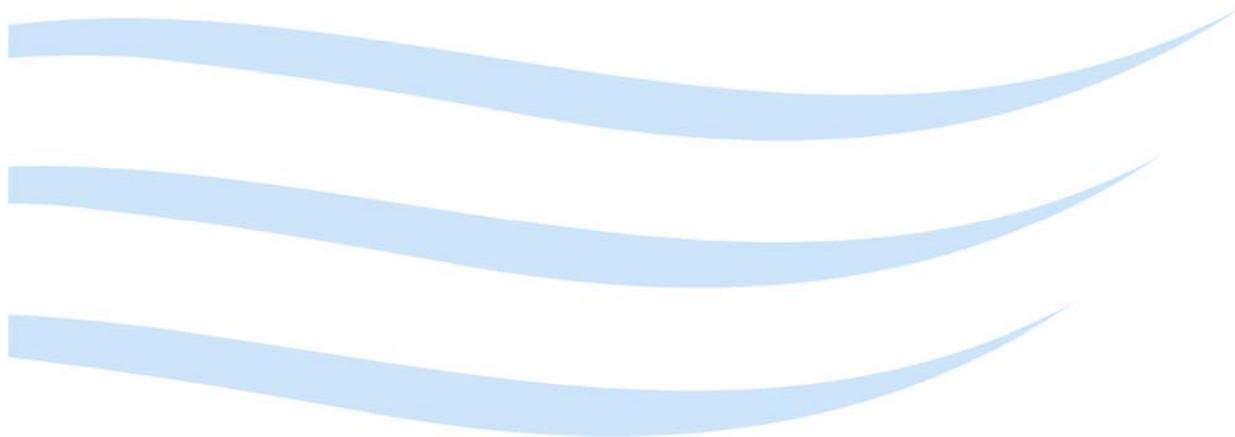


GUIDELINES FOR PRE-CONSTRUCTION REPORTS



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TABLE OF CONTENTS

1. PURPOSE AND STATUTORY REQUIREMENTS.....	3
1.1 Introduction.....	3
1.2 Limitations.....	3
1.3 Regulations & Legislation.....	3
2. PREPARATION OF PRE-CONSTRUCTION REPORTS ..	5
2.1 Format of Report	5
2.2 Wording in the Pre-construction Report	5
2.3 Variations to Pre-construction Reports.....	6
3. NOTES TO ASSIST WITH THE PREPARATION OF PRE-CONSTRUCTION REPORTS.....	6
3.1 Consequence Category of the Dam.....	6
3.2 Geotechnical Investigations.....	7
3.3 Existing Dam to be Raised or Otherwise Incorporated ..	8
3.4 Hydrological Assessment	8
3.5 Drawings	8
3.6 Standard Specifications	8
3.7 Compaction	8
3.8 Use of Filters	9
3.9 Conduits through Dams	9
3.10 Cut-off Trench	9
3.11 Monitoring Instrumentation.....	9
3.12 Engineering Supervision of the Dam Works.....	10

1. PURPOSE AND STATUTORY REQUIREMENTS

1.1 Introduction

The *Water Management Act 1999* (the Act) provides for the sustainable management and allocation of Tasmania's water resources. Part 8 of the Act regulates dam works and provides for the issuing of dam works permits which authorise the undertaking of dam works. Part 8 of the Act provides two pathways to obtaining a dam works permit. The first pathway provides for a Division 3 permit, obtained through an application and assessment process. The second pathway provides for a Division 4 permit, with no application necessary. This Guideline does not relate to:

- Division 4 permits; nor
- Division 3 Permits relating to a dam wall under 10 metres in maximum height and classified as a Very Low Consequence Category.

For all other Division 3 dam proposals, a Preconstruction Investigation and Design Report, undertaken in accordance with this Guideline and satisfying the requirements of the *Water Management (Safety of Dams) Regulations 2015*, must be submitted with the application for a Division 3 Permit.

These guidelines are to assist dam engineers to prepare pre-construction reports to meet the requirements of the Minister for Primary Industries and Water. In determining whether or not to approve an application for a Division 3 Permit, public safety is one of the matters to be addressed.

Pre-construction reports need to provide specialised information and advice specific to the dam proposal, for the purpose of ensuring the dam will be safe and successfully constructed.

Generally, if the Minister for Primary Industries and Water, or his or her delegate, approves a dam works permit application, the permit will require that the dam works are carried out strictly in accordance with the pre-construction report.

For the purposes of Regulation 10 of the *Water Management (Safety of Dams) Regulations 2015*, these guidelines replace/substitute the "Guidelines for pre-construction reports (dam works) – Assessment Committee for Dam Construction, May 2009", published by the Assessment Committee.

1.2 Limitations

These guidelines provide the minimum standard for pre-construction reports acceptable to the Minister for Primary Industries and Water.

If a pre-construction report is received that does not address the basic contents of these guidelines, then it can be expected that further information will be sought by the Minister.

1.3 Regulations & Legislation

The primary Act and Regulations that are relevant to dam safety are:

- *Water Management Act 1999*
- *Water Management (Safety of Dams) Regulations 2015*.

The Regulations require that dam works and related activities, including the preparation of pre-construction reports, must be undertaken in accordance with the relevant provisions of guidelines issued by the Australian National Committee on Large Dams (ANCOLD).

The *Water Management (Safety of Dams) Regulations 2015* prescribe the qualifications of persons preparing pre-construction reports.

Where the consequence category of the relevant dam is “Significant” or higher (up to “High B”) and for all dams over 10 metres in height, regardless of the consequence category, the report must be prepared by an engineer with specified experience.

Where the consequence category is “High B” or above and for all dams with a height exceeding 25 metres, the report must be prepared by an expert team.

2. PREPARATION OF PRE-CONSTRUCTION REPORTS

2.1 Format of Report

The following items must be detailed in a pre-construction report and they are included here as suggested headings for the format of the report:

1. Introduction and dam dimensions table.
2. Detailed assessment of the consequence category.
3. Description of the local geology and whether there are fossilised or active landslips at or nearby to the dam site.
4. Detailed assessment of the geotechnical conditions encountered at the dam site.
5. A detailed hydrological assessment and sizing of the spillway.
6. Details of the construction of the dam and equipment that is to be used
7. Appendix:
 - Geotechnical logs and test certificates.
 - ANCOLD Consequence category spreadsheet and description of flood impacted areas.
 - Spillway calculations.
 - Standard specifications.
 - Design drawings.

In general:

- The investigation, design and report, and preparation of design plans and specifications must be carried out by a professional engineer supported by appropriate professional specialists¹, engaged by the applicant for the dam works permit.
- The professional engineer must have relevant experience in the investigation, design and construction of dams similar in height, type and Consequence Category to the proposed dam and meet the competency level requirements of the Water Management (Safety of Dams) Regulations 2015. This may include expertise in, but not necessarily limited to, geotechnical, hydrological or construction aspects of dam investigation and design.
- The submitted report must set out details of the qualifications of the engineer and his or her specific experience relevant to the project, as well as the qualifications and relevant experience of other expert persons engaged by the applicant to prepare the report and design, verifying compliance with these requirements.

2.2 Wording in the Pre-construction Report

The pre-construction report must be specific to which actions and tasks are non-discretionary. Acceptable words for such actions and tasks are 'must', 'shall' and 'will', which accurately provide direction of the actions and tasks to be undertaken.

¹ The minimum requirements are prescribed by the *Water Management (Safety of Dams) Regulations 2015*.

Where actions or tasks are specified as non-discretionary, by use of words such as ‘may’, ‘should’, ‘could’ and ‘recommend’, information must be clearly provided as to why there is discretion to be applied to the task a hand.

As compliance with the pre-construction report will generally become a condition of the relevant dam works permit, the report will in effect become a legal document for the dam works. Therefore, it is expected that the engineer should specify most actions and tasks as non-discretionary. Where this is not possible, owing to a lack of sufficient information, the report should specify the options that need be undertaken and with the priority and basis on which the final choice of options will be made.

2.3 Variations to Pre-construction Reports

To suitably qualify the basis of the dam design provided in the pre-construction report, test results of assumed grades and volumes of materials need to be provided from materials/soil testing regime and other applicable geological and hydraulic assessment methods.

If however, during construction of the dam either geological, hydraulic or material grades or volumes are found to insufficiently vary in meeting the required aspects of the dam design, then a revised design will need to be submitted, and a variation of permit conditions must be applied for, in accordance with s.164 of the *Water Management Act 1999*.

Understandably this will require works to cease and approval must be received by the permit holder before recommencing construction.

Furthermore, if the variation is so significant it requires major alterations to the design a revised preconstruction report must be submitted.

Typically variations to Pre-construction Reports are likely to mostly apply to filter designs, where available materials assessment can vary significantly.

3. NOTES TO ASSIST WITH THE PREPARATION OF PRE-CONSTRUCTION REPORTS

3.1 Consequence Category of the Dam

The consulting engineer must independently assess what is at risk for the proposed dam in breach situation and this must be addressed within the pre-construction report. The resulting Consequence Category is used to ensure that the level of expert input to the further investigation, design and construction of the dam meets the requirements of the *Water Management (Safety of Dams) Regulations 2015*.

The consequence assessment is to mainly address, but is not necessarily limited to, the location of buildings, roads, other infrastructure and dams downstream of the dam works proposal.

This information must then be used to complete Table 2 ‘Severity of Damages and Losses’ contained within ANCOLD publication ‘*Guidelines on the Consequences of Dam Failure*’ and a copy of the completed table must be included in the appendices of the pre-construction report.

In assessing the Consequence Category of the dam the ANCOLD Guidelines assessment of Population at Risk (PAR) is as follows:

“Includes all those persons who would be directly exposed to flood waters within the dam break affected zone if they took no action to evacuate”

Noting that:

“Flood depths and velocities are relevant in estimating PAR (generally, an inundation depth of 0.3 metres or more can be used as an indication of the area where the population is at risk)”.

As an indication, the following standard is generally acceptable:

1. Where there is a building or dwelling in the path of a potential flood from a dam breach there is potential for loss of life where the ensuing flood is expected to reach at least 0.3 metres above the floor of the building or dwelling. This takes into account that the dwelling may contain less mobile persons such as children or elderly people.
2. Where there is a relatively major road downstream of the dam then it is recognised that there is potential for loss of life if a potential flood from a dam breach overtops the road by more than 1 metre.

The above standards are to guide the interpretation of the ANCOLD Guidelines only, and should not be interpreted as strict rules governing the consequence rating assessment. The actual situation at hand needs to be assessed and interpreted independently and appropriately explained in the pre-construction report.

3.2 Geotechnical Investigations

1. A detailed geotechnical assessment must be carried out to determine whether there are any adverse geotechnical conditions in the foundation of the proposed dam site. This may include, but is not necessarily limited to, a visual assessment, excavation of test pits drilling of bore holes and associated laboratory testing. Adverse geotechnical conditions may include the identification of highly reactive soils, highly erosive or dispersive soils, unstable soil conditions and high water tables.
2. Where there is an existing dam at the site that is to be raised or otherwise incorporated in the proposed dam works, a geotechnical assessment of the existing dam must be undertaken, using similar assessment procedures to the above, to the extent necessary to determine any adverse geotechnical or structural conditions which may impact on the stability and safety of those works. [Also refer paragraph 3(iii) below].
3. The purpose of the geotechnical investigation is generally to determine the following:
 - (i) If conditions at the dam site are appropriate for undertaking the proposed dam works.
 - (ii) To determine the condition and stability of any existing dams to be raised or otherwise incorporated into the proposed dam works.
 - (iii) To prove appropriate amounts of construction material are available.
 - (iv) To determine the mitigation measures necessary to address any adverse geotechnical conditions at the site.

Note:

- All soils must be classified according to the *Unified Soil Classification System (USCS)*.
- All soil testing must be carried out to *AS 1289 Methods of Testing Soils for Engineering Purposes*.
- All reporting including test pit or borehole logs must be carried out to *AS 1726 Geotechnical Site Investigations*. Logs sheets and test certificates must be contained within the appendix of the report.

3.3 Existing Dam to be Raised or Otherwise Incorporated

Where the dam works involve the raising or incorporation of an existing dam at the site, the pre-construction report must clearly show how the new dam is to be incorporated into the existing dam structure and provide evidence that the proposed incorporation will not adversely impact on the safety of the new or existing dam. This must include a geotechnical or other appropriate assessment of the integrity of the existing dam.

3.4 Hydrological Assessment

A flood spillway design to safely pass an extreme flood based on the incremental flood Consequence Category determined in accordance with relevant guidelines published by ANCOLD must be submitted. The spillway design must be included as a section in the report and the hydrological design calculation is to be included as an Appendix.

3.5 Drawings

Appropriate design drawings must be included in the Appendix of the pre-construction report. As a minimum, the following should be included: General Arrangements, Sections showing the zoning of the dam, Spillway design, and Outlet pipe design. Design drawings should also include a capacity survey of the dam, which is to be undertaken for all dams with a capacity of 100.0 megalitres or more.

3.6 Standard Specifications

Standard specifications must be included in the Appendix of the pre-construction report. These are to include such matters as pipeline installation, compaction specifications and equipment to be used such as the use of a tamper-foot (sheep's foot) roller for compaction.

3.7 Compaction

The difference between Standard Maximum Dry Density (Standard MDD) and Modified Maximum Dry Density (Modified MDD) is the weight of the hammer doing the laboratory test; more compaction energy is used to give a higher density in Modified MDD. The two Dry Density terms are often confused.

Standard MDD or Standard Proctor, is used to determine the maximum practically achievable density of soils, and is frequently used in geotechnical engineering. Standard MDD is generally specified for non-structural fills such as for dam embankments and Modified MDD for structural fills such as roads, airports and buildings foundations.

The tamper foot (sheeps foot) roller is the correct equipment to use for the compaction of fine-grained materials such as clay within the clay core of a dam. A vibratory roller is the most appropriate equipment for non-cohesive soils such as sand in dam filter zones. It is considered that the use of bulldozer tracks or a loaded scraper is inappropriate for the compaction of dam cores.

The dam permit will specify what type of equipment is to be used for the compaction of the material in an embankment dam. However, the pre-construction report must specify how the compaction effort as contained in the specifications is to be met and note that the compaction certificates will be included in the Work as Executed Report (see Section 3.12).

3.8 Use of Filters

Filters are generally used on earthen embankment dams for two purposes:

1. To protect the core of the dams from erosion; and
2. To lower the phreatic level in the dam embankment for a more stable structure.

It is recognised that the use of filters on a dam can be expensive; therefore consideration of the need for filters must be undertaken on a case by case basis. However, in the very least, filters would be expected to be adopted where it has been recognised that there is potential for loss of at least one life as a result of a breach of the proposed dam and for all embankment dams with a consequence category of “High C” or greater. If the Engineer concludes that a filter is not required in these situations for a particular proposal, then the reasons for this conclusion need to be appropriately detailed in the pre-construction report.

Only filter designs that meet the modern filter design concepts and criteria and best practice of *Sherard* and *Dunnigan*² are acceptable. This means that the filter will generally need to be manufactured.

3.9 Conduits through Dams

Poor placement of HDPE or PVC outlet pipes through dams is a major reason why dams fail. Under no circumstances should a pipe be placed in the embankment of a dam, as differential settlement as a result of poor compaction around the pipe may result in failure of the dam. Pipes must be placed in the foundation of a dam and back filled and properly compacted.

3.10 Cut-off Trench

A clay keyway must be constructed under the centre of the dam to minimise seepage and differential settlement. At the bottom of the trench, the width of this keyway must as a minimum allow for the width of the largest piece of construction equipment that is available to gain access to the trench for the keyway to sit in. The trench width must be designed to more than suitably prevent movement of water from the upstream sub foundation zones of the dam. The trench should have side slope of 1 Vertical to 1 Horizontal for depths of up to 3 metres and should be battered back further for greater depths.

3.11 Monitoring Instrumentation

Details of the instrumentation required to monitor the safety and operations of the dam need to be included in the pre-construction report. This may include devices such as piezometers, ‘V’ notch weirs and settlement and movement monitoring monuments etc.

² “*Geotechnical Engineering of Dams*” Fell R. et al 2005 AA Balkema Publishers

3.12 Engineering Supervision of the Dam Works

The pre-construction report should indicate the proposed level of supervision of the dam works. Supervision is to be in accordance with the *Water Management (Safety of Dams) Regulations 2015*.

The supervising engineer has to satisfy themselves that the dam has been built to an appropriate standard as they will need to sign off on the Work as Executed Report on the completion of the dam works. To achieve this, the supervising engineer will need to undertake an appropriate level of on-site inspection of the dam works. As a guide, it would be expected that, as a minimum, inspection would consist of the supervision of the following:

1. Clearing and grubbing and final inspection of the cut-off trench.
2. Construction of the clay keyway.
3. Installation of the outlet pipe.
4. Construction of the embankment at various stages and at a sufficient number of times to satisfy themselves that design specifications are being met.
5. Construction of the spillway and return slope.
6. On completion of the dam and at first filling.

As a minimum, written daily construction records (plods) and photographs must be taken and provided within the Work as Executed Report.

To determine whether the specified compaction effort has been met [such as 95% Standard (MDD) or other level as contained in the dam's specifications], testing must be undertaken. The site engineer must organise a NATA accredited soils technician to undertake the required tests. The testing must be sufficient for the site engineer to satisfy himself or herself that the level of compaction complies with the specifications and that a satisfactory outcome has resulted.

Likewise where filters are to be used for a dam, testing will also need to be undertaken by a technician with NATA accreditation for the specific tests that are to be carried out. The site engineer must satisfy himself or herself that the sufficient type and variety of tests have been carried out.

Note:

- Copies of all test certificates must be included in the Appendix of the Work as Executed report.