



**water affairs**

Department:  
Water Affairs  
**REPUBLIC OF SOUTH AFRICA**

# **DAM SAFETY OFFICE 2011/2012 ANNUAL REPORT**



**ADMINISTRATION OF THE DAM SAFETY  
LEGISLATION IN TERMS OF  
CHAPTER 12 OF THE NATIONAL WATER ACT,  
1998 (ACT No 36 OF 1998)**

## EXECUTIVE SUMMARY

The **mission** of the Dam Safety Office (DSO) is to promote the safety of new and existing dams with a safety risk so as to reduce the potential harm to the public, damage to property and to resource quality. The work of the DSO is carried out in terms of Chapter 12 of the National Water Act, 1998 (Act No. 36 of 1998). This report covers the activities of the Dam Safety Office for the period 1 April 2011 to 31 March 2012.

A total of 66 dams were registered during the year bringing the **total number of dams registered to date in South Africa to 4 755**. This includes the registration of new dams that were completed during the year, as well as of existing dams that were not registered previously. Some corrections were also made to the database. Altogether 80 registered dams were classified, bringing the total number of existing dams now classified to 4 475, that is 94% of the 4 755 dams registered to date.

Dam safety control over the construction of new dams and alterations to existing dams, involves the evaluation of design and other reports that form part of licence applications. A total of 31 dam safety licences were issued i.e. 12 licences to construct, 9 to alter, 9 licences to impound (commission) and 1 to abandon (decommission).

During the year a total of approximately 698 letters were sent to dam owners to ensure compliance with dam safety legislation. This included a total of 218 dam safety evaluation instructions issued to dam owners. In addition to the 698 letters, a total of 235 applications for approval as Approved Professional Persons for dam safety tasks were processed. The above statistics excludes a total of 94 dam safety inspection reports and a total of 24 operation and maintenance manuals with emergency preparedness plans for dams that were considered and accepted.

To date, 3 283 deficiencies at category 2 and 3 dams have been registered of which 956 (29%) have been rectified so far. Progress with the upgrading of the safety of dams is slow but steady. Personal finances and apathy on the part of some dam owners continue to be the most common stumbling blocks hampering progress with regard to the rectification of deficiencies at dams.

From statistics provided in the report, it is clear that **special attention should be focused on the first 100 to 200 dams on the DSO's priority list** as they have the greatest potential impact on the public. It is significant that 80% of the first 100 dams on the priority list belong to DWA and Municipalities. Ironically, in the past most incidents associated with loss of life or near misses have been caused by category 2 dams lower down on the priority list, indicating that these dams should not be neglected, even though they are not part of the first 100 to 200 dams. **Important recommendations are made in the report in order to maintain and preferably accelerate progress with the dam safety programme.**

The total direct expenditure incurred in administration of the dam safety legislation at Head Office was R5 023 000 compared to R4 795 000 in the previous reporting year, i.e. an increase of 5%. This is considered to be a moderate expenditure compared to the benefits of the dam safety programme in South Africa. One of the significant benefits is that not a single new category 2 or 3 dam for which a licence has been issued, has failed since 1987 when the dam safety legislation came in force.

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## LIST OF ABBREVIATIONS

AAR	alkali-aggregate reaction
APP	Approved Professional Person
CMA	Catchment management agency
DSO	Dam Safety Office
DSP	Dam Safety Programme
DWA	Department of Water Affairs
ECSA	Engineering Council of South Africa
EPP	Emergency preparedness plan
H	Maximum dam wall height in metres
m	metre
m <sup>3</sup>	cubic metre
NOC	Non-overspill crest
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O&M	Operation and maintenance
OMM	Operation and maintenance manual
R	Rand (South African)
RMF	Regional maximum flood peak
SANCOLD	South African National Committee on Large Dams
V	Storage capacity of dam in cubic metres
WARMS	Water Authorisation & Registration Management System
WMA	Water management area
x 10 <sup>6</sup> m <sup>3</sup>	million cubic metres
<	This sign means “less than” (e.g. H < 12 m is pronounced as “H is less than 12 metres”)

## **1. INTRODUCTION**

This annual report covers the activities of the Dam Safety Office within the Department of Water Affairs with regard to administration of the dam safety legislation in terms of Chapter 12 of the National Water Act, 1998 (Act 36 of 1998) read together with the relevant dam safety regulations, during the financial year 1 April 2011 to 31 March 2012. During the year the old regulations (G.N. R .1560 of 25 July 1986) were replaced by new Dam Safety Regulations promulgated on 24 February 2012 (published in Government Notice R. 139 in English and in Government Notice R. 138 in Sepedi, both dated 24 February 2012). The annual report also serves as an auditing tool. Progress with the dam safety programme can be assessed by comparing the current statistics with those of previous years as well as with targets that were set in the strategic business plan enclosed in Appendix A.

The statistics included in this report reflect the position as for the current nine DWA regions, which are based on river drainage regions that differ from provincial boundaries.

## **2. ADMINISTRATION**

Administration of the dam safety legislation is carried out jointly by the DSO and selected personnel from the regional offices.

The personnel listed below were employed by the Dam Safety Office at Head Office during the reporting year.

- Two Chief/Specialist Engineers
- One Control Engineering Technician (became vacant in December 2011)
- Two Chief Engineering Technicians (one became vacant in October 2011)
- One Deputy Director
- One Assistant Director
- Three Senior Administrative Clerks
- Two Senior Administrative Clerks doing registry clerk duties
- One Senior Administrative Clerk doing data capturing
- One Senior Administrative Clerk doing Logistic duties

The following posts have been vacant for longer than a year:

- One Specialist Engineer
- Three Chief Engineers
- One Engineering Technician
- One Senior Administrative Officer
- One Administrative Officer

The vacant posts impact negatively on the efficiency of the DSO and all vacant posts have been re-advertised and most should be filled in the near future.

During the year a total of approximately 933 letters were compiled by the Dam Safety Administration officials. The statistics in this regard for the past two years are compared in the two Tables below:

### Statistics for the previous reporting year (April 2010 – March 2011)

TASK	GA	FS	EC	NW	KZN	LI	MP	WC	NC	Total
Classification of dams (new/proposed)	7	2	18	0	9	2	3	16	0	57
Registration & classification of dams	11	7	37	0	7	3	9	39	0	113
Licence to construct/alter	2	1	1	0	3	2	2	3	1	15
Licence to impound	0	2	0	0	2	0	1	0	0	5
Licence to abandon	0	2	0	0	0	0	0	1	0	3
Dam safety inspection instructions	1	10	21	6	27	4	11	67	1	148
Implementation of recommendations	25	8	7	1	15	3	11	24	0	94
Approval of app's & prof teams (adm)	33	8	21	0	22	11	19	41	0	155
Approval of app's & prof teams (referred to ECSA for recommendation)	5	0	5	0	5	1	2	1	0	19
General letters and reminders/warnings	25	14	36	0	29	17	12	29	1	163
Legal Actions	0	0	0	0	0	0	0	0	0	0
Directives	0	0	0	0	0	0	0	0	0	0
Exemptions	0	0	0	0	0	0	0	0	0	0
Declarations of a dam with a safety risk	0	0	0	0	0	0	0	0	0	0
Dams not a safety risk "by definition"	1	0	1	1	1	0	0	3	0	7
Letters in connection with subsidies	0	0	0	0	0	0	0	0	0	0
Letters re inspection, investigation	19	63	52	2	109	23	58	36	1	363
Letters re licences to construct (design issues)	0	0	0	0	0	0	0	0	0	0
Miscellaneous letters (DSO)	0	0	0	0	0	0	0	0	0	0
No of Title Deeds searches	0	0	4	0	1	2	0	7	0	14
<b>Total for Period</b>	<b>129</b>	<b>117</b>	<b>203</b>	<b>10</b>	<b>230</b>	<b>68</b>	<b>128</b>	<b>267</b>	<b>4</b>	<b>1156</b>

### Statistics for the reporting year (April 2011 – March 2012)

TASK	GA	FS	EC	NW	KZ	LI	MP	WC	NC	Total
Classification of dams (new/proposed)	2	1	3	0	3	1	8	8	0	26
Registration & classification of dams	8	5	12	1	1	1	7	24	1	60
Licence to construct/alter	2	1	5	0	1	2	2	7	0	20
Licence to impound	3	1	0	0	1	0	1	0	0	6
Licence to abandon	0	1	0	0	0	0	0	0	0	1
Dam safety evaluation instructions	31	14	39	0	11	5	11	99	8	218
Implementation of recommendations	16	2	5	0	1	0	4	11	1	40
Approval of app's & prof teams (admin)										222
Approval of app's & prof teams (referred to ECSA for recommendation)										13
General letters and reminders/warnings	7	5	3	0	8	5	5	14	1	48
Legal Actions	0	0	0	0	0	0	0	0	0	0
Directives	0	0	0	0	0	0	0	0	0	0
Exemptions	0	0	0	0	0	0	0	0	0	0
Declarations of a dam with a safety risk	0	0	0	0	0	0	0	0	0	0
Dams not a safety risk "by definition"	2	4	2	0	0	0	4	2	0	14
Letters in connection with subsidies	0	0	0	0	0	0	0	0	0	0
Letters re inspection, investigation	36	46	45	0	42	0	20	74	2	265
Letters re licences to construct (design issues)	0	0	0	0	0	0	0	0	0	0
Miscellaneous letters (DSO)	0	0	0	0	0	0	0	0	0	0
No of Title Deeds searches	0	0	0	0	0	0	0	0	0	0
<b>Total for Period</b>	<b>107</b>	<b>80</b>	<b>114</b>	<b>1</b>	<b>68</b>	<b>14</b>	<b>62</b>	<b>239</b>	<b>13</b>	<b>933</b>

### 3. DIRECT COST OF DAM SAFETY ADMINISTRATION

The direct expenditure incurred in administration of the legislation at Head Office is shown in Table 1 below.

**Table 1: DSO Direct expenditure**

Item	Expenditure (R'000)	
	2010/11	2011/12
Employee component	4110	4352
Goods & Services	649	639
Transfers	0	0
Machinery	36	40
<b>Grand Totals</b>	4 795	5 023

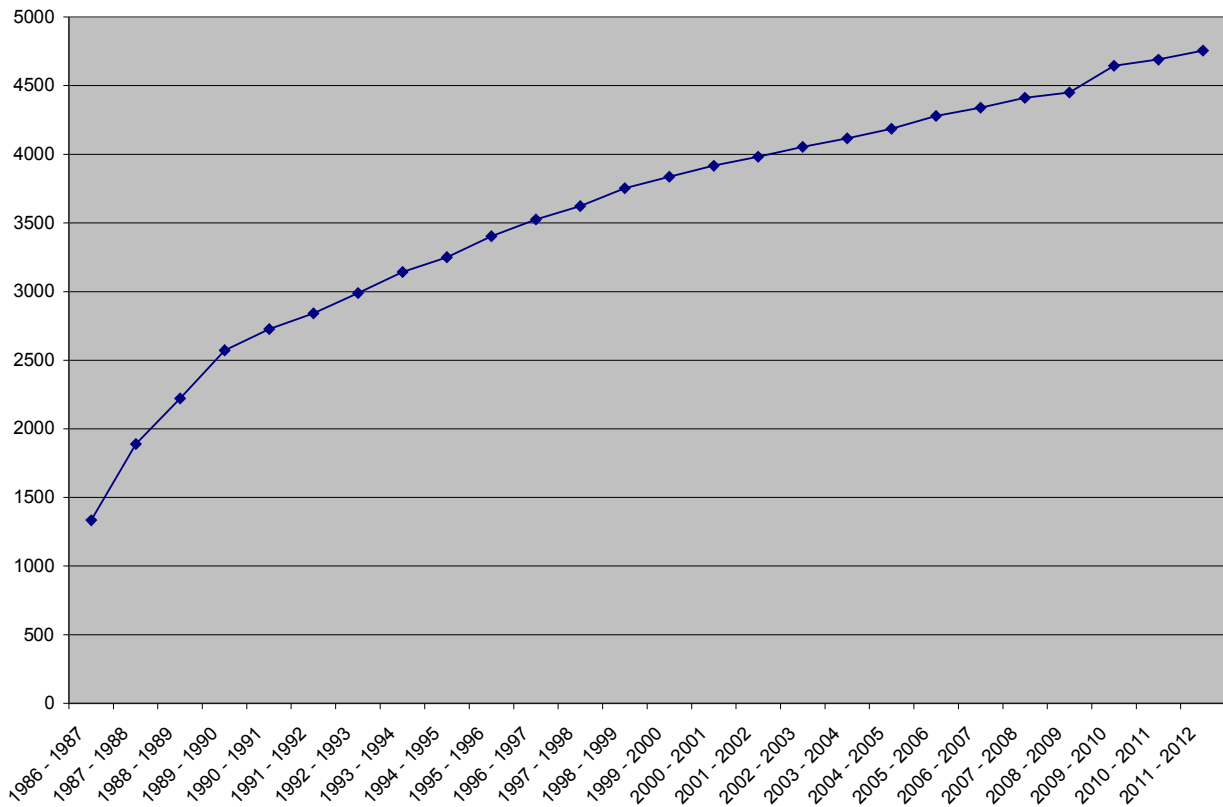
The total direct expenditure was R5 023 000 compared to R4 795 000 in the previous year, i.e. an increase of 5%.

Indirect costs (i.e. expenditure incurred by regional offices that assist the DSO and Head Office overhead cost) are not included in these amounts.

### 4. REGISTRATION OF DAMS

In terms of Section 120 of the NWA, all dams with a safety risk (i.e. if the wall height exceeds 5,0 m **and** if the storage capacity exceeds 50 000 m<sup>3</sup>) must be registered by dam owners. A total of 66 dams were registered during the year bringing the total number of dams registered to date in South Africa to 4 755. The figure of 66 includes registration of new dams that were completed during the year, as well as of existing dams that were not registered previously. Some corrections were also made to the database. The progress with registration of dams is illustrated in figure 1.

NUMBER OF REGISTERED DAMS



**Figure 1: Progress with registration of dams**

Distribution of registered dams according to size class, reservoir capacity and regional location is given in Tables 2 to 4.

**Table 2: Distribution of registered dams according to size class**

Size class	Number	%
Small (less than 12 m)	3 517	74%
Medium (12 m – 30 m)	1 059	22%
Large (30 m and higher)	179	4%
<b>Total</b>	<b>4 755</b>	<b>100</b>

**Table 3: Distribution of registered dams according to reservoir storage capacity**

Capacity (x 10 <sup>6</sup> m <sup>3</sup> )	Number	%
0,00 – 0,05	152	3.1%
0,05 – 0,10	1 181	24.8%
0,10 – 0,25	1 710	36%
0,25 – 1,00	1 078	22.7%
1,00 – 10,00	437	9.2%
10,00 – 100,00	129	2.7%
100 – 1 000	60	1.3%
1 000 – 10 000	8	0.2%
<b>Total</b>	<b>4 755</b>	<b>100</b>



**Table 4: Regional distribution of registered dams with a safety risk**

Region	Total No. registered to date	%
Eastern Cape	685	14%
Free State	402	8%
Gauteng	329	7%
Northwest	151	3%
KwaZulu-Natal	929	20%
Limpopo	317	7%
Mpumalanga	495	10%
Northern Cape	82	2%
Western Cape	1 366	29%
<b>Total</b>	<b>4 755</b>	<b>100%</b>

## 5. CLASSIFICATION OF DAMS

Altogether 80 registered dams were classified, bringing the total number of registered existing dams now classified to 4 475, which is 94,1% of the 4 755 dams registered to date. In addition, about 14 proposed dams were also classified.

Progress with the classification of registered dams in the regions is given in Table 5.

**Table 5: Progress with classification of dams on a regional office basis**

Region	Total No. registered to date	Total No. classified to date	% Classified to date	Number not classified yet
Eastern Cape	685	653	95%	32
Free State	402	358	89%	44
Gauteng	329	303	92%	26
Northwest	151	137	91%	14
KwaZulu-Natal	929	918	<b>99%</b>	11
Limpopo	317	300	95%	17
Mpumalanga	495	454	92%	41
Northern Cape	82	68	83%	14
Western Cape	1366	1284	94%	82
<b>Total</b>	<b>4 755</b>	<b>4 475</b>	<b>94,1%</b>	<b>281</b>

From Table 5 it can be seen that KZN has classified 99% of their registered dams. The percentage classified for the country as a whole increased to 94% due to the 80 dams that were classified during the year. The Dam Safety Office currently has 2 technicians who spend about 40% of their time on classifications. It will take about 4 years to classify most of the unclassified registered dams on the list if the current rate of 80 classifications per year can be maintained.

It should be noted that the outstanding classifications generally represent small dams and their hazard potential would mostly be low.

The distribution of existing dams classified according to hazard potential rating and category classification is given in tables 6 and 7.

**Table 6: Classification of existing dams according to size class and hazard potential**

Size class	Hazard potential rating			Total
	Low	Significant	High	
Small	2 518 (56%)	795 (18 %)	37 (1%)	<b>3 350 (75%)</b>
Medium	257 (6%)	577 (13%)	127 (3%)	<b>961 (21%)</b>
Large	1 (0%)	21 (0%)	142 (3%)	<b>164 (4%)</b>
<b>Total</b>	<b>2 776 (62%)</b>	<b>1 393 (31%)</b>	<b>306 (7%)</b>	<b>4 475 (100%)</b>

**Table 7: Category classification of existing dams**

Category classification	Number of dams	%
Category 1*	2 518	56 %
Category 2	1 666	37 %
Category 3	291	7%
<b>Total</b>	<b>4 475</b>	<b>100 %</b>

\* 34 of these dams are actually medium size dams that have been classified as indicated below, in terms of regulation 3.2 of the old dam safety regulations.

Size class : Medium  
Hazard potential rating : Low  
Category classification : 1

## 6. CONTROL OVER THE CONSTRUCTION & ALTERATIONS OF DAMS

**Table 8: Licences issued by DSO**

Category	Licence to construct	Licence to Alter	Licence to impound	Licence to Abandon	Total
1	1	1	0	0	2
2	10	6	8	1	25
3	1	2	1		4
<b>Total</b>	<b>12</b>	<b>9</b>	<b>9</b>	<b>1</b>	<b>31</b>

Dam safety control over the construction of new dams, including alterations to existing dams, involves the evaluation of design and other reports that form part of a licence application. A total of 31 dam safety licences were issued, i.e. 12 licences to construct, 9 to alter, 9 to impound and 1 to abandon (decommission).

Provision has been made for inspections by personnel of the regional offices during construction of category I and II dams, but very little success has been achieved in most of the regions because of the lack of human resources.

## 6.1 Site visits to dams

Response from APPs with regard to the submission of reports after site visits during construction work at dams varied from very good to fair.

The DSO made a total of 83 visits to dams during the year. Of these, 13 were to dams under construction whilst the remaining 70 were to existing dams, including for classification purposes. Where possible, contact was made with APPs to discuss design issues, general problems and quality control. A special effort was made to discuss dam safety engineering issues with owners, importance of operation and maintenance (including contingency plans), as well as the dam safety legislation requirements.

## 6.2 Evasion of the dam safety legislation

Several cases of dams having been built without a licence to construct are being handled by the Directorate Compliance Monitoring & Enforcement for possible prosecution. In the majority of cases the DSO and regions only find out when construction is near completion (or completed), and it is not always possible to stop construction at an early stage.

## 7. CONTROL OVER THE SAFETY OF EXISTING DAMS

### 7.1 Progress with the five-yearly inspections

The following table show the status of the dams with respect to the number of inspections performed to date for Category 2 and 3 dams:

**Table 9: Progress with 5-yearly inspections of Category 2 and 3 dams**

Sector	DWA	Municipal	Industry Mines Business	Other State Dams	Water Boards	Agri cultural	Total
Total number of Cat 2 & 3 dams	275	257	194	34	42	1 155	1957
Required number of inspections per year (7,5 year interval)	37	34	26	5	6	154	262
Actual number of inspections received this year	37	15	13	5	1	51	122
Outstanding first inspections	18	35	63	5	2	380	503
Total number of inspections done since 1987	654	413	260	49	56	1 046	2 478
Average inspection interval based on row above	10 years	14 years	17 years	16 years	17 years	25 years	18 years

The analysis shows that there are a large number of dam owners who are not complying with the target inspection intervals of between 5 and 10 years (average 7,5 years) between inspections. In addition a large number of Category 2 and 3 dams have not been inspected yet. The Table shows that DWA's (Infrastructure Branch) performance has been the most consistent since 1987, when the dam safety legislation came in force.

All the other Sectors perform unsatisfactorily. The poor performance of the Municipal Sector is of particular concern as their dams are in many cases located close to densely populated areas. In the case of the Industry/Mine Sector, it should be mentioned that in terms of the new dam safety regulations promulgated in February 2012, pollution control dams with a

safety risk are now automatically classified as category 2, which impacted negatively on this Sector's statistics for this reporting year.

The flow of dam safety inspection reports through the directorate during the reporting year was as follows (statistics of previous year are indicated in brackets):

**Table 10: Flow of dam safety evaluations**

	Number
Dam Safety Inspection Instructions Issued	203 (151)
Dam Safety Inspection Reports Received	123 (150)
Dam Safety Inspection Reports Accepted	94 (115)
Reports received but not evaluated or accepted at end of reporting period	127 (98)

Presently there are 1957 category II and III dams in the country and these dams should be inspected at an average interval of about 7,5 years. To achieve this, the ideal target should be set at 261 inspections submitted and accepted per year. The actual target for instructions is set at 225 per year as DWA dams are excluded. Instructions are currently not issued for dams under control of the DWA Infrastructure Branch because they follow a programme accepted by the DSO. Their dams are however included in the number of reports received and accepted.

The current capacity of the Dam Safety Office to evaluate and accept these reports is limited and only 94 were accepted and the year ended with a backlog of 127 reports that must still be finalised. More technical capacity is therefore essential.

## 7.2 Progress with rectification of deficiencies at category II and III dams

The deficiencies listed in Table 11 have been registered on the DSO database with regard to dams for which dam safety inspection reports have been formally accepted since implementation of the dam safety legislation in 1987.

**Table 11: Deficiencies/shortcomings at dams**

Description	Number of deficiencies	Number rectified
Hydraulic Problems	731	163
Leakage Problems	230	63
Structural Problems	274	78
Material Problems	37	8
Operation And Maintenance Problems	1 986	639
Other Problems	25	5
<b>TOTAL</b>	<b>3 283</b>	<b>956</b>

A total of 3 283 deficiencies have been registered of which 956 (29%) have been rectified since 1986. Rectification of a deficiency can also mean that a subsequent investigation into the matter proved that a deficiency previously recorded is no longer considered a problem because of better information. A more detailed breakdown of the deficiencies is included in Appendix B.

A total of 24 operation and maintenance manuals (OMM) including emergency preparedness plans (EPP) were formally accepted during the financial year. Approximately 996 dams now have both a OMM and EPP.

As in previous years much time and effort were spent on visiting owners, discussing shortcomings requiring rectification and associated problems. It is again reported that limited success has been achieved and where progress has been made, much personal input has been required. This is only possible for selected (more important) case studies. Financial circumstances and the state of the economy are still the most common “stumbling blocks”. Nevertheless, some dam owners have put a lot of effort into the upgrading and maintenance of their dams.

The Dam Safety Office tries to follow up in writing (ideally every 6 months) all cases where instructions have been issued and where important recommendations of 5 yearly dam safety evaluation reports have not been implemented. This objective has however not been achieved in all cases due to the shortage of technical and administrative staff. A total of 620 follow-up letters were compiled in this regard.

### **7.3 Prioritisation of existing dams**

Updating of the priority list of dams is an ongoing activity and takes place after receipt of dam safety evaluation reports, compiled by APPs. The total number of dams on the full list has increased from 1 327 (2010/11) to 1 334 (2011/12). The goal is to eventually reflect all category II and III dams (private as well as State dams) on the list. The list of the first 100 dams (thus including the most important outstanding dam safety work in South Africa) is appended in Appendix C. A simplified risk-based assessment is done to determine the relative risk and ranking of a dam on the list, based on information provided in dam safety inspection reports. The relative risk is based on the “possible loss of life during the life-span of a dam” (assumed as 100 years on average) and is calculated by using the following parameters:

- The estimated probability of failure of a dam (failure probabilities due to different causes at one dam are combined by using e.g. de Morgan's rule to prevent double-counting).
- The consequences of such a failure (hazard potential in terms of loss of life during a worst case scenario).
- A reduction factor determined from the standard of operation, maintenance, monitoring programme, emergency preparedness and general condition of a dam.

The priority list serves as a management tool for the DSO to:

- Identify priorities for the DSO.
- Determine appropriate inspection frequencies for dams. The proposed frequency as indicated in the last column of the list in Appendix C is one of the parameters used for the determination of intervals (years) between inspections.
- Monitor progress with the dam safety programme e.g. by comparing the total expected loss of life for all dams on the list or just for the first 50 dams on an annual basis.

It was found that the total relative risk or “possible loss of life” for all dams on the list increased by 5,6% from 4 896 (2010/11) to 5 170 (2011/12), as a result of new entries to the list and due to different assessments of risks in new dam safety evaluation reports. The total “possible loss of life” for the first 50 dams on the list increased by 6,4% from 3 440 (2010/11) to 3 662 (2011/12), due to the same reasons as given above. It should also be noted that there is a time lag before recent betterment work is reflected on the priority list, as the list is only updated after receipt of the next dam safety evaluation report following completion of rehabilitation work. Thus the list is not yet adequately “stable” and responsive

to be used as an accurate short term monitoring tool to measure progress with the dam safety programme. Nevertheless, some useful information can be extracted from the priority list as shown in the following paragraphs.

The information and statistics in Table 12 and in Appendices A, C2 and C3 have been corrected to take recently completed rehabilitation work into account. Table 12 shows the two main shortcomings under the first 100 dams on the priority list that require urgent attention. The relevant dams are listed in Appendices 2 and 3.

**Table 12: Main shortcomings under the first 100 dams on priority list**

<b>Shortcoming</b> (not complying with basic safety standards)*	<b>No. of dams</b>
• Deficient flood handling capacity	25
• Deficient structural stability	19
• Total number of dams not complying with basic safety standards	45

\*For the purposes of this Table, "compliance with basic safety standards" means the probability of failure of a dam is estimated to be less than 0,05% (1/2000) or 0,5% (1/200) per year for category 3 and 2 dams respectively.

An aspect that must be borne in mind is that some dams appear high on the list on the basis of their massive size and high theoretical hazard potential. Although no betterment work may be required at these dams because they comply with appropriate dam safety standards, it is important that adequate maintenance, monitoring, emergency preparedness and security measures are in place at these dams. These dams have been removed from the lists provided in Appendices C2 and C3 in order to highlight shortcomings at dams that need to be addressed in the short term.

Table 13 shows that 80% of the top 100 dams on the priority list belong to DWA and the Municipalities. Most of the large dams in the country fall within these two sectors.

**Table 13: Number of dams per sector within first 100 dams as ranked on priority list**

Sector	Total number of registered category 2 and 3 dams	Number of dams within first 100 dams as ranked on priority list
DWA Dams	275	58
Municipal Dams	257	22
Other State Dams	34	2
Water Board Dams	42	2
Mines, Industries, Business	194	4
Agricultural Dams	1 155	12
TOTAL	1 957	100

**The following useful information has been extracted from the priority list:**

- Of the total "possible loss of life" for all dams on the list (5 170), approximately 79% is caused by the first 100 dams or 87% by the first 200 dams. It is clear that special attention should be given to the first 100 to 200 dams on the priority list as they have the greatest potential impact on the public. Ironically, in the past most incidents associated with loss of life or near misses have been caused by category 2 dams lower down on the priority list, indicating that these dams should not be neglected, even though they are not part of the first 100 to 200 priority dams.

- 80% of the top 100 dams on the priority list belong to DWA and the Municipalities as shown in Table 13. It should be possible for these major dam owners to obtain and budget adequate funds to upgrade and/or maintain these dams in pristine condition
- The most important shortcomings at dams that need to be addressed in the short term are listed in Appendices C2 and C3, the latter showing DWA dams only. There are 18 dams on the latter list, of which 12 dams are already in the planning, tender, design or construction phase.
- The priority list also serves as a tool to help assess the current state of dam safety in South Africa and this is summarised under item 5 of the strategic business plan in Appendix A. It is clear that a lot of work must still be done by several role players to bring the state of dam safety in South Africa to satisfactory levels. The current rate of dam safety betterment work in South Africa is slow but steady. As reflected in Table 14, the current rehabilitation programme by DWA is making an important contribution in this regard.

#### 7.4 Legal/criminal proceedings

Several cases of dams having been built without a licence to construct are being handled by the Directorate Compliance Monitoring & Enforcement (CME) for possible prosecution.

### 8. APPROVAL OF PROFESSIONAL PERSONS FOR TASKS

A total of 235 applications for approval were received during the year. Of these 13 applications were submitted to the Engineering Council of South Africa (ECSA) and handled by its Committee on Professional Engineers for Dams. ECSA recommended 12 unconditional approvals and 1 conditional approval.

The 222 other applications were processed on the strength of similar previous recommended approvals by ECSA and they were not again referred to ECSA for a recommendation.

To date 156 persons have been approved as APPs for dam “tasks”. A total of about 76 APPs are classified as still active, i.e. not emigrated, retired or deceased and approved for at least 1 task during the past 5 years.

### 9. UPGRADING OF EXISTING DAMS

The major rehabilitation programme by the DWA: Infrastructure Branch is continuing to make a significant contribution to upgrade the safety of existing dams and must be commended. Total annual expenditure during the last four years varied between R241 million and R384 million. **Table 14** provide some statistics in this regard.

**Table 14: Upgrading of safety of existing DWA dams**

Description	Number of dams
Dams rehabilitated in full during last 7 years	19
Dams rehabilitated in full with regard to civil works, but mechanical refurbishment outstanding	11
Dams in tender, design or construction stage	39

## 10. INCIDENTS AT DAMS

The DSO has started with the upkeep of an incident database which will be posted on the DSO webpage. This list provides valuable statistics and details of dam incidents that have occurred in South Africa. From the list the major causes of dam failures are:

- Inadequate spillway capacity (41%)
- Piping through earthfill walls (21%)
- Failure through erosion of spillways and outflanking of weirs (17%)

The following significant incidents at dams during 2011/12 were reported to the DSO:

**Table 15: Incidents at Dams**

NAME OF DAM (TYPE)	LOCALITY AND NUMBER OF DAM	HEIGHT (m)	CAPACITY (‘000 m <sup>3</sup> )	CAT	INCIDENT OR DAMAGE
Klaserie (earthfill)	Hoedspruit B700/09	20	6 000	3	Damage when spillway training wall was overtopped during floods in January 2012. Dam wall toe was undermined.
Lake Panic No 1 (earthfill)	Skukuza Town, Kruger National Park	7	54	I	Failed by overtopping in January 2012 after heavy rains. The spillway was partially obstructed by a crossing built for golf carts.
<i>The dams below have concrete weirs or buttress spillways in the river section with earthfill flank walls at one or both sides. They are located in the Timbavati and Nharalumi River Areas adjacent (west) to Kruger National Park</i>					
Argyle	B706/27	9	220	I	These dams failed or partially failed by overtopping of the earthfill flank walls in January 2012 after heavy rains in Eastern Mpumalanga including the Hoedspruit area
Victor Wilkens (or Peru)	B706/28	7	270	I	
Sobeli	B706/29	7	260	I	
Argyle No 2	B706/30	7	165	I	
Jaydee	B706/31	7	204	I	
Ndlophu	B706/32	7	105	I	

## 11. REVISION OF THE DAM SAFETY REGULATIONS

In terms of section 123(1) of the NWA the old regulations (G.N. R .1560 of 25 July 1986) were replaced by new Dam Safety Regulations that were promulgated on 24 February 2012 (published in Government Notice R. 139 in English and in Government Notice R. 138 in Sepedi, both dated 24 February 2012).

The following are the main benefits of the new regulations compared to the old regulations:

- Better aligned with the terminology and especially with the objectives of the National Water Act of 1998 (Act 36 of 1998), e.g. raising the hazard potential rating of pollution control dams to at least significant, which is in the interest of protection of water resource quality.



- Provision for the establishment of a register of approved professional persons for tasks at dams with a safety risk (section 123(1)(a) of the NWA). This should reduce the administrative burden of considering applications and writing letters for each and every task at dams.
- The requirements for category 1 dams have been raised, especially with regard to spillway capacity. Inadequate spillway capacity is the main cause of dam failures.
- Experience gained since 1987 (when the old regulations came in force) has been implemented to make the new regulations more effective.

## 12. PROPOSED REGULATIONS ON FINANCIAL ASSISTANCE

Until 1 October 1998, subsidies were paid out for dam safety related work in accordance with conditions published in Government Notice No. 1854 dated 10 August 1990 (hereafter G.N. 1854), which were published in terms of section 9C (9A) of the previous Water Act, 1956. The National Water Act, 1998, came into effect on 1 October 1998. Since 1 October 1998, new subsidy applications could not be considered, as the previous subsidy conditions were not compatible with the new set of criteria specified in section 61 of the NWA.

The objective of the proposed financial assistance scheme would be to help dam owners who cannot afford it, to comply with requirements of the dam safety legislation to execute tasks such as dam safety evaluations, dam safety investigations and dam safety betterment work in order to upgrade the safety of category II and III dams to appropriate standards. It would only be practically possible to embark on this task once the technical capacity of the DSO has been strengthened.

## 13. COURSES, LECTURES & SYMPOSIUMS RE DAM SAFETY ENGINEERING

Event attended	Institution	Number of officials	Date
Design & management of dams and hydraulic structures (and presented lecture)	University of Stellenbosch	4	20-22 July 2011
Dam management & rehabilitation (and presented lectures)	Intelligent transfer	4	28-29 July 2011
Management & design of dams (and presented lectures)	SANCOLD	2	8 to 10 Nov 2011
Flood hydrology and climate change (and presented lecture)	University of Pretoria	2	31 Jan to 2 Feb 2012

## 14. CONCLUSIONS AND RECOMMENDATIONS

A summary of the current state of dam safety in South Africa is given in the strategic business plan for the dam safety programme (DSP), attached as Appendix A. This strategic business plan also gives an indication of progress made since commencement with the DSP in 1987. In addition, recommendations to achieve the objectives of DSP by different key role players (not only the DSO) are included in the last column. The salient points of the current state of dam safety in South Africa are as follows:

- It is expected that most category 2 and 3 dams have been registered, but there may still be a significant number of category 1 dams that have not been registered. Steps to improve on this statistic are proposed in the business plan. The DSO has started to use the WARMS database to identify unregistered dams. At the current rate, 99% of all registered dams should be classified by 2015 compared to the current 94%.
- Most new category 2 and 3 dams with a safety risk are being built in accordance with appropriate safety standards. Proposed steps to further improve on the quality of design and construction include training of the important role players. SANCOLD through its annual courses and/or conferences is assisting in this regard.
- Of the total of 1 957 category 2 and 3 dams, 1 462 (75%) dams have already undergone the first round of inspections by approved professional persons/engineers. Most of the larger and more important dams have been inspected. Steps to ensure that all category 2 and 3 dams are inspected at regular intervals are proposed in the business plan.
- It is a requirement of the new dam safety regulations that all category 2 and 3 dam owners must have an O&M manual and emergency preparedness plan compiled by an APP when so instructed by the Director-General. At present only about 51% of these dam owners comply with this objective. In the business plan steps to improve the standard of O&M at all dams with a safety risk are proposed.
- **Only an estimated 50% of the first 400 category II and III dams on the priority list comply with basic dam safety standards.** Steps to improve this situation are proposed in the business plan. Upgrading of the non-complying dams to appropriate safety standards remains a long-term task (until 2020 or later) and provisional targets are set on a prioritised basis in the business plan.
- **It is clear that a lot of work must still be done by several role players to bring the state of dam safety in South Africa to satisfactory levels.** The current rate of dam safety betterment work is slow but steady. The rehabilitation programme by DWA for DWA dams (see Table 14) is making an important contribution in this regard.
- Of the total "possible loss of life" for all dams on the list (5 170), approximately 79% is due to the first 100 dams or 87% due to the first 200 dams. It is clear that **special attention should be focused on the first 100 to 200 dams on the priority list** as they have the greatest potential impact on the public. Ironically, in the past most incidents associated with loss of life or near misses have been caused by category 2 dams lower down on the priority list, indicating that these dams should not be neglected.
- 80% of the top 100 dams on the priority list belong to DWA and the Municipalities as shown in Table 13. It should be possible for these major dam owners to obtain and budget adequate funds to upgrade and/or maintain these dams in pristine condition
- **The most important shortcomings under the first 100 dams that need to be addressed in the short term are listed in Appendix C2 (and of DWA dams only in Appendix C3).**
- The total direct expenditure incurred in administration of the dam safety legislation at Head Office was R5 023 000 compared to R4 795 000 in the previous reporting year, i.e. an increase of 5%. Because of the small size of the DSO, expenditure is very sensitive to personnel fluctuations. It is believed that the benefits of the dam safety programme far outweigh the total direct expenditure.

**The following specific recommendations are made in order to maintain and preferably accelerate progress with the dam safety programme:**

- The technical personnel component within the DSO should be strengthened. Significant momentum was lost when one Chief Engineer resigned 4 years ago. The DSO has also been unable to fill three vacant Chief Engineer posts over a long period of time.
- A financial assistance scheme should be implemented as soon as the technical personnel component within the DSO has been strengthened. Previously it was found that financial assistance acted as a moderate incentive for dam owners to implement dam safety betterment work. Dam safety is considered to be in public interest.
- A detailed action plan to achieve the objectives of the dam safety programme is proposed in the last column of the strategic business plan in Appendix A.

## APPENDIX A: STRATEGIC BUSINESS PLAN FOR DAM SAFETY PROGRAM

**Vision:** That all dams with a safety risk shall comply with appropriate safety standards in order to minimize loss of life, damage to property and harm to the environment.

**Responsibilities:** The success of the dam safety programme depends on action by several role players: Firstly dam **owners** (including Infrastructure Branch within DWA [DWA-IB]), secondly various other components within DWA (Dam Safety Office [DSO], Regional Offices [RO], Legal Services [LS]), Compliance Monitoring & Enforcement (CME), thirdly Disaster Management Structures [DM] and also SANCOLD.

Key Performance Area / Objectives	Short Term Targets	Current Status*	Possible Plan of Action to Attain Objectives (+Responsible Role Player)
1. That all dams* are registered and classified.	<ul style="list-style-type: none"> <li>99% dams* registered by 2015.</li> <li>99% of reg. dams classified by 2015.</li> </ul>	<ul style="list-style-type: none"> <li>4755 (±95% -estimate)</li> <li>4475 (94,1% of 4755)</li> </ul>	<ul style="list-style-type: none"> <li>Register dams from WARMS database plus advertising campaign. (RO)</li> <li>Check by Google-Earth (RO, DSO)</li> <li>Obtain services of consultants to assist some Regional Offices. (RO)</li> <li>Introduce fines to owners? (LS/CME)</li> </ul>
2. That all new dams* are designed/ built / altered in accordance with appropriate standards.	95% by 2015 (measurement of quality of construction subjective, especially of Cat I dams)	±95% for cat 2&3 (estimate allows for deficient quality of illegal dams) ±50% for cat 1 dams	<ul style="list-style-type: none"> <li>Prevent illegal construction by e.g. air and road reconnaissance. (RO)</li> <li>Introduce fines? (LS/CME)</li> <li>Training courses for APPs/contractors/ clerks of works? (DSO, SANCOLD)</li> <li>Improve control over cat I dams. (RO, DSO)</li> </ul>
3. That all Cat II & III dams are inspected and evaluated by APPs* according to schedule and to current dam engineering standards.	1550 1st inspections by 2015. Then 2 <sup>nd</sup> and 3 <sup>rd</sup> inspections to follow at required intervals.	1 <sup>st</sup> 1462 2 <sup>nd</sup> 670 3 <sup>rd</sup> 278 inspection reports received so far.	<ul style="list-style-type: none"> <li>Accelerate instructions. (DSO)</li> <li>Improve system of reminders, warnings, legal action, etc. (DSO, CME)</li> <li>Implement financial assistance scheme. (DSO, DWA)</li> <li>Inspection of some DWA dams should be contracted out. (DWA-IB)</li> <li>Training of APPs (SANCOLD, DSO)</li> </ul>
4. That all dams* are operated & maintained in accordance with appropriate safety standards and that effective OMMs* and EPPs* are in place.	1100 OMMs & EPPs compiled for Cat II and III by 2015. Standard OMM & EPP issued for all Cat I dams by 2015.	996 OMMs with EPPs compiled for Cat II and III dams so far.	<ul style="list-style-type: none"> <li>Improve system of instructions, reminders, warnings, etc. (DSO, CME)</li> <li>Ensure that all Cat II and III dams have OMMs &amp; EPPs. (DSO + owners)</li> <li>Compile a standard OMM &amp; EPP for Cat I dams and issue. (DSO)</li> <li>Motivate dam owners to keep up O&amp;M by two-yearly circulars. (DSO)</li> <li>Implement Disaster Management Act. (DM)</li> </ul>
5. That all dams* shall comply with appropriate safety standards (e.g. SANCOLD guidelines).  Where necessary, dams must be upgraded to acceptable standards.	<u>According to order of priority list:</u> <ul style="list-style-type: none"> <li>1<sup>st</sup> 100 dams 80% by 2020</li> <li>2<sup>nd</sup> 100 dams 70% by 2020</li> <li>3<sup>rd</sup> 100 dams 70% by 2020</li> <li>4<sup>th</sup> 100 dams 70% by 2020</li> <li>80% of all Cat II &amp; III dams by 2030</li> </ul>	<u>Basic* compliance:</u> <ul style="list-style-type: none"> <li>1<sup>st</sup> 100 dams 55%</li> <li>2<sup>nd</sup> 100 dams 44%</li> <li>3<sup>rd</sup> 100 dams 42%</li> <li>4<sup>th</sup> 100 dams 60%</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade dams on prioritized basis. Focus on first 100-200 dams on priority list. (Owners, DSO)</li> <li>Improve system of reminders, warnings, legal action, etc. (DSO, CME)</li> <li>Implement financial assistance scheme. (DSO, DWA)</li> <li>Training courses for APPs/contractors/ clerks of works? (APPs, DSO, SANCOLD)</li> <li>Give special attention to high priority cases &amp; monitor progress (DSO)</li> <li>Budget R400 M+ per year for DWA dams. (DWA-IB)</li> </ul>

\*Notes: APP means approved professional person. Basic compliance means the probability of failure of a dam is estimated to be less than 0,05% (1/2000) and 0,5% (1/200) per year for category 3 and 2 dams

respectively. **Dams** in this Table mean dams with a safety risk. **EPP** means emergency preparedness plan. **OMM** means O&M manual. **Current status** is the status as on 31 March 2012.

## APPENDIX B: DEFICIENCIES AT DAMS WITH A SAFETY RISK

Code	Description	Previous year		This Year	
		Number	Rectified	Number	Rectified
H01	Spillway capacity less than requirements of current criteria	442	86	456	94
H02	Erosion of toe of dam or downstream thereof	46	8	46	8
H03	Damage to spillway lining (e.g. erosion or cavitation)	81	22	80	22
H04	Damage to outlet works (e.g. cavitation)	16	4	15	4
H05	Mechanical equipment or outlet works out of order	42	10	42	10
H06	Spillway or gate vibration	2	1	2	1
H08	Erosion due to wave action (damage to upstream slope protection)	68	15	67	15
H09	Inadequate surface drainage or damage by "rainfall" erosion	22	8	22	8
H11	Hazard to human life upstream of dam during floods ("backwater" effects also)	1	1	1	1
	<b>HYDRAULIC PROBLEMS</b>	<b>720</b>	<b>155</b>	<b>731</b>	<b>163</b>
L01	Excessive loss of water	127	30	133	31
L02	High pore pressures, uplift forces, blocked drains	30	7	30	8
L03	Internal erosion, piping	19	2	20	3
L04	Wet patches observed	46	20	47	21
	<b>LEAKAGE PROBLEMS</b>	<b>223</b>	<b>59</b>	<b>230</b>	<b>63</b>
S01	Stability (gravity and buttress dams)	62	19	63	18
S02	Slope stability (earth and rockfill dams)	76	18	76	19
S03	Structural design criteria exceeded (arch dams)	10	3	10	3
S04	Foundation movement observed	3		3	
S05	Upstream "slip circle movement" observed	2	1	2	1
S06	Downstream "slip circle movement" observed	13	3	13	4
S07	"Flow slide" observed	3	1	3	1
S09	Excessive cracking or differential movement observed in mass concrete	15	4	15	4
S10	Excessive settlement of earth or rockfill dams	78	23	77	23
S11	Formation and development of cracks in earth dams	11	4	12	5
	<b>STRUCTURAL PROBLEMS</b>	<b>273</b>	<b>76</b>	<b>274</b>	<b>78</b>
M01	Weakening of concrete due to alkali-aggregate reaction or swelling/shrinking aggregate	18	4	18	4
M02	Chemical attack, leaching, weathering, bacteriological attack	4	1	4	1
M03	Break up of upstream membrane	1		1	
M06	"Foundation/ abutment material breakdown"(chemical)	1	1	1	1
M07	Corrosion ( mechanical equipment)	4	1	4	1
M09	Dispersive soils identified	8	1	8	1
M11	Crumbling/weathering/slaking of rock	1		1	
	<b>MATERIAL PROBLEMS</b>	<b>37</b>		<b>37</b>	<b>8</b>

Code	APPENDIX B (continued) Description	Previous year		This Year	
		Number	Rectified	Number	Rectified
B01	Flood control: Lack of personnel, untrained personnel	3		3	
B02	Operation and Maintenance Manual (OMM) must be compiled / updated	1 152	413	1 156	423
B03	Deficiencies in monitoring (instrumentation)	69	24	68	24
B04	Deficiencies in monitoring (routine inspections)	6	3	6	3
B05	Emergency Preparedness Plan (EPP) must be compiled / updated	390	53	421	63
B07	Trees and vegetation that must be removed	204	82	204	86
B08	Burrowing animals that must be exterminated	70	21	69	21
B09	Instruments not read/processed/evaluated	2		2	
B10	Flood control gates out of order	7	4	8	4
B11	Outlet works out of order	24	5	24	5
B12	Maintenance of slope protection	24	9	23	10
B13	Increase non overspill crest width	1		1	
B14	Inadequate freeboard	1		1	
	<b>OPERATION AND MAINTENANCE PROBLEMS</b>	<b>1 953</b>	<b>614</b>	<b>1 986</b>	<b>639</b>
A01	Sabotage	2		2	
A02	Earthquake Damage	2	1	2	1
A04	Problems in dam basin (unstable slopes, sedimentation)	1		1	
A05	Problems in the river downstream of a dam	1		1	
A06	Further investigations required	19	4	19	4
	<b>OTHER PROBLEMS</b>	<b>25</b>	<b>5</b>	<b>25</b>	<b>5</b>
	<b>TOTAL</b>	<b>3 231</b>	<b>917</b>	<b>3 283</b>	<b>956</b>

## APPENDIX C: PRIORITY LIST OF DAM SAFETY OFFICE

### APPENDIX C1: First 100 dams on list (10 pages)

Upon receipt of dam safety evaluation reports on category 2 and 3 dams, a basic risk assessment is done and the priority of a dam is determined on the basis of its "possible loss of life during the lifespan of the dam", taken as 100 years. There is a time lag before the list is updated after completion of dam safety betterment work, as the dam safety evaluation is done 3-5 years thereafter. There are currently 1 334 dams on the full list.

### APPENDIX C2: Dams under first 100 on the list needing urgent attention (45 dams)

As Appendix C1 but without dams that have been rehabilitated recently and without dams that are considered to comply with basic safety standards (annual probability of failure less than 1/200 for category 2 dams and less than 1/2000 for category 3 dams). Some dams in Appendix C1 appear high on the list because of their massive size and high theoretical hazard potential although they comply with appropriate safety standards. These dams have been omitted in Appendix C2. **Dams on this list should receive urgent attention because their annual probability of failure is considered to be too high.**

### APPENDIX C3: As Appendix C2 but only for DWA dams (18 dams)

Of the 18 dams on this list, 12 dams are already in the planning, tender, design or construction phase for upgrading work.

### LEGEND FOR PRIORITY LIST:

PF	<i>Probability of failure during lifespan of dam</i>
LL	<i>Hazard potential in terms of loss of life</i>
EL	<i>Possible loss of life during lifespan of dam based on worst case scenario (e.g. failure during night and slow evacuation)</i>
AL	<i>Reduction factor for good O&amp;MM and EPP</i>
N	<i>Lifespan of dam (100 years)</i>
T	<i>Average "recurrence period (years) between failures"</i>
1/T	<i>Annual probability of failure</i>
EPP	<i>Emergency preparedness plan</i>
Sector	<i>A (Agriculture), M (Municipal), W (DWA), S (State departments excluding DWA), O (Industry, Mines, Business)</i>

**The following guideline is used to determine intervals between dam safety evaluations (shown in the last column of Appendix C):**

<b>EL</b>	<b>Intervals between dam safety evaluations (years)</b>
<0,5	10
0,5 to 2	9
2 to 10	8
10 to 20	7
20 to 50	6
>50	5



**APPENDIX C 1**

No.	Sector	Loc. No.	Name of dam	Category	T(years)	PF	LL	AL	EL(total)	EPP (Y/N)	Status/Progress	DSI Interval (years)		
Major risk aspect		Action to be taken												
1	M	N120/01	NQWEBA DAM (PREVIOUSLY)	3						Y	Programmed for 2007/8 Programmed for 2007/8 Programmed for 2006/7	5		
					Spillway	*Investigate further	100	0.634	10				0.5	634.0
					Structure	*Investigate further and improve	100	0.634	2000				0.5	
					EPP out of date	EPP to be updated	0	0.000	0				0	
2	M	C601/01	BLOEMHOEK DAM	3						Y	Adequate Adequate	5		
					Spillway	None	2000	0.049	2140				0.6	284.2
					Structure	Adequate	500	0.181	2140				0.6	
							0	0.000	0				0	
3	W	A210/01	ROODEKOPJES DAM	3						N	Adequate Adequate Programmed for 2007/8 Ongoing	5		
					Spillway	None	2000	0.049	500				0.7	271.6
					Structure	None	2000	0.049	900				0.7	
					No O&MM and EPP	Revise existing O&MM and compile EPP	0	0.000	0				0	
4	W	N230/01	DARLINGTON DAM (LAKE ME)	3						Y	Programmed for 2010/1 & 2011/2 Adequate	5		
					Spillway	*Investigate and improve	200	0.394	608				0.9	231.9
					Structure - stability	None	2000	0.049	608				0.9	
							0	0.000	0				0	
5	W	W440/01	PONGOLAPOORT DAM	3						N	Programmed for 2009 Programmed for 2010	5		
					Spillway Capacity	Investigate further. Operate at reduced FSC(66%).	5000	0.020	6600				0.7	181.2
					Structural Stability	Investigate	5000	0.020	6600				0.7	
							0	0.000	0				0	
6	M	B100/04	WITBANK DAM	3						Y	Programmed for...? Programmed for...? Programmed for...?	5		
					Spillway	* Investigate and improve (gated spillway)	200	0.394	350				1	177.7
					Structure	Pendulums and cracking should be monitored. Concrete c/c	1000	0.095	350				1	
					Poor O&MM	Improve O&MM	1000	0.095	350				1	
7	W	C801/10	STERKFONTEIN	3						Y	Adequate Adequate Programmed for 2010	5		
					Spillway	None except correct operation	2000	0.049	2500				0.5	155.9
					Structure - filters not comprehensive	None except permanent monitoring and EP	5000	0.020	5000				0.5	
					Material parameters not fully known	Investigate further (design report)	5000	0.020	5000				0.5	
8	M	B100/13	MIDDELBURG DAM	3						Y	Ongoing Adequate	5		
					Spillway	Investigate options (overtopping spillway)	3000	0.033	6000				0.5	127.2
					Structure	None except when overtopping	10000	0.010	6000				0.5	
							0	0.000	0				0	
9	W	H800/03	DUIVENHOKS	3						Y	Adequate Programmed for 2007 to 2011	5		
					Spillway capacity	None necessary	2000	0.049	100				1	126.8
					Structural stability	(a) Investigate stability.(b) Stabilize left abutment	100	0.634	200				1	
							0	0.000	0				0	
10	W	C300/02	WENTZEL DAM	2						N	Programmed for 2007/8 & 2008/9 Adequate Programmed for 2008/9	5		
					Spillway	*Detailed investigation and improve	133	0.530	312				0.7	125.5
					Structure	None, but monitoring essential	1000	0.095	312				0.7	
					No O&MM and EPP	Compile	0	0.000	0				0	

No.	Sector	Loc. No.	Name of dam	Category	T(years)	PF	LL	AL	EL(total)	EPP (Y/N)	Status/Progress	DSI Interval (years)
	Major risk aspect		Action to be taken									
11	W	R101/01	CATA DAM	3						N		5
	Spillway		*Investigate and improve		500	0.181	750	0.7	116.2		Programmed for 2007/8 & 2008/9	
	Structure		None		2000	0.049	750	0.7			Adequate	
	No O&M and EPP		Compile		0	0.000	0	0			Programmed for 2008	
					0	0.000	0	0				
12	W	J330/01	STOMPDRIFT DAM	3						Y		5
	Spillway		* Increase spillway capacity		111	0.595	100	0.8	96.5		Programmed for 2009/10	
	Structure		* Improve structural adequacy		200	0.394	200	1			Programmed for 2009/10	
					0	0.000	0	0				
					0	0.000	0	0				
13	W	B310/05	RHENOSTERKOP DAM	3						N		5
	Spillway		Investigate further		5000	0.020	4000	0.7	82.8		Adequate	
	Structure		Do survey of saddle dam		10000	0.010	4000	0.7			Programmed for 3/97. Outstanding	
	No O&M and EPP		Compile		0	0.000	0	0			Programmed for 3/98. Outstanding	
						0.000						
14	M	M100/01	GROENDAL DAM	3						Y		5
	Spillway		None		2000	0.049	1000	0.7	66.6		Adequate	
	Structure		None		2000	0.049	1000	0.7			Adequate	
						0.000						
						0.000						
15	W	U200/04	INANDA DAM	3						Y		5
	Spillway		None		10000	0.010	1000	0.5	57.7		Adequate	
	Structure - foundation		RF Foundation jointed with weathering of joints		8000	0.012	1000	0.5			Adequate	
	Erosion emergency spillway		*Investigate erosion protection		1000	0.095	1000	0.5			Programmed for 2007/8	
						0.000						
16	W	C120/01	VAAL DAM	3						Y		5
	Spillway		None		2000	0.049	1600	0.6	55.9		Adequate	
	Structure		None		10000	0.010	1600	0.6			Adequate	
						0.000						
						0.000						
17	W	C520/02	KRUGERSDRIFT	3						Y		5
	Spillway		None		2000	0.049	930	0.6	53.1		Adequate	
	Structure		None		2000	0.049	930	0.6			Adequate	
						0.000						
						0.000						
18	A	G401/AM	SPIOENKOP	3						Y		5
	Spillway Capacity		None necessary		10000	0.010	20	0.8	52.0		Adequate	
	Structural Stability		* Repair cracking		50	0.867	40	0.9			Programmed for...?	
	Piping		Permanent monitoring		50	0.867	60	1				
					0	0.000	0	0				
19	W	U200/01	ALBERTFALLS DAM	3						Y		6
	Spillway		* Improve the spillway capacity		1500	0.065	1200	0.5	49.8		Programmed for 2007/8	
	Structure		Monitor seepage		5000	0.020	1200	0.5			Adequate	
						0.000						
						0.000						
20	W	E100/02	CLANWILLIAM DAM	3						Y		6
	Spillway		None		10000	0.010	76	0.8	40.8		Adequate	
	Structure		Rehabilitation		1000	0.095	76	0.8			Programmed for 2006/7 to 2008/9	
	No O&M and EPP		Compile and improve EPP		0	0.000	0	0			Programmed for ???	
	Spillway gate operation (human error)		Remove spillway gates - rehabilitation.		100	0.634	76	0.8			Programmed for 2006	

No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken	T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)	
21	W	A300/03	KLEIN MARICOPOORT DAM	3					N		6	
	Spillway		*Improve spillway	500	0.181	126	1	39.8		Programmed for 2007/8 & 2008/9		
	Structure		None, except monitoring	1000	0.095	206	1			Adequate		
	No O&MM and EPP		Compile	0	0.000	0	0			Programmed for 2007/8		
				0	0.000	0	0					
22	W	R300/01	NAHOON DAM	3					Y		6	
	Spillway		None	2000	0.049	400	0.7	39.0		Adequate		
	Structure		None	1000	0.095	400	0.7			Adequate		
				0	0.000	0	0					
				0	0.000	0	0					
23	W	C520/04	MOUTLOATSISSETLOGELO (	3					Y		6	
	Spillway		None	5000	0.020	1870	0.7	38.7		Adequate		
	Structure		None	10000	0.010	1870	0.7			Adequate		
					0.000							
					0.000							
24	S	X103/50	MBAMBISO DAM-WAS BOSKOP	3					Y		6	
	Spillway		Confirm / analyse spillway discharge capacity.	5000	0.020	40	1	34.9		Adequate		
	Structure		Maintenance must be done.	5000	0.020	40	1			Adequate		
	Relocate water supply pressure pipeline on dam		Investigate and relocate.	50	0.867	40	1			Programmed for ...?		
				0	0.000	0	0					
25	W	B200/01	BRONKHORSTSPRUIT DAM	3					N		6	
	Spillway capacity		Inspect apron area	10000	0.010	1740	1	34.5		Programmed for...?		
	Structural stability		Carry out FEA	10000	0.010	1740	1			Programmed for...?		
					0.000							
					0.000							
26	W	R101/03	MINYAMENI DAM	3							6	
	Spillway Capacity		* Improve	200	0.394	80	1	31.5				
	Structural Stability			0	0.000	0	0					
	O & MM			0	0.000	0	0					
				0	0.000	0	0					
27	W	C230/04	BOSKOP DAM	3					Y		6	
	Spillway capacity			2000	0.049	519	0.6	29.6		Adequate		
	Structural capacity		Low due to poor maintenance + sinkholes.	2000	0.049	519	0.6			Adequate		
					0.000							
					0.000							
28	B	X100/22	DRIEKOPPIES DAM	3					Y		6	
	Spillway Capacity		None	10000	0.010	2000	0.5	29.6		Adequate		
	Structural Stability - piping potential		Monitoring	5000	0.020	2000	0.5			Adequate		
				0	0.000	0	0					
				0	0.000	0	0					
29	W	B800/01	TZANEEN DAM (FANIEBOTHE)	3					Y		6	
	Spillway		None	10000	0.010	2000	0.5	29.6		Adequate		
	Structure		Improved monitoring required	5000	0.020	2000	0.5			Adequate		
					0.000							
					0.000							
30	W	B402/35	DER BROCHEN	3					Y		6	
	Spillway capacity: Cavities beneath spillway create		Improve spillway against erosion	50	0.867	30	1	26.2		Programmed for...?		
	Structural stability		Monitoring essential	2000	0.049	30	1			Adequate		
					0.000							

No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken		T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)
31	W	A210/02	HARTBEESPOORT DAM	3						N		6
	Spillway Structure		Routed flood that can be handled by channel before overtopping		1000	0.095	323	0.7	23.6		Programmed for ...?	
			None		10000	0.010	323	0.7			Adequate	
					0	0.000	0	0				
						0.000						
32	M	D200/18	SMITHFIELD DAM	3								6
	Spillway Capacity				200	0.394	60	0.9	21.3			
	Structural Stability				0	0.000	0	0				
	O & MM				0	0.000	0	0				
					0	0.000	0	0				
33	M	A600/06	DONKERPOORT DAM	3						Y		6
	Spillway capacity		Investigate + improve		200	0.394	100	0.5	21.2		Programmed for ...?	
	Structural stability		Investigate		2000	0.049	100	0.5			Programme for...?	
					0	0.000	0	0				
					0	0.000	0	0				
34	W	B800/02	EBENEZER DAM	3						N		6
	Spillway Structure		*Investigate further.		200	0.394	43	0.5	20.6		Programmed for ...?	
	Potential clogging of shaft spillway.		*Install safe seepage monitoring system.		1000	0.095	43	0.5			Programmed for ...?	
			*Install structure to prevent clogging.		50	0.867	43	0.5			Programmed for ...?	
						0.000						
35	W	A601/42	VAALKOP NO.II-DAM	2						N		7
	Spillway Structure		*Improve		100	0.634	20	1	20.0		Programmed for ...?	
			*Improve		20	0.994	20	1			Programmed for ...?	
						0.000						
						0.000						
36	W	A900/03	ALBASINI DAM	3						N		7
	Spillway Structure		Must be improved.		500	0.181	100	1	19.8		Programmed for 2012	
			Post-stressed cables must be monitored, investigated.		5000	0.020	100	1			Programmed for ...?	
					0	0.000	0	0				
						0.000						
37	M	S300/10	BONGOLO DAM	3						Y		7
	Spillway capacity				2000	0.049	600	0.6	17.9		Adequate	
	Structural stability				100000	0.001	600	0.6			Adequate	
					0	0.000	0	0				
					0	0.000	0	0				
38	M	C212/44	MIDDLE LAKE	2						Y		7
	Spillway capacity .				150	0.488	20	1	17.2			
	Structure stability.				1000	0.095	20	1				
	Lack of maintenance.				100	0.634	20	1				
					0	0.000	0	0				
39	A	A220/02	OLIFANTSNEK DAM	3						Y		7
	Spillway Structure		None		2000	0.049	292	0.6	16.7		Adequate	
			None		2000	0.049	292	0.6			Adequate	
					0	0.000	0	0				
					0	0.000	0	0				
40	W	S302/35	SHILOH DAM-CISKEI	3						N		7
	Spillway Structure		None		2000	0.049	250	0.7	16.7		Adequate	
	No O&MM and EPP		None		2000	0.049	250	0.7			Adequate	
			Compile		0	0.000	0	0			Programmed for 2007/8	

No.	Sector Major risk aspect	Loc. No.	Name of dam Action to be taken	Category						EPP (Y/N)	Status/Progress	DSI Interval (years)
					T(years)	PF	LL	AL	EL(total)			
41	Spillway Structure	J250/02	CALITZDORP DAM None necessary Investigate stability	3	2000	0.049	50	0.8	15.8	Y	Adequate Programmed for ...?	7
					500	0.181	100	0.8				
					0	0.000	0	0				
					0	0.000	0	0				
42	Spillway Structure	H300/02	PIETERSFONTEIN DAM None necessary None necessary	3	1000	0.095	210	0.7	15.8	Y	Adequate Adequate	7
					10000	0.010	280	0.7				
					0.000	0.000						
					0.000	0.000						
43	Spillway Structure	W S300/16	THRIFT DAM (MOUNTHOPE) Investigate and improve None	2	500	0.181	100	0.8	15.2	Y	Outstanding Adequate	7
					10000	0.010	100	0.8				
					0	0.000	0	0				
					0	0.000	0	0				
44	Spillway Structure	W J250/01	GAMKAPOORT DAM None None	3	10000	0.010	300	0.8	15.1	Y	Adequate Adequate	7
					3333	0.030	543	0.8				
					0	0.000	0	0				
					0	0.000	0	0				
45	Spillway Structure	O X201/68	NGODWANA DAM Adequate, but erosion should be monitored Adequate, but monitoring essential	3	10000	0.010	1000	0.5	14.8	N	Adequate Adequate	7
					5000	0.020	1000	0.5				
					0	0.000	0	0				
					0	0.000	0	0				
46	Spillway Structure	M G100/13	WEMMERSHOEK None None	3	18182	0.005	2000	0.7	14.6	N	Adequate Adequate	7
					10000	0.010	1000	0.7				
					0.000	0.000						
					0.000	0.000						
47	Spillway Structure	W J340/02	KAMMANASSIE None * Unblock/ clean pressure relief holes	3	1000	0.095	30	0.7	14.6	Y	Adequate	7
					200	0.394	50	0.7				
					0.000	0.000						
					0.000	0.000						
48	Spillway Structure	M U401/08	LAKE MERTHLEV Investigate & wall stability * Investigate integrity of post stressed bables	2	1000	0.095	21	1	14.0	N	Programmed for ??? Programmed for ???	7
					100	0.634	21	1				
					0	0.000	0	0				
					0	0.000	0	0				
49	Spillway Capacity Structural Stability	W H300/01	POORTJIESKLOOF DAM None None	3	1000	0.095	40	0.6	13.5	Y	Adequate	7
					2000	0.049	400	0.6				
					0.000	0.000						
					0.000	0.000						
50	Spillway Structure Internal erosion. Leaching sand from foundation Monitor	W H200/07	ROODE ELSBERG DAM None Structural analysis & risk analysis	3	10000	0.010	50	0.6	12.9	N	Adequate Programmed for 2010 Ongoing	7
					2000	0.049	50	0.6				
					200	0.394	50	0.6				
					0.000	0.000						

No.	Sector	Loc. No.	Name of dam	Category	PF	LL	AL	EL(total)	EPP (Y/N)	Status/Progress	DSI Interval (years)
	Major risk aspect		Action to be taken	T(years)							
51	W	L300/01	BEERVLEI DAM	3					N		7
	Spillway		None	200	0.394	41	0.7	12.2		Adequate	
	Structure		None	2000	0.049	41	0.7			Adequate	
					0.000						
					0.000						
52	W	V700/01	WAGENDRIFT DAM	3					Y		7
	Spillway Capacity		Check freeboard and spillway length	2000	0.049	250	0.5	11.9		Programmed for 2008	
	Structural Stability		Install monitoring instruments	2000	0.049	250	0.5			Programmed for 2008	
					0.000						
					0.000						
53	A	G101/AH	PARYS DAM	2					Y		7
	Spillway Capacity		None	500	0.181	20	0.8	11.3		Adequate	
	Structural Stability		None	10000	0.010	30	0.8			Adequate	
	O & MM			0	0.000	0	0				
	Erosion of spillway lining (reo mattresses)		* Repair	100	0.634	20	0.8			Programmed for 2006/7	
54	W	S302/33	GLENBROCK DAM	3					Y		7
	Spillway Capacity		* Improve	100	0.634	21	0.8	11.2		Programmed for 2008	
	Structural Stability		None	1000	0.095	21	0.8			Programmed for 2008	
					0.000						
					0.000						
55	W	A901/42	DAVANI DAM	3					N		7
	Spillway		Adequate	1000	0.095	60	1	10.9		Adequate	
	Structure		Adequate	1000	0.095	60	1			Adequate	
	No O&MM and EPP		Compile	0	0.000	0	0			Outstanding	
					0.000						
56	A	U700/11	BEAULIEU DAM	3					N		7
	Spillway capacity		Reinstate NOCL	500	0.181	62	0.5	10.2		Programmed for...?	
	Structural stability		Monitoring essential	500	0.181	62	0.5			Adequate	
				0	0.000	0	0				
				0	0.000	0	0				
57	W	A800/01	NZHELELE DAM(NJELELE)	3					N		7
	Spillway		Investigate spillway capacity	2000	0.049	250	0.7	10.2		Programmed for 2007/8	
	Structure		None	10000	0.010	250	0.7			Adequate	
	No O&MM and EPP		Compile	0	0.000	0	0			Outstanding	
					0.000						
58	M	G204/65	DRIFTSANDS STORMWATEF	2					Y		7
	Spillway		None	1000	0.095	106	1	10.1		Adequate	
	Structure		None	10000	0.010	5	1			Adequate	
				0	0.000	0	0				
				0	0.000	0	0				
59	A	B401/33	LEEUMKLIP DAM	2					N		8
	Spillway		*Enlarge / abandon	50	0.867	10	1	9.8		Programmed for 2004 Outstanding	
	Structure		*Improve / abandon	50	0.867	10	1			Programmed for 2004 Outstanding	
	No O&MM and EPP		Compile	0	0.000	0	0			Programmed for 2004 Outstanding	
				0	0.000	0	0				
60	W	B502/23	CHUNIESPOORT DAM	2					N		8
	Spillway		Investigate and improve	200	0.394	9	1	9.8		Programmed for 2007 - 2008	
	Structure		No drain - investigate dispersiveness	200	0.394	9	1			Programmed for 2007 - 2008	
	Outletpipe		*Investigate founding conditions	50	0.867	9	1			Programmed for 2007 - 2008	
	O&M Manual		Compile	0	0.000	0	0			Outstanding	

No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken	T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)	
61	A	C240/05	JOHAN NESER DAM (KLERK)	2					Y		8	
	Spillway Structure		Investigate betterments	200	0.394	30	0.8	9.6		Programmed for 2007/8		
			None	10000	0.010	30	0.8			Adequate		
					0.000							
					0.000							
62	M	D120/02	KLOOF DAM	3							8	
	Spillway Capacity			100	0.634	15	1	9.5				
	Structural Stability			0	0.000	0	0					
	O & M/M			0	0.000	0	0					
				0	0.000	0	0					
63	W	Q940/01	KATRIVIER DAM	3					Y		8	
	Spillway Capacity		Can take RMF + no apron protection	2000	0.049	82	0.8	9.1		Adequate		
	Structural Stability		* Improve stability	1000	0.095	82	0.8			Programmed for 2012/3 & 2013/4		
	O & M/M			0	0.000	0	0					
				0	0.000	0	0					
64	W	A220/07	BOSPOORT DAM	3					Y		8	
	Spillway - radial gates		*Inadequate. Enlarge spillway capacity	200	0.394	20	1	9.0		Programmed for 2008/9 & 2010/1		
	Structure		None	1000	0.095	20	1			Programmed for 2008/9 & 2010/1		
	O&M/M and EPP not to standard		Compile O&M/M and update EPP	0	0.000	0	0			Programmed for 2007/8		
				0	0.000	0	0					
65	M	H402/66	MCGREGOR-NUWE DAM NK	2					Y		8	
	Spillway Capacity		None	10000	0.010	8	1	8.9		Adequate		
	Structural Stability		None	500	0.181	10	1			Adequate		
	Piping		Monitoring	50	0.867	10	1			Ongoing		
				0	0.000	0	0					
66	A	J340/08	EZELJACHT DAM	3					Y		8	
	Spillway Structure		None	100000	0.001	5	0.6	8.9		Adequate		
			*Investigation to determine "safe operating level"	100	0.634	20	0.7			Programmed for 2006/7 & 2007/8		
				0	0.000	0	0					
				0	0.000	0	0					
67	W	B320/01	LOSKOP DAM	3					N		8	
	Spillway Structure		None	10000	0.010	500	0.6	8.9		Adequate		
	No O&M/M and EPP		*Monitoring essential / Improve drainage	5000	0.020	500	0.6			Adequate		
			Compile	0	0.000	0	0			Outstanding		
					0.000							
68	W	G200/12	KLEINPLAAS DAM	3					N		8	
	Spillway Structure		None	1177	0.081	60	0.8	8.8		Adequate		
			None	1818	0.054	120	0.8			Adequate		
				0	0.000	0	0					
				0	0.000	0	0					
69	M	Q800/13	BESTERSHOEK DAM	2							8	
	Spillway Capacity			2000	0.049	10	1	8.7				
	Structural Stability			50	0.867	10	1					
					0.000							
					0.000							
70	A	A213/52	HIPPO DAM	2					N		8	
	Spillway capacity			50	0.867	10	1	8.7				
	Structural Stability			0	0.000	0	0					
				0	0.000	0	0					

No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken	T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)	
71	W	C900/07	BLOEMHOF DAM	3					N		8	
	Spillway		None necessary	10000	0.010	50	0.8	8.3		Adequate		
	Structure		None necessary	10000	0.010	50	0.8			Adequate		
	Flood control		Improve skills and knowledge during emergency (flood) s	1000	0.095	100	0.8					
					0.000							
72	M	S401/05	KOCH DAM	2					Y		8	
	Spillway		*Recently improved	20	0.994	9	0.9	8.1		Still need to be verified		
	Structure		None	1000	0.095	9	0.9			Adequate		
				0	0.000	0	0					
				0	0.000	0	0					
73	W	C230/07	LAKESIDE DAM (POTCHEFS)	2					Y		8	
	Spillway		* Upgrade	100	0.634	18	0.7	8.0		Programmed for 2012		
	Structure		None	10000	0.010	18	0.7			Adequate		
	O&MM and EPP			0	0.000	0	0					
				0	0.000	0	0					
74	M	D540/01	VANWYKSVLEI	2					Y		8	
	Spillway Capacity		None	2000	0.049	5	0.8	8.0		Adequate		
	Structural Stability		None	1000	0.095	10	0.9			Adequate		
	Piping due to animal burrows.		* Maintenance and monitoring	100	0.634	14	0.9			Ongoing		
				0	0.000	0	0					
75	S	B800/25	LORNA DAWN DAM	2					Y		8	
	Spillway capacity		Monitor erosion	2000	0.049	9	1	7.9		Ongoing		
	Structural stability		Monitor seepage	2000	0.049	9	1			Ongoing		
	Strong leak at RF		Repair	50	0.867	9	1			Programmed for...?		
					0.000							
76	A	B501/17	UPPER GOMPIES DAM	2					N		8	
	Spillway		*Investigate / improve	50	0.867	9	1	7.9		Programmed for 2007		
	Structure		None	2000	0.049	9	1			Adequate		
	No O&MM and EPP		Compile	0	0.000	0	0			Outstanding		
					0.000							
77	W	W120/01	GOEDERTROUW DAM	3					Y		8	
	Spillway		Erosion must be monitored/repared	5000	0.020	400	0.5	7.8		Adequate		
	Structure		Monitoring	5000	0.020	400	0.5			Adequate		
				0	0.000	0	0					
78	W	B800/29	MIDDELLETABA DAM	3					N		8	
	Spillway		Investigate Further	500	0.181	30	1	7.8		Programmed for ???		
	Structure		Investigate stability of embankment and piping potential	1000	0.095	30	1			Programmed for ???		
					0.000							
					0.000							
79	O	C221/70	FLEURHOF DAM	2							8	
	Spillway Capacity			100000	0.001	12	1	7.6				
	Structural Stability		* Investigate and improve	100	0.634	12	1					
	O & MM			0	0.000	0	0					
				0	0.000	0	0					
80	M	G400/21	MOSSELRIEVER DAM	3					Y		8	
	Spillway		*Increase spillway capacity	500	0.181	50	0.8	7.6		Investigation to start 6/2000		
	Structure		None	3000	0.033	20	0.8			Adequate		
				0	0.000	0	0					



No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken	T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)	
81	O	A215/61	EASTERN PLATINUM MINE I	2					N		8	
	Spillway Capacity		None	200	0.394	31	0.6	7.3		Adequate		
	Structural Stability		None	10000	0.010	6	0.6			Adequate		
	O & MM		Compile	0	0.000	0	0			Programmed for 2006		
				0	0.000	0	0					
82	W	L820/01	KOUGA DAM (PAUL SAUER)	3					Y		8	
	Spillway		None	10000	0.010	100	0.7	7.3		Adequate		
	Structure		None	1000	0.095	100	0.7			Ongoing monitoring		
					0.000							
					0.000							
83	W	B501/14	MAHLANGU DAM	2					N		8	
	Spillway		None	2000	0.049	8	1	7.1		Adequate		
	Structure		Monitor	1000	0.095	8	1			Adequate		
	Pipeline buried in damwall		*Relocate / monitor	50	0.867	8	1			Programmed for 2006 - 2008		
					0.000							
84	W	C700/05	WELTEVREDE DAM	2					N		8	
	Spillway		*Investigate	50	0.867	9	0.8	7.1		Programmed for ...?		
	Structure		*Leakage along RHS pipe	50	0.867	9	0.8			Programmed for ...?		
	No O&MM and EPP		Compile	0	0.000	0	0			Programmed for ...?		
				0	0.000	0	0					
85	W	D350/02	GARIEP DAM (HENDRIK VEF	3					Y		8	
	Spillway		Monitoring	100000	0.001	5000	0.7	7.0		Adequate		
	Structure		Monitoring	100000	0.001	5000	0.7			Adequate		
					0.000							
					0.000							
86	W	D310/01	VAN DER KLOOF DAM (P.K.I	3					N		8	
	Spillway		Monitoring	80000	0.001	4000	0.7	7.0		Adequate		
	Structure		Monitoring	80000	0.001	4000	0.7			Adequate		
	No O&MM and EPP		Compile	0	0.000	0	0			Programmed for 2007		
					0.000							
87	W	A804/04	NWANEDZI	3					N		8	
	Spillway		Investigate erosion potetial during overtopping	2000	0.049	50	1	7.0		Programmed for 2007/8		
	Structure		*Do structural and foundation analysis	1000	0.095	50	1			Programmed for 2007/8		
	No O&MM and EPP		Compile	0	0.000	0	0			Outstanding		
					0.000							
88	A	G200/06	BLUEGUM DAM	3					Y		8	
	Spillway		None necessary	5000	0.020	100	0.6	6.9		Adequate		
	Structure		None necessary	2000	0.049	200	0.6			Adequate		
				0	0.000	0	0					
				0	0.000	0	0					
89	M	C212/46	KLEINFONTEIN DAM	2					N		8	
	Spillway		None	50	0.867	8	1	6.9		Adequate		
	Structure		None	2000	0.049	2	0.6			Adequate		
	No O&MM and EPP		Compile	0	0.000	0	0			Programmed for ???		
				0	0.000	0	0					
90	W	B501/11	FLAG BOSHELO DAM - WA	3					Y		8	
	Spillway capacity		None	10000	0.010	500	0.7	6.9		Adequate		
	Structura stability		None	10000	0.010	500	0.7			Adequate		
					0.000							

No.	Sector	Loc. No.	Name of dam	Category						EPP (Y/N)	Status/Progress	DSI Interval (years)		
					Major risk aspect	Action to be taken	T(years)	PF	LL				AL	EL(total)
91	W	A210/03	BUFFELSPOORT DAM	3						N	Adequate	8		
					Spillway Capacity	None	2000	0.049	20				0.8	6.8
					Structural Stability	* Investigate (AAR + GEODETIC SURVEYS)	200	0.394	20				0.8	
92	W	H200/06	LAKENVALLEI DAM	3						Y	Adequate	8		
					Spillway	None	100000	0.001	2600				0.65	6.7
					Structure	None	33333	0.003	2600				0.65	
93	O	A231/35	PREMIER MINE NO.7 SLIME	3						N	Adequate	8		
					Spillway	Overall estimate	1000	0.095	70				1	6.7
					Structure	None	0	0.000	0				0	
							0	0.000	0				0	
94	A	Q440/01	LAKE ARTHUR	3						Y	Adequate	8		
					Spillway	None	200	0.394	15				0.7	6.6
					Structure	None	200	0.394	15				0.7	
								0.000						
95	M	H402/74	DASSIESHOEK DAM	3						Y	Adequate	8		
					Spillway Capacity	None	100000	0.001	30				0.8	6.5
					Structural Stability	None	500	0.181	40				0.9	
							0	0.000	0				0	
96	M	E400/01	KAREE DAM	3						Y	Adequate	8		
					Spillway	None necessary	20000	0.005	12				0.7	6.4
					Structure	None necessary	2000	0.049	12				0.7	
					Retaining wall/embankment transition.	Monitor leakage(L03)	200	0.394	20				0.8	
							0	0.000	0				0	
97	B	U202/45	DURBAN HEIGHTS RESERV	3						N	Adequate.	8		
					Spillway capacity	None.	5000	0.020	20				0.5	6.4
					Structural stability	Investigate stability.	100	0.634	20				0.5	
							0	0.000	0				0	
98	M	G402/57	BOTRIVIER RAILWAYS DAM	2						Y	Programmed for 2006/7	8		
					Spillway	Increase spillway capacity	200	0.394	4				1	6.4
					Structure	None	500	0.181	9				1	
					Piping	*Remove antworks	100	0.634	9				1	
99	W	B310/01	RUST DE WINTER DAM	3						N	Programmed for 2006 - 2008	8		
					Spillway	*Improve	500	0.181	40				0.8	6.3
					Structure	Monitor	5000	0.020	40				0.8	
					No O&MM and EPP	Compile	0	0.000	0				0	
100	W	S702/07	XILINXA DAM	3						Y	Adequate	8		
					Spillway	Spillway capacity to be checked by checking crest level o	1000	0.095	30				0.8	6.2
					Structure	*Repair NOC to level. Investigation recommended.	500	0.181	30				0.8	

APPENDIX C 2

No.	Sector	Loc. No.	Name of dam	Category	T(years)	PF	LL	AL	EL(total)	EPP (Y/N)	Status/Progress	DSI Interval (years)
Major risk aspect		Action to be taken										
1	M	N120/01	NQWEBA DAM (PREVIOUSLY	3						Y		5
	Spillway		*Investigate further		100	0.633968	10	0.5	633.96766		Programmed for 2007/8	
	Structure		*Investigate further and improve		100	0.633968	2000	0.5			Programmed for 2007/8	
	EPP out of date		EPP to be updated		0	0	0	0			Programmed for 2006/7	
					0	0	0	0				
3	W	A210/01	ROODEKOPJES DAM	3						N		5
	Spillway		None		2000	0.048782	500	0.7	271.5749		Adequate	
	Structure		None		2000	0.048782	900	0.7			Adequate	
	No O&MM and EPP		Revise existing O&MM and compile EPP		0	0	0	0			Programmed for 2007/8	
	Spillway gate malfunction		*Investigate		200	0.39423	900	0.7			Ongoing	
4	W	N230/01	DARLINGTON DAM (LAKE ME	3						Y		5
	Spillway		*Investigate and improve		200	0.39423	608	0.9	231.89271		Programmed for 2010/1 & 2011/2	
	Structure - stability		None		2000	0.048782	608	0.9			Adequate	
					0	0	0	0				
					0	0	0	0				
6	M	B100/04	WITBANK DAM	3						Y		5
	Spillway		* Investigate and improve (gated spillway)		200	0.39423	350	1	177.68109		Programmed for...?	
	Structure		Pendulums and cracking should be monitored. Concrete co		1000	0.095208	350	1			Programmed for...?	
	Poor O&MM		Improve O&MM		1000	0.095208	350	1			Programmed for...?	
						0						
9	W	H800/03	DUIVENHOKS	3						Y		5
	Spillway capacity		None necessary		2000	0.048782	100	1	126.79353		Adequate	
	Structural stability		(a) Investigate stability.(b) Stabilize left abutment		100	0.633968	200	1			Programmed for 2007/8 & 2008/9 & 2010/1	
						0						
						0						
11	W	R101/01	CATA DAM	3						N		5
	Spillway		*Investigate and improve		500	0.181433	750	0.7	116.21658		Programmed for 2007/8 & 2008/9	
	Structure		None		2000	0.048782	750	0.7			Adequate	
	No O&MM and EPP		Compile		0	0	0	0			Programmed for 2008	
					0	0	0	0				
12	W	J330/01	STOMPDRIFT DAM	3						Y		5
	Spillway		* Increase spillway capacity		111	0.595451	100	0.8	96.481485		Programmed for 2009/10	
	Structure		* Improve structural adequacy		200	0.39423	200	1			Programmed for 2009/10	
					0	0	0	0				
					0	0	0	0				
15	W	U200/04	INANDA DAM	3						Y		5
	Spillway		None		10000	0.009951	1000	0.5	57.675631		Adequate	
	Structure - foundation		RF Foundation jointed with weathering of joints		8000	0.012423	1000	0.5			Adequate	
	Erosion emergency spillway		*Investigate erosion protection		1000	0.095208	1000	0.5			Programmed for 2007/8	
						0						
18	A	G401/AM	SPIOENKOP	3						Y		5
	Spillway Capacity		None necessary		10000	0.009951	20	0.8	52.042827		Adequate	
	Structural Stability		* Repair cracking		50	0.86738	40	0.9			Programmed for...?	
	Piping		Permanent monitoring		50	0.86738	60	1				
					0	0	0	0				
20	W	E100/02	CLANWILLIAM DAM	3						Y		6
	Spillway		None		10000	0.009951	76	0.8	40.827911		Adequate	
	Structure		Rehabilitation		1000	0.095208	76	0.8			Inadequate.Programmed for 2006/7 to 2008/9	
	No O&MM and EPP		Compile and improve EPP		0	0	0	0			Programmed for ???	
	Spillway gate operation (human error)		Remove spillway gates - rehabilitation.		100	0.633968	76	0.8			Programmed for 2006	

No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken		T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)
24	S	X103/50	MBAMBISO DAM-WAS BOSC	3						Y		6
	Spillway		Confirm / analyse spillway discharge capacity.		5000	0.019803	40	1	34.916848		Adequate	
	Structure		Maintenance must be done.		5000	0.019803	40	1			Adequate	
	Relocate water supply pressure pipeline on dan		Investigate and relocate.		50	0.86738	40	1			Programmed for ...?	
					0	0	0	0				
26	W	R101/03	MINYAMENI DAM	3								6
	Spillway Capacity		* Improve		200	0.39423	80	1	31.538365			
	Structural Stability				0	0	0	0				
	O & MM				0	0	0	0				
					0	0	0	0				
30	W	B402/35	DER BROCHEN	3						Y		6
	Spillway capacity: Cavities beneath spillway cre		Improve spillwal against erosion		50	0.86738	30	1	26.215499		Programmed for...?	
	Structural stability		Monitoring essential		2000	0.048782	30	1			Adequate	
					0							
					0							
32	M	D200/18	SMITHFIELD DAM	3								6
	Spillway Capacity				200	0.39423	60	0.9	21.288396			
	Structural Stability				0	0	0	0				
	O & MM				0	0	0	0				
					0	0	0	0				
33	M	A600/06	DONKERPOORT DAM	3						Y		6
	Spillway capacity		Investigate + improve		200	0.39423	100	0.5	21.189027		Programmed for ...?	
	Structural stability		Investigate		2000	0.048782	100	0.5			Programme for...?	
					0	0	0	0				
					0	0	0	0				
34	W	B800/02	EBENEZER DAM	3						N		6
	Spillway		*Investigate further.		200	0.39423	43	0.5	20.637157		Programmed for ...?	
	Structure		*Install safe seepage monitoring system.		1000	0.095208	43	0.5			Programmed for ...?	
	Potential clogging of shaft spillway.		*Install structure to prevent clogging.		50	0.86738	43	0.5			Programmed for ...?	
					0							
35	W	A601/42	VAALKOP NO.II-DAM	2						N		7
	Spillway		*Improve		100	0.633968	20	1	19.956658		Programmed for ...?	
	Structure		*Improve		20	0.994079	20	1			Programmed for ...?	
					0							
					0							
36	W	A900/03	ALBASINI DAM	3						N		7
	Spillway		Must be improved.		500	0.181433	100	1	19.764351		Programmed for 2012	
	Structure		Post-stressed cables must be monitored,investigated.		5000	0.019803	100	1			Programmed for ...?	
					0	0	0	0				
					0							
38	M	C212/44	MIDDLE LAKE	2						Y		7
	Spillway capacity .				150	0.487728	20	1	17.195652			
	Structure stability.				1000	0.095208	20	1				
	Lack of maintenance.				100	0.633968	20	1				
					0	0	0	0				
41	A	J250/02	CALITZDORP DAM	3						Y		7
	Spillway		None necessary		2000	0.048782	50	0.8	15.832912		Adequate	
	Structure		Investigate stability		500	0.181433	100	0.8			Programmed for ...?	
					0	0	0	0				

No.	Sector	Loc. No.	Name of dam	Category						EPP (Y/N)	Status/Progress	DSI Interval (years)	
					Major risk aspect	Action to be taken	T(years)	PF	LL				AL
48	M	U401/08	LAKE MERTHLEV	2						N		7	
			Spillway		Investigate & wall stability	1000	0.095208	21	1		14.045153		Programmed for ???
			Structure		* Investigate integrity of post stressed bables	100	0.633968	21	1				Programmed for ???
						0	0	0	0				
53	A	G101/AH	PARYS DAM	2						Y		7	
			Spillway Capacity		None	500	0.181433	20	0.8		11.303168		Adequate
			Structural Stability		None	10000	0.009951	30	0.8				Adequate
			O & MM			0	0	0	0				
56	A	U700/11	BEAULIEU DAM	3						N		7	
			Erosion of spillway lining (reo mattresses)		* Repair	100	0.633968	20	0.8				Programmed for 2006/7
			Spillway capacity		Reinstate NOCL	500	0.181433	62	0.5		10.2284		Programmed for...?
			Structural stability		Monitoring essential	500	0.181433	62	0.5				Adequate
59	A	B401/33	LEEJWKLIP DAM	2						N		8	
			Spillway		*Enlarge / abandon	50	0.86738	10	1		9.8241205		Programmed for 2004 Outstanding
			Structure		*Improve / abandon	50	0.86738	10	1				Programmed for 2004 Outstanding
			No O&MM and EPP		Compile	0	0	0	0				Programmed for 2004 Outstanding
60	W	B502/23	CHUNIESPOORT DAM	2						N		8	
			Spillway		Investigate and improve	200	0.39423	9	1		9.7752585		Programmed for 2007 - 2008
			Structure		No drain - investigate dispersiveness	200	0.39423	9	1				Programmed for 2007 - 2008
			Outletpipe		*Investigate founding conditions	50	0.86738	9	1				Programmed for 2007 - 2008
62	M	D120/02	KLOOF DAM	3						N		8	
			O&M Manual		Compile	0	0	0	0				Outstanding
			Spillway Capacity			100	0.633968	15	1		9.5095149		
			Structural Stability			0	0	0	0				
63	W	Q940/01	KATRIVIER DAM	3						Y		8	
			Spillway Capacity		Can take RMF + no apron protection	2000	0.048782	82	0.8		9.1410877		Adequate
			Structural Stability		* Improve stability	1000	0.095208	82	0.8				Programmed for 2012/3 & 2013/4
			O & MM			0	0	0	0				
65	M	H402/66	MCGREGOR-NUWE DAM NI	2						Y		8	
			Spillway Capacity		None	10000	0.009951	8	1		8.9240761		Adequate
			Structural Stability		None	500	0.181433	10	1				Adequate
			Piping		Monitoring	50	0.86738	10	1				Ongoing
66	A	J340/08	EZELJACHT DAM	3						Y		8	
			Spillway		None	100000	0.001	5	0.6		8.8755472		Adequate
			Structure		*Investigation to determine "safe operating level"	100	0.633968	20	0.7				Programmed for 2006/7 & 2007/8
						0	0	0	0				
69	M	Q800/13	BESTERSHOEK DAM	2						N		8	
			Spillway Capacity			2000	0.048782	10	1		8.7384995		
			Structural Stability			50	0.86738	10	1				

No.	Sector	Loc. No.	Name of dam	Category					EPP		DSI Interval
	Major risk aspect		Action to be taken	T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)
70	A	A213/52	HIPPO DAM	2					N		8
	Spillway capacity				50	0.86738	10	1	8.6738044		
	Structural Stability				0	0	0	0			
					0	0	0	0			
					0	0	0	0			
72	M	S401/05	KOCH DAM	2					Y		8
	Spillway		*Recently improved		20	0.994079	9	0.9	8.0566095	Still need to be verified	
	Structure		None		1000	0.095208	9	0.9		Adequate	
					0	0	0	0			
					0	0	0	0			
74	M	D540/01	VANWYKSVLEI	2					Y		8
	Spillway Capacity		None		2000	0.048782	5	0.8	7.993705	Adequate	
	Structural Stability		None		1000	0.095208	10	0.9		Adequate	
	Piping due to animal burrows.		* Maintenance and monitoring		100	0.633968	14	0.9		Ongoing	
					0	0	0	0			
75	S	B800/25	LORNA DAWN DAM	2					Y		8
	Spillway capacity		Monitor erosion		2000	0.048782	9	1	7.938612	Ongoing	
	Structural stability		Monitor seepage		2000	0.048782	9	1		Ongoing	
	Strong leak at RF		Repair		50	0.86738	9	1		Programmed for...?	
					0						
76	A	B501/17	UPPER GOMPIES DAM	2					N		8
	Spillway		*Investigate / improve		50	0.86738	9	1	7.8646496	Programmed for 2007	
	Structure		None		2000	0.048782	9	1		Adequate	
	No O&MM and EPP		Compile		0	0	0	0		Outstanding	
					0						
78	W	B800/29	MIDDELLETABA DAM	3					N		8
	Spillway		Investigate Further		500	0.181433	30	1	7.7810155	Programmed for ???	
	Structure		Investigate stability of embankment and piping potential		1000	0.095208	30	1		Programmed for ???	
					0						
					0						
79	O	C221/70	FLEURHOF DAM	2							8
	Spillway Capacity				100000	0.001	12	1	7.6120021		
	Structural Stability		* Investigate and improve		100	0.633968	12	1			
	O & MM				0	0	0	0			
					0	0	0	0			
80	M	G400/21	MOSSELRVIER DAM	3					Y		8
	Spillway		*Increase spillway capacity		500	0.181433	50	0.8	7.5658475	Investigation to start 6/2000	
	Structure		None		3000	0.032789	20	0.8		Adequate	
					0	0	0	0			
					0	0	0	0			
83	W	B501/14	MAHLANGU DAM	2					N		8
	Spillway		None		2000	0.048782	8	1	7.1191116	Adequate	
	Structure		Monitor		1000	0.095208	8	1		Adequate	
	Pipeline buried in damwall		*Relocate / monitor		50	0.86738	8	1		Programmed for 2006 - 2008	
					0						
84	W	C700/05	WELTEVREDE DAM	2					N		8
	Spillway		*Investigate		50	0.86738	9	0.8	7.0733668	Programmed for ...?	
	Structure		*Leakage along RHS pipe		50	0.86738	9	0.8		Programmed for ...?	
	No O&MM and EPP		Compile		0	0	0	0		Programmed for ...?	

No.	Sector	Loc. No.	Name of dam	Category						EPP		DSI Interval
	Major risk aspect		Action to be taken	T(years)	PF	LL	AL	EL(total)	(Y/N)	Status/Progress	(years)	
89	M	C212/46	KLEINFONTEIN DAM	2					N		8	
	Spillway		None	50	0.86738	8	1	6.9390436		Adequate		
	Structure		None	2000	0.048782	2	0.6			Adequate		
	No O&MM and EPP		Compile	0	0	0	0			Programmed for ???		
				0	0	0	0					
93	O	A231/35	PREMIER MINE NO.7 SLIME	3					N		8	
	Spillway		Overall estimate	1000	0.095208	70	1	6.6645497				
	Structure		None	0	0	0	0					
				0	0	0	0					
				0	0	0	0					
96	M	E400/01	KAREE DAM	3					Y		8	
	Spillway		None necessary	20000	0.004988	12	0.7	6.4387371		Adequate		
	Structure		None necessary	2000	0.048782	12	0.7			Adequate		
	Retaining wall/embankment transition.		Monitor leakage(L03)	200	0.39423	20	0.8			Programmed for...?		
				0	0	0	0					
98	M	G402/57	BOTRIVIER RAILWAYS DAM	2					Y		8	
	Spillway		Increase spillway capacity	200	0.39423	4	1	6.3669176		Programmed for 2006/7		
	Structure		None	500	0.181433	9	1			Adequate		
	Piping		*Remove antworks	100	0.633968	9	1			Programmed for 2006/7		
					0							
100	W	S702/07	XILINXA DAM	3					Y		8	
	Spillway		Spillway capacity to be checked by checking crest level c	1000	0.095208	30	0.8	6.2248124		Adequate		
	Structure		*Repair NOC to level. Investigation recommended.	500	0.181433	30	0.8			Programmed for ???		
					0							
					0							

APPENDIX C 3

No.	Sector	Loc. No.	Name of dam	Category	T(years)	PF	LL	AL	EL(total)	EPP (Y/N)	Status/Progress	DSI Interval (years)
Major risk aspect		Action to be taken										
3	W	A210/01	ROODEKOPJES DAM	3						N		5
	Spillway		None		2000	0.048782	500	0.7	271.5749		Adequate	
	Structure		None		2000	0.048782	900	0.7			Adequate	
	No O&MM and EPP		Revise existing O&MM and compile EPP		0	0	0	0			Programmed for 2007/8	
	Spillway gate malfunction		*Investigate		200	0.39423	900	0.7			Ongoing	
4	W	N230/01	DARLINGTON DAM (LAKE ME	3						Y		5
	Spillway		*Investigate and improve		200	0.39423	608	0.9	231.89271		Programmed for 2010/1 & 2011/2	
	Structure - stability		None		2000	0.048782	608	0.9			Adequate	
					0	0	0	0				
					0	0	0	0				
9	W	H800/03	DUIVENHOKS	3						Y		5
	Spillway capacity		None necessary		2000	0.048782	100	1	126.79353		Adequate	
	Structural stability		(a) Investigate stability.(b) Stabilize left abutment		100	0.633968	200	1			Programmed for 2007/8 to 2010/1	
					0							
					0							
11	W	R101/01	CATA DAM	3						N		5
	Spillway		*Investigate and improve		500	0.181433	750	0.7	116.21658		Programmed for 2007/8 & 2008/9	
	Structure		None		2000	0.048782	750	0.7			Adequate	
	No O&MM and EPP		Compile		0	0	0	0			Programmed for 2008	
					0	0	0	0				
12	W	J330/01	STOMPDRIFT DAM	3						Y		5
	Spillway		* Increase spillway capacity		111	0.595451	100	0.8	96.481485		Programmed for 2009/10	
	Structure		* Improve structural adequacy		200	0.39423	200	1			Programmed for 2009/10	
					0	0	0	0				
					0	0	0	0				
15	W	U200/04	INANDA DAM	3						Y		5
	Spillway		None		10000	0.009951	1000	0.5	57.675631		Adequate	
	Structure - foundation		RF Foundation jointed with weathering of joints		8000	0.012423	1000	0.5			Adequate	
	Erosion emergency spillway		*Investigate erosion protection		1000	0.095208	1000	0.5			Programmed for 2007/8	
					0							
20	W	E100/02	CLANWILLIAM DAM	3						Y		6
	Spillway		None		10000	0.009951	76	0.8	40.827911		Adequate	
	Structure		Rehabilitation		1000	0.095208	76	0.8			Inadequate.Programmed for 2006/7 to 2008/9	
	No O&MM and EPP		Compile and improve EPP		0	0	0	0			Programmed for ???	
	Spillway gate operation (human error)		Remove spillway gates - rehabilitation.		100	0.633968	76	0.8			Programmed for 2006	
26	W	R101/03	MNYAVENI DAM	3								6
	Spillway Capacity		* Improve		200	0.39423	80	1	31.538365			
	Structural Stability				0	0	0	0				
	O & MM				0	0	0	0				
					0	0	0	0				
30	W	B402/35	DER BROCHEN	3						Y		6
	Spillway capacity. Cavities beneath spillway cres		Improve spillway against erosion		50	0.86738	30	1	26.215499		Programmed for...?	
	Structural stability		Monitoring essential		2000	0.048782	30	1			Adequate	
					0							
					0							
34	W	B800/02	EBENEZER DAM	3						N		6
	Spillway		*Investigate further.		200	0.39423	43	0.5	20.637157		Programmed for ...?	
	Structure		*Install safe seepage monitoring system.		1000	0.095208	43	0.5			Programmed for ...?	
	Potential dogging of shaft spillway.		*Install structure to prevent dogging.		50	0.86738	43	0.5			Programmed for ...?	



No.	Sector Major risk aspect	Loc. No.	Name of dam Action to be taken	Category						EPP (Y/N)	Status/Progress	DSI Interval (years)
					T(years)	PF	LL	AL	EL(total)			
35	W Spillway Structure	A601/42	VAALKOP NO.II-DAM *Improve *Improve	2	100	0.633968	20	1	19.956658	N	Programmed for ...?	7
					20	0.994079	20	1	Programmed for ...?			
					0		0					
36	W Spillway Structure	A900/03	ALBASINI DAM Must be improved. Post-stressed cables must be monitored,investigated.	3	500	0.181433	100	1	19.764351	N	Programmed for 2012	7
					5000	0.019803	100	1	Programmed for ...?			
					0	0	0	0				
60	W Spillway Structure Outletpipe O&M Manual	B502/23	CHUNIESPOORT DAM Investigate and improve No drain - investigate dispersiveness *Investigate founding conditions Compile	2	200	0.39423	9	1	9.7752585	N	Programmed for 2007 - 2008	8
					200	0.39423	9	1	Programmed for 2007 - 2008			
					50	0.86738	9	1	Programmed for 2007 - 2008			
					0	0	0	0	Outstanding			
63	W Spillway Capacity Structural Stability O & MM	Q940/01	KATRIVIER DAM Can take RMF + no apron protection * Improve stability	3	2000	0.048782	82	0.8	9.1410877	Y	Adequate	8
					1000	0.095208	82	0.8	Programmed for 2012/3 & 2013/4			
					0	0	0	0				
					0	0	0	0				
78	W Spillway Structure	B800/29	MIDDELLETABA DAM Investigate Further Investigate stability of embankment and piping potential	3	500	0.181433	30	1	7.7810155	N	Programmed for ???	8
					1000	0.095208	30	1	Programmed for ???			
					0		0					
83	W Spillway Structure Pipeline burried in damwall	B501/14	MAHLANGU DAM None Monitor *Relocate / monitor	2	2000	0.048782	8	1	7.1191116	N	Adequate	8
					1000	0.095208	8	1	Adequate			
					50	0.86738	8	1	Programmed for 2006 - 2008			
					0		0					
84	W Spillway Structure No O&MM and EPP	C700/05	WELTEVREDE DAM *Investigate *Leakage along RHS pipe Compile	2	50	0.86738	9	0.8	7.0733668	N	Programmed for ...?	8
					50	0.86738	9	0.8	Programmed for ...?			
					0	0	0	0	Programmed for ...?			
					0	0	0	0				
100	W Spillway Structure	S702/07	XILINXA DAM Spillway capacity to be checked by checking crest level c *Repair NOC to level. Investigation recommended.	3	1000	0.095208	30	0.8	6.2248124	Y	Adequate	8
					500	0.181433	30	0.8	Programmed for ???			
					0		0					

**APPENDIX D: PHOTOGRAPHS OF SELECTED DAMS**



**De Hoop Dam near Steelpoort, Limpopo (DWA)**

New dam under construction, January 2012.

View of upstream face with inlet block in foreground.

A weak concrete layer was discovered just above the earthfill berm in the centre of the picture and the extent of this was being investigated.



**De Hoop Dam near Steelpoort, Limpopo (DWA)**

Another view of inlet block and right flank, January 2012.

The major portion of this concrete gravity dam consists of roller compacted concrete (RCC).





**De Hoop Dam near Steelpoort, Limpopo (DWA)**

Downstream view, January 2012.

Steelpoort River runs in centre of picture through temporary river diversion conduit.



**De Hoop Dam near Steelpoort, Limpopo (DWA)**

Block on the right flank being prepared for placing of RCC (roller compacted concrete).





**Goxhill Dam near Himeville in KZN.**  
(Pholela Irrigation Board)

Overview of new dam (almost complete) on the Pholela River near Himeville, September 2011.

Right bank bywash spillway visible in background.



**Goxhill Dam**

Upstream entrance of low flow service spillway. Entrance to be cleared of rubble.





### **Goxhill Dam**

Downstream reinforced concrete chute of low flow service spillway, September 2011.

The downstream end of the chute must be completed as soon as the water level has been drawn down.



### **Goxhill Dam**

Bywash spillway on the right bank. This spillway and downstream channel was provided with reinforced concrete ground beams (not visible in picture) to combat erosion.

(There is another bywash spillway on the left bank, not shown).





**Mhlabatsane Dam near Highflats, KZN.**  
(Umgeni Water)

New dam under construction, September 2011. Left flank foundation for earthfill wall visible in background.

Picture shows left and right gravity retaining walls with concrete spillway between them (not visible). Note inlet tower within right flank retaining wall in foreground.



**Mhlabatsane Dam**

Note labyrinth spillway structure on top of gravity wall, between left and right gravity retaining walls (looking downstream).



**Mhlabatsane Dam**

Closer view of inlet tower, with the outlet pipes running through the right flank retaining wall.

Note upstream sluice gates on inlet tower.





**Ludeke Dam near Bizana, KZN (Umgeni Water)**

New dam under construction, March 2012.

View of right flank, showing upstream and downstream rockfill zones and central clay core.



**Ludeke Dam**

Close-up of chimney filters downstream of clay core, March 2012.

Bridge to inlet tower visible on LHS and side-channel spillway visible in background.





### **Ludeke Dam**

Looking upstream towards inlet tower, with outlet conduit on RHS and temporary river diversion channel in centre of picture, March 2012.



### **Ludeke Dam**

Downstream end of outlet conduit.

Hood for sleeve valve being installed.





### **Ludeke Dam**

Spillway chute under construction on left flank.

Side-walls are anchored by soil nails into weathered rock.



### **Ludeke Dam**

Close-up of soil nails.





### **Ludeke Dam**

Spillway channel and chute will be concrete lined. Base of spillway walls is first gunited and anchored by soil nails.

Note provision for underdrains.



### **Ludeke Dam**

Side-channel spillway under construction. Ogee on LHS, March 2012..