesbania punicea, Cirsium vulgare, Verbena bonariense, Verbena brasiliense* and *Mirabilis jalapa,* as well as several other alien species, close to existing disturbances and developments.

Indigenous species include *Sporobolus africana, Eragrostis plana, Agrostis continuata, Kyllinga erecta, Schoenoplectus corymbosus, Phragmites australis, Andropogon eucomis* and several other species typical to wetland units in the area.

Although the various disturbances affect the vegetation composition of the wetland units, large portions of the vegetation are still in a fairly good condition. Since all wetland units are considered to be of conservation importance all the wetland units are considered to be of high sensitivity. These units, although of small surface area, provide ecological connectivity to similar units within their local catchments and is often utilised by facultative wetland fauna species such as the near threatened Serval (*Leptailurus serval*), Swamp Musk Shrew (*Crocidura mariquensis*) and the widespread albeit near threatened Vlei Rat (*Otomys auratus*). It is one of few habitat

types that often contains a distinct and prominent fauna assemblage which is absent from the surrounding "dryland" grassland units.

Dam Site B (Figure 5.14):
The following watercourses were identified – River (Gabosha River); Drainage lines (5 first order drainage lines) within the proposed Dam Site B (Figure 5.14). No wetlands or artificial wetlands were identified (Table 5.28).

Dam Site B is located within the Gabosha River (Figure 5.28). The portion of the Gabosha River at this location has a strong woody component, in addition to the grass, sedge and forb species present (Photo 5.11).

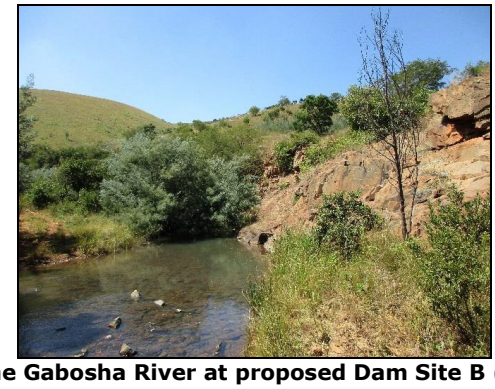


Photo 5.11: View of the Gabosha River at proposed Dam Site B (taken from Venter and Niemand, 2017)

Several alien and invasive plant species are present, including *Acacia dealbata, Ipomoea purpurea, Lantana camara, Solanum mauritianum, Tagetus minuta* and *Verbena rigida.* Indigenous species include *Diospyros lycoides, Sporobolus africana, Eragrostis plana, Clemaris brachiata, Fimbristylus complanata, Scadoxus* and *Kyllinga erecta.* The indigenous to alien species mix is approximately even.

Although the vegetation has a high percentage of alien and invasive plant species, several indigenous plant species are still present on site. A total of 4.87 ha of this vegetation unit falls within the Dam Site B and its 50m buffer (Table 5.28).

Several first order **drainage lines** are present on the steep slopes surrounding the proposed Dam Site B (Figure 5.14). The vegetation component of these drainage lines are the same as the indigenous woody vegetation present on these slopes, with a few patches invaded by *Acacia dealbata*. The drainage lines have an area of 1.71ha.

These linear features also play a major role in providing fauna taxa access to the large rivers where perennial surface water is present. The vegetation is therefore considered to have the same sensitivity as the indigenous woody vegetation unit and is therefore of high sensitivity.

Distribution Pipeline:
The following watercourses were identified along the proposed Distribution Pipeline route (Figure 5.13a & 5.13b): River; Channelled valley bottom (CVB); Seep Wetland; Artificial seep and dam.

The proposed distribution line will cross the Gabosha **River** in the northern portion of Amsterdam (Figure 5.13a & 5.13b). The vegetation is dominated

by grass and sedge species in this area, including *Eragrostis plana, Sporobolus africana, Paspalum dilatatum, Schoenoplectus corymbosus* and *Isolepis* species. A number of invasive species are also present, including *Acacia dealbata, Solanum sisymbriifolia, Solanum mauritianum, Populus x canescens* and *Cirsium vulgare.*

The vegetation has a higher density of alien and invasive species, especially invasive trees, lower downstream in Amsterdam. A river vegetation unit of 2.49ha falls within the Distribution Pipeline route and 100m buffer zone (Table 5.28).

Venter and Niemand (2017) indicated that four **Channelled Valley Bottom (CVB) wetland units** and a **seep** (Figure 5.13a & 5.13b) will be crossed by the proposed Distribution Pipeline. The size of the channelled valley bottom wetlands affected by Distribution Pipeline is 1.82 ha while the seep area is 1.79 ha (Table 5.28).

The wetland units are mostly dominated by indigenous grass and sedge species, but are being invaded by invasive species, including *Sesbania punicea, Cirsium vulgare, Verbena bonariense, Verbena brasiliense* and *Mirabilis jalapa,* as well as several other alien species, close to existing disturbances and developments.

Indigenous species include *Sporobolus africana, Eragrostis plana, Agrostis continuata, Kyllinga erecta, Schoenoplectus corymbosus, Phragmites australis, Andropogon eucomis* and several other species typical to wetland units in the area.

Although the various disturbances affect the vegetation composition of the wetland units, large portions of the vegetation are still in a fairly good condition. Since all wetland units are considered to be of conservation importance all the wetland units are considered to be of high sensitivity.

These units, although of small surface area, provide ecological connectivity to similar units in within their local catchments and is often utilised by facultative wetland fauna species such as the near threatened Serval (*Leptailurus serval*), Swamp Musk Shrew (*Crocidura mariquensis*) and the widespread albeit near threatened Vlei Rat (*Otomys auratus*). It is one of few habitat types that often contains a distinct and prominent fauna assemblage which is absent from the surrounding "dryland" grassland units.

Dams are present downslope of the Water Treatment Works, but are unlikely to be affected by the pipeline. In addition, water is continually leaking from the Water Treatment Works and causing a temporary **artificial seep** on the steep slope between the Water Treatment Works and the dam. The vegetation is similar to the vegetation in the natural seep wetlands (Photo 5.12).

Photo 5.12: Dams and artificial seep downslope of the water treatment works (taken from Venter and Niemand, 2017b)

A seep wetland is located in the southern portion of the Distribution Pipeline in KwaThandeka (Figure 5.13b). The seep is located between the houses and between the houses and the river. Several alien and invasive species are present in the unit and the hydrology of the wetland is affected by the surrounding development. The seep is dominated by grass species, including *Eragrostis plana* and *Sporobolus africana,* with several alien and invasive species also present.

Three channelled valley bottom (CVB) wetland units are crossed by the Distribution Pipeline (Figure 5.13a & 5.13b). CVB 1 is located to the north of the seep wetland and is still located in the KwaThandeka area (Figure 5.13b). The wetland is deeply eroded, with a high density of alien and invasive species present, including *Acacia dealbata, Sesbania punicea, Cirsium vulgare, Solanum sisymbrifolium, Verbena rigida, Conyza bonariense* and *Tagetus minuta*. The wetland also appears to be receiving polluted water from the developed area, since the water is greyish in colour and smells unpleasant. Litter also flows down the wetland and accumulate against the road crossings.

Two CVB wetlands (CVB 2 and 3) (Figure 5.13a & b) are located between Amsterdam and KwaThandeka and the wetland units are crossed by two roads and the culverts are causing erosion and channel incision in the wetland units. A seep is located adjacent to CVB 2 (the central wetland unit). Several alien and invasive plant species are present adjacent to the road crossings, especially at CVB 2, with the majority of the wetland units dominated by grass and sedge species. Common species include *Schoenoplectus corymbosus, Kyllinga erecta, Persicaria* species, *Leersia hexandra* and *Eragrostis plana*, as well as a number of alien and invasive plant species.

In addition to the wetland units on site, the project also affects portions of the Gabosha River. The Distribution Pipeline will cross the Gabosha River in Amsterdam next to a road crossing. The Gabosha River is a tributary of the Thole River. A seep wetland is located adjacent to the river south of the proposed river crossings and is therefore unlikely to be affected by the pipeline construction. The river has not been assessed as part of the wetland assessments.

Bulk water pipeline:
No **wetlands or artificial watercourses** will be crossed by the proposed Bulk Water Pipeline (Figure 5.15). No **rivers** will be crossed by the Bulk

Water Pipeline, but 0.65ha of the vegetation type falls within the 100m buffer of the pipeline.

Three **drainage lines** (Figure 5.15) will be crossed by the proposed Bulk Water Pipeline, with a surface area of 0.9ha. The vegetation of the drainage lines in this area is the same as at the proposed Dam Site B (Photo 5.13). The drainage lines cannot be classified as either wetland or riparian areas, since they are first order drainage lines and none of the characteristics of wetlands or riparian areas are present. No PES or EIS calculations are applicable to drainage lines.

Photo 5.13: View of one of the drainage lines to be crossed by the proposed Bulk Water Pipeline (taken from Venter and Niemand, 2017b).

Present Ecological State (PES)

As indicated in the preceding sections, wetlands were only identified at Dam Site A and along the Distribution Pipeline Route (Table 5.28). Table 5.29 provides the Present Ecological State (PES) of these wetlands.

Table 5.29: PES classes of the different wetland units crossed by the pipeline (taken from Venter and Niemand, 2017b)

Wetland Unit	Hydrology		Geomorphology		Vegetation		Combined	
	Impact Score	Class	Impact Score	Class	Impact Score	Class	Impact Score	Class
Seep	1.0	B	0.1	A	7.6	E	2.6	C
CVB 1	3.5	C	2.7	C	6.6	E	4.2	D
CVB 2	4.0	D	1.4	B	4.2	D	3.3	C
CVB 3	3.5	C	1.3	B	3.7	C	2.9	C

Venter and Niemand (2017b) indicated that the most significant impacts to the wetlands are associated with the residential and infrastructure development close to the wetland. The culverts under the roads concentrate water flow and cause erosion and channel incision. Some scouring was also observed in the CVB 2 below the dirt road crossing. The wetland units are significantly impacted by invasive plant species infestation, with very high densities of alien and invasive species in the wetland systems, especially in

the wetland systems close to KwaThandeka. Refer to Addendum E of Appendix 13 for more information.

No method exists for calculating PES class of **drainage lines**. The PES of the drainage lines is however estimated to be Class B, which is largely natural (Venter and Niemand, 2017b).

Ecological Importance and Sensitivity (EIS)
The EIS calculations were combined for similar wetland units. A combined EIS value was therefore calculated for the CVB wetlands and a second EIS value was calculated for the seep wetland. The EIS values for the CVB wetlands and for the seep wetland is Moderate and are therefore of regional to provincial importance. The hydro-functional importance of the CVB wetlands is High, while the hydro-functional importance of the seep is Moderate. The wetland units do not appear to have Direct Human Benefits (Addendum F of Appendix 13).

5.10 Groundwater

The Amsterdam area falls within an area identified as having a good potential for groundwater development (Task Team, 2008). The expected yields are high (0.5 – 2.0l/s) and the groundwater quality is predominantly good.

Task Team (2008) indicated that a very productive aquifer is present around the town of Amsterdam that could be used for higher demands. A detailed study is however required in order to quantify its characteristics and its role within the hydrological cycle of the area.

Groundwater is currently not used to supply the town of Amsterdam with water. However, groundwater could be used on smallholdings not supplied with municipal water and on farms in the surrounding area as a source of water. Sixty percent (60%) of the boreholes in and around Amsterdam are strong boreholes (3.5l/s).

The groundwater resource needs to be used with great care as groundwater is the main source of base flow for the whole basin (i.e. Maputo River Basin, Task Team, 2008).

Dam Site A:
Groundwater would be associated with the Thole River and associated wetlands where the proposed Dam Site A would be located. No boreholes are known to be present within this area.

Meyer (2016) indicated that no seepage was noted in any of the test pits and only the DPSH tests performed adjacent to the stream encountered water as expected. A relatively strong spring was noted on the eastern flank of the river, almost on the proposed dam wall axis (Figure 5.1c).

Potential sources of groundwater pollution within the surrounding area include:

- Contaminated runoff from the residential areas of Amsterdam and KwaThandeka (e.g. sewage, waste, etc.);
- The unrehabilitated Amsterdam Waste Disposal Site located on the western side of the proposed Dam Site A (Figure 5.7a);

- Effluent from the Amsterdam Waste Water Treatment Works (WWTW) located approximately 1.8km downstream.

Distribution pipeline:
The distribution pipeline would extend through the residential area of Amsterdam (Figure 5.7a) and would extend across the Gabosha River and a tributary of the Thole River. Groundwater would be associated with both the Gabosha River and the tributary of the Thole River.

Dam Site B:
Groundwater would be associated with the Gabosha River and drainage lines where the proposed Dam Site B would be located. No boreholes are known to be present within this area.

Since the immediate area surrounding the proposed Dam Site B is located away from residential areas and no cultivation, afforestation, mining, etc. takes place the risk in terms of potential groundwater pollution is minimal.

Meyer (2017a) indicated that no seepage was noted in any of the nineteen testpits (Figure 5.2b) excavated.

Bulk water pipeline:
Groundwater would be associated with the Gabosha River and drainage lines along which the proposed bulk water pipeline would extend. No boreholes are known to be present within this area.

5.11 Air quality

The air quality of the Amsterdam area in general is expected to be of good quality in view of the lack of major industrial and mining activities taking place. At times, the forestry industry could however, impact on the air quality of the area in view of cleared forestry areas being burnt.

Dam Site A:
As indicated in Figure 5.8a, the residential areas of Amsterdam and KwaThandeka occur in the immediate surrounding area of proposed Dam Site A (i.e. along the eastern side). Informal settlements and smallholdings are also present in this area. Old lands and areas of cultivation are also indicated to be present (Figure 5.8a).

The unrehabilitated Amsterdam Waste Disposal Site is located on the western side of the proposed Dam Site A (Figure 5.8a) while the Amsterdam Waste Water Treatment Works (WWTW) is located approximately 1.8km downstream.

The air quality of this area could therefore be impacted in terms of the above-mentioned activities.

Distribution pipeline:
The distribution pipeline would extend through the residential area of Amsterdam (Figure 5.8a). The air quality of this area could therefore be impacted in terms of the various activities taking place within this residential area.

Dam Site B:
As indicated in Figure 5.8b, no cultivation, afforestation or mining takes place within the immediate area surrounding the proposed Dam Site B. Afforestation is however present to the east of the dam site in the adjacent catchment area. The air quality of this area is therefore expected to be of good quality.

Bulk water pipeline:
As indicated in Figure 5.7b, no cultivation, afforestation, old lands or mining takes place within the immediate surrounding area of the proposed bulk water pipeline route. The provincial R65 road is however present to the south of the proposed route as indicated in Figure 5.8b.

5.12 Noise

Dam Site A:
As indicated in Figure 5.8a, the residential areas of Amsterdam and KwaThandeka occur in the immediate surrounding area of proposed Dam Site A (i.e. along the eastern side). Informal settlements and smallholdings are also present in this area. Old lands and areas of cultivation are also indicated to be present. Various activities thus take place within the surrounding area contributing to an elevated ambient noise level.

Distribution pipeline:
The distribution pipeline would extend through the residential area of Amsterdam (Figure 5.8a) where various activities would take place resulting in an elevated ambient noise level.

Dam Site B:
As indicated in Figure 5.8b, no cultivation, afforestation or mining takes place within the immediate area surrounding the proposed Dam Site B. Afforestation is however present to the east of the dam site in the adjacent catchment area. The ambient noise level of this area is therefore anticipated to be very low.

Bulk water pipeline:
As indicated in Figure 5.8b, no cultivation, afforestation or mining takes place within the immediate surrounding area of the proposed bulk water pipeline route. The provincial R65 road is however present to the south of the proposed route as indicated in Figure 5.8b and could contribute to the ambient noise of the area.

5.13 Sites of archaeological and cultural interest

Prof. A.C. van Vollenhoven of Archaetnos Culture & Cultural Resource Consultants was appointed to conduct a Cultural Heritage Impact Assessment (referred to as Van Vollenhoven, 2017b). A copy of the said report is provided in Appendix 15 and should be consulted with regards to the methodology used.

5.13.1 Archaeology and cultural sensitivity:
According to Van Vollenhoven (2017), this geographical area is not well-known as one containing many prehistoric sites. This could however be as a result of the lack of research in this area.

On the existing SAHRA Database three heritage reports are noted (Radford & Van Vollenhoven, 2012; Van der Walt, 2014; Van Schalkwyk 2016). Van Vollenhoven (2017) included information from these reports in the sections below.

5.13.1.1 Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools (Coertze & Coertze, 1996). In South Africa the Stone Age can be divided into three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation.

The division for the Stone Age according to Korsman & Meyer (1999) is as follows:

- Early Stone Age (ESA) 2 million – 150 000 years ago;
- Middle Stone Age (MSA) 150 000 – 30 000 years ago;
- Late Stone Age (LSA) 40 000 years ago – 1850 - A.D.

The larger geographical region has been inhabited by humans since at least the Middle Stone Age (MSA). During this time people became more mobile, occupying areas formerly avoided. They preferred open sites near watercourses and as a result, tools belonging to this period mostly occur in the open or in erosion dongas (Van Schalkwyk, 2016).

Late Stone Age (LSA) people had an even more advanced technology than the MSA people and therefore occupied more diverse habitats. Apart from stone tools, people now also used other material to produce ostrich eggshell beads, bone arrowheads and wood. These people occupied rock shelters and caves (Van Schalkwyk, 2016).

A number of Stone Age sites, including rock painting sites are known in the Ermelo, Chrissiesmeer and Carolina areas, but none in the Amsterdam area (Bergh, 1999). This provides evidence of Stone Age people being present in the wider geographical area. However no sites are known from Amsterdam.

5.13.1.2 Iron Age

The Iron Age is the name given to the period of human history when metal was mainly used to produce metal artefacts (Coertze & Coertze, 1996).

In South Africa it can be divided in two separate phases according to Van der Ryst & Meyer (1999), namely:

- Early Iron Age (EIA) 200 – 1000 A.D.
- Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007) however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

- Early Iron Age (EIA) 250 – 900 A.D.
- Middle Iron Age (MIA) 900 – 1300 A.D.
- Late Iron Age (LIA) 1300 – 1840 A.D.

The Amsterdam area is not known for its Iron Age sites.

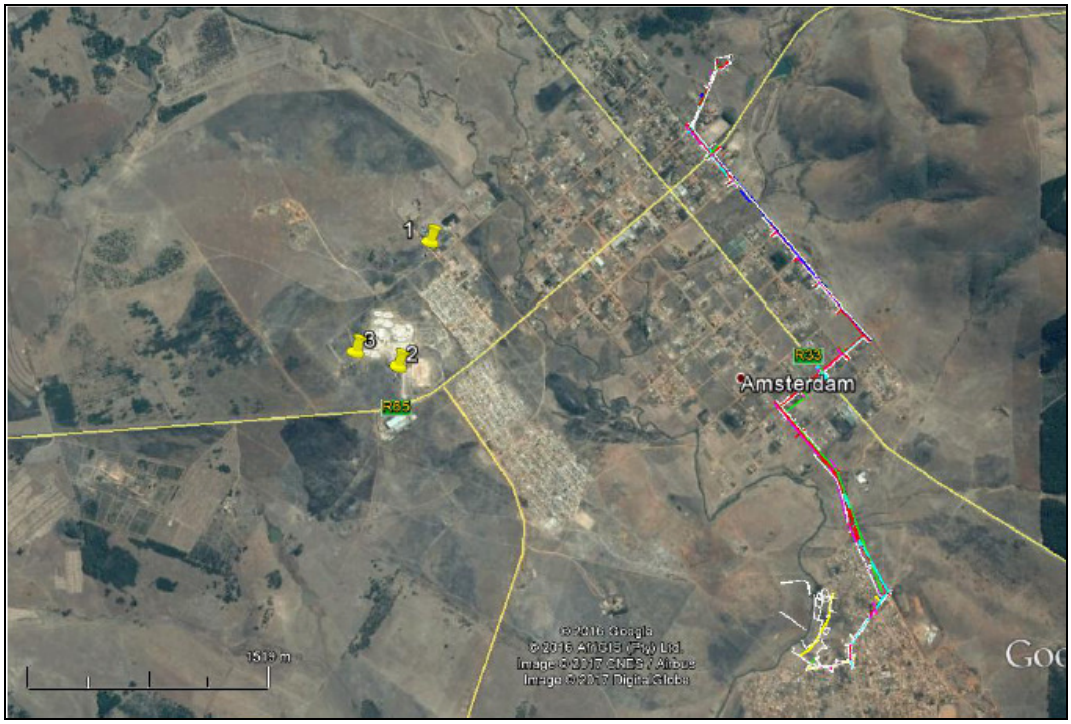
During the EIA people only cultivated cereals (sorghum, millet) that required summer rainfall. Therefore EIA people did not move outside this rainfall zone, and thus did not occupy the central interior Highveld area.

Iron Age people preferred to settle on the alluvial soils near rivers for agricultural purposes, but also for firewood and water. The occupation of the larger geographical area did not start much before the 1500s. This was due to climatic change, with the climate becoming warmer and wetter, creating conditions that allowed LIA farmers to occupy areas previously unsuitable, such as the Mpumalanga Highveld. At the same time, maize was introduced from Maputo and grown extensively. Maize crops yield far more than sorghum and millets. The increase in food production led to increased populations by the 19th century (Van Schalkwyk, 2016).

Late Iron Age people preferred to settle on the steep slopes of a mountain, possibly for protection, or for cultural considerations (such as grazing for their enormous cattle herds). Because of the lack of trees they built their settlements in stone (Van Schalkwyk, 2016).

A number of stone-walled archaeological sites, which date to the Late Iron Age (c. AD 1640 - AD 1830s), were identified west of the study area, and some of them have been excavated (Taylor, 1979; Pelser et al., 2007). These sites are conventionally associated with Tswana-speaking people. The Tswana-speakers were located to the south and west in the study area, with the Ndzundza Ndebele (Nguni-speakers) to the north (Van Schalkwyk, 2016).

Radford & Van Vollenhoven (2012) identified an Iron Age site on the Remainder of Portion 11 of the farm Amsterdam 408 IT. This included a site consisting of two small circles with packed stones, either indicating a platform or possible graves. These are located to the north-west of the Amsterdam (Figure 5.20) and therefore relatively far from the proposed development and will not be impacted.



(Legend: Site 1: Two small circles with packed stones (possible graves), Site 2: Shembe Circle; Site 3: Shembe Circle)

Figure 5.20: Known heritage sites in relation to the proposed development (taken from van Vollenhoven, 2017b)

5.13.1.3 Historical Age

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write.

Between 1800 and 1820 a major drought must have caused an agricultural collapse on a large, subcontinental scale. It also was a period of great military tension. By 1821 the military tension spilled onto the Highveld. Various marauding groups of displaced Sotho-Tswana moved across the plateau in the 1820s and Mzilikazi raided the plateau extensively between 1825 and 1837 (Van Schalkwyk, 2016). This was called the Difaquane. It however seems as if the Amsterdam region was not affected much by the Difaquane. The geographical area towards the east of the study area was occupied by Swazi-speakers, also of Nguni origin (Bergh, 1999).

In addition, none of the known historical trade routes went through this area (Bergh, 1999). The first white settlers moved into this area in the late 1850's (Bergh, 1999). The area formed part of the Lydenburg District by 1845, but the town was only established in 1882 when it became part of the Ermelo District. During this time an international border with Swaziland was also established nearby (Bergh, 1999).

Amsterdam, like most towns in the vicinity have various buildings older than 60 years, giving it a latent heritage significance. Two such buildings were noted along the pipeline route, both church buildings in KwaThandeka (Photo 5.14; Photo 5.15). These buildings will however not be impacted by the proposed development.

Photo 5.14: Church building just south of the point where the proposed pipeline route starts in KwaThandeka (taken from Van Vollenhoven, 2017b)

Photo 5.15: Another church building along the route in KwaThandeka (taken from Van Vollenhoven, 2017b)

The various battles and skirmishes resulting from the conflict during the Anglo-Boer War (1899-1902) had a huge impact on heritage resources in the area, as many farms were burnt down. However, regarding large events during this war, the only one to be noted at Amsterdam is that the commando of C Botha retreated towards Amsterdam on 13 August 1900 during the British March of February-October 1900 (Bergh, 1999).

Much of the heritage potential of the study area is located within the many farmsteads in the area. Farmhouses and related structures (e.g. barns, sheds, etc.), as well as cemeteries, dot the landscape. Equally important, are the homesteads, related structures and cemeteries of the farm labourers living on these farms (Van Vollenhoven, 2017a).

Industrial and mining activities also took place in the region, on an ever increasing scale. Coal mining dates to the beginning of the 20th century, although there is written evidence that it was exploited by farmers prior to that. Forestry also became a big operation, going back as far as the early 1900s (Van Vollenhoven, 2017a).

Graves were previously identified on the Remainder of Portion 11 of the farm Amsterdam 408 IT (Radford & Van Vollenhoven, 2012). Another site identified during the mentioned survey are two Shembe Circles which, at that time were still being used by the local community as a church site. As already indicated, these are located to the north-west of the Amsterdam (Figure 5.20) and therefore relatively far from the proposed development and will not be impacted.

A spring is present on the eastern side of the proposed dam wall site (Dam Site A, Figure 5.1c) which could be of cultural significance.

5.13.1.4 Conclusion

Van Vollenhoven (2017b) indicated that no sites of cultural heritage significance were identified within the proposed development area namely, proposed Dam Site A, proposed Dam Site B, bulk water pipeline and distribution line (including river crossings).

The possibility of finding Iron Age remains is real, as such features have previously been found. There is also always a chance that Stone Age tools might be found. It seems however, unlikely that a large site will be identified during the survey, due to the proposed dam being located within a valley (i.e. Dam Site B).

In view of the above-mentioned, Van Vollenhoven (2017b) recommended the following:

- This report is seen as ample mitigation and the proposed development may thus continue, but only after the report is approved by SAHRA.
- It should be noted that the subterranean presence of archaeological and/or historical sites, features or artefacts is always a distinct possibility.
- Due to the density of vegetation it is also possible that some site may only become known later on.
- Operating controls and monitoring should therefore be aimed at the possible unearthing of such features. Care should therefore be taken when development commences that if any of these features are discovered, a qualified archaeologist be called in to investigate the occurrence.

5.13.2 Palaeontological sensitivity

According to the palaeontological map supplied by the South African Heritage Resources Agency (SAHRA, 2014), the palaeontological sensitivity of the proposed Dam Site A, Dam Site B, distribution pipeline and bulk water pipeline route is deemed low (grey area indicated in Figure 5.21) requiring no further study (Table 5.31).

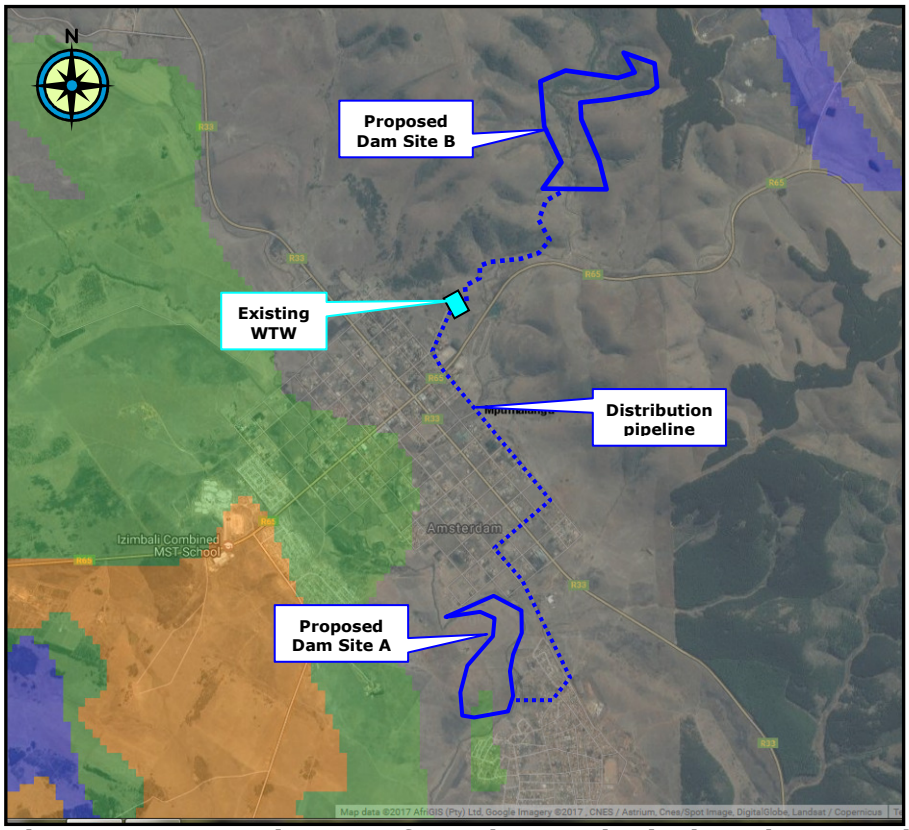


Figure 5.21: Requirement for palaeontological study w.r.t. the project area (taken from SAHRA, 2013).

However, the southern portion of the proposed Dam Site A is indicated as having a moderate palaeontological sensitivity (area indicated in green; Figure 5.21) requiring a desktop study.

Dr. Heidi Fourie (Heidi Fourie Consulting) was appointed to conduct a Palaeontological Impact Assessment – Desk Study (referred to as Fourie, 2017b). A copy of the said report is provided in Appendix 16 and should be consulted with regards to the methodology used.

The aim of a Desk Study is to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and state if any mitigation or conservation measures are necessary.

5.13.2.1 Outline of the geology and palaeontology

The palaeontological sensitivity of a site is closely related to the underlying geology, since fossils mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature.

According to the 1:250 000 geology map (2630 Mbabane), the proposed Dam Site A, Dam Site B, bulk water pipeline route and distribution pipeline route are underlain by pyroclastic rocks and ash-flow tuff of the Gobasha Member, Amsterdam Formation (Rag; Figure 5.22). These rocks are of Randian Age and thus very old.

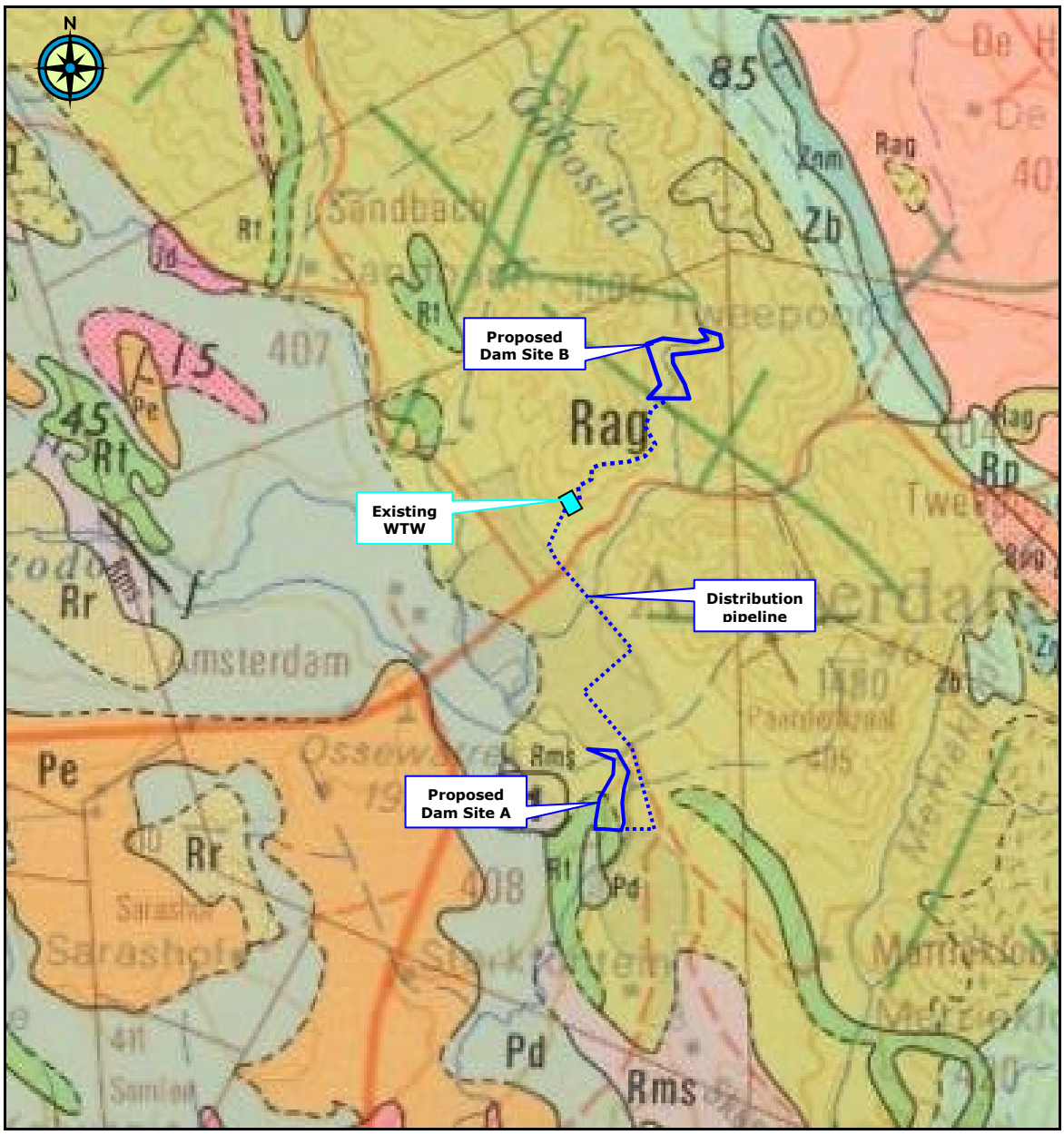


Figure 5.22: Underlying geology of the site.

Proposed Dam Site A:
The southern section of Dam Site A is underlain by ultrabasic rocks, pyroxenite and norite of the Suite Thole, also of Randian Age (Rt; Figure 5.22). The Suite Thole is older than the Amsterdam Formation (Fourie, 2017b).

The geology of the surrounding area includes tillite and shale of the Dwyka Group (Pd; Figure 5.13) and quartzite of the Skurwerant Formation (Rms; Figure 5.22). The Skurwe Formation is the basal unit of the Mozaan Group and can be up to 400m thick (Fourie, 2017b).

According to Fourie (2017b), formations present are part of the Karoo Supergroup, which is renowned for its fossil wealth. The Dwyka Group is the lowermost unit of the Karoo Supergroup and is overlain by the Ecca Group. It is underlain by the Witteberg Group, Bokkeveld or Table Mountain Groups and various other groups. It ranges in age from Late Carboniferous to early Permian.

Clastic rocks containing diamictite, varved shale, conglomerate, pebbly sandstone and mudrock are present. The rocks display features reflecting a glacial and glacially-related origin. Fossils are present (Kent 1980, Visser *et al.* 1990). Thickness varies between 100-800 m (Visser *et al.* 1990).

As Gondwana drifted northward the first sediments to be deposited would have been the Dwyka. As the glaciers melted they left striations on the surface as well as vast quantities of mud and large fragments of rock which formed the characteristic, poorly sorted Dwyka tillite (McCarthy and Rubidge 2005).

Visser *et al.* (1990) proposed two subdivisions for the Dwyka Group in the main Karoo basin, the Elandsvlei and Mbizane Formations. In the far north, the Tshidzi and Wellington Formations also form part of the Dwyka Group.

Fourie (2017b) found that part of the proposed Dam Site A is underlain by Dwyka rocks. This area is located on a sloping topography and is presently part of the river system.

Proposed Dam Site B:
According to Fourie (2017b), the Amsterdam Formation is present at the proposed Dam Site B, the proposed bulk water pipeline and the distribution line (Figure 5.22). The Amsterdam Formation is in the form of a syncline and reaches a thickness of 250m. Rhyolite is present at the base and top. Two Members are present, the Gabosha Dacite and the Vaalkop Rhyolite.

5.13.2.2 Background to the palaeontology of the area

Table 5.30 provides an indication of the occurrence of fossils in the Dwyka Group.

Table 5.30: Occurrence of fossils in the Dwyka Group (Groenewald and Groenewald 2014).

Subgroup / Supergroup	Group	Formation	Fossil Heritage	Comment
Karoo Supergroup	Dwyka	-	Most of the fossils are recorded from the mudstone facies, and include spores, pollen, plant remains, arthropod trackways and fish trails	Globally important and under collected

Spores and acritarchs have been reported from the interglacial mudrocks of the Dwyka Group while spores, pollen and plant remains have been recorded in the interbedded mudrocks as well as the diamictite itself. In places, anthropod trackways and fish trails are present on bedding planes (Visser *et al.* 1990). Stromatolites are present in the Insuzi Group (Kent 1980).

5.13.2.3 Description of significant fossil occurrences (heritage value)

Plant fossils have been described from outcrops of the Dwyka Formation in Limpopo Province, with special reference to this formation in the Springbok

Flats region. Outcrops of the formation are however rare in the Mpumalanga Province and any recording of fossils will be highly significant (Groenewald and Groenewald 2014).

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. All Karoo Supergroup geological formations are ranked as LOW to VERY HIGH, and here the impact is potentially MODERATE for the Dwyka Group (Table 5.31).

At the proposed Dam Site A, the impact is Moderate (Table 5.31) as significant fossil resources (shale) may be impacted by the development while at the proposed Dam Site B the impact on palaeontological sensitivity is very low (Table 5.31). This is also the case with regards to the bulk water pipeline and the distribution line which will also impact on the Amsterdam Formation.

Table 5.31: Palaeontological sensitivity criteria used (Fossil Heritage Layer Browser/SAHRA) (taken from Fourie, 2017b)

Rock Unit	Description	Sensitivity	Recommended action
Dwyka Group (Pd; Figure 5.13)	Tillite and shale with dropstones, fluvioglacial sediment (grey). Dwyka Group, Karoo Supergroup. Permian.	Moderate	Desktop study required.
Amsterdam Formation (Rag; Figure 5.13)	Pyroclastic rocks, ashflow tuff (khaki). Gobosha Member, Amsterdam Formation. Randian.	Very Low	No study required.
Amsterdam Formation (Rt; Figure 5.13)	Ultrabasic rocks, pyroxenite, norite (green). Suite Thole. Randian.	Very Low	No study required.
Amsterdam Formation (Rms; Figure 5.13)	Quartzite with interlayered shale (brown). Skurwerant Formation. Randian.	Low – fossils cannot be seen with the naked eye.	No study required, however a protocol for finds is required.

5.13.2.4 Conclusion

According to Fourie (2017b), the impact of the development on fossil heritage at the proposed Dam Site A is Moderate as significant fossil resources (shale) may be impacted by the development.

Fourie (2017b) however indicated no objection to the development of the proposed Dam Site B. It was further indicated that it is not necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study in order to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is Moderate. A Phase 2 Palaeontological Mitigation is also not required. Caution is however, required due to the presence of the fossiliferous Dwyka Group at the proposed Dam Site A and therefore the Protocol for Finds as provided in Appendix 1 of Appendix 16 must be followed if the said site is development.

Fourie (2017b) indicated that the development of the proposed Dam Site B would be preferable as the Amsterdam Formation with a Very Low Palaeontological Sensitivity would be impacted. This would also be the case in terms of the bulk water pipeline and the distribution line.

5.14 Sensitive landscapes

Venter and Niemand (2017b) indicated that most of the natural vegetation units - primarily all the watercourses, the indigenous woody areas, and untransformed (montane) grassland units - are regarded as sensitive (Table 5.32). These units provide potential habitat for a high richness of threatened and near threatened bird and mammal species. More importantly, the watercourses play an important role in animal dispersal and genetic cohesion between faunal sub-populations.

Vegetation units of Moderate sensitivity were subjected to low intensity disturbances and grazing regimes, but still provide ephemeral habitat for a range of fauna species.

All natural watercourses (including wetland and river units) are considered to be of high sensitivity, due to the importance of watercourses in the country. Artificial watercourses are not considered to be sensitive as habitat for plant species, but may provide habitat for facultative fauna species and is therefore of Moderate sensitivity.

Table 5.32: Sensitivity of each vegetation unit according to the vegetation, watercourse and fauna sensitivity (taken from Venter and Niemand, 2017b)

VEGETATION UNIT	SUB-UNIT	SENSITIVITY			
		VEGETATION	WATERCOURSE	FAUNA	COMBINED
Watercourses	River	Low	High	High	High
	Drainage lines	High	High	High	High
	Seep wetland	Low	High	High	High
	CVB Wetland	Low	High	High	High
Artificial watercourses	Dams	Low	Low	Moderate	Moderate
	Artificial seeps	Low	Low	Moderate	Moderate
Woody areas	Indigenous	High	Low	High	High
	Invasive	Moderate	Low	Low	Low
Grassland areas	Grassland	High	Low	High	High
	Modified	Moderate	Low	Moderate	Moderate
	Wet	Low	Low	Moderate	Moderate
	Weedy	Low	Low	Low	Low

Please refer to Figures 5.12, 5.13a, 5.13b, 5.14 and 5.15 for the location of the various vegetation and watercourse units identified.

5.15 Visual aspects

Dam Site A
Dam Site A would be located adjacent to the residential area of KwaThandeka (Figure 5.8a) and downstream of the residential area of Amsterdam (Figure 5.8a). The proposed site would be highly visible from the adjacent residential areas and the immediate surrounding area as well as from the various provincial and local roads.

Distribution pipeline
The distribution pipeline would be installed within the Amsterdam residential area and more specifically within the road reserve associated with the internal roads within this area. The said route is therefore highly visible from surrounding roads and houses.

Dam Site B
Dam Site B would be located to the north of the residential area of Amsterdam within an undeveloped area surrounded by high ridges. It would be screened from Amsterdam and immediate surrounding areas by the high ridges located on either side of the valley in which the dam will be located. The proposed dam site would not be visible from the R65 provincial road (Figure 5.8b).

Bulk water pipeline
The proposed bulk water pipeline would be located to the north of the residential area of Amsterdam within an undeveloped area. The construction of a portion of the bulk water pipeline would be highly visible from the R65 provincial road.

5.16 Traffic

Dam Site A
Dam Site A would be located adjacent to the residential area of KwaThandeka (Figure 5.8a) and downstream of the residential area of Amsterdam (Figure 5.8a). The dam site can indirectly be accessed from the tarred road between Amsterdam and KwaThandeka or from the internal roads of the KwaThandeka residential area. No gravel roads extend across the proposed dam site. Footpaths are however evident.

Distribution pipeline
The distribution pipeline will be installed within the Amsterdam residential area and more specifically within the road reserve associated with the internal roads within this area. The said pipeline would however, extend across the R65 and the R33 provincial roads (Figure 5.8a).

Dam Site B
Dam Site B would be located to the north of the residential area of Amsterdam within an undeveloped area. A gravel road extends through the site and provides access from the R65 provincial road (Figure 5.8b).

Bulk water pipeline
The proposed bulk water pipeline would be located to the north of the residential area of Amsterdam within an undeveloped area. A gravel road extending from the R65 provincial road (Figure 5.8b) would provide access to a portion of this route. Otherwise the said pipeline route is inaccessible.

5.17 Sense of place

Dam Site A
Dam Site A would be located adjacent to the residential area of KwaThandeka (Figure 5.8a) and downstream of the residential area of Amsterdam (Figure 5.8a). This area is currently not zoned or included as part of the Amsterdam CBD Spatial Development Framework (Figure 5.23).

Distribution pipeline
The distribution pipeline will be installed within an urban area as indicated in the Amsterdam CBD Spatial Development Framework (Figure 5.23).

Dam Site B
Dam Site B would be located to the north of the residential area of Amsterdam in an area currently not zoned or included as part of the Amsterdam CBD Spatial Development Framework (Figure 5.23).

Bulk water pipeline
The proposed bulk water pipeline would be located to the north of the residential area of Amsterdam in an area currently not zoned or included as part of the Amsterdam CBD Spatial Development Framework (Figure 5.23).

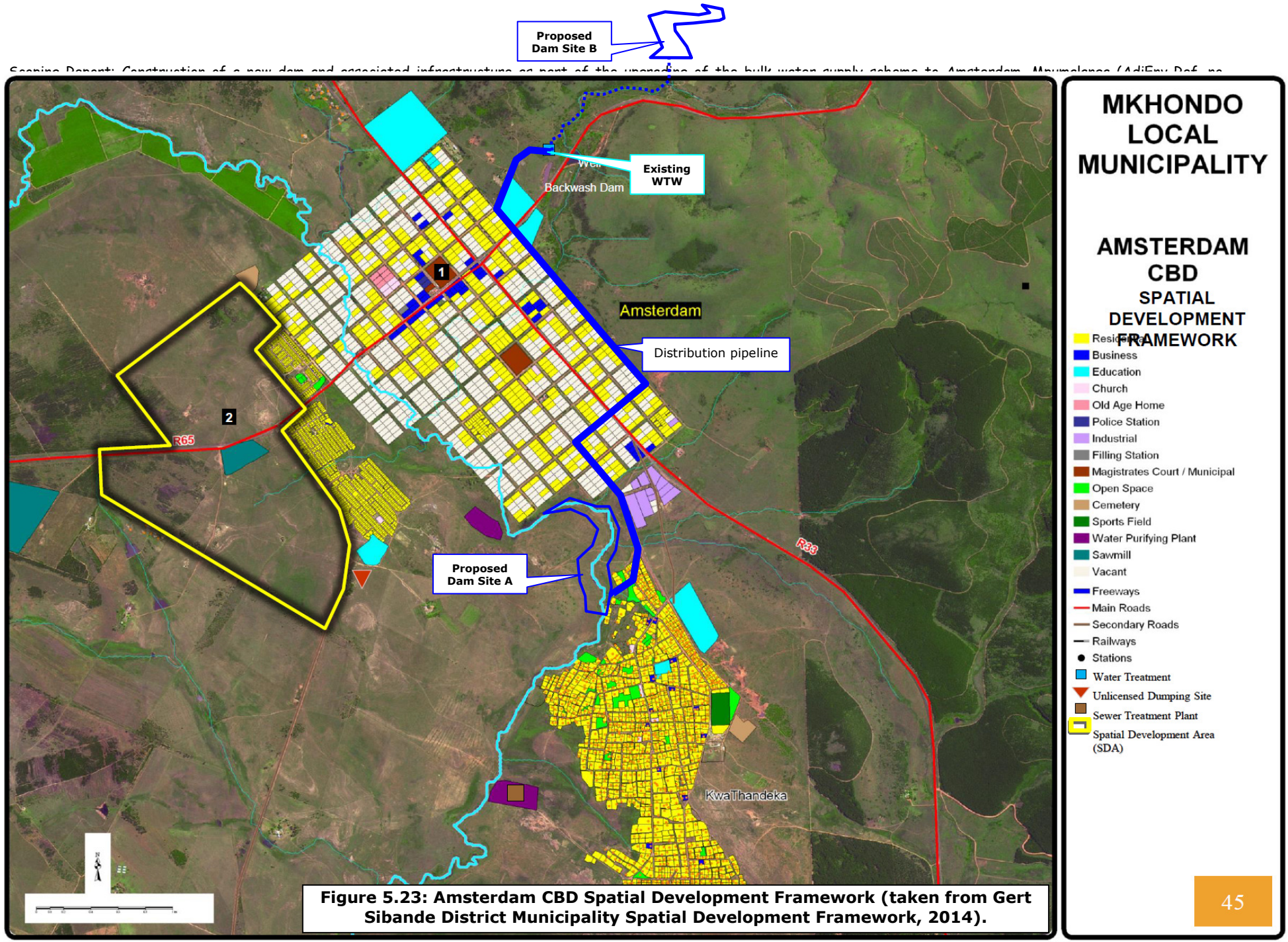


Figure 5.23: Amsterdam CBD Spatial Development Framework (taken from Gert Sibande District Municipality Spatial Development Framework, 2014).