

RAISING OF CLANWILLIAM DAM AND ASSOCIATED REALIGNMENT OF AFFECTED ROADS IN THE CLANWILLIAM AREA

DRAFT ENVIRONMENTAL IMPACT REPORT: EXECUTIVE SUMMARY ~
APRIL 2007



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Introduction

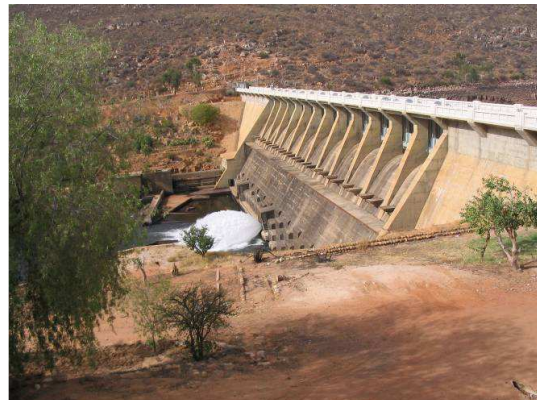
The Clanwilliam Dam, located on the Olifants River in the Western Cape, was originally built in 1935, and was raised in the 1960s by adding 13 crest gates and through the use of pre-stressed cables. The height of the dam wall is currently 43 m and the net storage capacity of the dam is 122 million m³/a.

In order to comply with current dam safety legislation and standards applicable during extreme events, the Department of Water Affairs and Forestry (DWAF) envisages that remedial measures will be required at the dam in the near future. This presents an opportunity to raise the full supply level (FSL), if the marginal cost of raising over and above the cost of strengthening the dam wall, is such that the raising is economically viable, socially desirable and environmentally acceptable.

The Reconnaissance Study (DWAF, 2003), which formed part of the Olifants/Doring River Basin Study Phase II, concluded that raising the Clanwilliam Dam could cost-effectively result in the provision of increased water yield for the area and recommended that it be investigated further at a feasibility level of study. In January 2004, the Clanwilliam Dam Raising Association, comprising Ninham Shand, Asch Consulting Engineers and Jakoet & Associates was appointed by DWAF to undertake a Feasibility Study for the possible raising of the Clanwilliam Dam (hereinafter referred to as the Feasibility Study).

Should the dam be raised, sections of the N7 National Road would be inundated, and would

therefore require realignment. Other roads in the vicinity would also be affected by the inundation. DWAF, in collaboration with the Provincial Government of the Western Cape (PGWC), agreed to undertake the investigation and design work associated with the potential road realignment.



Existing Clanwilliam Dam wall

The Proposed Project

The proposed project entails the following activities for which environmental authorisation are being sort:

- The raising of the Clanwilliam Dam by up to 15 m;
- Realignment of a portion of the N7 National road between km 89.32 and km 95.92, totalling some 2 700 m in length¹; and
- Raising of a portion of the N7 National road between km 68.77 and km 70.22, totalling some 1 km in length.
- Realignment of the gravel access road on the eastern side of the dam to retain maintenance access to the top of the dam wall.

¹ It must be noted that the road works are only required if the dam wall is raised.

The Environmental Impact Assessment (EIA) Process

Regulation 1182 of the Environment Conservation Act (No. 73 of 1989) identifies certain activities which "*could have a substantial detrimental effect on the environment*". These scheduled activities require authorisation from the competent environmental authority. The Provincial Department of Environmental Affairs and Development Planning (D:EA&DP) was granted delegation by the national Department of Environmental Affairs and Tourism (DEAT) to act as the competent environmental authority for this project.

The DWAF is applying for authorisation to undertake the following scheduled activities in the process of raising the Clanwilliam Dam and realigning portions of the N7:

- upgrading of a dam and associated infrastructure affecting the flow of a river,
- realignment of roads and associated structures,
- storage of hazardous substances on the construction site, during the construction period, such as diesel fuel; and
- the change of land use from agricultural or zoned undetermined use or an equivalent zoning to any other land use
- The cultivation or any other use of virgin ground.

The proposed project therefore requires authorisation from D:EA&DP, following the prescribed Environmental Impact Assessment (EIA) process as detailed in Regulation 1183.

The EIA process consists of a Scoping Report Phase and an Environmental Impact Report (EIR) Phase.

The Scoping Report Phase identified those aspects that required specialist investigation and assessment during the EIR Phase. The Final Scoping Report was submitted to D:EA&DP in December 2005.

The purpose of the EIR Phase (the findings of which are presented here) is to describe and assess the potential environmental impacts of the feasible alternatives identified during Scoping. These reports provide the basis for informed decision-making by the DWAF with respect to which option to pursue, and by D:EA&DP regarding whether or not to authorise the activity and if so, under what conditions.

Public Participation

Public participation forms an integral component of the EIA process. The nature of the public consultation during the Scoping Phase was comprehensive and included advertising in regional and local newspapers, distribution of background information, holding of public meetings and focus group meetings and capturing issues in issues trails which are included in the reports.

This was detailed in the Final Scoping Report. Since the completion of the Scoping Phase (Dec 2005), the public participation office has endeavoured to keep interested and affected parties (I&APs) registered on the database up to date with the project progress.

Please note: Since the onset of this EIA process in June 2005, new EIA Regulations have been enacted in terms of the National Environmental Management Act (NEMA) (No. 107 of 1998). In terms of the transitional arrangements provided for in Chapter 9 of the GN R385 "An application for authorisation of an activity submitted in terms of the previous regulations [ECA EIA Regulations] and which is pending when these Regulations take effect, must despite the repeal of the previous regulations be dispensed with in terms of the previous regulations as if the previous regulations were not repealed". Moreover, "Any authorisation issued following an application in terms of [the ECA EIA Regulations] must be regarded to be an environmental authorisation issued in terms of these Regulations". Accordingly, since the current application will be completed in terms of the ECA EIA Regulations, the NEMA EIA Regulations have no bearing. This notwithstanding, in undertaking the environmental investigation the full range of environmental implications have been considered, and hence any "new" activities introduced by the NEMA EIA Regulations are covered in terms of the impact assessment.

The public engagement since December 2005 entailed the following:

- Letter to registered I&APs (14 May 2006) via post. Notification of a delay in the project due to awaiting approval for the plan of study for EIR and finalisation of the Reserve requirements.
- Letter to registered I&APs (31 Oct 2006) via post and email. Notification of the approval to continue with the EIR phase and providing updated timeframes for the project.
- Letter to registered I&APs (20 February 2007) via post and email. Notification of further delay of EIR.
- Letter to registered I&APs (5 April 2007) via post and email. Notification of release of Draft EIR and invitation to public meeting.

The next stage of the public participation process involves the lodging of the Draft Environmental Impact Report in public libraries, municipal offices and hosting another round of public meetings. The purpose of the public meeting is to present the findings of the Draft EIR and to provide an opportunity for the public to comment on the findings.

Alternatives considered

The following alternatives were assessed in the EIR:

Raising of the Dam:

- Alternative dam raising options
 - Strengthening of the dam wall only (also referred to as 0 m raising)
 - Raising the dam wall by 5 m
 - Raising the dam wall by 10 m
 - Raising the dam wall by 15 m
- Outlet structure alternatives
 - Multi level outlet works
 - Status quo

Realignment/raising of sections of the N7²:

- 3 alternative realignments of the N7 between km 89.32 and km 95.92
- Raising of the N7 between km 68.77 and km 70.22

² This portion of the N7 is also known as the Trunk Road 11 Section 4

Realignment/raising of divisional or minor roads:

- Raising of affected sections of DR1487 and MR 539 in the vicinity of the Olifants River crossing, including the construction of a bridge
- Raising and/or realignment of portions of DR 2183
- Raising and/or realignment of portions of MR16/2 Renbaan Road

Construction site layout alternatives

- Site 1 (western bank of the river)
- Site 2 (eastern bank + portion of the western bank)
- Realignment of the service road to the east of the dam wall (downstream of the dam wall)

Refer to **Map 1** showing the location of the dam and the portions of the N7, divisional and minor roads of road which will be potentially affected by the various dam raising options.

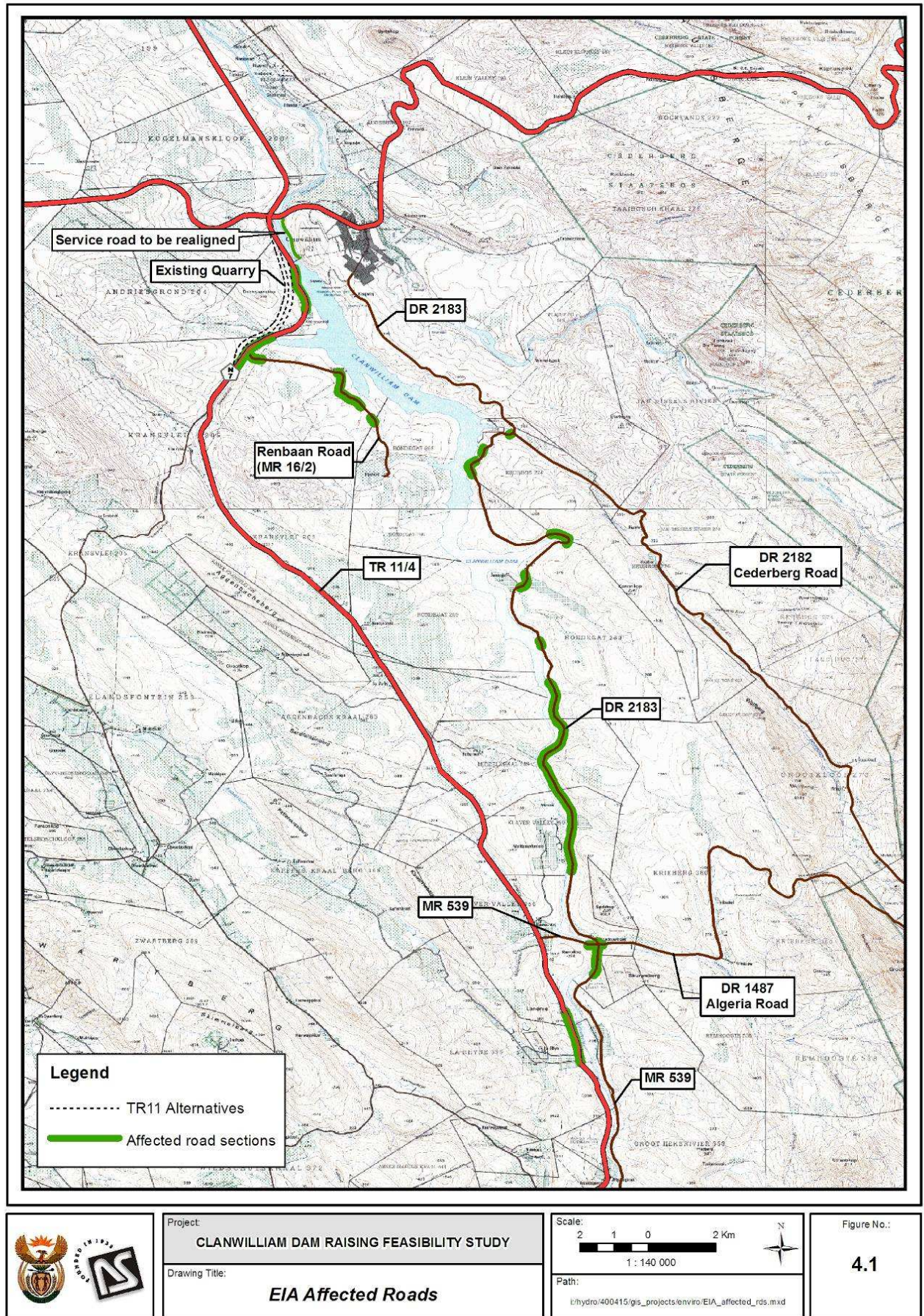
Identified Potential Impacts

Raising of the Dam (Operational Phase)

- Impact on flora
- Impact on terrestrial fauna
- Impact of reservoir-induced seismicity
- Impact on ability to achieve recommended Scenario for Ecological Water Requirements (Ecological Reserve)
- Impact on Riverine Fish
- Impact on groundwater resources
- Visual impacts
- Impact on heritage resources
- Impact of inundation of roads on access
- Impact of inundation of existing infrastructure, other than roads
- Impact of loss of agricultural land on livelihood security
- Impact on assurance of supply to farmers
- Impact of increased water yield on Resource Poor Farmers
- Impact on the local economy
- Macro-economic impacts

Raising of the Dam (Construction Impacts)

- Disturbance of flora
- Disturbance of fauna
- Sedimentation and erosion
- Deterioration of water quality
- Traffic impacts
- Interruption of water releases



- Storage and utilisation of hazardous substances on site
- Risk of fire
- Creation of employment opportunities
- Influx of workers to the area (health and safety risks)
- Influx of job seekers
- Creation of business opportunities for local businesses
- Disturbance to sense of place, visual aesthetics
- Windblown dust
- Litter/ waste pollution
- Noise pollution
- Light pollution
- Impact of sourcing construction material

Realignment/raising of affected portions of the N7 (Operational phase)

- Impact on flora
- Impact on fauna
- Visual impacts
- Impact on heritage resources
- Impact on livelihood security

Realignment/raising of affected portions of the N7 (Construction Phase)

- Impact of sourcing construction material
- Disturbance of flora and fauna
- Impact on aquatic ecosystems
- Sedimentation and erosion
- Deterioration of water quality
- Increase in traffic volumes
- Interruption of road services
- Road safety
- Storage and utilisation of hazardous substances on site
- Risk of fire
- Disturbance to sense of place, visual aesthetic
- Security risks
- Health issues
- Windblown dust
- Litter/waste pollution
- Noise pollution

The methodology applied to this EIA process is broadly consistent with that described in the DEAT Guideline Document on the EIA Regulations (1998). This methodology was outlined in the Plan of Study for EIA and approved by D:EA&DP. Using a tabulated system, each impact is described according to its extent (spatial scale), magnitude (size or degree scale) and duration (time scale).

Mitigation measures are described for each impact to minimise the negative impacts and enhance the positive impacts.

The criteria above are used to ascertain the significance of the impact, firstly in the case of no mitigation and then with the most effective mitigation measures in place. Once significance of an impact has been determined, the probability of this impact occurring as well as the confidence in the assessment of the impact is determined and documented. Lastly the reversibility of the impact is estimated.

Challenges faced during the application of the methodology as described relate to the subjectivity in assigning significance to an impact, the consideration of cumulative impacts and the need for integration with other development in the area.

The EIR has identified and provided a comparative assessment of the potential environmental impacts that are likely to occur as a result of the proposed activities. The outcome of the assessment, namely the significance of the impact and the probability of it occurring is summarised in two colour-coded matrices (**Refer to Table 1 and 2**) at the end of this Executive Summary.

Please note: Due to a lack of technical information at this time regarding how the quarry and borrow pits would be mined, the Environmental Management Plan Report (EMPR) required by the Dept Mineral & Energy (DME) has not yet been compiled. Whilst the authorisation from DME is therefore still outstanding, the potential environmental impacts associated with extending the existing quarry to the west of the dam wall are considered in the Draft EIR, but will further addressed in the EMPR required by DME.

Assessment of Potential Impacts

Operational Phase Impacts Associated with the Raising of the Clanwilliam Dam Wall

The most significant negative operational phase impacts of the raising of Clanwilliam Dam (refer to **Table 1**) on the biophysical and social environment without mitigation, include the following:

- Impact on achieving the recommended scenario for ecological water requirements all proposed height increases.
- Impact on riverine fish for all proposed height increases.
- Impact on reservoir induced seismicity for all proposed height increases.
- Impact on heritage resources for all proposed height increases.
- Impact of inundation of roads and access with height increases of 10m and 15m.
- Impact of inundation on existing infrastructure other than roads with height increases of 10m and 15m.
- Impact on local livelihood security with height increases of 10m and 15m.
- Impact on flora with a height increase of 15m.

Even though the mitigation measures mentioned in the EIR would not eliminate these above-mentioned impacts, their significance would be reduced considerably. Further more, the probability of these impacts would be marginally reduced.

In addition to the aforementioned negative impacts, there would be several **positive impacts** arising without mitigation:

- The impact on assurance of supply to farmers progressively increases as the proposed heights of the dam wall increase.
- The impact of increased water yield on resource poor farmers steadily improves as the proposed heights of the dam wall increases.

- Impact on the local economy gradually improves with an increase in the proposed height of the dam wall.
- Impact on the macro economy gradually improves with an increase in the proposed height of the dam wall.

If mitigation measures were implemented these impacts are enhanced and become even more significant positive impacts.

It should be noted that for the impact on the ecological flow requirements and riverine fish the introduction of a multi-level outlet structure which is the recommended mitigation measure significantly improves the current water quality situation and provides a **medium positive** impact as it improves on the existing situation.

Construction Phase Impacts of the Raising of the Clanwilliam Dam Wall

The construction phase of the proposed raising of the Clanwilliam Dam would result in several negative impacts on the bio-physical and social environment (Refer to **Table 1**).

In this regard, the following were highlighted as being of highest significance:

- Deterioration of water quality
- Sedimentation and erosion
- Impact on aquatic ecology
- Storage and utilisation of hazardous substances for all proposed height increases.
- Noise pollution

Nevertheless the negative impacts, in terms of their significance, are likely to be reduced by the relatively short duration of the impact and can be mitigated by the development and implementation of an appropriate Environmental Management Plan.

Creation of employment opportunities is a significant **positive impact** of the construction phase.

Operational Phase Impacts associated with the realignment of the N7

The operational phase impacts of highest significance without mitigation associated with the realignment of the N7 (refer to **Table 2**), as follows:

- Impact on the local livelihood security using alignment 1, 2 and 3.
- The impact on heritage resources using alignment 1, 2 and 3.
- The visual impact using alignment 1 and 2.

The impact on traffic flow is considered to be a high **positive impact** as it ensures the existing level of service to be maintained.

With the implementation of mitigation measures outlined in the EIR, the significance of the negative impacts would be considerably reduced. Furthermore, the probability of these impacts would be marginally reduced.

Conclusions and Recommendations

Conclusions

Potential raising of the Clanwilliam Dam

The impacts associated with the development of infrastructure such as a dam take place on two distinct levels. There are a series of local impacts that include the biophysical and socio-economic impacts of the increased inundation area, and the regional impacts which result from additional water being made available for use. The recipients of the operational phase project benefits are generally located in the broader Olifants Valley region whereas those who are most directly affected by the consequences of the potential dam raising are located in the immediate vicinity of the dam and its lake area.

There are two critical elements of the project with respect to ecological health of the river system. Firstly, the multilevel outlet structure, is required for all the dam raising options as it is critical to ensuring that the aquatic environment in

the immediate downstream vicinity of the wall derives maximum benefit from flows released from the dam. Secondly, the estuary must receive sufficient baseflow during dry months in order to stabilise its ecological status and halt deterioration. Therefore the operation of the Clanwilliam Dam - Bulshoek Weir must be optimised to allow the appropriate releases to be made whilst minimising the effect of these releases on the yield.

It is important to highlight the findings of the Olifants Doorn Water Management Area Reserve Determination which recommended that water resource infrastructure development on the Olifants River be maximised through the raising of Clanwilliam Dam and that the Doring River remain unimpounded and free of large dams. This option was documented in that study to be the best compromise between potential economic development and agricultural expansion in the catchment and the ecological requirements of the aquatic ecosystem.

It is clear from the assessment (summarised in Table 1 and 2) **that all raising options namely 5, 10 and 15m, provide greater significant positive impacts than the dam safety work (0m raising) alone.** In order to access the potential socio-economic benefits, increased water needs to be made available for use in the region. **The difference between the 5, 10 and 15m impacts are not sufficient to motivate one raising option strongly over another for environmental reasons.**

There are no impacts that, with mitigation, are so significant that they would rule out a raising up to the 15m option.

Construction of the Dam

The construction phase is likely to result in a number of impacts on the biophysical and social environment. The duration of the construction period is anticipated to be 24months (0m raising), 30months (5m raising), 36months (10m raising) or 42months (15m raising). Although the construction

phase impacts have a high nuisance value to local residents and visitors, the impacts are limited in duration and are mostly reversible. They therefore are of limited significance in the context of an EIA. All reasonable steps should be taken to minimise disturbance to the local population throughout the construction period. The construction phase potential impact which is likely to have the most significant impact is damage to the river downstream of the dam. In this regard, the following were highlighted as being of concern:

- Impact on aquatic ecology
- Sedimentation and erosion
- Deterioration of water quality

The significance of the construction phase impacts are likely to be curtailed by strict control of compliance with the construction phase Environmental Management Plan (EMP) by an appropriately qualified Environmental Control Officer (ECO) and the relatively short duration.

A framework EMP is provided in this report. During the detailed design phase environmental specifications will need to be developed to ensure that the potential construction impacts of all aspects of the programme and anticipated works are controlled. A detailed riverine monitoring programme will also need to be developed and implemented. The monitoring programme will need to specify all significant monitoring criteria, thresholds and appropriate responses to potential situations during construction.

Proposed Realignments of Trunk Road 11 Section 4 Between Km 89.32 and Km 95.92

If the dam is raised the N7 (Trunk Road 11 Section 4) needs to be realigned to maintain the level of services. Three alignment options were assessed. Alignment 3 is the preferred alternative in terms of technical criteria, and it has the lowest botanical and visual impacts. Alignment 3 has the lowest overall environmental impact and therefore the technical recommendation to pursue Alignment 3 is supported.

Realignment and/or Raising of Secondary Roads

Authorisation for secondary activities viz the raising/realignment of divisional or minor roads affected by the raising of the dam, is not being applied for in this application. These secondary activities and their alternatives are however considered in this report at a Scoping level to ensure holistic consideration of the possible impacts associated with the raising of the dam. This was undertaken to determine whether there are any fatal flaws associated with these secondary activities and their potential alternatives.

The viable alternatives considered in this preliminary screening include:

- For the affected sections of DR 2183
 - Realignment and raising of affected sections of DR2183
 - The DWAF to purchase properties if no access can be provided.
- For the affected sections of Minor Road 16/2 (Renbaan Road)
 - Realignment and/or raising of the 2 affected sections of the road.
- For the affected sections of DR1487 and Minor Road 539 crossing on the Olifants River
 - Raising of a 100 m length of the road in the vicinity of the Olifants River crossing and build a bridge where the existing road alignment would cross the dam.
- For the affected sections of Minor Road 539 (Citrusdal Road)
 - Raising a portion of the road or insert a culvert.

The conceptual and detailed design for viable alternatives would only be undertaken during the Dam Detailed Design Phase. Once detailed design of the activities has occurred, those activities that require environmental approval in terms of the National Environmental Management Act (108 of 1998) would be subjected to the necessary

processes. It should be noted however that the DWAF would not necessarily be the proponent, as the relevant roads authority may wish to undertake the activities.

Confidence in information for Decision-making

The draft EIR has provided a comprehensive assessment of the bio-physical and socio-economic impacts associated with the proposed activity. In recognising the extent of the information available at this stage of the project planning cycle (i.e. feasibility study), the confidence in the environmental assessment undertaken is regarded as acceptable for informed environmental decision-making.

Recommendations

The Draft EIR has outlined various mitigation measures, which, if implemented, could minimise the negative impacts, and enhance the positive effects associated with the proposed projects. Mitigation measures are outlined in Chapters 6 and 7 of the report. The following mitigation measures are highlighted:

- A multi-level outlet structure must be built for all options to ensure that the water quality and temperature requirements of the downstream environment can be satisfied.
- Making releases from the system to meet the recommended scenario Ecological Flow Requirements, to ensure that the Olifants River and estuary receive the required volume and quality of water, at the right times.
- Environmental specifications for the construction phase need to be developed in concert with the detailed design of the dam and associated infrastructure. These must include a detailed riverine monitoring programme and vegetation rehabilitation plan.
- Provision of fair, comprehensive and timeous compensation by the State for land, built structures and infrastructure affected by the proposed activities must be made.
- The DWAF should consider renting land back to farmers wherever feasible between the inundation line and purchase line for use to

minimise the impact on agriculture surrounding the dam and the associated jobs.

- DWAF must commit to ensuring that as much as possible of the water made available from the raising of the Clanwilliam Dam goes towards transformation and poverty alleviation in the area.
- The appropriate heritage permits, for the re-interment of graves and for the removal, preservation and/or recording of heritage artefacts must be obtained.
- No lay-bys or picnic areas are situated within easy walking distance of the Andriesgrond Cave, to minimise the risk of vandalism of the rock art or deposits.
- Any road construction activities at the present Kransvlei River marsh crossing must avoid changing the Kransvlei River channel itself and its immediate banks;

Construction Impacts Clanwilliam Dam and N7 realignment

As outlined previously, the DWAF Generic EMP for the construction phase is included in the report as a framework but should be further detailed during detailed design phase. Moreover, an ECO should be appointed to monitor and report on the implementation of this EMP.



DR 2183 at the upper end of the dam

The Way Forward

The Draft Environmental Impact Report will be lodged in the Clanwilliam and Cape Town public libraries, at the Clanwilliam Municipal Office and the LORWUA office from 12 April 2007. It will also be available on the Ninham Shand website www.ninhamshand.co.za (Go to 'hot topics' on the home page to find it).

A public meeting will be held at the Clanwilliam Bowling Club on Wednesday, 18 April 2007 from 10h00 to 12h30. The purpose of the public meeting is to present the findings of the Draft EIR and to provide an opportunity for the public to comment on the findings.

The **comment period** will commence on 12 April 2007, **end on 14 May 2007**. At the end of the comment period, all comments and responses received, will be integrated into the Final Environmental Impact Report.

Once the Final EIR has been completed and all I&AP comments have been incorporated into the report, it will be submitted to DWAF and PGWC for their review. On the basis of the findings of the EIR as well as other financial and technical considerations, the DWAF would decide whether they would like to proceed with the project. At this point, the Final EIR together with a letter from DWAF motivating for their decision and indicating which mitigation measures they are prepared to commit to, would be submitted to D:EA&DP for their review and decision.

Once they have reviewed the document and are satisfied that it contains sufficient information to make an informed decision, D:EA&DP will use the information contained within the EIR to determine

the environmental acceptability of the proposed project.

Thereafter D:EA&DP will issue a Record of Decision outlining the nature of their decision and the Conditions of Approval attached to any authorisation should the proposed activity be approved.

Once it has been issued, the Record of Decision will be communicated by means of letter to all identified I&APs. Following the issuing of the Record of Decision, there will be a 30-day appeal period during which I&APs will have an opportunity to appeal against D:EA&DP's decision to the provincial Minister of Environmental Affairs and Development Planning in terms of the Environment Conservation Act.

Any comments on the report may be forwarded to the Public Participation Co-ordinator:

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by 14 May 2007.

**Alternatively comments may be forwarded to
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TABLE 1: MATRIX OF IMPACTS FOR THE CLANWILLIAM DAM RAISING INDICATING SIGNIFICANCE & PROBABILITY

Impact	0m		5m		10m		15m	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
OPERATIONAL PHASE IMPACTS (DAM RAISING)								
Impact on flora	VERY LOW (-) Highly Prob.	VERY LOW(-) Highly Prob.	LOW – MED(-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW – MED(-) Probable	MED – HGH(-) Highly Prob.	MED (-) Probable
Impact on fauna	NEUTRAL Definite	N/A	VERY LOW (-) Highly Prob.	VERY LOW (-) Probable	LOW (-) Highly Prob.	VERY LOW (-) Probable	LOW (-) Highly Prob.	VERY LOW (-) Probable
Impact of reservoir associated seismicity	MEDIUM (-) Unlikely	N/A	HIGH (-) Unlikely	N/A	HIGH (-) Unlikely	N/A	HIGH (-) Unlikely	N/A
Impact on achieving the Ecological Water Requirements	HIGH (-) Highly Prob	MED (+) Probable	HIGH (-) Highly Prob	MED (+) Probable	HIGH (-) Highly Prob	MED (+) Probable	HIGH (-) Highly Prob	MED (+) Probable
Impact on riverine fish	HIGH (-) Highly Prob	MED (+) Probable	HIGH (-) Highly Prob	MED (+) Probable	HIGH (-) Highly Prob	MED (+) Probable	HIGH (-) Highly Prob	MED (+) Probable
Impact on groundwater resources	NEUTRAL Definite	N/A N/a	LOW (-) Probable	VERY LOW Possible	LOW – MED(-) Probable	LOW (-) Possible	MED (-) Probable	LOW-MED (-) Possible
Visual impacts	VERY LOW (-) Definite	VERY LOW (-) Definite	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW – MED(-) Definite	LOW – MED(-) Highly Prob.	MED (-) Definite	MED (-) Highly Prob.
Impact on heritage resources	VERY LOW (-) Definite	VERY LOW (-) Definite	HIGH (-) Definite	MED – LOW(-) Definite	HIGH (-) Definite	MED – LOW(-) Definite	HIGH (-) Definite	MED – LOW(-) Definite
Impact of inundation of roads and access	NEUTRAL Definite	N/A	MED (-) Definite	VERY LOW (-) Unlikely	HIGH (-) Definite	VERY LOW (-) Unlikely	HIGH (-) Definite	VERY LOW (-) Unlikely
Impact of inundation on existing infrastructure, other than roads	NEUTRAL Definite	N/A	LOW (-) Highly Prob.	VERY LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	HIGH (-) Highly Prob.	LOW (-) Probable
Impact on local livelihood security	NEUTRAL Definite	N/A	LOW (-) Highly Prob.	VERY LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	HIGH (-) Highly Prob.	LOW (-) Probable
Impact on estuarine livelihoods	MED - HIGH(-) Definite	MED (-) Probable	MED - HIGH(-) Highly Prob.	MED (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	LOW (-) Highly Prob.	VERY LOW (-) Probable
Impact on assurance of supply to farmers	HIGH (-) Highly Prob.	N/A	LOW (+) Possible	N/A	MED (+) Possible	N/A	HIGH (+) Possible	N/A
Impact of increased water yield on Resource Poor Farmers	NEUTRAL Probable	N/A	LOW (+) Possible	MED (+) Highly Prob.	MED – HIGH (+) Possible	HIGH (+) Highly Prob.	HIGH (+) Possible	HIGH (+) Highly Prob.
Impact on the local economy	NEUTRAL Definite	NEUTRAL Definite	LOW (-) Probable	VERY LOW(+) Probable	MED–LOW(-) Probable	LOW (+) Probable	MED (-) Probable	MED–LOW(+) Probable
Macro-economic impacts	NEUTRAL Definite	NEUTRAL Definite	LOW (+) Probable	MED (+) Probable	MED (+) Probable	HIGH (+) Probable	HIGH (+) Probable	HIGH (+) Probable

TABLE 1: MATRIX OF IMPACTS FOR THE CLANWILLIAM DAM RAISING INDICATING SIGNIFICANCE & PROBABILITY

Impact	0m		5m		10m		15m	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
CONSTRUCTION PHASE IMPACTS (DAM RAISING)								
Disturbance of flora	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.
Disturbance of terrestrial fauna	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.
Sedimentation and erosion	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible
Deterioration of water quality	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible	MED - HIGH(-) Highly Prob	MED – LOW(-) Possible
Impact on aquatic ecology	MED - HIGH(-) Highly Prob	LOW (-) Probable	MED - HIGH(-) Highly Prob	LOW (-) Probable	MED - HIGH(-) Highly Prob	LOW (-) Probable	MED - HIGH(-) Highly Prob	LOW (-) Probable
Traffic impacts	MED (-) Highly Prob	LOW (-) Highly Prob	MED (-) Highly Prob	LOW (-) Highly Prob	MED (-) Highly Prob	LOW (-) Highly Prob	MED (-) Highly Prob	LOW (-) Highly Prob
Interruption of water releases	MED (-) Probable	LOW (-) Possible	MED (-) Probable	LOW (-) Possible	MED (-) Probable	LOW (-) Possible	MED (-) Probable	LOW (-) Possible
Storage and utilisation of hazardous substances on site	HIGH (-) Possible	VERY LOW (-) Unlikely	HIGH (-) Possible	VERY LOW (-) Unlikely	HIGH (-) Possible	VERY LOW (-) Unlikely	HIGH (-) Possible	VERY LOW (-) Unlikely
Risk of fire	MED (-) Possible	VERY LOW (-) Unlikely	MED (-) Possible	VERY LOW (-) Unlikely	MED (-) Possible	VERY LOW (-) Unlikely	MED (-) Possible	VERY LOW (-) Unlikely
Creation of job opportunities	MED (+) Definite	HIGH (+) Highly Prob	MED (+) Definite	HIGH (+) Highly Prob	MED (+) Definite	HIGH (+) Highly Prob	MED (+) Definite	HIGH (+) Highly Prob
Influx of workers to area (Health & Safety Risks)	MED (-) Possible	LOW (-) Probable	MED (-) Possible	LOW (-) Probable	MED (-) Possible	LOW (-) Probable	MED (-) Possible	LOW (-) Probable
Impact on services - influx of job seekers	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable
Disturbance to sense of place/ aesthetics	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable
Windblown dust	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable	MED (-) Highly Prob.	LOW (-) Probable
Litter/ waste pollution	MED (-) Highly Prob.	VERY LOW (-) Probable	MED (-) Highly Prob.	VERY LOW (-) Probable	MED (-) Highly Prob.	VERY LOW (-) Probable	MED (-) Highly Prob.	VERY LOW(-) Probable
Noise pollution	MED - HIGH(-) Definite	MED-LOW (-) Highly Prob.	MED - HIGH(-) Definite	MED-LOW (-) Highly Prob.	MED - HIGH(-) Definite	MED-LOW (-) Highly Prob.	MED - HIGH(-) Definite	MED-LOW (-) Highly Prob.
Light pollution	MED (-) Definite	LOW (-) Highly Prob.	MED (-) Definite	LOW (-) Highly Prob.	MED (-) Definite	LOW (-) Highly Prob.	MED (-) Definite	LOW (-) Highly Prob.
Impact of sourcing construction material	MED (-) Definite	LOW (-) Highly Prob.	LOW-MED(-) Definite	LOW (-) Highly Prob.	MED (-) Definite	MED-LOW(-) Highly Prob.	MED (-) Definite	MED-LOW(-) Highly Prob.

TABLE 2: MATRIX OF IMPACTS FOR THE N7 RE-ALIGNMENT INDICATING SIGNIFICANCE & PROBABILITY

Impact	Alignment 1		Alignment 2		Alignment 3	
	Without mitigation	With mitigation	<u>Without mitigation</u>	<u>With mitigation</u>	Without mitigation	With mitigation
OPERATIONAL PHASE IMPACTS (N7 RE-ALIGNMENT)						
Impact on flora	LOW-MED (-) Definite	LOW (-) Highly Prob.	LOW – MED (-) Definite	LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.
Impact on fauna	LOW (-) Highly Prob.	VERY LOW (-) Possible	LOW (-) Highly Prob.	VERY LOW (-) Possible	LOW (-) Highly Prob.	VERY LOW (-) Possible
Visual impact	LOW – MED (-) Definite	LOW (-) Highly Prob.	LOW – MED (-) Definite	LOW (-) Highly Prob.	LOW (-) Definite	VERY LOW (-) Highly Prob.
Impact on heritage resources	MED (-) Possible	VERY LOW (-) Unlikely	MED (-) Possible	VERY LOW (-) Unlikely	MED (-) Possible	VERY LOW (-) Unlikely
Impact on local livelihood security	HIGH (-) Definite	LOW (-) Highly Prob.	HIGH (-) Definite	LOW (-) Highly Prob.	HIGH (-) Definite	VERY LOW (-) Highly Probable
Impact on traffic flow on the N7	HIGH (+) Highly Prob.	N/A	HIGH (+) Highly Prob.	N/A	HIGH (+) Highly Prob.	N/A
CONSTRUCTION PHASE IMPACTS (N7 RE-ALIGNMENT)						
Integrated construction phase impacts	LOW – MED (-) Highly Probable	LOW – V. LOW (-) Probable	LOW – MED (-) Highly Probable	LOW – V. LOW (-) Probable	LOW – MED (-) Highly Probable	LOW – V. LOW (-) Probable

