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REPORT NO.: P 02/B810/00/0608/02 Annexure I

GROOT LETABA RIVER WATER DEVELOPMENT PROJECT (GLeWaP)

Environmental Impact Assessment

(DEAT Ref No 12/12/20/978)

ANNEXURE I: NOISE IMPACT ASSESSMENT

MARCH 2010

JKA

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DECLARATION OF INDEPENDENCE

Jongens Keet Associates, who are noise impact specialists, are independent consultants to ILISO Consulting (Pty) Ltd for the Department of Water Affairs and Forestry), i.e. they have no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

REPORT DETAILS PAGE

Project name:	***Groot Letaba River Water Development Project***
Report Title:	***Environmental Impact Assessment Appendix J: Noise Impact Assessment***
Author:	***Derek Cosijn & Erica Cosijn***
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Project Director

EXECUTIVE SUMMARY

The Groot Letaba Water Development Project (GLeWaP) is aimed at improving the management of the water resources in the Groot Letaba River catchment area and consists of non-infrastructure options to manage the available water as well as the construction of infrastructure components. The project comprises improvements at Tzaneen Dam, the construction of a new dam at the site known as Nwamitwa, the realignment of sections of two provincial roads to accommodate the backwaters of the new dam, expansion of existing water treatment works and the construction of the necessary water reticulation infrastructure in the area to the north, north-east and north-west of the new dam. Jongens Keet Associates was appointed by ILISO Consulting (Pty) Ltd to undertake the investigation to assess the potential noise impact of the project.

The general procedure used to determine the noise impact was guided by the requirements of the South African National Standard SANS 10328:2003: Methods for Environmental Noise Impact Assessments. The level of investigation was the equivalent of an Environmental Impact Assessment (EIA) of the situation. The noise impact criteria used specifically take into account those as specified in the South African National Standard SANS 10103:2004, The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication as well as those in the National Noise Control Regulations.

Findings: Prevailing Noise Climate:

- *Tzaneen Dam Study Area: The main sources of noise are from traffic on the main roads, the water purification works, power boats on the Tzaneen Dam and the railway line to the west of the dam. The noise sensitive receptors in the area are the residences to the south, south-west and east of the dam wall, the farmhouses to the west and north of the dam, the Merensky High School and the Tzaneen Nature Reserve. The existing noise climate close to the main roads is degraded with regard to residential living. In the existing and developing residential areas to the south and east of the Tzaneen Dam wall, at the farmhouses on the western and northern sides of the dam, and at the Merensky High School the residual (existing) noise levels are relatively low and fall within the limits recommended by SANS 10103.*

- *Nwamitwa Dam and Reticulation Study Area: The main sources of noise are from traffic on the main roads, the Nkambako water treatment works, the pump on the Groot Letaba River feeding the water treatment works. The noise sensitive receptors in the area are the farmhouses and farm labourer houses along the river valley, the rural villages to the north, north-east and north-west of the proposed dam and the village schools. The existing noise climate alongside the main roads is degraded with regard to residential living. In the areas that are not close to and are relatively shielded from the main roads the residual (existing) noise levels are relatively low. In general the conditions on the farms and villages in the area meet the acceptable standards as per SANS 10103.*

Findings: Noise Impacts during the Pre-Construction Phase

- *Activities during the planning and design phase that have possible noise implications in the Tzaneen Dam Study Area are possible concrete core testing on the spillway.*

- *Activities during the planning and design phase that have possible noise implications in the Nwamitwa Dam and Reticulation Study Area are those related to field surveys (such as seismic testing and geological test borehole drilling) mainly at planned building, bridge and other major structure sites. Although some of these activities such as the drilling operations can be noisy, a major disturbance is generally unlikely in the area as these activities are of short duration at any one site and normally take place during the day. Drilling activities near schools will cause minor problems.*

Findings: Noise Impacts during the Construction Phase

- *Tzaneen Dam Study Area: It is understood that construction will take place only during the day-time at this site. Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over any working period. From the details presently available, it appears that the construction noise impact is not likely to be too severe in the residential areas near to the dam wall.*

- *Nwamitwa Dam and Weir Study Area: It is understood that construction will take place on a 24-hour basis. There will be a significant noise impact from the construction activities at the dam on the Ka-Malubana and Ka-Mswazi Villages*

north of, and the farms to the north and east (Deeside 733-LT) of, the dam wall, particularly from the night-time construction activities. The residual noise levels in the village and on the surrounding farms are fairly quiet and significant noise nuisance effects and noise disturbance effects are anticipated from the construction in these residential areas. The main impact from the construction phase will be from the quarrying operation, namely from the rock drills and the crusher. The impact from blasting at the aggregate quarry, however, is likely to be minimal on residents in the area, provided that blasting is restricted to the day-time. Blasting is anticipated only once every two weeks and will be limited to the daytime. Although the volumes of construction site generated traffic are not expected to be high, noise from site traffic could be a problem, depending on the location of these roads relative to the Ka-Malubana Village and farmhouses.

- *Noise Impact from Road Construction: The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. The new alignment of Road R529 (both Alternative 1 and Alternative 2) will now be routed close to a number of farmhouses on the Farm Riverside 514-LT. The new alignment of Road P43/3 to the east of the existing alignment will place the new road relatively close to farm worker residences on the farm Nagude 517-LT. As construction is likely to take place during daytime, no major noise impact is anticipated at these residences. The impacts in any one area will be relatively short-term as the construction activities progress along the route.*

- *Noise Impact related to Water Treatment Works: The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. The noise from this site will be dominated to a large extent by the noise from the construction at the dam area and aggregate quarry, but will have a minor cumulative effect on the noise levels from the various other construction sites.*

- *Noise Impact related to Pipelines, Pump Stations and Reservoirs: The noise sensitive areas/sites that could be impacted by noise along the whole length of the respective pipeline routes are mainly residential land uses. There are also a number of schools that are potentially affected. The noise sensitive sites closest to the roads (where the pipelines are laid in the reserve) will be affected the most by the construction noise. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period. If construction activities are restricted to the daytime, the impact conditions at residences will not be that severe.*

Findings: Noise Impacts during the Operational Phase

- *Tzaneen Dam: No change in the general operating noise climate is anticipated from the alterations to the dam wall.*

- *Nwamitwa Dam and Weir: No noise disturbance is anticipated from the sound of constant outflow of dam water into the stilling basin due firstly to the character of the sound (namely a waterfall sound) and secondly due to the distance attenuation of the sound. The noise from water flowing over the weir will be of a nature that will have no impact. No major change in general noise climate is anticipated from the operations at the dam.*

- *Roads: Existing noise levels close to the main roads in the Tzaneen Dam Study Area and the Nwamitwa Dam and Reticulation Study Area are already high for residential land use and particularly at night. The situation of these "noise degraded" areas will continue to worsen with the general growth of traffic through the study area. The main impact from traffic noise will be on the realigned sections of Road R529 and Road P43/3. Specifically on the realigned section of Road R529 there are a number of farm houses that will be within 500m of the realigned sections of the road and where the noise level will exceed the 45dBA (LR,dn) allowable.*

- *Water Treatment Works: Residences in the southern sector of Ka-Malubana Village could be adversely affected by the noise from the works as well as the delivery pump station, particularly at night. The exact position of the delivery pump station for the water treatment works has not yet been determined. The*

farms to the north-east and east of the Nwamitwa Dam should not be affected by the noise from these two sources.

- *Pipelines, Pump Stations and Reservoirs: As no final details of the location, position and orientation for the pump stations are available at this stage, no specific impact predictions are possible. Typically the noise impact on residences (particularly at night) and schools within 250 metres of a pump station could be significant.*

The following conclusions may be drawn from the noise impact analysis:

i) The primary source of noise impacting the respective study areas at present is from road traffic. This is likely to remain the case in the future, with the situation worsening as traffic volumes increase.

ii) The ambient noise climate at many of the areas where elements of the project are to be built can be defined as being degraded, particularly where these sites are along or close to main roads with attendant high traffic generated noise levels. The noise situation is one varying between very quiet when there is no traffic to very noisy when vehicles pass by. Noise impact thus also varies from a situation of being insignificant to one of high significance.

iii) The noise climate in the Nwamitwa Dam and Reticulation Study Area away from the main roads is relatively quiet.

iv) The noise from elements of the Project, if unmitigated, has the potential to have a negative impact on some of the noise sensitive areas surrounding the respective project sites.

v) The main impact period will be during the construction phase but noise problems are also possible during the operational phase.

vi) There are appropriate noise mitigating measures that can be implemented to reduce or prevent any noise impact during construction and operation.

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ABBREVIATIONS

CBD	Central Business District
dBA	Decibel (A-weighted)
DWAF	Department of Water Affairs and Forestry
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GLeWaP	Groot Letaba River Water Development Project
GWW	Government Water Works
NEMA	National Environment Management Act
SABS	South African Bureau of Standards
SANS	South African National Standard
SPL	Sound Pressure Level

1. STUDY INTRODUCTION

1.1 BACKGROUND TO PROJECT

The Department of Water Affairs and Forestry (DWAF) is currently undertaking an Environmental Impact Assessment (EIA) to investigate the environmental feasibility of raising the Tzaneen Dam, the construction of a storage dam in the Groot Letaba River and associated bulk water infrastructure (water treatment, pipelines, pump stations, off-takes and reservoirs) in the Limpopo province. The EIA is being undertaken by ILISO Consulting with Zitholele Consulting providing the public participation support. The EIA is being undertaken according to the EIA Regulations under Section 24 (5) of the National Environmental Management Act (NEMA), (Act No 107 of 1998) as amended in Government Notice R385, 386, 387 – Government Gazette No. 28753 of 21 April 2006.

ILISO Consulting has appointed Jongens Keet Associates to undertake the Noise Impact Assessment as part of the EIA.

1.2 STRUCTURE OF THIS REPORT

This specialist study will be undertaken in compliance with regulation 33(2) of GN 385. **Table 1.1** indicates how Regulation 33 of GN385 has been fulfilled in this report.

Table 1.1: Indication of compliance with Regulation 33 in this report

Regulatory Requirements	Section of Report
(a) The person who prepared the report; and the expertise of that person to carry out the specialist study or specialised process.	Chapter 2
(b) a declaration that the person is independent	Page i
(c) an indication of the scope of, and the purpose for which, the report was prepared	Chapter 3
(d) a description of the methodology adopted in preparing the report or carrying out the specialised process	Chapter 6
(e) a description of any assumptions made and any uncertainties or gaps in knowledge	Chapter 7
(f) a description of the findings and potential implications of such findings on the	Chapter 8

impact of the proposed activity, including identified alternatives, on the environment	
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	Chapter 9
(h) a description of any consultation process that was undertaken during the course of carrying out the study	Chapter 10
(i) a summary and copies of any comments that were received during any consultation process	N/A
(j) any other information requested by the competent authority.	N/A

1.3 STUDY AREAS

The noise impact investigation focussed on the respective areas of influence (for noise) at the Tzaneen Dam Study Area and the planned Nwamitwa Dam and Reticulation Study Area (refer to **Figure 1.1).** Relevant details of the affected areas are given in **Chapter 5**.

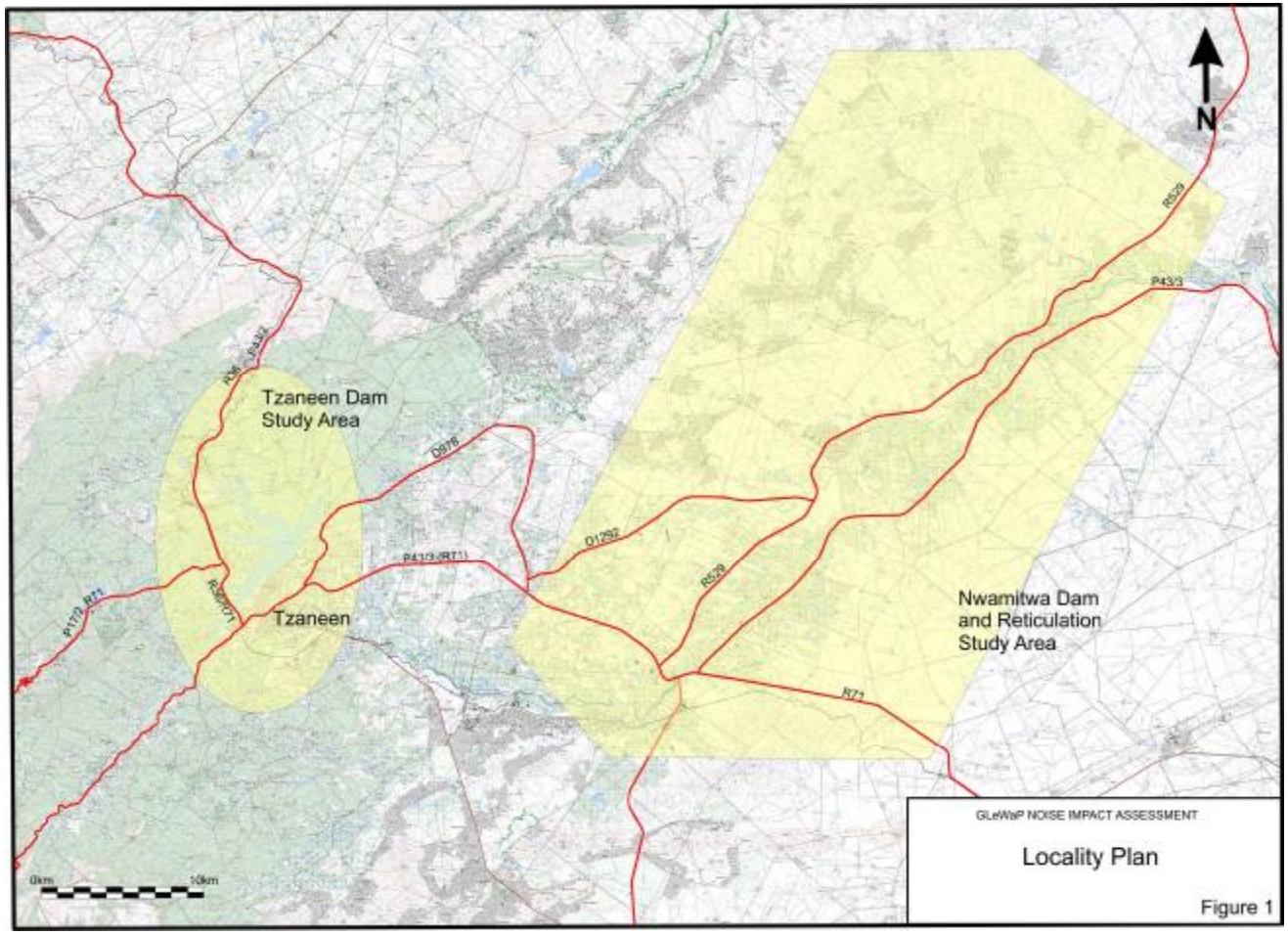


Figure 1.1: Locality PLan

2. PROJECT TEAM

Derek Cosijn of Jongens Keet Associates undertook the noise impact assessment. Derek Cosijn is a partner with Jongens Keet Associates and Calyx Environmental cc. He is a professional engineer registered with the Engineering Council of South Africa (ECSA), a Fellow of SAICE, a Member of the Southern African Acoustics Institute (SAAI) and is also certified as an Environmental Assessment Practitioner of South Africa.

He has had 40 years of professional experience over a wide range of civil engineering, transportation planning, environmental and acoustic engineering projects. He qualified as a civil engineer in 1967 and then studied further to obtain a post-graduate Diploma in Town Planning (both at the University of the Witwatersrand). He has worked in both the planning and construction aspects of the civil engineering profession gaining experience in road construction, road planning, transportation planning, traffic engineering and general environmental and environmental noise issues. He has been actively involved in numerous environmental projects since 1975, when he worked in Canada for three years. His area of special expertise is environmental noise (acoustical engineering). The environmental projects have ranged through EIAs and noise impact assessments, policy formulation and procedural guideline development. He has worked with a wide client base, ranging from the National Department of Transport, Provincial transportation/road authorities, Provincial environmental authorities, the metropolitan authorities and many local councils to private organizations. Some of the 110 odd environmental and noise impact projects with which he has been involved with over the last 10 years are the City of Tshwane Noise Management Policy, Gautrain Noise Impact Study, Tutuka Power Station Coal Supply Railway Noise Impact Assessment, Majuba Power Station Coal Supply Railway Noise Impact Assessment, Gauteng Freeway Congestion SEA Noise Impact Assessment, Petronet Multi-product Pipeline (Northern Section) Noise Impact Assessment, Matimba B Power Station Noise Impact Assessment, Olifants River Water Resources Development Project Noise Impact Assessment.

He was assisted by Dr Erica Cosijn. Erica Cosijn joined Jongens Keet Associates in October 2007. Previous employment experience includes working as an Information Specialist with consulting engineers, the CSIR and JCI and as a lecturer at the University of Pretoria. She has a Masters Degree in Philosophy (specializing in Logic), and a DPhil (Information Science). She has been involved in the following acoustics

projects: Majuba CCGT Power Station, Merensky Motocross Track, Tirisano Diamond Mine, KNP Marula Region SEA, Morupule Power Station (Botswana) and Heineken Brewery.

3. PURPOSE OF REPORT AND SCOPE OF WORK

3.1 TERMS OF REFERENCE

The terms of reference (TOR) were as follows:

i) A sufficiently detailed quantitative (by measurement) and qualitative assessment within the area of influence of the planned Groot Letaba Water Development Project (GLeWaP) (refer to **Chapter 4** and **Appendix I3** for the scope of the project) was to be undertaken in order to enable a full appreciation of the nature, magnitude, extent and implications of the potential noise impact.

ii) The level of investigation was to that of an environmental impact assessment (EIA). The analysis needed to be tailored to the situation that no final designs of the various elements of the project are available at this stage.

iii) All aspects of the investigation were to conform to the requirements of relevant environmental legislation and noise standards.

iv) The potential impacts of the pre-construction, construction and operational phases of the project were to be assessed.

v) Where relevant, appropriate noise mitigating measures were to be identified. These needed only to be conceptual at this stage.

4. DETAILS OF THE PROJECT

The project will comprise of the following components:

- The raising of the Tzaneen Dam;
- A new dam at the site known as Nwamitwa;
- A riverflow gauging weir just downstream from the Nwamitwa Dam;
- Associated relocation of roads at Nwamitwa Dam;
- Access roads to the Nwamitwa Dam;
- Upgrading of the existing Water Treatment Works just north of the Nwamitwa Dam wall site;
- Water reticulation pipelines inclusive of appurtenant infrastructure, namely pump stations and reservoirs, to the villages in the area to the north, north-east and north-west of the Nwamitwa Dam.

4.1 TZANEEN DAM

The dam wall will be raised by a maximum of 3,5m by using a labyrinth spillway, fuse-gates or a side channel spillway. The raising of Tzaneen dam will not require acquisition of additional land as the design flood level remains within the area purchased for the existing dam. The size of the downstream flood will also not be affected.

Construction facilities such as offices, workshops and stores will be required on site, and will be located within the property of the existing Government Water Works (GWW). Construction is expected to start in 2010.

4.2 NWAMITWA DAM AND WEIR

The largest component of the GLeWaP project is the proposed new dam at the site known as Nwamitwa. The dam will be located on the Groot Letaba River downstream of the confluence of the Nwandezi River. An earth fill embankment on both flanks with a central concrete spillway is envisaged. The detailed design of the dam and outlet works has not yet been completed but the structure will have an appearance similar to other composite construction type dams such as Tzaneen Dam.

The earth embankments will be protected against wave action and erosion on the upstream side by a layer of rock rip-rap. The downstream slopes will also be protected but by a layer of mainly crushed stone. The embankments are expected to have a total crest length of up to 3 000 m while the length of the concrete spillway would be about 500 m. These dimensions are subject to finalization in the detailed design phase. An outlet control structure with multiple draw-off levels will be an integral part of the concrete spillway structure and will be located on the left flank of the spillway.

Construction is expected to commence approximately in October 2009, and take 5 years to complete, with the storage of water and associated benefits expected to commence in 2012.

The site of the construction camp for the dam will be on the left bank of the Groot Letaba River, just upstream of the dam wall. The construction camp will be approximately 35.6 ha in extent excluding access roads. The site will accommodate the following:

- Concrete batching plants;
- Site Offices and Parking — comprising two office blocks (one to house the personnel of the Resident Engineer, and one to house the Site Agent and his personnel) and 20 covered parking bays per office block, and a taxi rank;
- Materials testing Laboratory;
- Workshops and Stores — approximately five buildings;
- Reinforcing Steel Bending Yard;
- Permanent Housing — Houses for two married operating personnel;
- Weather Station; and
- Sand and crushed stone Stockpile Areas — less than 450 m x 250 m with access roads (above area of inundation).

Areas for the handling of hazardous substances, an explosives storage magazine, wash bays for construction plant, radio communication infrastructure, facilities for the bulk storage and dispensing of fuel for construction vehicles, power lines, a small-scale sewage treatment plant and a temporarily licensed solid waste disposal facility will also be provided. Various temporary access roads, low level river crossings and haul roads will be required in and around the dam wall and borrow pits and quarry sites will be located within the dam basin.

Construction activities will commence with the stripping of vegetation and topsoil to establish access and construction roads, site offices, dam foundations and crusher and concrete mixer stations. Topsoil will be stockpiled for reuse during the rehabilitation stage, whilst cleared woody vegetation suitable for firewood will be stockpiled for collection by the local population for a period of time, after which it will be burnt.

Soon after commencement the river will be diverted to expose the rock foundations for the concrete spillway section. During this period, cofferdams will be constructed to protect all foundation activities in the riverbed against flood damage. Excavators, bulldozers and trucks will be engaged to remove all loose material on the foundation of the dam until rock is exposed. Blasting will be necessary.

A team specializing in quarry operations and the crushing of aggregate for concrete will be set up on site. Drill rigs will be in operation 24 hours a day. Blasting will be required, on average, every 14 days, and will be scheduled to take place only during daylight hours. A crusher will also be erected.

Sand required for the production of concrete will be collected from the identified borrow areas. Unsuitable material will be disposed of at locations to be agreed on by the Environmental Control Officer (ECO).

Concrete production at the batching plant will then commence and placement in the central spillway section, outlet works and apron areas, probably by roller compaction techniques and the use of high tower and mobile cranes, will occur 24 hours a day, seven days a week. Earth embankments will be constructed on both banks by compacting material hauled in by large trucks from the borrow areas upstream of the dam.

The temporary site administrative buildings will be erected complete with security fencing, a water supply, sewage purification plant and an electric overhead supply line.

After construction activities have been completed, estimated to be in 2013, all the crushers, mixers and site offices, etc. will be removed and the construction site rehabilitated. All temporary access roads and other hard surfaced areas will be ripped and covered with topsoil and planted with suitable grass and tree cover. The aim is to return the whole construction site as close as possible to its original appearance. Areas that are inundated by water in the dam will be shaped to accommodate storm runoff and no grass will be planted.

Two permanent houses will be erected within the project area to accommodate operation and maintenance staff.

The labour force for construction of the proposed dam will be approximately 300. Approximately 50 people will be skilled workers and be housed with their families in Letsitele. 200 workers will be recruited locally and. approximately 100 of these workers will acquire a new skill by the end of this project. The remaining 50 workers will be experienced in dam construction and will be transferred from elsewhere and be housed at Letsitele in single quarter's accommodation.

The proposed borrow area for the earthfill material is on the right flank (looking downstream) immediately upstream of the embankment. Two potential borrow areas for filter materials and concrete sand have been identified in the Merekome River on the farm Letaba Drift and in the Phatle/Lerwatlou River on the farm La Parisa. Authorisation of the borrow areas from the Department of Minerals and Energy Affairs is being applied for as a concurrent process to the EIA.

Coarse aggregates for concrete and rock for the rip-rap and rock toe zones of the embankment will be sourced from existing permitted quarries or commercial sources.

A new flow-measuring weir will be required downstream of the new dam in order to measure the flow that is released from the dam. The exact location of the weir has not yet been determined, but will be fairly close to the dam wall (downstream side). The weir will take about three months to construct and will be a low concrete structure with erosion control measures on both banks to prevent out-flanking. It is envisaged that the construction of the weir will form part of the dam construction contract.

4.3 ROADS

Main Roads

Sections of Road P43/3 and Road R529 will require re-alignment to accommodate the proposed dam. There is only one alternative alignment considered for Road P43/3. There are three alternative alignments being considered for Road R529 (Refer also to **Figure 4.1**):

- Alternative 1: The new road will deviate westwards from the existing R529 alignment approximately 5km north of the intersection with Route R71 up to Road D1292, where it turns eastward to follow the alignment of the latter for 1km where it deviates northwards again to link with the existing Road R529 alignment 1km south of Ka-Malubana Village.
- Alternative 2: The new road will deviate westwards from the existing R529 alignment approximately 5km north of the intersection with Route R71 up to Road D1292 (same as Alternative 1), where it turns directly northwards for approximately 3km, it then turns eastwards to link with the existing alignment of Road R529 just south of Ka-Malubana Village.
- Alternative 3: The new road will deviate westwards from the existing R529 alignment approximately 5km north of the intersection with Route R71 and will be aligned in a westerly direction up to Road D1292.

The re-alignment would require the construction of at least two major bridges and the upgrading of two existing bridges. The road design will be very similar to the existing roads, which are of a high standard, as well as be constructed using the same material. The road pavement will be designed to accommodate normal traffic flow.

Construction of the roads will take place only during the daytime.

Internal Roads and Constriction Site Access Roads

The exact positions of the required access roads to the construction sites and the on-site roads at the dam and appurtenant works have not yet been identified.

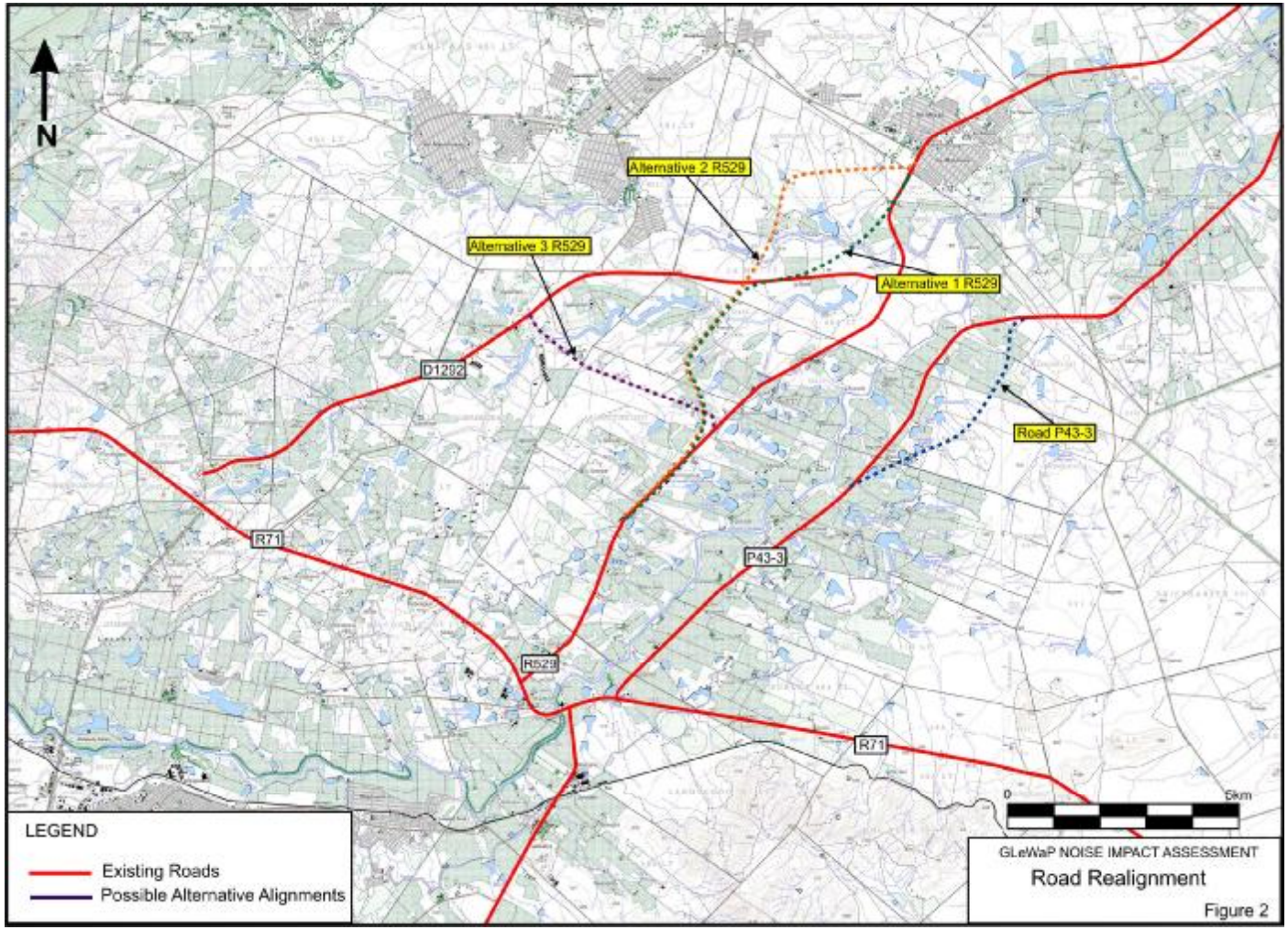


Figure 4.1: Road re-alignment

4.4 WATER TREATMENT WORKS

At present the Nkambako Water Treatment Works, which is located just south-east of Ka-Malubana Village, draws water from the Groot Letaba River about 1 km downstream from the Nwamitwa Dam site. The existing facility is to be expanded. After completion of the project, water will be abstracted from the dam and treated at the existing and new treatment works extensions located adjacent to the existing works. The existing run of river abstraction will be abandoned.

4.5 PIPELINES, PUMP STATIONS AND RESERVOIRS

Pipelines

Bulk water distribution pipelines will be constructed to augment potable water supplies in the various existing supply zones. The bulk distribution infrastructure from the treatment works will be optimised during the detailed design phase and the final configuration and sizing is not known at this stage. It is envisaged that new pipelines will be located adjacent to existing pipelines or along road reserves. Some sectors of pipeline will traverse open land. A ten metre wide strip would be impacted during construction.

Construction of the pipelines will commence with pipes being laid out along the pipeline routes and trenches up to 3,5 m deep and 2,5 m wide for the largest of the pipes being excavated. Under normal circumstances a maximum of 5 km of open trench is permitted, whilst the pipes will be strung out as they arrive from the manufacturer. Excess spoil material from the trenches will be transported to a suitable disposal site and sandy material will be brought in as selected backfill for pipe protection. Once the pipes have been laid and tested, the trench will be backfilled, compacted and shaped to the natural ground profile. Topsoil will be replaced to re-establish vegetation.

Pump Stations

Currently 4 booster pump stations are envisaged along the pipeline routes although the exact number and position will only be determined during the detail design stage. The following areas are being considered as possible sites:

- Between Ga-Mookgo Village (east) and Ga-Mookgo Village (west).

- Between Ga-Maakgo Village (west) and Ga-Moloko Village.
- Between Mawa Village and Hlohlokwe Village (the area demarcated is immediately adjacent to Hlohlokwe Village).
- On alternative pipeline route south of Hlohlokwe Village.

An area of approximately 1 – 2 ha will be fenced for each pump station. No balancing dams are envisaged. Construction of a single pump station will take approximately 24 months.

A new raw water pump station will be constructed to pump water to the Water Treatment Works.

Reservoirs

Although the reservoirs associated with the pipelines may differ according to their individual capacity and local topography, the technical details will be similar for each. Four new reservoirs are being considered at ten alternative sites within close vicinity to the following villages (See **Figure 4.2**).

- Sorolorole (Reservoir A);
- Babanana (Reservoir B);
- Mothomeng (Reservoir C1 and C3);
- Hlohlokwe (Alternative Reservoir C1 and C2)
- Mabyepelong (Reservoir C2); and
- Gamokgwathi (Reservoir D1, D2 and D3).

It is anticipated that construction will only take place during the day.

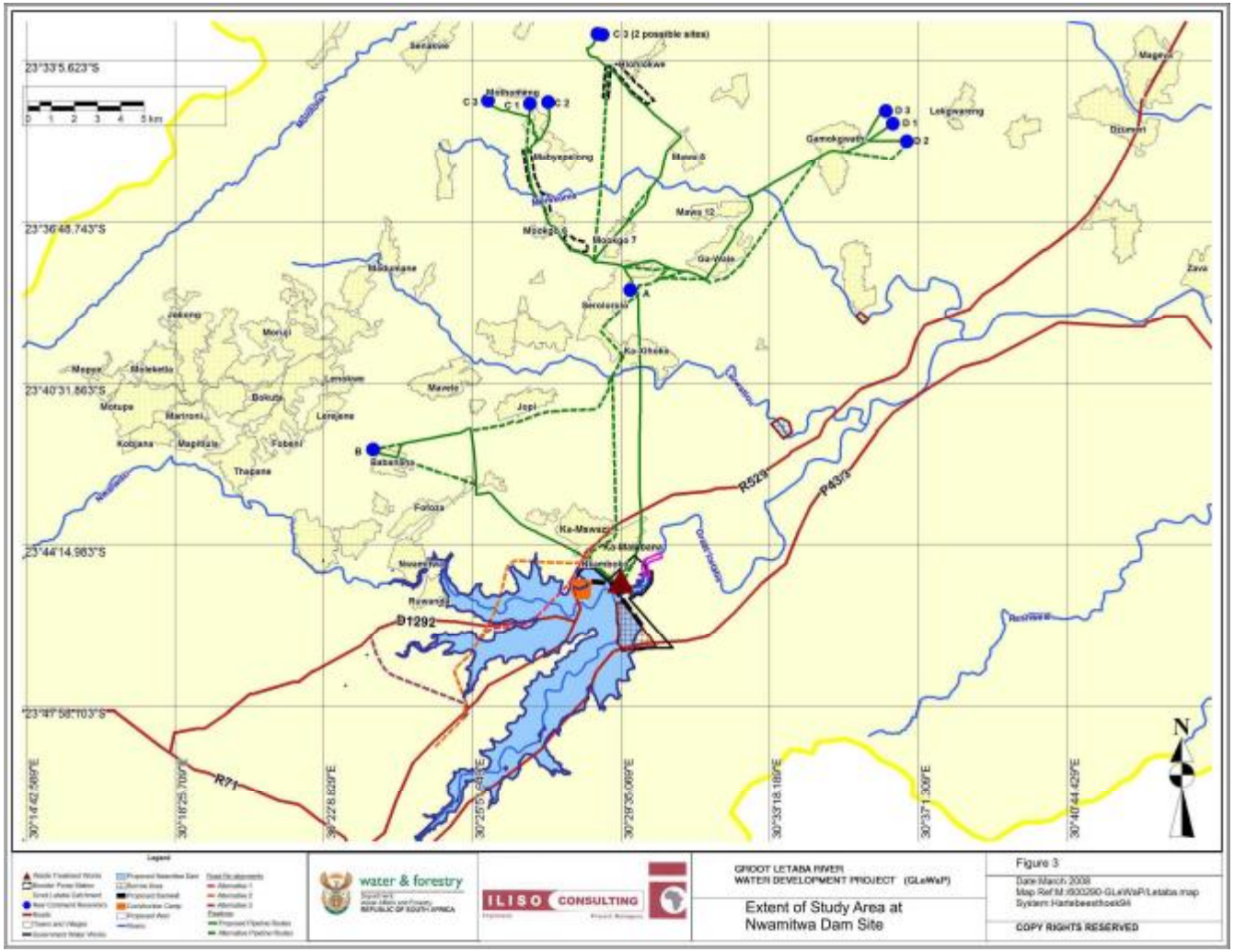


Figure 4.2: Extent of Study area at site known as Nwamitwa

5. THE DETAILS OF THE STUDY AREAS

Only the details that have an influence on aspects of the noise impact assessment are identified and analysed.

5.1 TOPOGRAPHY

The Greater Tzaneen Local Municipality area is characterised by mountainous, inaccessible terrain in the west and south, and even topography (gentle slopes) to the north and east. The Greater Letaba, Greater Giyani and Ba-Phalaborwa municipal areas are flatter than the rest of the study area. The Groot Letaba River is a major feature in both of the Study Areas.

5.2 ROAD SYSTEM

The respective study area(s) are well serviced by a provincial road network.

The main roads involved in the Tzaneen Dam Area are:

i) Section 1: Road P43/3 (Route R71) just west of Road D978 (Deerfield Road)
ii) Section 2: Road P43/2 / Road P17/3 (Route R71/Route R36) between Road P17/2 (Route R71) and Road D528.
iii) Section 3: Road P17/2 (Magoebaskloof Road) (Route R71) just west of Road P43/2 / Road P17/3.
iv) Section 4: Road P43/2 (Modjadjiskloof Road) (Route R36) north of Road P17/2 (Magoebaskloof Road).
v) Section 5: Road D978 (Deerfield Road) just north of Road P43/3 (Route R71).

The main roads in the Nwamitwa Dam and Reticulation Study Area are:

i) Section 6: Road P43/3 (Route R71) west of Road R529.
ii) Section 7: Road P43/3.
iii) Section 8: Road R529 north of the intersection with D1292.
iv) Section 9: Road R529 south of the intersection with D1292.
v) Section 10: Road D1292.

The area for reticulation to the north, north-east and north-west of the dam wall is largely characterised by a network of gravel roads that link the scattered villages. Most of these roads seem to be poorly maintained.

5.3 LAND USE

The existing land uses in the areas adjacent to the Tzaneen Dam Study Area are as follows:

i) Residential

a) The area in the river valley south of Tzaneen Dam is presently being intensively developed with housing estates.

b) Residential township of Aqua Park lies to the south-west of the dam wall and follows the frontage of the dam.

c) DWAF houses lie just to the north of the dam wall.

d) Farm houses on the western and northern banks of the dam.

ii) Educational: Merensky High School lies directly west across the dam.

iii) Retail/Commercial: Tzaneen CBD lies 3km to the south of the dam wall.

iv) Agricultural: There are farms to the east and north-east of the dam wall and on the western and northern banks of the dam.

v) Recreational: Tzaneen Dam Nature Reserve lies on the western side of the Tzaneen Dam.

There is no information on future developments in the respective study areas, but it may be anticipated that the housing estates will continue to develop in the area east of the dam.

The existing land uses in the areas in the Nwamitwa Dam and Reticulation Study Area are as follows:

i) Residential

a) There are several farmhouses and farm labourer residences in the southern part of the study area along the Groot Letaba River.

b) There are some twenty formal villages in the proposed reticulation area to the north, north-east and north-west of the proposed dam.

ii) Educational: There are several schools in the villages.

iii) Agricultural: There are several farms in the area straddling the Groot Letaba River.

iv) Recreational: There are three Nature Reserves in the close vicinity of the Study Area, but these are not directly affected by the planned water resources project.

There is no information on the future developments in the respective study areas but it may be anticipated that the formal villages will continue to develop and will expand.

The residential, educational and nature reserve land uses may be classified as being "noise sensitive".

5.4 RAILWAY LINES

The main Makhado-Tzaneen-Kaapmuiden railway line runs just to the west of the Tzaneen Dam, and to the south of Road R71 (just south of the planned Nwamitwa Dam).

5.5 ASPECTS OF ACOUSTICAL SIGNIFICANCE

The main meteorological aspect that will affect the transmission (propagation) of the noise is the wind. The wind can result in periodic enhancement downwind or reduction upwind of noise levels. Analysis of the wind records for the area indicates that the main prevailing winds blow from the north-eastern quadrant (32%). Approximately 38% *still* periods are experienced annually. The wind directions will be modified by the orientation of the hills and valleys in the respective area.

6. METHODOLOGY

6.1 GENERAL

The general procedure used to determine the noise impact was guided by the requirements of the South African National Standard (SANS) 10328:2003: *Methods for Environmental Noise Impact Assessments.* The level of investigation was the equivalent of an Environmental Impact Assessment (EIA) of the situation. The noise impact criteria used specifically take into account those as specified in the South African National Standard SANS 10103:2004, *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication* as well as those in the National Noise Control Regulations. Note that the Limpopo Province has not yet promulgated its Noise Control Regulations.

The investigation comprised the following:

i) Determination of the existing situation (residual noise climate).

ii) Determination of the situation during and after construction.

iii) Assessment of the change in noise climate induced by the project and its impact during each phase.

iv) Identification of mitigating measures.

6.2 DETERMINATION OF THE EXISTING CONDITIONS

This phase comprised the following:

i) The relevant technical details of the project and the existing and planned land uses adjacent to the various elements were reviewed in order to establish a comprehensive understanding of all aspects of the project that will influence the future noise climate in the respective Study Areas.

ii) Using these data, the limits of the respective Study Area were determined and the potential noise sensitive areas, other major noise sources and potential problems in these areas were identified.

iii) Applicable noise standards were established. The National Noise Control Regulations, and the SANS 10103:2004 standards were applied.

iv) The existing *noise climates* of the respective study areas were determined by means of a field inspection and a noise measurement survey. The measurement survey appropriately covered both Study Areas, focussing specifically on the identified noise sensitive/problem areas. Measurements were taken at sixteen monitoring sites. Both the daytime and night-time conditions were measured. The sound pressure level (SPL) (noise) measurements were taken in accordance with the requirements of the Code of Practice SANS 10103:2004, *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and to Speech Communication*. Type 1 Integrating Sound Level Meters were used for the noise measurements. All measurements were taken under dry weather and normal traffic (that is mid-week/school term) conditions. Refer to **Appendix I2**.

v) At the same time as each individual measurement was being taken, the qualitative nature of the *noise climate* in the area of the measurement site was assessed and recorded. This comprised an appraisal of the general prevailing acoustic conditions based on the subjective response to the sounds as perceived by the listener (i.e. *auditory observation* by the surveyor), as well as identifying those noise incidents which influenced the noise meter readings during that measurement period. This procedure is essential in order to ensure that that there is a *human* correlation between the noise as perceived by the human ear and that which is measured by the meter, as well as to establish any anomalies in the general ambient noise conditions.

vi) The noise generated by the main roads was also calculated to establish 24-hour noise descriptors. The existing noise climate as related to the current traffic volumes and patterns on four main roads was established. Traffic noise levels were calculated using the South African National Standard SANS 10210 (SABS 0210) *Calculating and Predicting Road Traffic Noise* for Route. The Year 2007 traffic was used as the baseline reference. Refer to **Appendix I2** for details.

vii) The baseline noise profile of pump stations typical to those being considered for the project was established from measurements at the Clapham pump station on

the Lebalelo pipeline and the Politsi Purification Scheme Final Water Pump Station.

viii) The baseline noise profile of dam outlet discharge was established from measurements at the Tzaneen Dam and the Flag Boshielo Dam.

6.3 ASSESSMENT OF PLANNING/DESIGN PHASE IMPACTS

Aspects of the pre-design field surveys and activities that potentially will have a noise impact were identified and where appropriate mitigating measures have been recommended.

6.4 ASSESSMENT OF CONSTRUCTION PHASE IMPACTS.

Aspects of the construction activities that potentially will have a noise impact were identified and where appropriate mitigating measures have been recommended. Although the exact details of the construction, that is the *modus operandi* and equipment, are not known at this stage, standard procedures and typical conditions were used to calculate the likely noise climate. A worst case scenario approach was used. Refer to **Appendix I3**.

6.5 ASSESSMENT OF OPERATIONAL PHASE IMPACTS

The main focus of the operational phase assessment was to establish the nature, magnitude and extent of the potential change in *noise climates* in the respective study areas directly related to and within the area of influence of the planned project elements. Consideration has been given mainly as to how residences and educational facilities within the area of influence of the project as well as users of adjacent facilities will be affected. Operational conditions were established as follows:

i) Tzaneen Dam. The baseline outflow condition noise (water discharge from valves into the stilling pond) was used to calculate the impact by applying the method specified in the South African National Standard SANS 10357 (SABS 0357), *Calculation of Sound Propagation by means of the Concawe Method*.

ii) Nwamitwa Dam. The baseline outflow condition noise (water discharge from valves into the stilling pond) was used to calculate the impact by applying the

method specified in the South African National Standard SANS 10357 (SABS 0357), *Calculation of Sound Propagation by means of the Concawe Method*.

iii) Water Purification Works and Pump Station. The predicted noise and impact was based on reference measurements taken at the Tzaneen Dam Water Purification Plant.

iv) Re-aligned sections of Roads R529 and P43/3. The future traffic related noise levels for the Year 2012 (anticipated commissioning date) were calculated using the South African National Standard SANS 10210. These data were used to determine impact on the adjacent areas.

v) Pipelines. The operation of the pump stations will be the main element of noise generation along the pipelines during this phase. The baseline pump station noise was based on the Clapham pump station and the Politsi Purification Scheme Final Water Pump Station noise profiles. These were used to calculate the impact by applying the method specified in the South African National Standard SANS 10357.

vi) A conservative approach was taken, that is the likely *worst condition* scenario (related to all the noise generation and attenuation factors) was modelled in all calculations.

vii) The predicted noise levels and the altered ambient noise condition (inclusive of both the quantitative and qualitative condition) were then reviewed to assess the nature, magnitude and extent of the noise impact as related to appropriate maximum noise zone (land use) standards.

viii) The final details of some of the elements of the project are not known at this stage. Where this was the case, a *worst scenario* approach was taken in the analysis of impact.

ix) Based on the findings, appropriate noise mitigating measures have been investigated and recommendations made. These are conceptual and not detailed to final design level.

6.6 SIGNIFICANCE RATING

The following criteria were used to evaluate significance:

Nature

The nature of the impact was classified as positive or negative, and direct or indirect.

Extent and location

Magnitude of the impact was classified as:

- **Local**: the impacted area is only at the site – the actual extent of the activity
- **Regional**: the impacted area extends to the surrounding, the immediate and the neighbouring properties.
- **National**: the impact can be considered to be of national importance.

Duration

This measures the lifetime of the impact, and was classified as:

- **Short term**: the impact will be for 0 – 3 years, or only last for the period of construction.
- **Medium term**: three to ten years.
- **Long term**: longer than 10 years or the impact will continue for the entire operational lifetime of the project.
- **Permanent**: this applies to the impact that will remain after the operational lifetime of the project.

Intensity

This is the degree to which the project affects or changes the environment, and was classified as:

- **Low**: the change is slight and often not noticeable, and the natural functioning of the environment is not affected.

- **Medium**: The environment is remarkably altered, but still functions in a modified way.
- **High**: Functioning of the affected environment is disturbed and can cease.

Probability

This is the likelihood or the chances that the impact will occur, and was classified as:

- **Low**: during the normal operation of the project, no impacts are expected.
- **Medium**: the impact is likely to occur if extra care is not taken to mitigate them.
- **High**: the environment will be affected irrespectively; in some cases such impact can be reduced.

Confidence

This is the level knowledge/information, the environmental impact practitioner or a specialist had in his/her judgement, and was rated as:

- **Low**: the judgement is based on intuition and not on knowledge or information.
- **Medium**: common sense and general knowledge informs the decision.
- **High**: Scientific and or proven information has been used to give such a judgement.

Significance

Based on the above criteria the significance of issues was determined. This is the importance of the impact in terms of physical extent and time scale, and was rated as:

- **Low**: the impacts are less important, but may require some mitigation action.
- **Medium**: the impacts are important and require attention; mitigation is required to reduce the negative impacts
- **High**: the impacts are of great importance. Mitigation is therefore crucial.

Cumulative Impacts

The possible cumulative impacts were also considered.

Mitigation

Mitigation for significant issues will be incorporated into the EMP for construction.

7. ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

In interpreting the study findings it is important to note the limitation and assumptions on which the assessment was based. The most important limitations and assumptions of the noise impact assessment were as follows:

i) The exact modus operandi for and equipment to be used during the construction works at the Tzaneen Dam and the Nwamitwa Dam and Weir are not yet available and typical conditions have been estimated on works at similar sites.

ii) The exact position of reservoirs and pump stations has not yet been finalised and the noise impact from these construction areas had to be estimated.

iii) The details of the volume of traffic generated by the various construction sites are also not available and estimates had to be made.

iv) The type of pumps at the new draw-off point (Nwamitwa Dam) and at the pump stations along the pipeline routes, and the position of these pump stations has not yet been finalised. Possible conditions had to be estimated based on noise measurements at similar type facilities.

8. FINDINGS AND ASSESSMENT OF IMPACT

The following conditions were observed in the respective study areas and the following aspects were determined from the noise surveys, calculations and the predictive modelling undertaken for the assessment of the noise impact of the planned GLeWaP works.

8.1 GENERAL ASPECTS

General aspects of note were as follows:

i) The weather conditions on the survey days were such that the measurements to establish the ambient noise levels were not adversely affected and no specific corrective adjustments needed to be made.

ii) There are a large number of noise sensitive areas/land uses (mainly residences/residential areas and schools) that have the potential to be adversely affected by elements of the project. This applies to both study areas. Refer to **Chapter 5.3**.

8.2 THE EXISTING AMBIENT NOISE CLIMATE

The findings related to the existing conditions are based on the measurements and *auditory observations* taken at 16 main sites covering the two study areas. For details about the noise measurement procedure and description of the noise measurement sites, refer to **Appendix I2** and **Figures B1** and **B2.** Conditions for the daytime and evening periods were ascertained. The summary of the noise measurements, which were taken at the various sites are given in **Tables B3** and **B4** in **Appendix I2**. The equivalent sound pressure (noise) level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}) are indicated. Note that the equivalent sound pressure (noise) level may, in layman's terms, be taken to be the average noise level over the given period. This "average" is also referred to as the residual noise level (excluding the impacting noise under investigation) or the ambient noise level (if the impacting noise under investigation is included). The measured data also provide an indication of the variability of the sound content, namely the variation between the maximums and minimums.

The present (Year 2007) effect of the traffic-generated noise along the main roads in the two study areas is given in **Tables B5** and **B6** in **Appendix I2**.

8.2.1 Prevailing Noise Climate in the Tzaneen Dam Study Area

In overview, the existing situation with respect to the existing *noise climate* in the study area was found to be as follows:

i) The main sources of noise in the area are from:

- Traffic of the main roads.
- Tzaneen Dam water purification works.
- Power boats on the Tzaneen dam.
- Railway line to the west of the Tzaneen Dam.

ii) The existing *noise climate* alongside the main roads is degraded with regard to residential living (using 40dBA as the night-time impact criterion). Residences in some areas are negatively impacted from traffic noise (particularly at night) for up to the following distances from these roads:

Section of Road	**Offset Distance**
Section 1: Road P43/3 (Route R71) just west of Road D978 (Deerfield Road).	500m
Section 2: Road P43/2 / Road P17/3 (Route R71/Route R36) between Road P17/2 (Route R71) and Road D528.	1000m
Section 3: Road P17/2 (Magoebaskloof Road) (Route R71) just west of Road P43/2 / Road P17/3.	250m
Section 4: Road P43/2 (Modjadjiskloof Road) (Route R36) north of Road P17/2 (Magoebaskloof Road).	800m
Section 5: Road D978 (Deerfield Road) just north of Road P43/3 (Route R71).	250m

iii) The residual (existing background) noise levels are relatively low (quiet) in the existing and developing residential areas to the south and east of the Tzaneen Dam wall. Daytime ambient conditions range from about 45dBA to 57dBA. Early evening conditions fall in the range of 54dBA to 57dBA, while the night-time ambient levels will fall to about 40dBA. These are acceptable suburban residential conditions (SANS 10103).

iv) The noise climates at the farmhouses at the western and northern sides of the dam are relatively quiet.

v) The residual noise levels at the Merensky High School fall within the limits recommended in SANS 10103.

8.2.2 Prevailing Noise Climate in the Nwamitwa Dam and Reticulation Study Area

In overview, the existing situation with respect to the existing *noise climate* in the study area was found to be as follows:

i) The main sources of noise in the area are from:

- Traffic on the main roads.
- Nkambako Water Treatment Works.
- Pump on the Groot Letaba River feeding the Nkambako Water Treatment Works.
- Noise from cicadas dominated at Sites 9 and 12, and had a significant influence on the noise levels at Site 8 as well. This was the situation during both day-time and night-time measurements. This is considered to be a seasonal condition in the normal rural climate. Without the noise from the cicadas, the noise climate will be relatively quiet.

ii) The existing noise climate alongside the main roads is degraded with regard to residential living (using 40dBA as the night-time impact criterion). This is an anomalous situation in that many of these areas are normally very quiet (rural conditions) when there is no traffic on the road but are significantly impacted when traffic passes by. There is a significant variation between the no traffic condition background noise level and each “single event” maximum noise level

as a vehicle passes. Noise levels varying between 35dBA and 80dBA can be experienced close to the respective roads. Residences in some areas are negatively impacted from traffic noise (particularly at night) for up to the following distances from these roads:

Section of Road	**Offset Distance**
Section 6: Road P43/3 (Route R71) west of Road R529.	500m
Section 7: Road P43/3.	100m
Section 8: Road R529 north of the intersection with D1292 (in KwaMalubana Village)	320m
Section 9: Road R529 south of the intersection with D1292	300m
Section 10: Road D1292.	500m

iii) The residual (existing background) noise levels are relatively low (quiet) in the areas that are not close to and are relatively shielded from the main roads. Daytime ambient conditions range from about 41dBA to 54dBA. Night-time conditions will tend to fall to between 30dBA and 35dBA. In general the conditions on the farms and villages in the area meet the acceptable standards as per SANS 10103.

For more details of the existing conditions refer to **Section B5.3** in **I2B**. The applicable acceptable noise levels (standards and impact criteria) are as prescribed by SANS 10103:2004 as indicated in **Appendix I1**.

8.3 ASSESSMENT OF THE PRE-CONSTRUCTION PHASE

Activities during the planning and design phase that have possible noise implications in the Tzaneen Dam Study Area are possible concrete core testing on the spillway.

Activities during the planning and design phase that have possible noise implications in the Nwamitwa Dam and Reticulation Study Area are those related to field surveys (such seismic testing and geological test borehole drilling) mainly at planned building, bridge and other major structure sites. Although some of these activities such as the drilling operations can be noisy, a major disturbance is generally unlikely in an area as these activities are of short duration at any one site and normally take place during the day. Drilling activities near schools will cause minor problems.

8.4 ASSESSMENT OF THE CONSTRUCTION PHASE

8.4.1 General

By its very nature the construction phase will be noisy and has the potential for causing a noise disturbance or nuisance. The construction details of the various elements of the project, as presently known or as realistically estimated are documented in **Chapter 4** and **Section C3** of **Appendix I3**.

8.4.2 Noise Impact at the Tzaneen Dam

It has been assumed that at this site construction will take place only during the day-time.

iv) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over any working period.

v) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work modus operandi and type of equipment have not been finalised. From present information available, ambient noise levels during the daytime period at the nearest houses to the dam wall, namely the DWAF houses at the north-eastern side of the dam wall, the residences in the Tzangeni and Golden Acres Security Estates to the south-east of the dam wall and the farmhouses on the western and northern sides of the dam should not exceed 50dBA. Thus, no noise disturbance effects are predicted. Working on a worst case scenario basis, it is estimated that the maximum instantaneous noise levels from general construction operations should not

exceed 72dBA at the nearest houses to the dam wall. The residual noise levels are fairly quiet at these residences and thus there are likely to be noise nuisance effects from individual incidents from the construction in these residential areas.

vi) The Merensky High School on the western side of the dam will not be affected by the noise from the construction noise from the dam during the day. The school has residences and any night-time construction could have sleep disturbance effects at the dormitories. The school area is already impacted by the noise from traffic on the dual carriageway road to the west of the dam.

vii) Construction workers working with or in close proximity to equipment will be exposed to high levels of noise as can be seen from **Table C1** of **Appendix I3** (refer to the 5 metre offset noise levels).

viii) There will be an increase in traffic (mainly delivery vehicles) on the main routes into the area, but the volumes are unlikely to raise the ambient noise levels along the roads.

It should be noted that for residential areas, higher ambient noise levels than recommended in SANS 10103 are normally accepted as being reasonable during the construction period, provided that the very noisy construction activities are limited to the daytime and during the week, and that the contractor takes reasonable measures to limit noise from the work site. Note that it has been assumed that construction will generally take place from 07h00 to 18h00 with no activities (or at least no noisy construction activities) at night. From the details presently available, it appears that the construction noise impact is not likely to be too severe in the residential areas near to the dam wall. Refer to 8.4.2 (ii) above.

8.4.3 Noise Impact at the Nwamitwa Dam and Weir

i) There will be a significant noise impact from the construction activities at the dam on the Ka-Malubana and Ka-Mswazi Villages north of and the farms to the north and east (Deeside 733-LT) of the dam wall, particularly from the night-time construction activities.

ii) Source noise levels from many of the construction activities will be high (refer to Table C1 in Appendix J3). Noise levels from all work areas will vary constantly and in many instances significantly over any working period.

iii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work *modus operandi* and type of equipment have not been finalised. From present information available, *ambient* noise levels during the daytime period at the nearest houses to the dam wall, namely the residences in Ka-Malubana Village at the northern side of the dam wall (200m offset), should not exceed 54dBA. The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. Thus, no noise disturbance effects are predicted during the day, but significant noise impact is anticipated at night.

iv) Working on a worst case scenario basis, it is estimated that the maximum instantaneous noise levels from general construction operations could be of the order of 74dBA at the nearest houses to the dam wall in Ka-Malubana Village. The residual noise levels in the village and on the surrounding farms are fairly quiet and significant noise nuisance effects and noise disturbance effects are anticipated from the construction in these residential areas.

v) The main impact from the construction phase on the Ka-Malubana Village will be from the quarrying operation, namely from the rock drills and the crusher. When the quarrying operations are closest to the Village (estimated offset of 250 metres) ambient noise levels could be of the order of 79dBA (dependent on the number of rock drills). The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. The noise impact will be significant. The impact from blasting at the aggregate quarry, however, is likely to be minimal on residents in the area, provided that blasting is restricted to the day-time. Blasting is anticipated only once every two weeks and will be limited to the daytime.

vi) Construction workers working with or in close proximity to equipment will be exposed to high levels of noise as can be seen from **Table C1** (refer to the 5 metre offset noise levels).

vii) There will be an increase in traffic (mainly delivery vehicles) on the main routes into the area, but the volumes are unlikely to raise the ambient noise levels along the roads. Night-time traffic could cause nuisance problems at some of the noise sensitive sites along the main roads into the area of the dam.

viii) The position of the access roads to the construction site has not yet been defined. Although the volumes of construction site generated traffic are not expected to be high, noise from site traffic could be a problem, depending on the location of these roads relative to the Ka-Malubana Village and farmhouses.

It should be noted that for residential areas, higher ambient noise levels than recommended in SANS 10103 are normally accepted as being reasonable during the construction period, provided that the very noisy construction activities are limited to the daytime and during the week, and that the contractor takes reasonable measures to limit noise from the work site. Construction activities, however, will take place on a 24-hour, 7 day a week basis and therefore significant impacts are anticipated in the village and on some of the farms

8.4.4 Noise Impact for Road Construction

The nature of the noise impact from the road construction site is likely to be as follows:

i) The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

ii) As no specific construction details or possible locations of major ancillary activity sites are available at this stage, the anticipated noise from various types of construction activities cannot be calculated accurately. In general at this stage, it can be said that the typical noise levels of construction equipment at a distance of 50 metres lie in the range of 65 decibels (dBA) to 75dBA. Refer also to **Table C1** in **Appendix I3**. Based on data from similar "linear" construction sites, a one hour equivalent noise level of between 75dBA and 78dBA at a point 50 metres from the construction would be typical for the earthmoving phase. The reconstruction of these roads is in the farming areas where ambient noise levels during the day are normally of the order of 40-50dBA.

iii) All three alternatives for the re-alignment of Road R529 (Alternatives 1, 2 and 3) will now be routed close to a number of farmhouses. Alternatives 1 and 2 affect the Farm Riverside 514-LT and Alternative 3 affects residences on La Gratitude

513-LT and on Taganashoek 465-LT. There are more noise sensitive sites along Alternative 3 than on the other two. The re-alignment of Road P43/3 to the east of its existing alignment will place the new road relatively close to farm worker residences on the farm Nagude 517-LT. As construction is likely to take place during daytime, no major noise impact is anticipated at these residences.

iv) The impacts in any one area will be relatively short-term as the construction activities progress along the route.

v) The noise levels generated from the bridge construction sites will be of the order of that indicated in **Table C2** in **Appendix I3**.

vi) There is likely to be noise impact from trucks on routes to and from the various borrow sites and spoil sites.

8.4.5 Noise Impact related to Water Treatment Works

i) The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

ii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work modus operandi and type of equipment have not been finalised. Working on a worst case scenario basis, it is estimated that the maximum instantaneous noise levels from general construction operations could be of the order of 70dBA at the nearest houses to the treatment works in Ka-Malubana Village. The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. The noise from this site will be dominated to a large extent by the noise from the construction at the dam area and aggregate quarry, but will have a minor cumulative effect on the noise levels from the various construction sites.

8.4.6 Noise Impact related to Pipelines, Pump Stations and Reservoirs

The noise sensitive areas/sites that could be impacted by noise along the whole length of the respective pipeline routes are mainly residential land uses. There are

also a number of schools that are potentially affected. The nature of the noise impact from the construction activities on nearby noise sensitive areas/sites is likely to be as follows:

i) The noise level and character of the noise will vary along the project route dependant on the type of construction activity. For example, the noise from a section where only a pipeline is being laid will differ from a site where a valve box or a road crossing is also being constructed.

ii) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period. The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

iii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work modus operandi and type of equipment have not been finalised. Typical ambient noise conditions from a small construction site are as indicated in **Table C2** (**Appendix I3**). These general noise levels are more representative of the sites where concreting operations also take place. For more specific plant/equipment related noise levels refer to **Table C1** (**Appendix I3**).

iv) If discrete sections of pipeline are completed at a time (namely excavation, laying and backfilling), the duration of the noise impact will be short-term.

v) The construction times for the pump stations and reservoirs could extend over several months with attendant variable noise impact.

vi) The noise sensitive sites closest to the roads (where the pipelines are laid in the reserve) will be affected the most by the construction noise. If construction activities are contained to the daytime, the impact conditions at residences will not be that severe.

vii) Schools close to the pipeline routes will be adversely affected.

8.5 ASSESSMENT OF THE OPERATIONAL PHASE

8.5.1 Tzaneen Dam

i) The only sources of noise during the operational phase will be:

- Water outflow from the dam outlet works valves into the stilling basin.
- Routine maintenance work on the dam infrastructure.

ii) In addition, the general noise climate of the area will also be influenced by:

- Traffic on the main roads.
- Power boats on the Tzaneen Dam.
- Tzaneen Dam water purification works.
- Rail traffic on the line to the west of the Tzaneen Dam.

iii) No change in the general noise climate is anticipated from the alterations to the dam wall.

iv) No noise disturbance is anticipated from the sound of constant outflow of dam water into the stilling basin due firstly to the character of the sound (namely a waterfall sound) and secondly due to the distance attenuation of the sound. The alterations to the dam will not affect the general pattern of outflow into the stilling basin. The noise from the outflow of water was measured at 83.6dBA at 15m from the flume, reducing to 65.2dBA at 60m from the flume. This noise level is likely to be of the order of 50dBA at a distance of 500 metres from the dam wall.

v) Maintenance works are unlikely to have an impact on the area as these will be at relatively long term intervals and will be contained to the daytime.

8.5.2 Nwamitwa Dam and Weir

i) The only sources of noise during the operational phase will be:

- Water outflow from the dam outlet works valves into the stilling basin.

- Routine maintenance work on the dam infrastructure.

ii) In addition, the general noise climate of the area will also be influenced by:

- Traffic on the main roads.
- Nkambako Water Treatment Works (expanded works).
- Pump station at the dam for feeding the water purification works.

iii) No noise disturbance is anticipated from the sound of constant outflow of dam water into the stilling basin due firstly to the character of the sound (namely a waterfall sound) and secondly due to the distance attenuation of the sound. Baseline noise measurements indicate that this noise level is likely to be of the order of 50dBA at a distance of 500 metres from the overflow section of the dam wall. The "noise" at the nearest residences will be of the order of 40dBA.

iv) Maintenance works are unlikely to have an impact on the area as these will be at relatively long term intervals and will be contained to the daytime.

v) The noise from water flowing over the weir will be of a nature that will have no impact.

vi) No major change in general noise climate is anticipated from the operations at the dam.

8.5.3 Roads

i) Sources of noise during the operating phase will be:

- General traffic.
- Routine road maintenance activities.

ii) Existing noise levels close to the main roads in the Tzaneen Dam Study Area and the Nwamitwa Dam and Reticulation Study Area are already high for residential land use and particularly at night. The situation of these "noise degraded" areas will continue to worsen with the general growth of traffic through the study area.

iii) The main impact from traffic noise will be on the realigned sections of Road R529 and Road P43/3 (see **Section C3.4.1** in **Appendix J3**). Specifically on the realigned section of Road R529 there are a number of farm houses that will be within 500m of the realigned sections of the road and where the noise level will exceed the 45dBA ($L_{R,dn}$) allowable.

iv) The character (qualitative aspect) of the traffic noise will be as follows:

a) Where the traffic is travelling at high speed, the main noise component will be that of high frequencies generated by the interaction between vehicle tyres and the road surface.

b) Where there are long steep grades and heavy vehicles on the upgrade slow down, low-frequency mechanical noise becomes more evident. There may also be mechanical noise from the heavy vehicles on the downgrade using their air-brakes. This will be a minor component on the re-aligned road.

c) There will also be a difference in the sound from continuous flow traffic versus the passing of single vehicles. The noise from continuous flow traffic tends to form a "background" of noise while, when general traffic flows are low, the noise from a single vehicle can be found to be rather intrusive. This is particularly so at night.

8.5.4 Water Treatment Works

i) The main sources of noise during the operational phase are anticipated to be:

- The expanded water treatment works.
- Extraction-pump station at the dam.

ii) The expanded water treatment works could generate noise levels of about 51dBA at 500m. The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. Residences in the southern sector of Ka-Malubana Village will be adversely affected by the noise from the works, particularly at night.

iii) The exact position of the extraction pump station for the water treatment works has not yet been determined. Conservatively it is estimated that the noise from these pumps could also be of the order of 50dBA at 500m. Residences in Ka-Malubana Village will be adversely affected by the noise from the works, particularly at night.

iv) The farms to the north-east and east of the Nwamitwa Dam should not be affected by the noise from these two sources.

8.5.5 Pipelines, Pump Stations and Reservoirs

i) The main sources of noise during the operational phase of the pipelines will be:

- The pump stations.
- Water hammer in the pipelines when the pumps are switched on.
- Routine maintenance.

ii) As no final details of the location, position and orientation for the pump stations are available at this stage, no specific impact predictions are possible. Typically the noise impact on residences (particularly at night) and schools within 250 metres of a pump station will be significant.

iii) Noise from water hammer effects, namely the noise caused by the pressure surges in the pipeline from the water when the pumps are started is unlikely to have any significant effect on people living and working along the pipelines, as there will be relatively few such occurrences due to the planned continuous pumping operation.

iv) Maintenance works are unlikely to have an impact on the areas along the pipelines as these activities will be at relatively long term intervals and will be contained to the daytime.

v) No noise impacts are anticipated from the reservoir sites.

8.6 ASSESSMENT OF IMPACT SIGNIFICANCE

The impacts identified for the construction and operational phases of the project both without and with the identified mitigating measures have been summarised in general in table format. The tables are:

i) Table 8.1: The Impact Significance Rating for the Tzaneen Dam.
ii) Table 8.2: The Impact Significance Rating for the Nwamitwa Dam and Weir.
iii) Table 8.3: The Impact Significance Rating for the Quarry at the Nwamitwa Dam.
iv) Table 8.4: The Impact Significance Rating for the Road Realignments.
v) Table 8.5: The Impact Significance Rating for the Water Treatment Works and Supply Pump Station.
vi) Table 8.6: The Impact Significance Rating for the Pump Stations.
vii) Table 8.7: The Impact Significance Rating for the Pipeline and Reservoirs.

These tables should be read in conjunction with the description of the impacts and mitigating measures as set out in **Chapters 8** and **9** respectively.

Table .8.1: The Impact Significance Rating for the Raising of the Tzaneen Dam

Description of potential impact	Noise from general construction for raising of dam wall and operation of dam	
Nature of impact	Negative, Direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative, Direct	Negative, Direct
Extent of impact	Regional	Regional
Duration of impact	Short term	Long Term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	High	High
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	See Chapter 9.2	N/A
Level of significance after mitigation	Medium	N/A
Cumulative Impacts	None	None
Comments or Discussion:		

Table 8.2: The Impact Significance Rating for the Nwamitwa Dam and Weir

Description of potential impact	Noise from general construction and operation of the dam	
Nature of impact	Negative, Direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative, Direct	Negative, Direct
Extent of impact	Regional	Regional
Duration of impact	Short term	Long Term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	High	High
Level of significance before mitigation	Medium (Daytime) High (Night-time)	Low
Mitigation measures (EMP requirements)	See Chapter 9.2	N/A
Level of significance after mitigation	Medium (Daytime) High (Night-time)	N/A
Cumulative Impacts	None	None
Comments or Discussion:		

Table 8.3: The Impact Significance Rating for the quarry AT THE Nwamitwa Dam

Description of potential impact	Noise from general construction and operation of the dam	
Nature of impact	Negative, Direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative, Direct	Negative, Direct
Extent of impact	Regional	Regional
Duration of impact	Short term	Long Term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	High	High
Level of significance before mitigation	High (Daytime) High (Night-time)	Low
Mitigation measures (EMP requirements)	See Chapter 9.2	N/A
Level of significance after mitigation	High (Daytime) High (Night-time)	N/A
Cumulative Impacts	None	None
Comments or Discussion:		

Table 8.4: The Impact Significance Rating for the Road Realignments

Description of potential impact	Noise impact from construction and traffic noise impact along the new sections of road	
Nature of impact	Negative, direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative, Direct	Negative, Direct
Extent of impact	Regional	Regional
Duration of impact	Short term	Long Term
Intensity	Medium	Medium
Probability of occurrence	Medium	Medium
Confidence of assessment	High	High
Level of significance before mitigation	Medium	Medium
Mitigation measures (EMP requirements)	See Chapter 9.2	See Chapter 9.2
Level of significance after mitigation	Medium	Low
Cumulative Impacts	None	None
Comments or Discussion		

Table 8.5: The Impact Significance Rating for the Water Treatment Works

Description of potential impact	Noise impact related to construction and operation of the water treatment works and water supply pump station	
Nature of impact	Negative, direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative, Direct	Negative, Direct
Extent of impact	Regional	Regional
Duration of impact	Short term	Long Term
Intensity	Medium	Medium
Probability of occurrence	Medium	Medium
Confidence of assessment	High	High
Level of significance before mitigation	Medium	Medium
Mitigation measures (EMP requirements)	See Chapter 9.2	See Chapter 9.2
Level of significance after mitigation	Medium	Low
Cumulative Impacts	None	None
Comments or Discussion		

Table 8.6 The Impact Significance Rating for Pump Stations

Description of potential impact	Noise impact related to construction and operation of the pump stations	
Nature of impact	Negative, direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative, Direct	Negative, Direct
Extent of impact	Regional	Regional
Duration of impact	Short term	Long term
Intensity	Medium	Medium
Probability of occurrence	Medium	Medium
Confidence of assessment	High	High
Level of significance before mitigation	Medium	Medium
Mitigation measures (EMP requirements)	See Chapter 9.2	See Chapter 9.2
Level of significance after mitigation	Medium	Low
Cumulative Impacts	None	None
Comments or Discussion		

Table 8.7: The Impact Significance Rating for the Pipelines and Reservoirs

Description of potential impact	Noise impact related to construction and operation of the water treatment works and water supply pump station	
Nature of impact	Negative, direct	
Legal requirements	To comply with SANS 10103:2004	
Stage	Construction and decommissioning	Operation *
Nature of Impact	Negative, Direct	None
Extent of impact	Regional	N/A
Duration of impact	Short term	N/A
Intensity	Medium	N/A
Probability of occurrence	Medium	N/A
Confidence of assessment	High	N/A
Level of significance before mitigation	Medium	N/A
Mitigation measures (EMP requirements)	See Chapter 9.2	N/A
Level of significance after mitigation	Medium	N/A
Cumulative Impacts	None	None
Comments or Discussion: * During the operational phase, the only noise will occur during maintenance operations		

9. RECOMMENDED MITIGATION MEASURES

Applicable noise mitigating measures for the project were assessed. There are various measures that can, if correctly applied, significantly reduce or prevent the identified potential impacts. As many aspects of the planned project have not yet been finalised, the mitigating measures are reviewed in concept as no detailed designs are possible at this stage. Once the final design and construction details are known, the mitigating measures are to be finalised in detail and the requirements are to be included in the respective Environmental Management Plans (EMP) for the construction and operational phases.

9.1 PRE-CONSTRUCTION PHASE

Where relevant, local affected residents and affected schools are to be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities are to be undertaken at reasonable times of the day. These works should not take place at night or on weekends.

During this phase, consideration must be given to the noise mitigating measures required during the construction phase for inclusion in the tender document specifications and those required for incorporation in the design.

9.2 CONSTRUCTION PHASE RELATED MEASURES

There are several general noise mitigating measures/principles which must be applied during the construction phase in order to prevent/minimise impact on the identified noise sensitive areas. The requirements apply to all of the construction areas of the project.

i) Construction site yards, concrete batching plants, asphalt batching plants, construction worker camps and other noisy fixed facilities should be located well away from noise sensitive areas. Once the proposed final layouts are made available by the contractor(s), the sites must be evaluated in detail and specific measures designed in to the system.

ii) All construction vehicles, plant and equipment are to be kept in good repair.

iii) Truck traffic should be routed away from noise sensitive areas, where possible.

iv) Noisy operations should be combined so that they occur where possible at the same time.

v) Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day should be limited, blasting should be undertaken at the same times each day and no blasting should be allowed at night.

vi) Construction activities are to be contained to reasonable hours during the day and early evening. Night-time activities near noise sensitive areas should be avoided wherever possible.

vii) Deliveries of material and any noisy offloading activities should be restricted to the day.

viii) With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.

ix) As construction workers operate in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). Where necessary ear protection gear should be worn.

It should be noted that any mitigating measures taken for construction noise will limit the impact of only the construction generated noise, and generally will not contribute to improving the degraded noise climate from other sources in the areas where there is already a problem.

9.3 OPERATIONAL PHASE RELATED MEASURES

The following specific noise mitigating measures will need to be considered:

9.3.1 Tzaneen Dam

Noisy maintenance works should only be carried out during the day.

9.3.2 Nwamitwa Dam and Weir

Noisy maintenance works should only be carried out during the day.

9.3.3 Roads

i) Some noise mitigating measures to protect the farm houses and farm labourer residences along the realigned sections of the Road R529 and Road P43/3 may be necessary. Strategically placed sections of earth berm noise attenuation barrier may be necessary along the edges of the respective road reserves to adequately protect these noise sensitive areas. Final details of the road (and particularly the longitudinal profile design) are not yet available. These are necessary to finalise the design of the mitigating measures.

ii) The surfacing material of the road should be acoustically designed. Properly designed gap-graded rubber bitumen can reduce the tyre-road interaction noise by at least 5dBA.

iii) The speed limit along this section of road should be posted at 100 km/h.

iv) Maintenance works should only be carried out during the day.

It should be noted that any measures taken at the road will limit the impact of only the traffic generated noise, and generally will not contribute to improving the degraded noise climate from other sources in the areas where there is already a problem.

9.3.4 Water Treatment Works

i) The designs of the new water treatment works and delivery pump station are to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (L_{Rdn}), namely a noise level of 70dBA (just inside the *property projection plane*, namely the property boundary) as specified for industrial districts in SANS 10103. Refer to **Appendix I1**. Notwithstanding this provision, the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the water treatment works property. Where the noise level at such an external site is presently lower than

the maximum allowed, the maximum for that land use zoning shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased. Note that the induced ambient noise levels in the residential areas of Ka-Malubana Village shall not exceed 50dBA during the day and 40dBA at night.

ii) The latest technology incorporating maximum noise mitigating measures for the water treatment plant and extraction pump station components should be designed into the system.

iii) The design process is to consider, *inter alia*, the following aspects:

a) The position and orientation of buildings on the site.

b) The design of the buildings to minimise the transmission of noise from the inside to the outdoors.

c) The insulation of particularly noisy plant and equipment.

It should be noted that any mitigating measures taken at the development site will limit the impacts in the specific areas designed for, and will not necessarily contribute to improving the degraded noise climates in adjacent areas where there is already a problem from another source(s).

9.3.5 Pipelines, Pump Stations and Reservoirs

i) The pump stations should not be sited closer than 250 metres to houses or schools.

ii) The latest technology incorporating maximum noise mitigating measures for the pump station components should be designed into the system.

iii) As the internal noise levels in the pump stations are high, the buildings housing the pumps should be adequately designed to limit the transmission of the pump generated noise and other internal equipment noise to the outside of the building. Insertion losses for the building of at least 30dBA must be achieved.

iv) Where there are external sources of noise such as ventilation intake fans, appropriate measures will need to be taken. No details of the pump stations are

available at this stage but typically measures such as the following should be taken:

- Fan intakes to be low mounted (preferably ground mounted).
- Fans to have a low sound power output.
- Fan intakes to be effectively screened off by an appropriately designed noise attenuation barrier (wall) with an insertion loss capability of at least 20dBA.

v) Maintenance works should only be carried out during the day. Where close to schools, appropriate times of the day should be selected. No pump stations are presently located close to schools but this standard should be borne in mind if sites for any of these new facilities are moved.

It should be noted that any measures taken at the pump station will limit the impact of only that noise source, and generally will not contribute to improving the degraded noise climate from other sources in the areas where there is already a problem.

10. CONSULTATION PROCESS

Engagement with Interested and Affected Parties (I&APs) forms an integral component of the EIA process. I&APs have an opportunity at various stages throughout the EIA process togain more knowledge about the proposed project, to provide input into the process and to verify that their issues and concerns have been addressed.

The proposed project was announced in July 2007 to elicit comment from and register I&APs from as broad a spectrum of public as possible. The announcement was done by the following means:

- the distribution of Background Information Documents (BIDs) in four languages,
- placement of site notices in the project area,
- publishment of advertisements in regional and local newspapers,
- publishment of information on the DWAF web site,
- announcement on local and regional radio stations; and
- the hosting of five focus group meetings in the project area.

Comments received from stakeholders were captured in the Issues and Response Report (IRR) which formed part of the Draft Scoping Report (DSR). The DSR was made available for public comment in October 2007. A summary of the DSR (translated into four languages) was distributed to all stakeholders and copies of the full report at public places. Two stakeholder meetings were held in October to present and discuss the DSR. The Final Scoping Report was made available to stakeholders in December 2007.

The Draft Environmental Impact Assessment Report, its summary (translated in four languages), the various specialist studies, the Environmental Management Plans and Programmes were made available for a period of thirty (30 days) for stakeholders to comment. Stakeholder comments were taken into consideration with the preparation of the final documents. The availability of the final documents will be announced prior to submission to the decision-making authority.

11. CONCLUSIONS

The following conclusions may be drawn from the foregoing analysis:

i) The primary source of noise impacting the respective study areas at present is from road traffic. This is likely to remain the case in the future, with the situation worsening as traffic volumes increase.

ii) The ambient noise climate at many of the areas where elements of the project are to be built can be defined as being degraded, particularly where these sites are along or close to main roads with attendant high traffic generated noise levels. The noise situation is one varying between very quiet when there is no traffic to very noisy when vehicles pass by. Noise impact thus also varies from a situation of being insignificant to one of high significance.

iii) The noise climate in the Nwamitwa Dam and Reticulation Study Area away from the main roads is relatively quiet.

iv) The noise from elements of the Project, if unmitigated, has the potential to have a negative impact on some of the noise sensitive areas surrounding the respective project sites.

v) The main impact period will be during the construction phase but noise problems are also possible during the operational phase.

vi) There are appropriate noise mitigating measures that can be implemented to reduce or prevent any noise impact during construction and operation.

12. RECOMMENDATIONS

The following are recommended:

i) The main guidelines for addressing the potential noise impact on this project are the National Noise Control Regulations and SANS 10103:2004.

ii) Various measures to prevent or reduce the potential noise impact from the elements of the Groot Letaba River Water Development Project will be necessary during all phases of the project, and the mitigating measures indicated in **Chapter 9** need to be considered.

iii) There are however gaps in the present data base. Once the final design details of the project and the construction details are known, these need to be re-evaluated for their specific noise impacts and the final appropriate mitigating measures need to be identified and adequately designed. These aspects need to be included in the design plans, the contract documents and the Environmental Management Plans as appropriate. Further investigation of the potential impacts of the following aspects may be necessary:
   a) Borrow pits.
   b) Traffic between the borrow pits and the construction sites.
   c) General construction generated traffic.
   d) Operational phase generated traffic.
   e) Pumping stations.
   f) Re-aligned sections of Road P43/3, Road R529 and Road D1292.

iv) The noise mitigating measures should be designed by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.

v) When the project is commissioned, the noise footprints of relevant elements of the scheme should be measured.

13. REFERENCES

- South African National Standard SANS 10103:2004 — *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and to Speech Communication*.
- South African National Standard SANS 10210 (SABS 0210) — *Calculating and Predicting Road Traffic Noise*
- South African Bureau of Standards Code of Practice SANS 10328 (SABS 0328) — *Methods for Environmental Noise Impact Assessments*
- South African National Standard SANS 10357 (SABS 0357), — *The Calculation of Sound Propagation by the Concawe Method*
- Transportation Research Library, (1977) — *The Prediction of Noise from Road Construction Sites*, TRL, Crowthorne UK.
- Watkins, LH — *Environmental Impact of Roads and Traffic*, Applied Science Publishers Ltd, Essex, UK.
- British Standard BS 5228: 1997 — *Noise and Vibration Control on Construction and Open Sites*

APPENDIX I1

GLOSSARY OF TERMS AND NOISE IMPACT CRITERIA

APPENDIX I1: GLOSSARY OF TERMS AND NOISE IMPACT CRITERIA

A1. GLOSSARY OF TERMS

In order to ensure that there is a clear interpretation of this report the following meanings should be applied to the acoustic terminology:

- **Ambient sound level** or **ambient noise** means the totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far. Note that ambient noise includes the noise from the noise source under investigation. The use of the word *ambient* should however always be clearly defined (compare with *residual noise*).
- **A-weighted sound pressure, in Pascals**: The root-mean-square sound pressure determined by use of frequency-weighting network A.
- **A-weighted sound pressure level (SPL) (noise level) (L_{pA}), in decibels**: The sound pressure level of A-weighted sound pressure is given by the equation:

  $L_{pA} = 10 \log (p_A/p_o)^2$ where:

  p_A is the A-weighted sound pressure, in Pascals; and

  p_o is the reference sound pressure (p_o = 20 micro Pascals (μPa))

  Note: The internationally accepted symbol for sound pressure level, dB(A), is used.
- **Controlled areas** as specified by the National Noise Control Regulations are areas where certain noise criteria are exceeded and actions to mitigate the noise are required to be taken. Controlled areas as related to roads, airports and factory areas are defined. These Regulations presently exclude the creation of *controlled areas* in relation to railway noise.
- **dB(A)** means the value of the sound pressure level in decibels, determined using a frequency weighting network A. (The "A"-weighted noise levels/ranges of noise levels that can be expected in some typical environments are given in Table A2 at the end of this appendix).
- **Disturbing noise** means a noise level that exceeds the outdoor equivalent continuous rating level for the time period and neighbourhood as given in Table 2 of SANS 10103:2004. For convenience, the latter table is reproduced in this appendix as Table A1.
- **Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$)** means the value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, has the same mean-square sound pressure as a sound under consideration whose level varies with time.

- **Equivalent continuous rating level ($L_{Req,T}$)** means the equivalent continuous A-weighted sound pressure level during a specified time interval, plus specified adjustments for tonal character and impulsiveness of the sound and the time of day.
- **Equivalent continuous day/night rating level ($L_{R,dn}$)** means the equivalent continuous A-weighted sound pressure level during a reference time interval of 24-hours, plus specified adjustments for tonal character and impulsiveness of the sound and the time of day. (An adjustment of +10dB is added to the night-time rating level).
- **Integrating sound level meter** means a device that integrates a function of the root mean square value of sound pressure over a period of time and indicates the result in dBA.
- **Noise** means any acoustic phenomenon producing any aural sensation perceived as disagreeable or disturbing by an individual or group. Noise may therefore be defined as any *unwanted* sound or sound that is *loud, unpleasant or unexpected*.
- **Noise climate** is a term used to describe the general character of the environment with regard to sound. As well as the ambient noise level (quantitative aspect), it includes the qualitative aspect and the character of the fluctuating noise component.
- **Noise Control Regulations** means the regulations as promulgated by the National Department of Environmental Affairs.
- **Noise impact criteria** means the standards applied for assessing noise impact.
- **Noise level** means the reading on an integrating impulse sound level meter taken at a measuring point in the presence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation, and, if the alleged disturbing noise has a discernible pitch, for example, a whistle, buzz, drone or music, to which 5dBA has been added. (The "A"-weighted noise levels/ranges of noise levels that can be expected in some typical environments are given in Table A2 at the end of this appendix).
- **Noise nuisance** means any sound which disturbs or impairs or may disturb or impair the convenience or peace of any reasonable person considering the location and time of day. This applies to a disturbance which is not quantitatively measurable such as barking dogs, etc. (compared with disturbing noise which is measurable).
- **Residual sound level** means the ambient noise that remains at a position in a given situation when one or more specific noises are suppressed (compare with *ambient noise*).
- **Sound exposure level or SEL** means the level of sound accumulated over a given time interval or event. Technically the sound exposure level is the level of the time-integrated mean square A-weighted sound for stated time or event, with a reference time of one second.
- **Sound (pressure) level** means the reading on a sound level meter taken at a measuring point.

- **SANS 10103** means the latest edition of the South African National Standard SANS 10103 titled *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and to Speech Communication*.
- **SANS 10210** means the latest edition of the South African National Standard SANS 10210 titled *Calculating and Predicting Road Traffic Noise*.
- **SANS 10328** means the latest edition of the South African National Standard SANS 10328 titled *Methods for Environmental Noise Impact Assessments*.
- **SANS 10357** means the latest edition of the South African National Standard SANS 10357 titled *The Calculation of Sound Propagation by the Concawe Method*.
- **Sound** means the aural sensation caused by rapid, but very small, pressure variations in the air. In quantifying the subjective aural sensation, "loudness", the letters dBA after a numeral denote two separate phenomena:
    - "dB", short for *decibel*, is related to the human's subjective response to the change in amplitude (or largeness) of the pressure variations.
    - The "A" denotes the ear's different sensitivity to sounds at different frequencies. The ear is very much less sensitive to low (bass) frequency pressure variations compared to mid-frequencies.

  The level of environmental sound usually varies continuously with time. A human's subjective response to varying sounds is primarily governed by the total sound energy received. The total sound energy is the average level of the fluctuating sound, occurring during a period of time, multiplied by the total time period. In order to compare the effects of different fluctuating sounds, one compares the average sound level over the time period with the constant level of a steady, non-varying sound that will produce the same energy during the same time period. The average energy of sound varying in amplitude is thus equivalent to the continuous, non-varying sound. The two energies are equivalent.

- Refer also to the various South African National Standards referenced above and the Noise Control Regulations for additional and, in some instances, more detailed definitions.

TABLE A1: TYPICAL NOISE RATING LEVELS FOR AMBIENT NOISE IN DISTRICTS (NOISE ZONES)

Type of District	Equivalent Continuous Rating Level for Noise ($L_{Req,T}$) (dBA)					
	Outdoors			Indoors with open windows		
	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time ($L_{Req,n}$)	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time ($L_{Req,n}$)
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts (little road traffic)	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON RESIDENTIAL DISTRICTS						
d) Urban districts (some workshops, business premises and main roads)	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

TABLE A2: NOISE LEVELS/RANGES OF NOISE LEVELS THAT MAY BE EXPECTED IN SOME TYPICAL ENVIRONMENTS

Noise Level dB(A)	Typical Environment	Subjective Description
140	30m from jet aircraft during take-off	
130	Pneumatic chipping and riveting (operator's position)	Unbearable
>120	Hearing damage possible even for short exposure	
120	Large diesel power generator	
105-120	Low level military aircraft flight	
110-120	100 m from jet aircraft during take-off	
110	Metal workshop (grinding work), circular saw	
105-110	High speed train at 300 km/h (peak pass-by level at 7,5m)	
90-100	Printing press room	Very noisy
95-100	Passenger train at 200km/h (peak pass-by level at 7,5m).	Very noisy
95-100	Freight train at 100 km/h (peak pass-by level at 7,5 m)	Very noisy
90-100	Discotheque (indoors)	
75-100	7,5 m from passing motorcycle (50 km/h)	
75-80	10 m from edge of busy freeway (traffic travelling at 120 km/h)	
80-95	7,5 m from passing truck (50 km/h)	
80	Kerbside of busy street	
70	Blaring radio	Noisy
70	3 m from vacuum cleaner	Noisy
60-80	7,5 m from passing passenger car (50 km/h)	
65	Normal conversation	
65	Large busy office	
60	Supermarket/small office	
50	Average suburban home (day conditions)	Quiet
40	Library	
40-45	Average suburban home (night-time)	
30-35	Average rural home (night-time)	
25-30	Slight rustling of leaves	
20	Background in professional recording studio	Very quite
20	Forest (no wind)	
0-20	Experienced as complete quietness	
0	Threshold of hearing at 1000 Hz	

A2. NOISE IMPACT CRITERIA

The international tendency is to express noise exposure guidelines in terms of absolute noise levels. These guidelines imply that in order to ascertain an acceptable living environment, ambient noise in a given type of environment should not exceed a specified absolute level. This is the approach provided by the environmental guidelines of the World Bank and World Health Organisation, which specify 55dBA during the day (06:00 to 22:00) and 45dBA during the night (22:00 to 06:00) for residential purposes, determined over any hour. SANS 10103 conforms to the described international tendency. The recommended standards to be applied are summarised in Table A1.

Communities generally respond to a change in the ambient noise levels in their environment, and the guidelines set out in SANS 10103 provide a good indication for estimating their response to given increases in noise. The suggested severity criteria for the noise impacts are summarised in terms of the above guidelines in Table A3.

TABLE A3: CATEGORIES OF COMMUNITY/GROUP RESPONSE (CRITERIA FOR THE ASSESSMENT OF THE SEVERITY OF NOISE IMPACT)

Increase in Ambient Noise Level (dBA)	Estimated Community/Group Response	
	Category	**Description**
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 - 20	Strong	Threats of community/group action
Greater than 15dBA	Very strong	Vigorous community/group action

Changes in noise level are perceived as follows:

- *3dBA:* For a person with average hearing acuity, an increase in the general ambient noise level of 3dBA will be just detectable.
- *5dBA:* For a person with average hearing acuity an increase of 5dBA in the general ambient noise level will be significant, that is he or she will be able to identify the source of the intruding noise. According to SANS 10103 the community response for an increase of less than 5dBA will be 'little' with 'sporadic complaints'. For an increase of equal or more than 5dBA the response changes to 'medium' with 'widespread complaints'.
- *10dBA:* A person with average hearing will subjectively judge an increase of 10dBA as a doubling in the loudness of the noise. According to SANS 10103 the estimated

community reaction will change from ‘medium’ with ‘widespread complaints’ to ‘strong’ with ‘threats of community action’.

In the National Noise Control Regulations which are applicable in Limpopo Province, an intruding noise is defined as ‘disturbing’ if it causes the ambient noise level to rise by 7dBA or more.

APPENDIX I2:

DETAILS OF THE NOISE MEASUREMENT SURVEY AND EXISTING NOISE CLIMATE CONDITION ASSESSMENT

APPENDIX I2: DETAILS OF THE NOISE MEASUREMENT SURVEY AND EXISTING NOISE CLIMATE CONDITION ASSESSMENT

B1. GENERAL

The technical details of the noise measurement survey and general *noise climate* investigation related to the potential noise impact of the proposed Groot Letaba River Development Project which is to be developed in the area to the east of Tzaneen in the Limpopo Province are dealt with in this Appendix. The noise impact was divided into two study areas, namely:

- Tzaneen Dam Area.
- Nwamitwa Dam and Reticulation Area.

The noise impact assessment was undertaken in accordance with the requirements of the South African National Standard SANS 10328 (SABS 0328) *Methods for Environmental Noise Impact Assessments*. Daytime and evening period noise measurements were taken at twelve main monitoring sites at appropriate locations in the study area in order to establish the residual (existing) *noise climate*.

B2. STANDARDS AND MEASUREMENT EQUIPMENT

The sound pressure level (SPL) (noise) measurements were taken in accordance with the requirements of the South African National Standard SANS 10103:2004, *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication*. Two Type 1 Integrating Sound Level Meters, a Bruël and Kjaer Model 2230 meter and a Larson Davis 824 were used for the noise measurements. Both meters were calibrated at an accredited acoustical laboratory within the last 12 months. The calibration status of the meters was also checked before and after completion of the total measurement period of the day. A calibrated signal with a sound pressure level of 94,0dB at 1 kHz and 114,0dB at 1 kHz were applied to the Bruël and Kjaer meter and the Larson Davis meter respectively. A Larson Davis Model CAL200 was used.

For all measurements taken to establish the ambient noise levels, the equivalent noise level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}) during that measurement period were recorded. The frequency weighting setting was set on "A" and the time weighting setting of the meters were set on *Impulse* (I). Measurement periods of a minimum of 10 minutes were used. In addition, the variation in instantaneous sound pressure level (SPL) over a short period was also measured at some of the Sites. For these latter measurements the time weighting setting of the meter was also set on *Impulse* (I).

At all the measurement sites, the meters were set up with the microphone height at 1,3 metres above ground level and well clear of any reflecting surfaces (a minimum of 3 metres clearance). For all measurements, a standard windshield cover (as supplied by the manufacturers) was placed on the microphone of each meter.

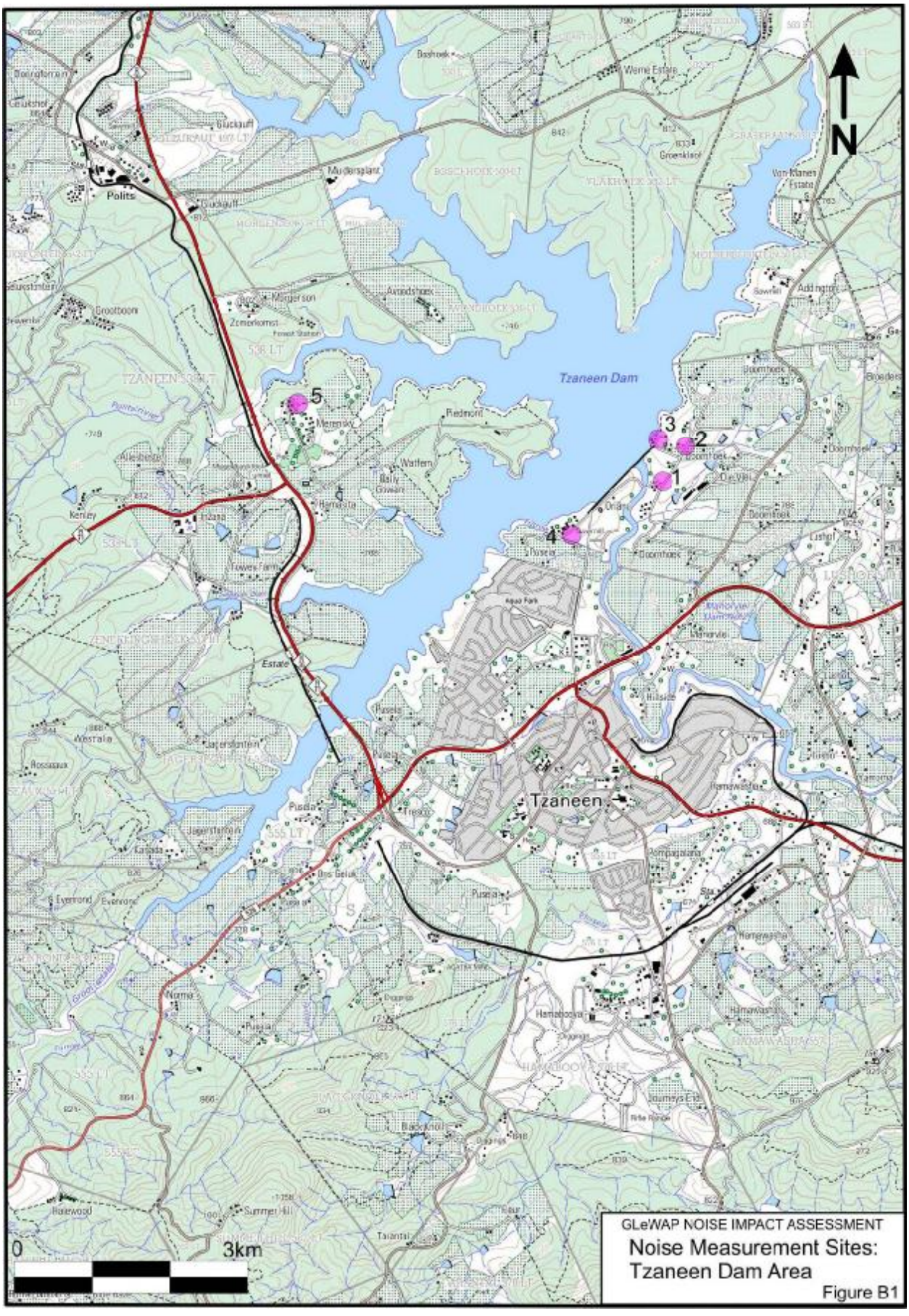
At the same time as each individual measurement was being taken, the qualitative nature of the *noise climate* in the area of the measurement site was assessed and recorded. This comprised an appraisal of the general prevailing acoustic conditions based on the subjective response to the sounds as perceived by the listener (i.e. *auditory observation* by the surveyor), as well as identifying those noise incidents, which influenced the noise meter readings during that measurement period. This procedure is essential in order to ensure that that there is a *human* correlation between the noise as perceived by the human ear and the noise, which is measured by the meter, as well as to establish any anomalies in the general ambient noise conditions.

B3. MEASUREMENT SITES

Noise measurements to establish current ambient noise conditions were taken at sixteen (16) main sites in the study area. A first set was in the Tzaneen Dam Study Area, as indicated in Table B1 and Figure B1.

TABLE B1: NOISE MEASUREMENT SITES – TZANEEN DAM STUDY AREA

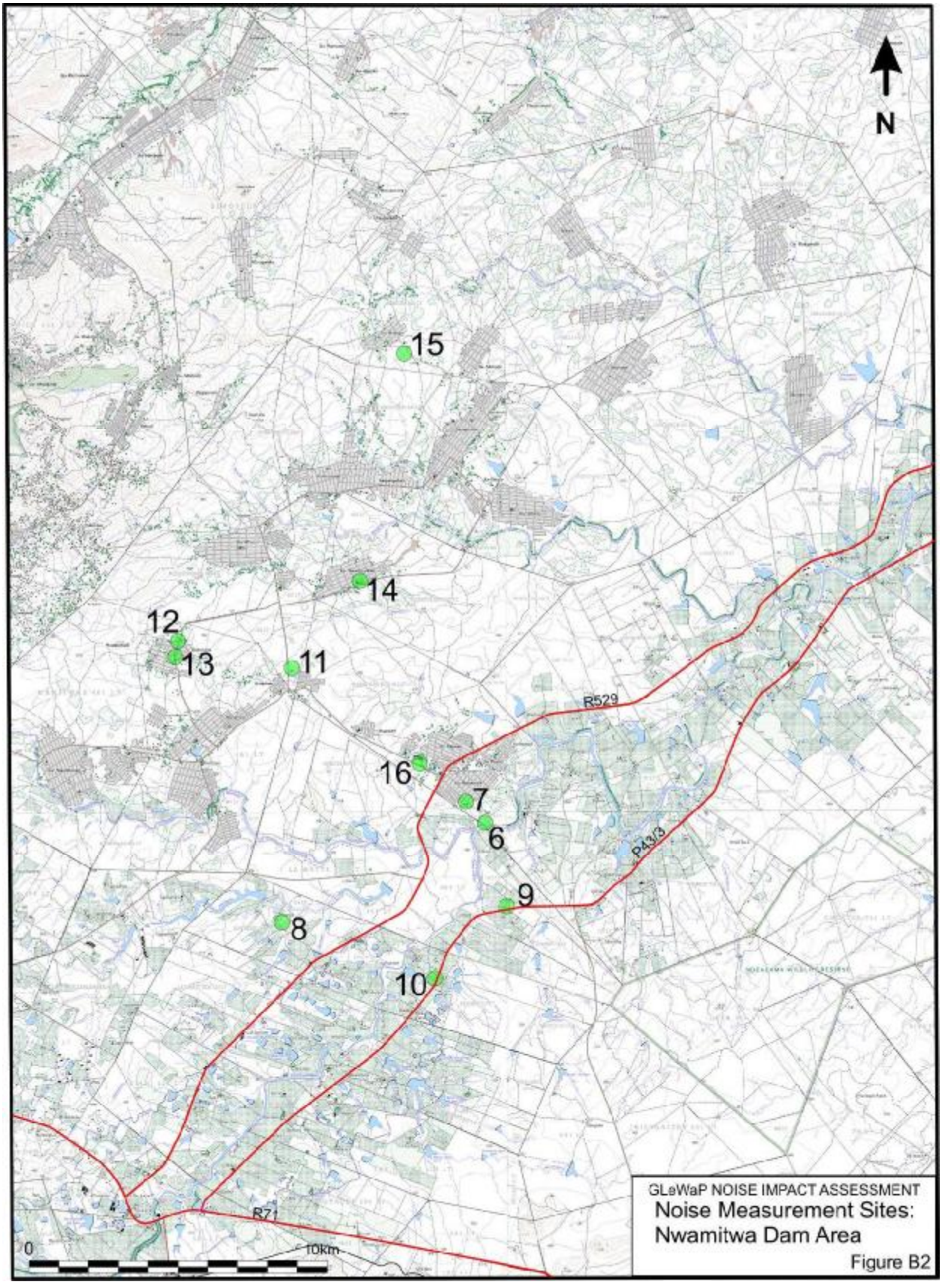
Site No	Location Description	GPS Co-ordinates
1	Outside gates of Tzaneen Dam water purification plant	S23º48.092' E030º10.114'
2	At DWAF houses on the north-eastern side of dam wall	S23º47.914' E030º10.230'
3	At DWAF houses on the north-eastern side of dam wall outside no. 13 at dam wall	S23º47.841' E030º10.000'
4	Outside DWAF Area Office and on southern boundary fence of Tzangeni Security Estate	S23º48.415' E030º09.467'
5	Merensky School on north-eastern side of school at dormitories	S23º47.617' E030º07.646'


N
Tzaneen Dam
Polits
Tzaneen
1
2
3
4
5
0
3km
GLeWAP NOISE IMPACT ASSESSMENT
Noise Measurement Sites:
Tzaneen Dam Area
Figure B1

A second set of measurements were taken in the Nwamitwa Dam and Reticulation Study Area, as indicated in Table B2 and Figure B2.

TABLE B2: NOISE MEASUREMENT SITES – NWAMITWA DAM AND RETICULATION STUDY AREA

Site No	Location Description	GPS Co-ordinates
6	South-east of KwaMalubana Village and south-east of water purification works	S23º45.071' E030º29.588'
7	On the southern edge of KwaMalubana Village	S23º44.840' E030º29.293'
8	On farm Riverside 514 Portion 14 approximately 100m west of farmhouse	S23º47.197' E030º26.046'
9	At entrance to Laborie 515 LT, approximately 20m north of centreline of Road P43-3	S23º46.654' E030º30.068'
10	50m north-west of centreline of Road P43-3 and entrance to farm Nagude (Riverside 514 LT)	S23º47.883' E030º28.659'
11	Outside Hetiseka Secondary School (Musiphane Village)	S23º42.613' E030º26.015'
12	On northern edge of Babanana Village	S23º42.093' E030º23.992'
13	On main road through Babanana Village, 200m from northern urban edge	S23º42.216' E030º23.947'
14	On south side of school on southern urban edge of Ka-Nwamngololo Village	S23º41.123' E030º27.316'
15	On road between Ga-Mookgo Village East and Ga-Mookgo Village West	S23º37.354' E030º28.437'
16	40m off centreline of gravel road on south-western side of Ka-Mswazi Village	S23º37.354' E030º28.437'


N
15
14
12
13
11
16
7
6
9
8
10
R529
P43/3
R71
0
10km
GLeWaP NOISE IMPACT ASSESSMENT
Noise Measurement Sites:
Nwamitwa Dam Area
Figure B2

B4. MEASUREMENT DATES/TIMES

General observation of the noise conditions in the study area as well as the site specific sound pressure level (noise) measurements and observations were taken on Friday 30 November, Saturday 1 December and Monday 3 December 2007 during the daytime period from 09h00 to 17h00 and in the evening/night from 19h30 to 22h30.

B5. NOISE MEASUREMENT DETAILS

B5.1. Summary of the Residual Sound Pressure Level Measurements

The results of the residual noise condition measurement survey are summarised in Table B3 (Tzaneen Dam Study area) and Table B4 (Nwamitwa Dam and Reticulation Study Area). The equivalent sound pressure (noise) level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}) are indicated. Note that the equivalent sound pressure (noise) level may, in layman's terms, be taken to be the average noise level over the given period. This "average" is also referred to as the residual noise level (excluding the impacting noise under investigation) or the ambient noise level (if the impacting noise under investigation is included).

TABLE B3: MEASURED CURRENT NOISE LEVELS IN THE TZANEEN DAM STUDY AREA (YEAR 2007)

Measurement Site	Measured Sound Pressure Level (dBA)					
	Daytime Period			Late Evening Period		
	L_{Aeq}	L_{max}	L_{min}	L_{Aeq}	L_{max}	L_{min}
Site 1	57.0	74.2	46.8	-	-	-
Site 2	48.3	69.6	35.9	56.9	61.1	49.8
Site 3	45.5	65.2	34.7	53.0	60.0	48.0
Site 4	46.6	62.4	39.4	54.1	60.5	51.1
Site 5	49.8	64.7	40.4	-	-	-

TABLE B4: MEASURED CURRENT NOISE LEVELS IN THE NWAMITWA DAM AND RETICULATION STUDY AREA (YEAR 2007)

Measurement Site	Measured Sound Pressure Level (dBA)					
	Daytime Period			Late Evening Period		
	L_{Aeq}	L_{max}	L_{min}	L_{Aeq}	L_{max}	L_{min}
Site 6	41.0	51.8	26.4	30.0 *	-	-
Site 7	46.3	59.8	32.3	62.9	66.4	53.7
Site 8	50.9	64.5	36.3	50.7	54.7	45.8
Site 9	70.1	76.7	64.0	48.7	56.3	32.2
Site 10	49.9	65.0	33.4	44.4	51.6	41.2
Site 11	53.7	70.3	37.3	30.0 *	-	-
Site 12	69.3	71.4	68.3	30.0 *	-	-
Site 13	42.9	50.3	37.6	30.0 *	-	-
Site 14	41.7	54.3	39.2	30.0 *	-	-
Site 15	41.7	50.3	31.2	30.0 *	-	-
Site 16	50.7	61.7	31.2	30.0 *	-	-
Note: * These are the levels to which the ambient noise climate will tend in the night-time period.						

The weather conditions on the survey days were such that the measurements to establish the ambient noise levels were not adversely affected and no specific corrective adjustments needed to be made.

B5.3. Noise Climate Related to the 24 hour Road Traffic

In order to complement the short-term noise measurements the main roads in the two study areas, the existing 24-hour residual noise levels related to the average daily traffic (ADT) flows on the main roads were also calculated. These data provide an accurate base for the SANS 10103 descriptors. The noise levels generated from the traffic on these roads were calculated using the South African National Standard SANS 10210 (SABS 0210), *Calculating and Predicting Road Traffic Noise*. Typical situations were used for the calculation site. The Year 2007 traffic data were used as the baseline for the calculations. The traffic data were obtained from ILISO Consulting (Pty) Ltd.

The noise profiles of the following roads have been calculated in the Tzaneen Dam:

- Section 1: Road P43/3 (Route R71) just west of Road D978 (Deerfield Road)
- Section 2: Road P43/2 / Road P17/3 (Route R71/Route R36) between Road P17/2 (Route R71) and Road D528.

- Section 3: Road P17/2 (Magoebaskloof Road) (Route R71) just west of Road P43/2 / Road P17/3.
- Section 4: Road P43/2 (Modjadjiskloof Road) (Route R36) north of Road P17/2 (Magoebaskloof Road).
- Section 5: Road D978 (Deerfield Road) just north of Road P43/3 (Route R71).

The noise profiles of the following roads have been calculated in the Nwamitwa Dam and Reticulation Study Area:

- Section 6: Road P43/3 (Route R71) west of Road R529.
- Section 7: Road P43/3.
- Section 8: Road R529 north of the intersection with D1292.
- Section 9: Road R529 south of the intersection with D1292.
- Section 10: Road D1292.

The noise levels at various offsets from the relevant road centrelines were established and are summarised in Table B5 for the Tzaneen Dam Study Area and in Table B6 for the Nwamitwa Dam and Reticulation Study Area. The noise descriptors used are those prescribed in SANS 10103:2004, namely:

i) Daytime equivalent continuous rating (noise) level ($L_{Req,d}$) (L_d used in Table), namely for the period from 06h00 to 22h00).

ii) Night-time equivalent continuous rating (noise) level ($L_{Req,n}$) (L_n used in Table), namely for the period from 22h00 to 06h00).

iii) Day-night equivalent continuous rating (noise) level ($L_{R,dn}$) (L_{dn} used in Table), namely for the 24 hour period from 06h00 to 06h00).

The noise levels given are for generalised and the unmitigated conditions. There will be greater attenuation than shown with distance where there are houses, other buildings and terrain restraints in the intervening ground between the source and the receiver point.

TABLE B5: EXISTING NOISE CLIMATE ADJACENT TO THE MAIN ROADS IN THE TZANEEN DAM STUDY AREA (YEAR 2007 TRAFFIC)

Road Section	Noise Climate Alongside the Main Roads at Given Offset from Centreline (SANS 10103 Indicator) (dBA)																	
	25m Offset			50m Offset			100m Offset			250m Offset			500m Offset			1000m Offset		
	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
1	64.2	53.8	64	61.2	50.8	61.0	58.2	47.8	58.0	54.2	43.8	54.0	51.2	40.8	51.0	48.2	37.8	48.0
2	66.3	55.9	66.1	63.3	52.9	63.1	60.3	49.9	60.1	56.3	45.9	56.1	53.3	42.9	53.1	50.3	39.9	50.1
3	59.7	49.3	59.6	56.7	46.3	56.6	53.7	43.3	53.6	49.7	39.3	49.6	46.7	36.3	46.6	43.7	33.3	43.6
4	64.6	54.2	64.5	61.6	51.2	61.5	58.6	48.2	58.5	54.6	44.2	54.5	51.6	41.2	51.5	48.6	38.2	48.5
5	60.2	49.8	60.1	57.2	46.8	57.1	54.2	43.8	54.1	50.2	39.8	50.1	47.2	36.8	47.1	44.2	33.8	44.1

TABLE B6: EXISTING NOISE CLIMATE ADJACENT TO THE MAIN ROADS IN THE NWAMITWA DAM AND RETICULATION STUDY AREA (YEAR 2007 TRAFFIC)

Road Section	Noise Climate Alongside the Main Roads at Given Offset from Centreline (SANS 10103 Indicator) (dBA)																	
	25m Offset			50m Offset			100m Offset			250m Offset			500m Offset			1000m Offset		
	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
6	63.2	52.9	63.1	60.2	49.9	60.1	57.2	46.9	57.1	53.2	42.9	53.1	50.2	39.9	50.1	47.2	36.9	47.1
7	57.4	46.5	57.1	54.4	43.5	54.1	51.4	40.5	51.1	47.4	36.5	47.1	44.4	33.5	44.1	41.4	30.5	41.1
8	61.0	51.0	61.0	58.0	48.0	58.0	55.0	45.0	55.0	51.0	41.0	51.0	48.0	38.0	48.0	45.0	35.0	45.0

9	61.1	50.8	61.0	58.1	47.8	58.0	55.1	44.8	55.0	51.1	40.8	51.0	48.1	37.8	48.0	45.1	34.8	45.0
10	61.5	53.6	64.3	58.5	50.6	61.3	55.5	47.6	58.3	51.5	43.6	54.3	48.5	40.6	51.3	45.5	37.6	48.3

B5.4. Prevailing Noise Climate in the Tzaneen Dam Study Area

In overview, the existing situation with respect to the existing *noise climate* in the study area was found to be as follows:

i) The main sources of noise in the area are from:
   a) Traffic of the main roads.
   b) Tzaneen Dam water purification works.
   c) Power boats on the Tzaneen dam.
   d) Railway line to the west of the Tzaneen Dam.

ii) The existing *noise climate* alongside the main roads is degraded with regard to residential living (using 40dBA as the night-time impact criterion). Residences in some areas are negatively impacted from traffic noise (particularly at night) for up to the following distances from these roads:

Section of Road	**Offset Distance**
Section 1: Road P43/3 (Route R71) just west of Road D978 (Deerfield Road).	500m
Section 2: Road P43/2 / Road P17/3 (Route R71/Route R36) between Road P17/2 (Route R71) and Road D528.	1000m
Section 3: Road P17/2 (Magoebaskloof Road) (Route R71) just west of Road P43/2 / Road P17/3.	250m
Section 4: Road P43/2 (Modjadjiskloof Road) (Route R36) north of Road P17/2 (Magoebaskloof Road).	800m
Section 5: Road D978 (Deerfield Road) just north of Road P43/3 (Route R71).	250m

iii) The residual (existing background) noise levels are relatively low (quiet) in the existing and developing residential areas to the south and east of the Tzaneen Dam wall. Daytime ambient conditions range from about 45dBA to 57dBA. Early evening conditions fall in the range of 54dBA to 57dBA, while the night-time ambient levels will fall to about 40dBA. These are acceptable suburban residential conditions (SANS 10103).

iv) The noise climates at the farmhouses on the western and northern sides of the dam are relatively quiet.

v) The residual noise levels at the Merensky High School fall within the limits recommended in SANS 10103.

B5.5. Prevailing Noise Climate in the Nwamitwa Dam and Reticulation Study Area

In overview, the existing situation with respect to the existing *noise climate* in the study area was found to be as follows:

i) The main sources of noise in the area are from:
   a) Traffic on the main roads.
   b) Nkambako Water Treatment Works on the south-eastern side of Ka-Malubana Village.
   c) Pump on the Groot Letaba River feeding the Nkambako Water Treatment Works.
   d) Noise from cicadas dominated at Sites 9 and 12, and had a significant influence on the noise levels at Site 8 as well. This was the situation during both day-time and night-time measurements. This is considered to be a seasonal condition in the normal rural climate. Without the noise from the cicadas, the noise climate will be relatively quiet.

ii) The existing *noise climate* alongside the main roads is degraded with regard to residential living (using 40dBA as the night-time impact criterion). Residences in some areas are negatively impacted from traffic noise (particularly at night) for up to the following distances from these roads:

Section of Road	**Offset Distance**
Section 6: Road P43/3 (Route R71) west of Road R529.	500m
Section 7: Road P43/3.	100m
Section 8: Road R529 north of the intersection with D1292 (in Ka-Malubana Village)	320m
Section 9: Road R529 south of the intersection with D1292.	300m
Section 10: Road D1292.	500m

iii) The residual (existing background) noise levels are relatively low (quiet) in the areas that are not close to and are relatively shielded from the main roads. Daytime ambient conditions range from about 41dBA to 54dBA. Night-time conditions will tend to fall to between 30dBA and 35dBA. In general the conditions on the farms and villages in the area meet the acceptable standards as per SANS 10103.

B6. BASELINE MEASUREMENTS

Baseline noise measurements were taken at the Tzaneen Dam Water Treatment Works and the Politsi Purification Scheme Final Water Pump Station. These noise data represent the typical noise conditions of the respective plant that will be installed on the GLeWaP Project.

APPENDIX I3

ASSESSMENT OF NOISE IMPACT

APPENDIX I3: ASSESSMENT OF NOISE IMPACT

C1. GENERAL

The assessment of the noise impact was guided by the requirements of the South African National Standard SANS 10328 (SABS 0328) titled *Methods for Environmental Noise Impact Assessments* and the Noise Control Regulations. A comprehensive assessment using the appropriate noise impact descriptors (standards) has been undertaken. The noise impact criteria used in this investigation specifically take into account those as specified in the South African National Standard SANS 10103:2004, *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication,* as well as those in the National Noise Control Regulations. The Limpopo Provincial Government has not yet promulgated their Noise Regulations and thus need to apply the National Noise Control Regulations. Relevant aspects of these Regulations and SANS 10103:2004 are provided in Appendix A.

The infrastructure components of the project include:

- The raising of the Tzaneen Dam;
- A new dam at the site known as Nwamitwa;
- Associated relocation of roads at Nwamitwa Dam;
- Access roads to the Nwamitwa Dam;
- A riverflow gauging weir just downstream from the Nwamitwa Dam;
- Upgrading of the existing Water Treatment Works just north of the Nwamitwa Dam;
- Water reticulation pipelines;
- Pump stations;
- Reservoirs.

Borrow areas required to provide construction materials are covered separately by submission of the relevant documentation to the Department of Minerals and Energy Affairs.

C2. ASSESSMENT OF THE PRE-CONSTRUCTION PHASE

Activities during the planning and design stages that have possible impact implications in the study area are related to field surveys (such as seismic testing and geological test borehole drilling) at Nwamitwa Dam, at pump station and reservoir sites, at the weir and along sections of the provincial roads that have to be realigned and along access road routes. These survey activities will be of short duration in any one area.

C3. ASSESSMENT OF THE CONSTRUCTION PHASE

C3.1. General

Data was sourced from officials at DWAF, from various consultants and experience that JKA has had working on similar sites. Although much of the project construction related data and exact location of facilities such as pump stations are provisional, these are adequate to provide a sound basis for analysis of typical conditions and impacts that are likely to prevail on the project.

C3.1.1. Construction Areas

The potential future noise climate was established for the construction conditions:

i) At the Tzaneen Dam.
ii) At the Nwamitwa Dam and at the riverflow gauging weir.
iii) Along the sections of Road R529 and Road P43/3 that are to be realigned, and along access roads to the Nwamitwa Dam.
iv) At the water treatment works.
v) Along the pipelines and at pump stations and reservoirs.

C3.1.2. Sources of Construction Noise

The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

The following are the potential sources of noise at the construction sites (for more specific details of the individual construction sites, refer to the relevant sections below):

i) Construction camp establishment. This will be for the site offices, workshops, accommodation camp for the workers and stores on site.
ii) Activities related to the relocation of services.
iii) Excavation of service trenches and foundations. Blasting may be required in places but in general pneumatic breakers will be used where rock is encountered.
iv) Piling operations.
v) Erection of shuttering for concrete works.
vi) Fixing of steel reinforcing.
vii) Placing and vibration of concrete. Poker vibrators will be used.
viii) Stripping of shuttering after concrete pour.
ix) Erection of structural steelwork.

x) Installation of plant and equipment.
xi) Finishing operations.
xii) General movement of heavy vehicles such as concrete delivery vehicles, mobile cranes, mechanical dumpers and water trucks (dust suppression) around the site.
xiii) De-watering pumps for storm-water and ground water in the excavations. A 24-hour operation may sometimes be necessary.
xiv) Road construction equipment. Scrapers, dozers, compactors, etc. (Construction of internal roads, access roads and relocation of sections of Provincial Roads).
xv) Construction site fabrication workshops and plant maintenance workshops.
xvi) Construction material and equipment delivery vehicles.
xvii) Drilling, blasting and crushers at quarry for aggregate (Nwamitwa Dam area)
xviii) Concrete batching plant and asphalt batching plant on site.

Typical noise levels generated by various construction equipment are given in Table C1.

TABLE C1: TYPICAL NOISE LEVELS GENERATED BY CONSTRUCTION EQUIPMENT

Plant/Equipment	Typical Operational Noise Level at Given Offset (dBA)							
	5m	50m	100m	250m	500m	1000m	2000m	3000m
Air compressor	91	71	65	57	51	46	40	36
Compactor	92	72	66	58	52	46	40	36
Concrete mixer	95	75	69	61	55	49	43	39
Concrete vibrator	86	66	60	52	46	40	34	30
Conveyor belt	77	57	51	43	37	32	-	-
Crusher (aggregate)	90	70	64	56	50	44	38	34
Crane (mobile)	93	73	67	59	53	47	41	37
Dozer	95	75	69	61	55	49	43	39
Loader	95	75	69	61	55	49	43	39
Mechanical shovel	98	78	72	64	58	52	46	42
Pile driver	110	91	85	77	71	65	59	55
Pump	86	66	60	52	46	40	34	30
Pneumatic breaker	98	78	72	64	58	52	48	44
Rock drill	108	88	82	74	68	62	56	52
Roller	84	64	58	50	44	38	32	28
Trucks		67	64	60	57	54	51	48

These noise levels assume that the equipment is maintained in good order. Conservative attenuation conditions (related to intervening ground cover conditions and topographical screening) have been applied.

General ambient noise conditions related to construction sites are given in Table C2.

TABLE C2: TYPICAL CONSTRUCTION NOISE LEVELS AT GIVEN OFFSETS FROM THE CONSTRUCTION SITE

Equipment	Sound pressure level at given offset (dBA)										
	200 m	400 m	500 m	600 m	700 m	800 m	1000 m	1200 m	1500 m	2000 m	2500 m
Total construction operation	53.5	46.4	43.9	41.9	40.1	38.5	35.7	33.4	30.4	26.3	22.9

C3.2. Tzaneen Dam Construction Conditions

C3.2.1. ***Details***

The dam wall will be raised by a maximum of 3,5m and the spillway will be designed to accommodate a flood of 5 100m³/s .This will be achieved by using either a labyrinth spillway, fusegates or a side channel spillway.

The raising of Tzaneen dam will not require acquisition of additional land as the design flood level remains within the area purchased for the existing dam. The size of the downstream flood will also not be affected.

Construction facilities such as offices, workshops and stores will be required on site, and will be located within the property of the existing Government Water Works (GWW). Construction is expected to start in 2010.

C3.2.2. ***Noise Impact***

It has been assumed that at this site construction will take place only during the day-time.

i) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over any working period.

ii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work *modus operandi* and type of equipment have not

been finalised. From present information available, *ambient* noise levels during the daytime period at the nearest houses to the dam wall, namely the DWAF houses at the north-eastern side of the dam wall, the residences in the Tzangeni and Golden Acres Security Estates to the south-east of the dam wall and the farmhouses on the western and northern sides of the dam should not exceed 50dBA. Thus, no noise disturbance effects are predicted. Working on a worst case scenario basis, it is estimated that the maximum *instantaneous* noise levels from general construction operations should not exceed 72dBA at the nearest houses to the dam wall. The residual noise levels are fairly quiet at these residences and thus there are likely to be noise nuisance effects from individual incidents from the construction in these residential areas.

iii) The Merensky High School on the western side of the dam will not be affected by the noise from the construction noise from the dam during the day. The school has residences and any night-time construction could have sleep disturbance effects at the dormitories. The school area is already impacted by the noise from traffic on the dual carriageway road to the west of the dam.

iv) Construction workers working with or in close proximity to equipment will be exposed to high levels of noise as can be seen from Table C1 (refer to the 5 metre offset noise levels).

v) There will be an increase in traffic (mainly delivery vehicles) on the main routes into the area, but the volumes are unlikely to raise the ambient noise levels along the roads.

It should be noted that for residential areas, higher ambient noise levels than recommended in SANS 10103 are normally accepted as being reasonable during the construction period, provided that the very noisy construction activities are limited to the daytime and during the week, and that the contractor takes reasonable measures to limit noise from the work site. Note that it is understood that construction will generally take place from 07h00 to 18h00 with no activities (or at least no noisy construction activities) at night. From the details presently available, it appears that the construction noise impact is not likely to be too severe in the residential areas near to the dam wall.

C3.3. Nwamitwa Dam and Weir Construction Conditions

C3.3.1. ***Details***

The largest component of the GLeWaP project is the proposed new dam at the site known as Nwamitwa. The dam will be located on the Groot Letaba River downstream of the

confluence of the Nwandezi River. An earth fill embankment on both flanks with a central concrete spillway is envisaged. The detail design of the dam and outlet works has not yet been completed but the structure will have an appearance similar to other composite construction type dams such as Tzaneen Dam.

The earth embankments will be protected against wave action and erosion on the upstream side by a layer of rock rip-rap. The downstream slopes will also be protected but by a layer of mainly crushed stone. The embankments are expected to have a total crest length of up to 3 000 m while the length of the concrete spillway would be about 500 m. These dimensions are subject to finalization in the detailed design phase.

An outlet control structure with multiple drawoff levels will be an integral part of the concrete spillway structure and will be located on the left flank of the spillway.

Construction is expected to commence approximately in October 2009, and take 5 years to complete, with the storage of water and associated benefits expected to commence in 2012.

The site of the construction camp for the dam will be on the left bank of the Groot Letaba River, just upstream of the dam wall. The construction camp will require approximately 35.6 ha excluding access roads. The site will accommodate the following:

- Concrete Batching Plants;
- Site Offices and Parking - comprising two office blocks (one to house the personnel of the Resident Engineer, and one to house the Site Agent and his personnel) and 20 covered parking bays per office block, and a taxi rank;
- Materials testing Laboratory;
- Workshops and Stores - approximately five buildings;
- Reinforcing Steel Bending Yard;
- Permanent Housing- Houses for two married operating personnel;
- Weather Station; and
- Sand and crushed stone Stockpile Areas – less than 450 m x 250 m with access roads (above area of inundation).

Areas for the handling of hazardous substances, an explosives storage magazine, wash bays for construction plant, radio communication infrastructure, facilities for the bulk storage

and dispensing of fuel for construction vehicles, powerlines, a small-scale sewage treatment plant and a temporarily licensed solid waste disposal facility will also be provided.

Various temporary access roads, low level river crossings and haul roads will be required in and around the dam wall and borrow pits and quarry sites will be located within the dam basin.

Construction activities will commence with the stripping of vegetation and topsoil to establish access and construction roads, site offices, dam foundations and crusher and concrete mixer stations. Topsoil will be stockpiled for reuse during the rehabilitation stage, whilst cleared woody vegetation suitable for firewood will be stockpiled for collection by the local population for a period of time, after which it will be burnt.

Soon after commencement the river will be diverted to expose the rock foundations for the concrete spillway section. During this period, cofferdams will be constructed to protect all foundation activities in the riverbed against flood damage. Excavators, bulldozers and trucks will be engaged to remove all loose material on the foundation of the dam until rock is exposed. Blasting will be necessary.

A team specializing in quarry operations and the crushing of aggregate for concrete will be set up on site. Drill rigs will be in operation 24 hours a day. Blasting will be required, on average, every 14 days, and will be scheduled to take place only during daylight hours. A crusher will also be erected.

Sand required for the production of concrete will be collected from the identified borrow areas. Unsuitable material will be disposed of at locations to be agreed on by the Environmental Control Officer (ECO).

Concrete production at the batching plant will then commence and placement in the central spillway section, outlet works and apron areas, probably by roller compaction techniques and the use of high tower and mobile cranes, will occur 24 hours a day, seven days a week. Earth embankments will be constructed on both banks by compacting material hauled in by large trucks from the borrow areas upstream of the dam.

The temporary site administrative buildings will be erected complete with security fencing, a water supply, sewage purification plant and an electric overhead supply line.

After construction activities have been completed, estimated to be in 2013, all the crushers, mixers and site offices, etc. will be removed and the construction site rehabilitated. All temporary access roads and other hard surfaced areas will be ripped and covered with a topsoil and planted with suitable grass and tree cover. The aim is to return the whole construction site as close as possible to its original appearance. Areas that are inundated by water in the dam will be shaped to accommodate storm runoff and no grass will be planted.

Two permanent houses will be erected within the project area to accommodate operation and maintenance staff.

The labour force for construction of the proposed dam will be approximately 300. Approximately 50 people will be skilled workers and be housed with their families in Letsitele. 200 workers will be recruited locally and. approximately 100 of these workers will acquire a new skill by the end of this project. The remaining 50 workers will be experienced in dam construction and will be transferred from elsewhere and be housed at Letsitele in single quarter's accommodation.

The proposed borrow area for the earthfill material is on the right flank (looking downstream) immediately upstream of the embankment. Two potential borrow areas for filter materials and concrete sand have been identified in the Merekome River on the farm Letaba Drift and in the Phatle/Lerwatlou River on the farm La Parisa. Authorisation of the borrow areas from the Department of Minerals and Energy Affairs is being applied for as a concurrent process to the EIA.

Coarse aggregates for concrete and rock for the rip-rap and rock toe zones of the embankment will be sourced from existing permitted quarries or commercial sources.

A new flow-measuring weir will be required downstream of the new dam in order to measure the flow that is released from the dam. The exact location of the weir has not yet been determined, but will be fairly close to the dam wall (downstream side). The weir will take about three months to construct and will be a low concrete structure with erosion control measures on both banks to prevent out-flanking. It is envisaged that the construction of the weir will form part of the dam construction contract.

C3.3.2. ***Noise Impact***

For sources of noise, see Section C3.3.1.

i) There will be a significant noise impact from the construction activities at the dam on the Ka-Malubana and Ka-Mswazi Villages north of and the farms to the north and east (Deeside 733-LT) of the dam wall, particularly from the night-time construction activities.

ii) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over any working period.

iii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work *modus operandi* and type of equipment have not been finalised. From present information available, *ambient* noise levels during the daytime period at the nearest houses to the dam wall, namely the residences in Ka-Malubana Village at the northern side of the dam wall (200m offset), should not exceed 54dBA. The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. Thus, no noise disturbance effects are predicted during the day, but significant noise impact is anticipated at night.

iv) Working on a worst case scenario basis, it is estimated that the maximum instantaneous noise levels from general construction operations could be of the order of 74dBA at the nearest houses to the dam wall in Ka-Malubana Village. The residual noise levels in the village and on the surrounding farms are fairly quiet and significant noise nuisance effects and noise disturbance effects are anticipated from the construction in these residential areas.

v) The main impact from the construction phase on the Ka-Malubana Village will be from the quarrying operation, namely from the rock drills and the crusher. When the quarrying operations are closest to the Village (estimated offset of 250 metres) ambient noise levels could be of the order of 79dBA (dependent on the number of rock drills). The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. The noise impact will be significant. The impact from blasting at the aggregate quarry, however, is likely to be minimal on residents in the area, provided that blasting is restricted to the day-time. Blasting is anticipated only once every two weeks and will be limited to the daytime.

vi) Construction workers working with or in close proximity to equipment will be exposed to high levels of noise as can be seen from Table C1 (refer to the 5 metre offset noise levels).

vii) There will be an increase in traffic (mainly delivery vehicles) on the main routes into the area, but the volumes involved are unlikely to raise the ambient noise levels along the roads. Night-time traffic could cause nuisance problems at some of the noise sensitive sites along the main roads into the area of the dam construction.

viii) The positions of the access roads to the construction site have not yet been defined. Although the volumes of construction site generated traffic are not expected to be high, noise from site traffic could be a problem, depending on the location of these roads relative to the Ka-Malubana Village and farmhouses.

It should be noted that for residential areas, higher ambient noise levels than recommended in SANS 10103 are normally accepted as being reasonable during the construction period, provided that the very noisy construction activities are limited to the daytime and during the week, and that the contractor takes reasonable measures to limit noise from the work site. Construction activities, however, will take place on a 24-hour, 7 day a week basis and therefore significant impacts are anticipated in the village and on some of the farms.

C3.4. Road Construction Conditions

C3.4.1. ***Details***

Main Roads

Sections of Road R529 and Road P43/3 will require re-alignment to accommodate the backwaters of the proposed dam. There are two alternative alignments being considered for Road R529 (Refer also to Figure 3);

- Alternative 1: The new road will deviate westwards from the existing R529 alignment approximately 5km north of the intersection with Route R71 up to Road D1292, where it turns eastward to follow the alignment of the latter for 1km where it deviates northwards again to link with the existing Road R529 alignment 1km south of Ka-Malubana Village.
- Alternative 2: The new road will deviate westwards from the existing R529 alignment approximately 5km north of the intersection with Route R71 up to Road D1292 (same as Alternative 1), where it turns directly northwards for approximately 3km, it then turns eastwards to link with the existing alignment of Road R529 just south of Ka-Malubana Village.

The road re-alignment would require the construction of at least two major bridges and the upgrading of two existing bridges. The road design will be very similar to the existing roads, which are of a high standard, as well as be constructed using the same material. The road pavement will be designed to accommodate normal traffic flow.

The major items of work to be carried out are the following:

- Clearing of the road reserve;
- Installation and operation of a bitumen plant;
- Construction of the road to bituminous surfacing;
- The pavement structure for the road will consist of various gravel sub-base layers with a double stone surface seal;
- The gravel for the pavement layers and fill will be obtained from DME approved borrow pits and/or cuttings along the road;
- All stormwater drainage will be accommodated using either pipe or portal culverts; and
- The existing roads will be utilised whilst the new realigned roads are constructed so avoiding the need for temporary detours during construction.

Construction of the roads will take place only during the daytime.

Internal Roads and Construction Site Access Roads

The exact positions of the required access roads to the construction sites and the on-site roads at the dam and appurtenant works have not yet been identified.

C3.4.2. ***Noise Impact***

The nature of the noise impact from the road construction site is likely to be as follows:

i) The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

ii) As no specific construction details or possible locations of major ancillary activity sites are available at this stage, the anticipated noise from various types of construction activities cannot be calculated accurately. In general at this stage, it can be said that the typical noise levels of construction equipment at a distance of 50 metres lie in the range of 65 decibels (dBA) to 75dBA. Refer also to Table C1. Based on data from similar “linear” construction sites, a one hour equivalent noise level of between 75dBA

and 78dBA at a point 50 metres from the construction would be typical for the earthmoving phase. The reconstruction of these roads is in the farming areas where ambient noise levels during the day are normally of the order of 40-50dBA.

iii) All three alternatives for the re-alignment of Road R529 (Alternatives 1, 2 and 3) will now be routed close to a number of farmhouses. Alternatives 1 and 2 affect the Farm Riverside 514-LT and Alternative 3 affects residences on La Gratitude 513-LT and on Taganashoek 465-LT. There are more noise sensitive sites along Alternative 3 than on the other two. The re-alignment of Road P43/3 to the east of its existing alignment will place the new road relatively close to farm worker residences on the farm Nagude 517-LT. As construction is likely to take place during daytime, no major noise impact is anticipated at these residences.

iv) The impacts in any one area will be relatively short-term as the construction activities progress along the route.

v) The noise levels generated from the bridge construction sites will be of the order of that indicated in Table C2.

vi) There is likely to be noise impact from trucks on routes to and from the various borrow sites and spoil sites.

C3.5. Water Treatment Works Construction Conditions

C3.5.1. ***Details***

At present the Nkambako Water Treatment Works, which is located just south-east of Ka-Malubana Village, draws water from the Groot Letaba River about 1 km downstream from the Nwamitwa Dam wall site. The existing facility is to be expanded. After completion of the project, water will be abstracted from the dam and treated at the existing and new treatment works extensions located adjacent to the existing works. The existing run of river abstraction will be abandoned.

Only daytime construction will take place at this site.

C3.5.2. ***Noise Impact***

i) The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

ii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work modus operandi and type of equipment have not been finalised. Working on a worst case scenario basis, it is estimated that the maximum instantaneous noise levels from general construction operations could be of the order of 70dBA at the nearest houses to the treatment works in Ka-Malubana Village. The residual noise levels in the village are approximately 45dBA during the day and 40dBA at night. The noise from this site will be dominated to a large extent by the noise from the construction at the dam area and aggregate quarry, but will have a minor cumulative effect on the noise levels from the various construction sites.

C3.6. Pipelines, Pump Stations and Reservoir Construction Conditions

C3.6.1. ***Details***

Pipelines

Bulk water distribution pipelines will be constructed to augment potable water supplies in the various existing supply zones. The bulk distribution infrastructure from the treatment works will be optimised during the detailed design phase and the final configuration and sizing is not known at this stage. It is envisaged that new pipelines will be located adjacent to existing pipelines or along road reserves. Some sectors of pipeline will traverse open land. A ten metre wide strip would be impacted during constructing.

Construction of the pipelines will commence with pipes being laid out along the pipeline routes and trenches up to 3,5 m deep and 2,5 m wide for the largest of the pipes being excavated. Under normal circumstances a maximum of 5 km of open trench is permitted, whilst the pipes will be strung out as they arrive from the manufacturer. Excess spoil material from the trenches will be transported to a suitable disposal site and sandy material will be brought in as selected backfill for pipe protection. Once the pipes have been laid and tested, the trench will be backfilled, compacted and shaped to the natural ground profile. Topsoil will be replaced to re-establish vegetation.

Pump stations

Currently 4 booster pump stations are envisaged along the pipeline routes although the exact number and position will only be determined during the detail design stage. The following areas are being considered as possible sites:

- Between Ga-Mookgo Village (east) and Ga-Mookgo Village (west).

- Between Ga-Maakgo Village (west) and Ga-Moloko Village.
- Between Mawa Village and Hlohlokwe Village (the area demarcated is immediately adjacent to Hlohlokwe Village).
- On alternative pipeline route south of Hlohlokwe Village.

An area of approximately 1 – 2 ha will be fenced for each pump station. No balancing dams are envisaged.

A new raw water pump would be constructed to pump water from the dam to the Water Treatment Works.

Building activities will include cranes, mixer trucks, excavators, tipper trucks, loaders and delivery vehicles (refer also to Section C3.1.2). Construction of a single pump station will take approximately 24 months.

Reservoirs

Although the reservoirs associated with the pipelines may differ according to their individual capacity and local topography, the technical details are similar for each.

Four new reservoirs are being considered at ten alternative sites within close vicinity to the following villages (See Figure 2).

- Sorolorole (Reservoir A) ;
- Babanana (Reservoir B);
- Mothomeng (Reservoir C1 and C3);
- Hlohlokwe (Alternative Reservoir C1 and C2)
- Mabyepelong (Reservoir C2); and
- Gamokgwathi (Reservoir D1, D2 and D3).

It is anticipated that construction will only take place during the day.

C3.6.2. ***Noise Impact***

The noise sensitive areas/sites that could be impacted by noise along the whole length of the respective pipeline routes are mainly residential land uses. There are also a number of schools that are potentially affected. The nature of the noise impact from the construction activities on nearby noise sensitive areas/sites is likely to be as follows:

i) The noise level and character of the noise will vary along the project route dependant on the type of construction activity. For example, the noise from a section where only a pipeline is being laid will differ from a site where a valve box or a road crossing is also being constructed.

ii) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period. The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

iii) Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme, work *modus operandi* and type of equipment have not been finalised. Typical ambient noise conditions from a small construction site are as indicated in Table C2. These general noise levels are more representative of the sites where concreting operations also take place. For more specific plant/equipment related noise levels refer to Table C1.

iv) If discrete sections of pipeline are completed at a time (namely excavation, laying and backfilling), the duration of the noise impact will be short-term.

v) The construction times for the pump stations and reservoirs could extend over several months with attendant variable noise impact.

vi) The noise sensitive sites closest to the roads (where the pipelines are laid in the reserve) will be affected the most by the construction noise. If construction activities are contained to the daytime, the impact conditions at residences will not be that severe.

vii) Schools close to the pipeline routes will be adversely affected.

C4. ASSESSMENT OF THE OPERATIONAL PHASE

C4.1. General

The potential future noise climate was established for the operational conditions:

i) At the Tzaneen Dam.

ii) At the Nwamitwa Dam and at the riverflow gauging weir.

iii) Along the sections of Road R529 and Road P43/3 that are to be realigned, and along access roads to the Nwamitwa Dam.

iv) At the water treatment works inclusive of the delivery pump station.

v) Along the pipelines and at pump stations and reservoirs.

C4.2. Tzaneen Dam Operational Conditions

C4.2.1. ***Sources of Noise***

The only sources of noise during the operational phase will be:

i) Water outflow from the dam outlet works valves into the stilling basin.

ii) Routine maintenance work on the dam infrastructure.

iii) In addition, the general noise climate of the area will also be influenced by:
   a) Traffic on the main roads.
   b) Power boats on the Tzaneen Dam.
   c) Tzaneen Dam water purification works.

C4.2.2. ***Noise Impact***

i) No change in the general noise climate is anticipated from the alterations to the dam wall.

ii) No noise disturbance is anticipated from the sound of constant outflow of dam water into the stilling basin due firstly to the character of the sound (namely a waterfall sound) and secondly due to the distance attenuation of the sound. The alterations to the dam will not affect the general pattern of outflow into the stilling basin. The noise from the outflow of water was measured at 83.6dBA at 15m from the flume, reducing to 65.2dBA at 60m from the flume. This noise level is likely to be of the order of 50dBA at a distance of 500 metres from the dam wall.

iii) Maintenance works are unlikely to have an impact on the area as these will be at relatively long term intervals and will be contained to the daytime.

C4.3. Operational Conditions at the Nwamitwa Dam and Weir

C4.3.1. ***Sources of noise***

The only sources of noise during the operational phase will be:

i) Water outflow from the dam outlet works valves into the stilling basin.

ii) Routine maintenance work on the dam infrastructure.

iii) In addition, the general noise climate of the area will also be influenced by:
   a) Traffic on the main roads.
   b) Nkambako Water Treatment Works (expanded works).
   c) Pump station at the dam for feeding the water purification works.

C4.3.2. ***Noise Impact***

i) No noise disturbance is anticipated from the sound of constant outflow of dam water into the stilling basin due firstly to the character of the sound (namely a waterfall

sound) and secondly due to the distance attenuation of the sound. Baseline noise measurements indicate that this noise level is likely to be of the order of 50dBA at a distance of 500 metres from the overflow section of the dam wall. The "noise" at the nearest residences will of the order of 40dBA.

ii) Maintenance works are unlikely to have an impact on the area as these will be at relatively long term intervals and will be contained to the daytime.

iii) The noise from water flowing over the weir will be of a nature that will have no impact.

iv) No major change in general noise climate is anticipated from the operations at the dam.

C4.4. Operational Conditions along Roads

C4.4.1. ***Sources of noise***

Sources of noise during the operating phase will be:

i) General traffic. The noise levels generated from the traffic on the main roads at the estimated commissioning date of the dam (Year 2012) were calculated using the South African National Standard SANS 10210, *Calculating and Predicting Road Traffic Noise*. The existing traffic generated noise levels are predicted to increase by 0.6dBA by 2012. The anticipated noise levels along the roads in the Tzaneen Dam Study Area for 2012 are given in Table C3 and those for the Nwamitwa Dan and Reticulation Study Area are given in Table C4. The noise levels given are the unmitigated values. The day-night equivalent continuous rating (noise) level ($L_{R,dn}$), namely that for the 24 hour period from 06h00 to 06h00 noise descriptor is given.

The road sections analysed the Tzaneen Dam Study Area are:

- Section 1: Road P43/3 (Route R71) just west of Road D978 (Deerfield Road)
- Section 2: Road P43/2 / Road P17/3 (Route R71/Route R36) between Road P17/2 (Route R71) and Road D528.
- Section 3: Road P17/2 (Magoebaskloof Road) (Route R71) just west of Road P43/2 / Road P17/3.
- Section 4: Road P43/2 (Modjadjiskloof Road) (Route R36) north of Road P17/2 (Magoebaskloof Road).
- Section 5: Road D978 (Deerfield Road) just north of Road P43/3 (Route R71).

TABLE C3: PREDICTED NOISE LEVELS ALONG ROADS IN THE TZANEEN DAM STUDY AREA (YEAR 2012)

Road Section	Day-night Equivalent Continuous Rating (noise) Level ($L_{R,dn}$) at given Offset (dBA)					
	25m	**50m**	**100m**	**250m**	**500m**	**1000m**
1	64.7	61.7	58.7	54.7	51.7	48.7
2	66.8	63.8	60.8	56.8	53.8	50.8
3	60.2	57.2	54.2	50.2	47.2	44.2
4	65.1	62.1	59.1	55.1	52.1	49.1
5	60.7	57.7	54.7	50.7	47.7	44.7

The road sections analysed in the Nwamitwa Dam and Reticulation Study Area are:

- Section 6: Road P43/3 (Route R71) west of Road R529.
- Section 7: Road P43/3.
- Section 8: Road R529 north of the intersection with D1292.
- Section 9: Road R529 south of the intersection with D1292.
- Section 10: Road D1292.

TABLE C4: PREDICTED NOISE LEVELS ALONG ROADS IN THE NWAMITWA DAM AND RETICULATION STUDY AREA (YEAR 2012)

Road Section	Day-night Equivalent Continuous Rating (noise) Level ($L_{R,dn}$) at given Offset (dBA)					
	25m	**50m**	**100m**	**250m**	**500m**	**1000m**
6	63.7	60.7	57.7	53.7	50.7	47.7
7	57.7	54.7	51.7	47.7	44.7	41.7
8	61.6	58.6	55.6	51.6	48.6	45.6
9	61.6	58.6	55.6	51.6	48.6	45.6
10	64.9	61.9	58.9	54.9	51.9	48.9

ii) Routine road maintenance activities.

C4.4.2. *Noise Impact*

The following impacts are anticipated:

i) Existing noise levels close to the main roads in the Tzaneen Dam Study Area and the Nwamitwa Dam and Reticulation Study Area are already high for residential land use and particularly at night. The situation of these "noise degraded" areas will continue to worsen with the general growth of traffic throughout the study area.

ii) The main impact from traffic noise will be on the realigned sections of Road R529 and Road P43/3 (see Section C3.4.1). Specifically on the realigned section of Road R529 there are a number of farm houses that will be within 500m of the road where the noise level will exceed the 45dBA ($L_{R,dn}$) allowable.

iii) The character (qualitative aspect) of the traffic noise will be as follows:

   a) Where the traffic is travelling at high speed, the main noise component will be that of high frequencies generated by the interaction between vehicle tyres and the road surface.

   b) Where there are long steep grades and heavy vehicles on the upgrade slow down, low-frequency mechanical noise becomes more evident. There may also be mechanical noise from the heavy vehicles on the downgrade using their air-brakes. This will be a minor component on the re-aligned road.

   c) There will also be a difference in the sound from continuous flow traffic versus the passing of single vehicles. The noise from continuous flow traffic tends to form a "background" of noise while, when general traffic flows are low, the noise from a single vehicle can be found to be rather intrusive. This is particularly so at night.

C4.5. Operational Conditions at the Water Treatment Works

C4.5.1. *Sources of noise*

The main sources of noise during the operational phase are anticipated to be:

i) The expanded water treatment works.

ii) Delivery pump station at the dam.

C4.5.2. *Noise Impact*

i) The expanded water treatment works could generate noise levels of about 51dBA at 500m. Residences in the southern sector of Ka-Malubana will be adversely affected by the noise from the works, particularly at night.

ii) The exact position of the delivery pump station for the water treatment works has not yet been determined. Conservatively it is estimated that the noise from these pumps could also be of the order of 50dBA at 500m. Residences in Ka-Malubana will be adversely affected by the noise from the works, particularly at night.

iii) The farms to the north-east and east of the Nwamitwa Dam should not be affected by the noise from these two sources.

C4.6. Operational Conditions along the Pipelines, at the Pump Stations and Reservoirs

C4.6.1. ***Sources of noise***

The main sources of noise during the operational phase are anticipated to be:

i) The pump stations. The main noise as heard externally will be from the ventilation intake fans for the building housing the pumps. Typical worst noise levels in the vicinity of the type of pump station that is likely to be built fro the project are as given in Table C5. The noise levels were established using the baseline measurements from the Clapham pump station (near Steelpoort) and the Politsi Purification Scheme Final Water Pump Station (north of Tzaneen). The calculation model SANS 10357 (SABS 0357) *The Calculation of Sound Propagation by the Concawe Method* was used. The average noise level over one hour (L_{Aeq}) and the day-night equivalent continuous rating (noise) level ($L_{R,dn}$) are indicated. These are the unmitigated values.

TABLE C5: TYPICAL NOISE LEVELS AT PUMP STATIONS

Descriptor	Noise Level at given Offset (dBA)				
	10m	**25m**	**50m**	**100m**	**200m**
L_{Aeq}	69	62	56	50	44
$L_{R,dn}$	75	67	61	56	50

The nature of the sound from the pump house area will be that of a continuous "swishing" noise of virtually unvarying intensity. It has been indicated that, in general, the pumping operations will be virtually continuous over any 24-hour period.

ii) Water-hammer in the pipelines when the pumps are switched on.

iii) Routine maintenance.

C4.6.2. ***Noise Impact***

C4.6.2.1. Pump Stations

As no final details of the location, position and orientation for the pump stations are available at this stage, no specific impact predictions are possible. The following impacts are anticipated:

i) The noise impact on residences within 250 metres of a pump station will be significant particularly at night.

ii) The noise impact on schools within 250 metres of a pump station will be significant.

C4.6.2.2. Other Issues

i) Noise from water hammer effects, namely the noise caused by the pressure surges in the pipeline from the water when the pumps are started is unlikely to have any significant effect on people living and working along the pipelines, as there will be relatively few such occurrences due to the planned continuous pumping operation.

ii) Maintenance works are unlikely to have an impact on the areas along the pipelines as these activities will be at relatively long term intervals and will be contained to the daytime.

iii) No noise impacts are anticipated from the reservoir sites.