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CONSULTING ENGINEERS



# ADDENDUM TO PRELIMINARY GEOTECHNICAL RISK AND FOUNDATION ASSESSMENT

## BULLER SKI LIFTS



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# NORTHSIDE SNOW FACTORY, MT BULLER, VIC 3723

## PRELIMINARY GEOTECHNICAL AND FOUNDATION ASSESSMENT ADDENDUM NO. 1

### CONSTRUCTION OF FOUNDATION AND INSTALLATION OF SNOW FACTORY AT NORTHSIDE SPURS

Prepared For:

Timothy Meier
Buller Ski Lifts
26 Breathtaker Road
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Prepared By:

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| **G. P. Taylor**<br>BEng (Civil/Structural)<br>PE 0001251<br>MIE (Aust), NER | **08/01/2024** | |

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## 1. Decision Required

This addendum modifies and supplements the attached Report compiled by Taylor Consulting Engineers (TCE) and Phil Styles & Associates Pty Ltd (PSA) dated 4/12/2023. Refer Appendix A.

A *qualitative* geotechnical risk assessment and review of proposed foundation conditions was compiled for purposes of supporting Planning Permit PA2302644, to install a proposed snow factory located in the Spurs/Northside area adjacent Burnt Hut Reservoir.

A submission response from Department of Transport and Planning requests further information with respect to a nominated *moderate* risk as outlined in the letter dated 14/12/2023 included in Appendix A – Report dated 4/12/2023.

In accordance with the Alpine Resorts Planning Scheme Erosion Management Overlay, Section 4.2 of Schedule 1 to Clause 44.01 a *quantitative* risk assessment of the proposed snow maker installation quantitative is required.

## 2. Available Information

Discussion with Buller Ski Lift Staff has noted the original qualitative Report did not include information on the original construction detail of the concrete lined Burnt Hut Reservoir nor include discussion on the redevelopment of the Northside area, including decommissioning of the reservoir.



Drawings compiled by the Public Works Department of Victoria in 1963 for the construction of the concrete lined Burnt Hut Reservoir include: -

- 63/78.2 Mt Buller Alpine Village; Water Supply, Storage Basin, General Plan dated 1963
- 63/78.3 Mt Buller Alpine Village; Water Supply, Storage Basin; Details of Outlet Box & Valves dated 1963
- 63/78.4 Mt Buller Alpine Village; Water Supply, Storage Basin; Details of Partition Wall & Joints dated 1963
- 63/215 Mt Buller ; Cross Sections Storage Basin ; Site Plan
- 62/631 Mt Buller Alpine Village ; Layout of 8" Water Supply Line & Storage Basin
- 63/78.1 Mt Buller ; Layout of Intake, Outlet & Overflow Pipes

Extracts of the Public Works Department of Victoria drawings are included in Appendix *C* – Burnt Hut Reservoir Construction Drawings 1963Appendix C. With details of key joints and concrete thickness extracted into Figure 1.

The reservoir, constructed in the early 1960's is now 60 years old. Whilst there are no design life parameters shown on the drawings available, it is likely the Public Works Department of Victoria designed the reservoir for a 100-year life. As such the structure can be considered to have reached 60% of its design life.

Further, we understand decommissioning and redevelopment of the Burnt Hut Reservoir is anticipated to occur within 5 years.

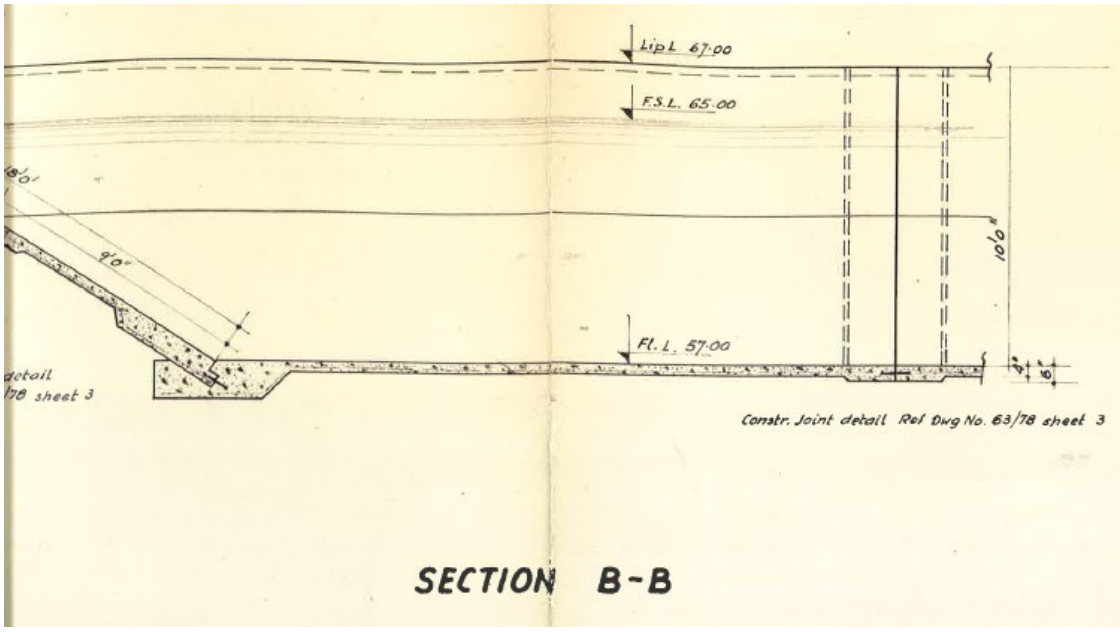


*Figure 1: Burnt Hut Reservoir, typical concrete lining detail.*

## 3. Review of Landslide Risk Assessment

As noted in the Report, **hazard identifiers 1, 3** and **4** are **low risk** and are usually acceptable with no further action required, however recommended risk mitigation measures are provided in the table where the owner may wish to further reduce risk. Undertaking recommended risk mitigation measures on low or very low risk is typically dependent on the owners Operational and Maintenance Policy (not sighted).



**Hazard identifier 2 - *failure of reservoir*** concrete lining during its design life causing a debris flow landslide resulting in damage to the proposed snow factory and its foundations has a major consequence to Property and results in a **moderate** risk to property.

The likelihood of **failure of reservoir** reduces to **not credible** once decommissioned and lining removed.

Significant cracking and displacement of the reservoir reinforced concrete lining to allow sufficient water flow to instigate a debris flow landslide within the next 5 years is assessed to have a lower likelihood of **rare** - *conceivable only under exceptional circumstances*. This changes the risk outcome from **moderate** (within 40 years, 2064) to **low** (within 5 years, 2029). Refer Table 1.

With respect to **hazard identifiers 1, 3 and 4**; those too will have a reduced likelihood of occurrence upon decommissioning of the Bunt Hut Reservoir. Those assessed risks are not further discussed where those risks remain low or reduce to very low.

In summary, following review of additional information, assessment now supports a modified risk assessment where all assessed risks are **'Low'** or 'very low'.

| LIKELIHOOD | CONSEQUENCES TO PROPERTY | | | | |
|---|---|---|---|---|---|
| | **Catastrophic** Structure completely destroyed or large scale damage, or requiring large scale engineering works for stabilisation | **Major** Extensive damage to most of structure, or requiring significant reinstatement and stabilisation works | **Moderate** Moderate damage to some structure, or significant part of site requiring large stabilisation works | **Minor** Limited damage to part of structure, or part of site requiring some reinstatement or stabilisation works | **Insignificant** Little damage, minor road reinstatement or stabilisation |
| **Almost Certain** The event is expected to occur | VH | VH | VH | H | M or L |
| **Likely** The event is will probably occur under adverse conditions | VH | VH | H | M | L |
| **Possible** The event could occur under adverse conditions | VH | H | M | M | VL |
| **Unlikely** The event might occur under very adverse conditions | H | M | L | L | VL |
| **Rare** The event is conceivable but only under exceptional circumstances | M | L[2] | L | VL | VL |
| **Not Credible** The event is unconceivable or fanciful | L | VL | VL | VL | VL |

*Table 1: Modified assessment for property damage resulting from Slope Instability and Landslide Risk*

* Note: red encircled annotation [2] refer to assessed scenarios detailed in Table 2.

| Hazard ID. | Geotechnical Hazard | Consequence to Life | Consequence to Property | Likelihood | Risk to life | Risk to Property | Comments | Recommended Mitigation Measure(s) |
|---|---|---|---|---|---|---|---|---|
| 2 | Failure of reservoir | - | **Major** | **Rare** | - | **Low** | Cracking and seepage through the concrete reservoir lining sufficient to mobilise the reservoir embankment causing a landslide, resulting in toppling or burial of the containerised units.<br>The event is conceivable within 5 years but only under exceptional circumstances causing extensive damage to most of structure, or requiring significant reinstatement and stabilisation works.<br>*a 60-year-old steel reinforced concrete lined reservoir assumed supported by earthworks that behave as a soil (clay, silt, sand, gravel). A reduced consequence may be applicable where supported by rock construction (cobbles, boulders). | • Undertake annual reservoir condition inspections, review construction and monitoring records and undertake recommended repair works as nominated.<br>• Undertake monthly checks of flow rates within the open drain. Consider installation of a flow meter or 'v' notch weir within open drain to monitor and quantify flow rates and turbidity (suspended solids) to check for increased flows plotted against rainfall to determine change in conditions. Above average flow rates to be escalated for further review or action, such as a structural inspection for cracking of the concrete lining |

*Table 2: Modified summary of Geotechnical Risk Assessment*

## Appendix A – Report dated 4/12/2023

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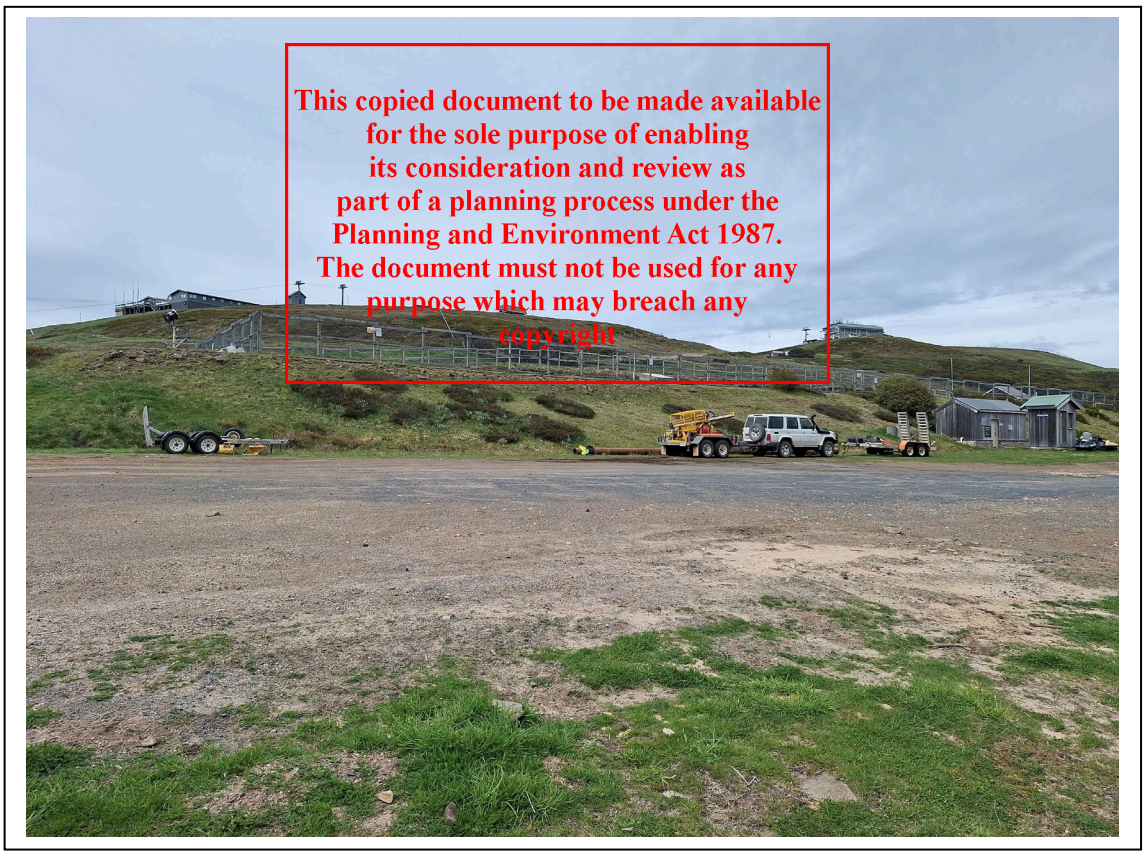
# PRELIMINARY GEOTECHNICAL RISK AND FOUNDATION ASSESSMENT

## BULLER SKI LIFTS

## NORTHSIDE SNOW FACTORY







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# NORTHSIDE SNOW FACTORY, MT BULLER, VIC 3723

## PRELIMINARY GEOTECHNICAL AND FOUNDATION ASSESSMENT
## 21 NOVEMBER 2023

### CONSTRUCTION OF FOUNDATION AND INSTALLATION OF SNOW FACTORY AT NORTHSIDE SPURS

Prepared For:

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| **G. P. Taylor**<br>BEng (Civil/Structural)<br>PE 0001251<br>MIE (Aust), NER | **4/12/2023** | |
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## 1. INTRODUCTION

Taylor Consulting Engineers (TCE) and Phil Styles & Associates Pty Ltd (PSA) have been engaged by Timothy Meier of Buller Ski Lifts to undertake a geotechnical risk assessment and review of proposed foundation conditions for the proposed snow factory to be located in the Spurs/Northside area adjacent Burnt Hut Reservoir. Refer Appendix A – Site Plans.

Information provided shows the proposed machinery housing structure to be a modular containerised building which is transportable, being placed on a concrete slab foundation. A typical layout was provided in an email from Timothy Meier dated 17/11/2023. Refer Figure 1 below.

*Figure 1: Snow factory, typical installation using 40" modified containers.*



This geotechnical assessment report has been compiled to address the requirements outlined in the Alpine Resorts Planning Scheme - Erosion Management Overlay - Schedule 1: *Management of Geotechnical Hazard Local Planning Policy* for Planning Application Purposes. This report aims to assess the foundation conditions and geotechnical hazards and make appropriate recommendations for foundation construction and to reduce any risks associated with geotechnical hazards to acceptable levels.

## 2. AVAILABLE INFORMATION

The site assessment has been based on the following sources of information:

- Email works request from Timothy Meier of Buller Ski Lifts dated 15/11/2023
- Site Plan dated 16/11/2023 (refer Appendix A)
- Site Plan dated 14/11/2023 (refer Appendix A)
- Victorian Geology Maps available from Geovic (refer Appendix B)
- Personal knowledge of the region by Mr Toby Creighton (Geotechnical Engineer with NSW RMS Accreditation)
- Personal knowledge of the site by Mr Philip Styles (Principal Engineering Geologist, Phil Styles & Associates Pty Ltd)

No information on the design, construction or maintenance of the adjacent reservoir has been provided for consideration in the assessment.

## 3. SITE INSPECTION AND FIELDWORK

A site inspection and fieldwork were undertaken by Messrs Ken Cousins and Toby Creighton of Taylor Consulting Engineers on the 21 November 2023. The weather conditions at the time of the visit were fine and clear, with storms blowing in by the completion of work.

A site walkover was completed, and two boreholes were drilled at the proposed location of the snow factory to assist with the assessment of ground conditions.

Photographs taken during the inspection are included in Appendix C.

### 3.1 Site Observations

- The site has been levelled. Imported gravel hardstand has been placed to form a trafficable surface. Refer photos 1-3, 9-10.
- The snow factory site is located directly adjacent the concrete lined Burnt Hut Reservoir.
- Free water was observed on the northern batter slope of the reservoir, which anecdotally has an ongoing history of minor leakage. Refer photo 5.
- There is an open, unlined drain at the toe of the northern batter. It is our understanding that this drain has been constructed to collect the seepage from the embankment face and channel it away from the road. The drain contained water at the time of the inspection. Refer photos 2, 4, 8-10.



### 3.2 Subsurface Conditions

The Resources Victoria online service, Geovic, indicates that the surface geology at the site comprises the Bryce Plain Basalt of Priabonian to Rupelian age (37.8 to 28.1 Ma) olivine tholeiitic basalt, commonly referred to as Tertiary age Older Volcanics Basalt (refer Appendix B).

The walkover and borehole investigation (refer photos 11 & 12) noted the presence of around 200 mm of rock fill and black 'topsoil' consisting of basalt gravel, cobbles and boulders. This was consistent with the exposed batter material in the embankments of the adjacent reservoir.

The two boreholes were drilled using auger bits and failed to penetrate any deeper than 0.2 m as the augers met drilling refusal on cobbles and boulders. Further attempts to investigate deeper using a fencing bar achieved a total depth of 0.3 m before experiencing refusal on cobbles.

No surface outcrops of basalt were observed at the site during the site visit.

Based on our site observations of the topography and the presence of rock outcrops nearby, it is anticipated that competent rock (moderately weathered or better-quality) would be encountered within 1 m of the existing surface. It is also possible that basalt 'corestones' may be encountered within the proposed foundation excavation, making excavation of a flat

even cut floor difficult and requiring level regulation with quarry product or blinding concrete.

No historic records of ground instability or movement have been reported for the proposed snow factory location and no evidence of instability was observed at the time of the site inspection.

## 4. FOUNDATION RECOMMENDATIONS

Following a review of the snowflake factory specifications, the proposed design and considering the results from the site inspection, TCE recommends the following:

- For a 125 mm thick supporting concrete slab, the existing surface be removed to a depth of 200 mm. Rock boulders may be experienced. Geotechnical inspection recommended.
- A test roll is to be achieved on the cut floor. Any soft areas are to be removed and reinstated with 20 mm class 3 crushed rock.
- Where required, 20 mm class 3 crushed rock (or blinding concrete) be applied to regulate the cut floor surface level.
- 75 mm (minimum) layer of 20 mm class 3 crushed rock be placed and compacted to achieve a test roll.
- A test roll is not required if crushed rock base material is substituted for blinding concrete.
- 20 mm Class 3 crushed rock base to be compacted with a smooth drum roller to achieve a test roll prior to placement of the proposed concrete slab foundation. Geotechnical inspection recommended.



Test roll testing to comply with AS3798, including the following: -

a) Static smooth steel wheeled rollers shall have a mass of not less than 12 tonnes and a load intensity under either the front or rear wheels of not less than 6 tonnes per metre width of wheel.
b) Pneumatic tyred plant shall have a mass of not less than 20 tonne and shall have a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre. The area over which this ground contact pressure shall be applied shall not be less than 0.035 $m^2$ per tyre.
c) Highway truck with rear axle or axles loaded to not less than 8 t each with tyres inflated to 550 kPa.

Successful placement and testing of the foundation base should provide a foundation with an allowable bearing capacity of 100 $kN/m^2$ (100 kPa).

# 5. LANDSLIDE RISK ASSESSMENT

## 5.1 Risk Assessment Procedure

In accordance with the Erosion Management Overlay Schedule 1, Management of Geotechnical Hazard (EMO1) in the Alpine Planning Information Kit, the slope risks associated with the development of the site have been considered in the context of "Landslide Risk Assessment and Management ', published in Australian Geomechanics Society publication Vol 42, March 2007 (AGS Guidelines). The system is based on the identification of the likelihood of occurrence, and its consequences to the structure and human life for the identified hazards. These assessments are then combined using a matrix to obtain an overall risk assessment for the specific site for each hazard.

## 5.2 Principles of Risk Assessment

Risk assessment and management principles applied to slopes can be interpreted as answering the following questions: -

- What are the issues? (SCOPE DEFINITION).
- What might happen? (HAZARD IDENTIFICATION).
- How likely is it? (LIKELIHOOD).
- What damage or injury might result? (CONSEQUENCE).
- How important is it? (RISK EVALUATION).
- What can be done? (RISK TREATMENT).



The risk is the combination of the likelihood, the consequences, and the exposure to the identified hazard. All these factors are considered when evaluating risk and deciding whether treatment is required. In the following sections of the report, we have assessed the risks to property and life using a qualitative approach as per the recommendations of the AGS Guidelines (2007).

The qualitative likelihood, consequence and risk terms used in this report are explained in Appendix *D*. A matrix that brings together different combinations of likelihood and consequence defines the risk terms. Risk matrices help communicate the results of risk assessment, rank risks, set priorities and develop transparent approaches to decision making. The risk assessment of the site regarding the proposed snow factory is presented in Tables 1 to 3.

## 5.3 Potential Geotechnical Hazards

Based on site observations, the results of field testing and known details of the proposed development, the following potential slope hazards have been identified at the development site:

1. Wetting and softening of snow factory foundation materials due to seepage of water from the adjacent upslope reservoir.
2. Failure of the reservoir concrete lining causing a debris flow landslide resulting in damage to the proposed snow factory and its foundations.

## 5.4 Risk to Property

The AGS Guidelines recommends that the risk to property should be considered when assessing landslide risk. The following matrix has been used to rate each of the risks identified based on the likelihood and consequence determined. The risk matrix is based on the AGS Guidelines for Landslide Risk Assessment, 2007.

| LIKELIHOOD | CONSEQUENCES TO PROPERTY | | | | |
|---|---|---|---|---|---|
| | **Catastrophic** Structure completely destroyed or large scale damage, or requiring large scale engineering works for stabilisation | **Major** Extensive damage to most of structure, or requiring significant reinstatement and stabilisation works | **Moderate** Moderate damage to some structure, or significant part of site requiring large stabilisation works | **Minor** Limited damage to part of structure, or part of site requiring some reinstatement or stabilisation works | **Insignificant** Little damage, minor road reinstatement or stabilisation |
| **Almost Certain** The event is expected to occur | VH | VH | VH | H | M or L |
| **Likely** The event is will probably occur under adverse conditions | VH | VH | H | M | L |
| **Possible** The event could occur under adverse conditions | VH | H | M | M | VL |
| **Unlikely** The event might occur under very adverse conditions | H | M[2] | L[1] | L | VL |
| **Rare** The event is conceivable but only under exceptional circumstances | M | L | L | VL | VL |
| **Not Credible** The event is unconceivable or fanciful | L | VL | VL | VL | VL |

*Table 1: Assessment for property damage resulting from Slope Instability and Landslide Risk*

* Note: encircled annotation [1] and [2] refer to assessed scenarios detailed in Table 3.

## 5.4 Risk of Loss of Life

The AGS Guidelines recommends that the risk to life should be considered when assessing landslide risk. The landslide record from Australia and elsewhere indicates that most deaths and injuries are associated with fast moving landslides and associated high-speed moving objects when there is insufficient warning for people present to take evasive action. People are most vulnerable if buried in open space, trapped in vehicles that are buried and crushed or in a building that collapses or is inundated with debris.

| LIKELIHOOD | CONSEQUENCES TO LIFE | | | | |
|---|---|---|---|---|---|
| | **Catastrophic** Almost certain fatality | **Major** Likely fatality | **Moderate** Possible fatality | **Minor** Unlikely fatality | **Insignificant** Rare fatality |
| **Almost Certain** The event is expected to occur | VH | VH | VH | H | M or L |
| **-Likely** The event is will probably occur under adverse conditions | VH | VH | H | M | L |
| **Possible** The event could occur under adverse conditions | VH | H | M | M | VL |
| **Unlikely** The event might occur under very adverse conditions | H | M | L[3] | L | VL |
| **Rare** The event is conceivable but only under exceptional circumstances | M | L[4] | L | VL | VL |
| **Not Credible** The event is unconceivable or fanciful | L | VL | VL | VL | VL |

*Table 2: Assessment for loss of life resulting from Slope Instability and Landslide Risk*

* Note: encircled annotation [3] and [4] refer to assessed scenarios detailed in Table 3.

## 5.5 Geotechnical Risk Assessment Summary

| Hazard ID. | Geotechnical Hazard | Consequence to Life | Consequence to Property | Likelihood | Risk to life | Risk to Property | Comments | Recommended Mitigation Measure(s) |
|---|---|---|---|---|---|---|---|---|
| 1 | Wetting and softening of foundation | - | **Moderate** | **Unlikely** | - | **Low** | Blockage of adjacent open drain leading to seepage of water beneath the foundation causing softening, differential movement, and movement of the building.<br>The event might occur under very adverse conditions causing moderate damage to some structure, or significant part of site requiring large stabilisation works. | • Move foundation 2 m (min.) from drain to provide service access to the drain.<br>• Ensure depth of open drain is below the foundation, and invert maintained at that level. |
| 2 | Failure of reservoir | - | **Major** | **Unlikely** | - | **Moderate** | Cracking and seepage through the concrete reservoir lining sufficient to mobilise the reservoir embankment causing a landslide, resulting in toppling or burial of the containerised units.<br>The event might occur under very adverse conditions causing extensive damage to most of structure, or requiring significant reinstatement and stabilisation works<br>*Assumes reservoir embankments constructed of and behave as a soil (clay, silt, sand, gravel), with reduced consequence where rock batters have been constructed (cobbles, boulders). | • Review construction and monitoring records of the reservoir to re-assess the risk.<br>• Undertake repair works as nominated in the reservoir inspections.<br>• Install flow meter within open drain to monitor flow rates and turbidity (suspended solids) to check for increased flows calibrated against rainfall to determine change in conditions.<br>• Install embankment displacement monitoring (inclinometers).<br>• Install HDPE liner.<br>• Empty the reservoir and decommission |
| 3 | Wetting and softening of foundation | **Moderate** | - | **Unlikely** | **Low** | - | As per Hazard ID 1.<br>A possible fatality might occur under very adverse conditions where building only occasionally occupied. | As per Hazard ID 1. |
| 4 | Failure of reservoir | **Major** | - | **Rare** | **Low** | - | As per Hazard ID 2.<br>A likely fatality is conceivable but only under exceptional circumstances where building only occasionally occupied. | As per Hazard ID 2. |

*Table 3: Summary of Geotechnical Risk Assessment*

The results of the risk assessment indicate that there is a **'Low'** and **'Moderate'** risk classification of the development site.

### 5.6 Recommended Risk Mitigation

In accordance with the results of Section 5.3, 5.4 and 5.5 above, the highest assessed risk is **Moderate** risk of failure of the reservoir (Hazard ID 2 in Table 3) causing damage to property the proposed snow factory. All other scenarios are assessed as a low risk requiring no further action.

The **Moderate** risk of failure of the reservoir causing damage to the snow factory and its foundations should be managed by the owner through consideration and application of the Recommended Mitigation Measures provided in Table 3.

The above-mentioned risks are eliminated at the point of decommissioning the reservoir.

Due to the age of the reservoir and its apparent condition, should the reservoir be required (not decommissioned) a desktop review not limited to historic records including drawings, construction records, water monitoring, structural assessments with respect to installation of mitigation measures should be undertaken internally or by a consultant.

## 6. FORM 1 – MANAGEMENT OF GEOLOGICAL HAZARD

The completed Form 1 as required by the Alpine Resorts Planning Scheme is included in Appendix E.

## 7. APPLICABILITY

Recommendations and opinions contained in this report are based on the interpretation of field observations at point locations and information from published geological maps. The nature and continuity of the subsoil away from the test locations are inferred, but it must be appreciated that actual conditions could vary from the assumed geotechnical model. If conditions other than those described are encountered, PSA/TCE should be engaged to assess whether the recommendations should be revised. The attached "Important Information" (Appendix F) provides additional information in the uses and limitations of this report.

## 6. REFERENCES

1. Australian Geomechanics Society Volume 42 No 1, March 2007 - Landslide Risk Management

## Appendix A – Site Plans



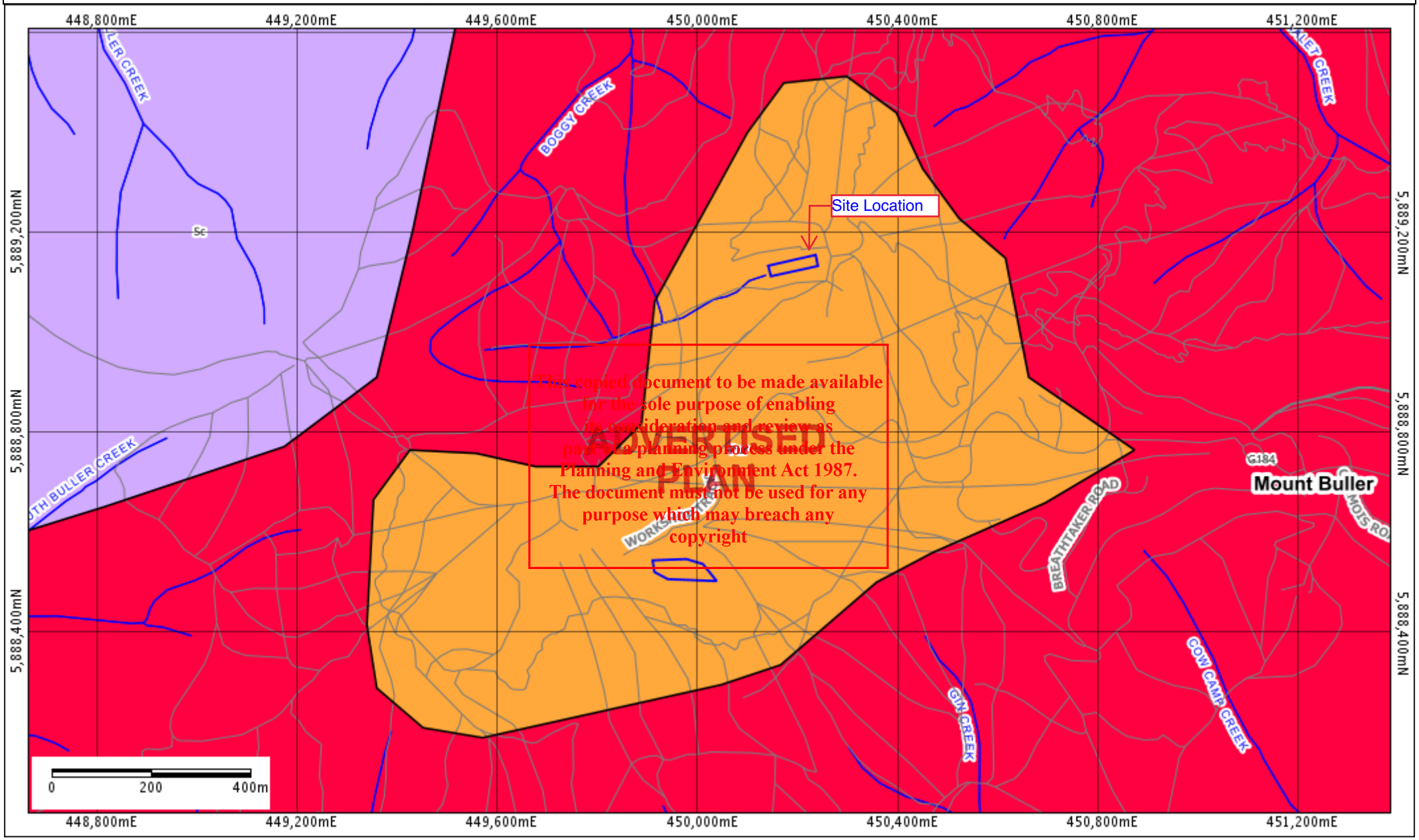

Site Plan: proposed location of the Northside snow factory


Test site location plan.

## Appendix B – Geovic Geology Map

Department of Energy,
Environment and Climate Action

# Mt Buller





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Map Created Fri Nov 24 2023 12:37:51 GMT+1100 (AEDT)

Map Scale: 1:10,000

Projection: MGA94 55

The map contains zonal grid lines that extends beyond their zone boundary.

GDA

VICTORIA State Government

# Legend

Towns (25K)

- Locality
- Small Town
- Town
- Large Town
- Major Town
- Regional Centre
- City

GSV Geological Unit Contact (250K)

Roads (vmtrans)

- Freeway
- Highway
- Main Road
- Medium Road
- Other Roads

Victoria Boundary (25K)

- State Boundary
- Coastline

Shear zones 250K

Watercourses (vmhydro)

- Rivers
- Creeks
- Other

Lakes (vmhydro)

GSV Geological Unit (250K)

- Bryce Plain Basalt (-Pur) (1)
- Cobbannah Group (Sc) (1)
- Mount Stirling Granodiorite (G184) (1)

## Appendix C – Site Photos

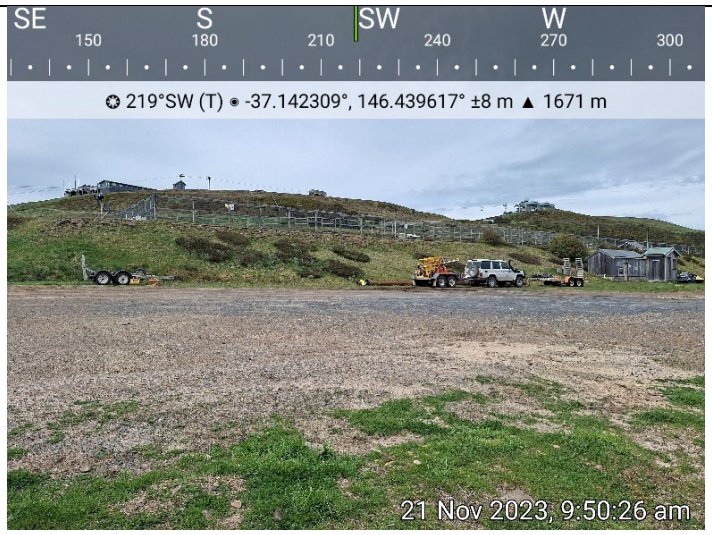



Photo 1: view southwest towards reservoir and proposed snow factory site

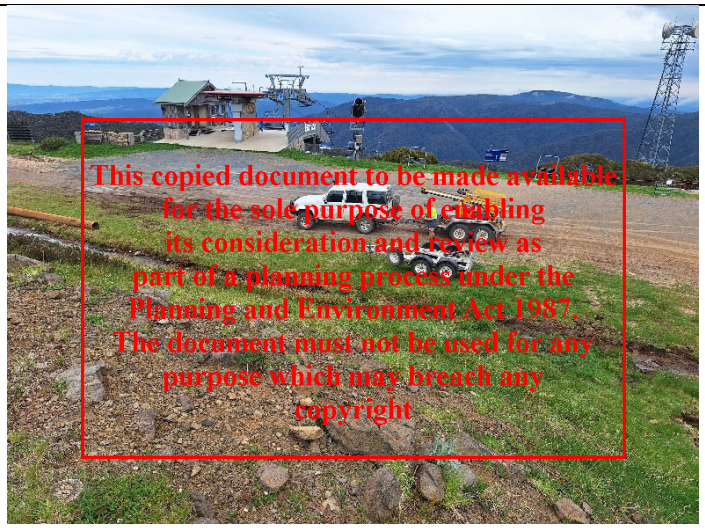




Photo 2: view northeast from top of reservoir towards proposed snow factory location. Bonza lift in background


Photo 3: view east of site, Northside lift and Spurs restaurant. Level gravel access

Photo 4: view west across reservoir. Site downslope to the right

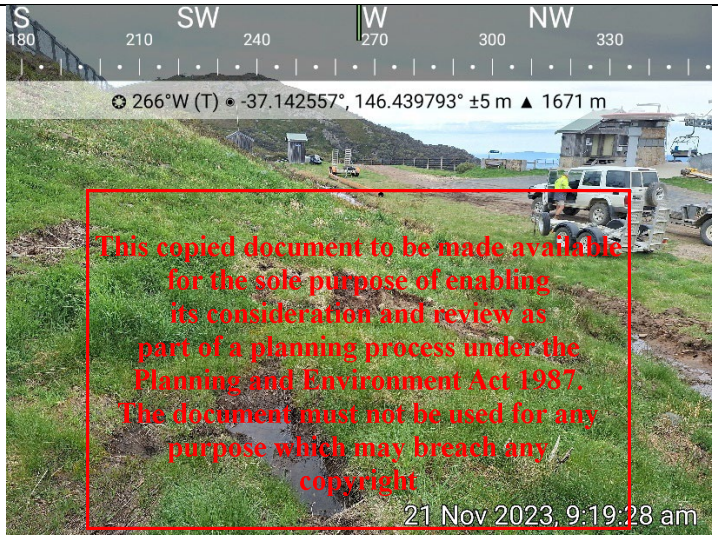





Photo 5: view west across reservoir batter. Note free water in surface depressions

Photo 6: view north noting downslope drainage. Site to the left

Photo 7: existing standpipe water supply by information boards

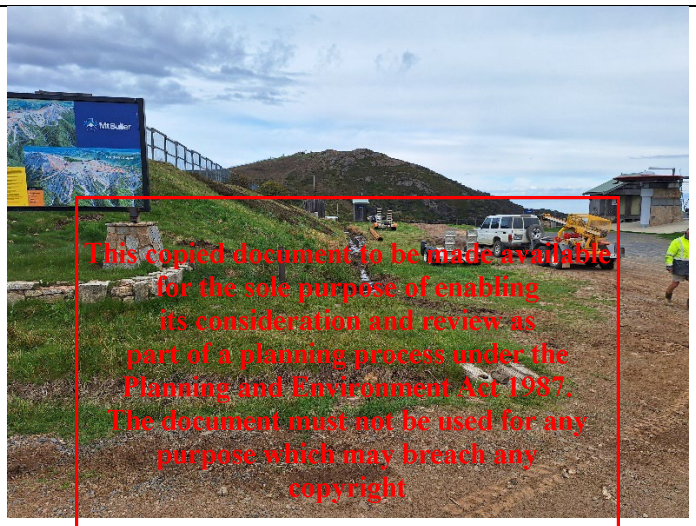




Photo 8: view west along reservoir batter. Note drain along toe

Photo 9: view west along reservoir batter. Noting reservoir, levelled site and drain along toe

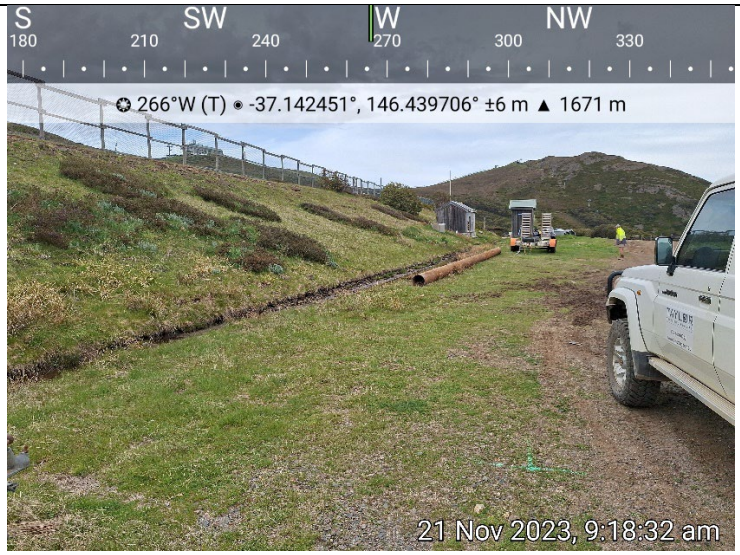



Photo 10: proposed site location

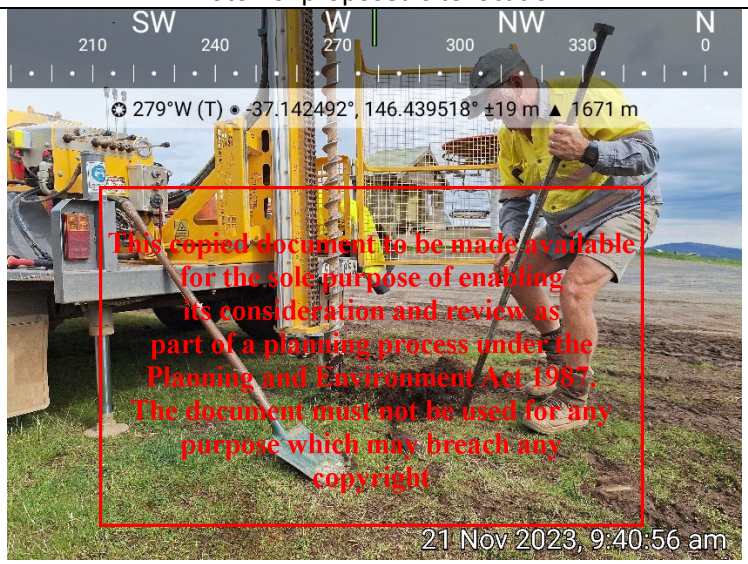





Photo 11: refusal of auger at 0.2 m and fencing bar at 0.3 m


Photo 12: 'topsoil', clay, sand, gravel, & basalt cobbles

## Appendix D – Risk Assessment Procedure

# QUALITATIVE LIKELIHOOD, CONSEQUENCE AND RISK TERMS

The following risk assessment procedure has been sourced from Australian Geomechanics Society publication "Landslide risk management concepts and guidelines," May 2007.

### QUALITATIVE LIKELIHOOD TERMS

| TERM | LIKELIHOOD OF LANDSLIDE DURING DESIGN LIFE OF SLOPE OR STRUCTURE |
|---|---|
| **Almost Certain** | The event is expected to occur early in the design life. |
| **Likely** | The event will occur under adverse conditions. |
| **Possible** | The event may occur under adverse conditions. |
| **Unlikely** | The event may occur under very adverse circumstances. |
| **Rare** | The event is conceivable but only under exceptional circumstances. |
| **Not Credible** | The event is inconceivable or judged to be extremely unlikely. |

### QUALITATIVE CONSEQUENCE TERMS

| TERM | EXAMPLES OF CONSEQUENCES |
|---|---|
| **Catastrophic** | Structure completely destroyed or large-scale damage requiring major engineering works for stabilisation. |
| **Major** | Extensive damage to most of the structure requiring significant stabilisation works. |
| **Moderate** | Moderate damage to part of the structure or part of site requiring extensive stabilisation works. |
| **Minor** | Limited damage to part of structure or site requiring minor stabilisation works. |
| **Insignificant** | Little or no damage. |

## QUALITATIVE CONSEQUENCE TERMS

| LIKELIHOOD | CONSEQUENCES TO PROPERTY/LIFE | | | | |
|---|---|---|---|---|---|
| | Catastrophic | Major | Moderate | Minor | Insignificant |
| Almost Certain | VH | VH | VH | H | M or L |
| Likely | VH | VH | H | M | L |
| Possible | VH | H | M | M | VL |
| Unlikely | H | M | L | L | VL |
| Rare | M | L | L | VL | VL |
| Not Credible | L | VL | VL | VL | VL |

## RESPONSE TO RISK

In general, it is the responsibility of the client and/or owner and/or regulatory and/or others who may be affected to decide whether to accept or treat the risk. The risk assessor and/or other advisers may assist by making risk comparisons, discussing treatment options, explaining the risk management process, and advising how others have reacted to risk in similar situations. Attitudes to risk vary widely and risk evaluation often involves considering more than just property damage (e.g., environmental effects, public reaction, business confidence etc).

In certain situations, development control decisions (e.g., by local government authorities) are related to qualitative risk (or hazard) ranking terms. For example, regulatory authorities will not allow new development where the risk (or hazard) has been described as “high” (according to definitions included in the development controls).

The following is a guide to typical responses to assessed risk based on our experience.

| ASSESSED RISK | | TYPICAL RESPONSE OF CLIENT/ OWNER/ REGULATOR/ PERSON AFFECTED |
|---|---|---|
| VH | Very high | Unacceptable without treatment.<br>Trained geotechnical engineer to reinspect every 6 months.<br>Monitoring instrumentation to be installed.<br>Planning of medium-long term remedial works to be undertaken and implemented within 1 year including detailed investigation and research, planning and implementation of treatment options to reduce risk to acceptable level. May avoid development of new site. |
| H | High | Unacceptable without management.<br>Trained geotechnical engineer to reinspect every 12 months<br>Monitoring instrumentation to be installed<br>Short term remedial works to be undertaken as required<br>Planning of medium-long term remedial works to be undertaken and implemented within 3 years, not limited to detailed investigation, planning and implementation of treatment options to reduce risk to acceptable level. |
| M | Medium | May be tolerated in certain circumstances. Owner to monitor further development of hazard. May require investigation and planning of treatment options to reduce risk if achievable. |
| L | Low | Usually, acceptable. No further action required, though treatment requirements may be defined to reduce risk |
| VL | Very low | Acceptable. No further action required. Manage by normal slope maintenance procedures. |

## Appendix E – Form 1

Department of Sustainability and Environment

ALPINE RESORTS PLANNING SCHEME
Erosion Management Overlay – Schedule 1 Management of Geotechnical Hazard

**FORM 1**

**Declaration and/or verification made by geotechnical engineer or engineering geologist as part of a geotechnical report**

Name of application: North Side Snowmaking Machine, The Spurs, Mount Buller

Address of subject site: Summit Road, Mount Buller

I, Philip Styles (insert name) of Phil Styles & Associates Pty Ltd (trading or company name)

on 4 December 2023 (insert date)

certify that I am a geotechnical engineer or engineering geologist as defined by the Erosion Management Overlay (Schedule 1 – Management of Geotechnical Hazard) and I have: (tick appropriate box):

☐ prepared the Geotechnical Report referenced below in accordance with the Australian Geomechanics Society's Geotechnical Risk Management Guidelines and Clause 3 of the EMO1

or

☒ technically verified that the geotechnical report referenced below has been prepared in accordance with the AGS's Geotechnical Risk Management Guidelines and Clause 3 of the EMO1.



**Geotechnical report details:**

Report title: Preliminary Risk and Foundation Assessment for the North Side Snow Factory

Report date: 4 December 2023

Report reference:

Author: Toby Creighton

Author's affiliation: MIE (Aust) PE 0001251

**Documentation relied upon in report preparation:**

Please refer to attached sheet

I am aware that the Geotechnical Report I have either prepared or am technically verifying for the above development is to be submitted in support of a development application for the proposed development requiring approval from the Minister for Planning. Construction of North Side Snow Factory (name of development)

Further, I hold a current professional indemnity insurance policy of at least $2 million, evidence of which is attached with this form.

Name Philip Styles

Signature Philip Styles

Date 4/12/2023

Victoria The Place To Be

Documentation relied upon during report preparation:

- Email works request from Timothy Meier of Buller Ski Lifts dated 15/11/2023
- Site Plan dated 16/11/2023
- Site Plan dated 14/11/2023
- Victorian Geology Maps available from Geovic
- Personal knowledge of the region by Mr Toby Creighton (Geotechnical Engineer with NSW RMS Accreditation)
- Personal knowledge of the site by Mr Philip Styles (Principal Engineering Geologist, Phil Styles & Associates Pty Ltd)

# Certificate of Currency

This Certificate is evidence that a contract of insurance has been effected as per the details below. The insurance expires 26/04/2024 and a new Insurance policy is required to continue the insurance past that date.

**No insurance is provided past the Expiry Date of 26/04/2024**

Policy No : TU/PI/20180296 BRIC Ref: 354500/9

Class of Insurance : **PROFESSIONAL INDEMNITY INSURANCE**

The Insured : **Phil Styles & Associates Pty Ltd**

including all Principals, Partners, Directors and Employees of the Insured.



Policy Period: **From** Wednesday 26 April 2023 to Friday, 26 April 2024

Insurer: Lloyd's of London via Tasman Underwriting

Profession Insured: Consulting Geotechnical Engineers

Retroactive Date: Friday, 6 February 2015

Sum Insured: **$5,000,000**

Excess: $10,000

Policy Wording: Tasman Underwriting Civil Liability policy wording (tasman2018miscPIwdgNovember18) Covers Civil Liability incurred in the conduct of the professional business activities (Does not require a breach of professional duty of care).

Cover Includes:

- Liability arising from Consultants/Sub Consultants
- Trade Practices and/or Fair Trading Acts
- Estates and Legal Representatives
- Loss of Documents
- Dishonesty of Employees (Innocent Parties cover)
- Severability & Non Imputation

Aggregation of Limit: The limit is also the aggregate amount to be paid in any one year unless a reinstatement is provided and specified in the Special Conditions below.

Special Conditions: Defence costs provided within the limit (costs inclusive). Excess is costs inclusive. Limit in the aggregate is $10,000,000 (i.e. one reinstatement). Endorsements as attached.



**Signed By** :

BRIC Bovill Risk & Insurance Consultants

A.C.N. 072 412 474

**Dated** : Tuesday 25 April 2023

**IMPORTANT NOTE:**

The above information is a summary of the major components of the policy and does not represent the full scope of cover provided by the policy. For more detail regarding how the policy operates we strongly recommend the policy wording is examined. This document does not infer any rights upon the holder and is only current at the date of issue.

## Appendix F – Important Information About Your TCE/PSA Report

PHIL STYLES & ASSOCIATES

ADVERTISED PLAN

TAYLOR CONSULTING ENGINEERS

# Important information about your **TCE/PSA** Report

TCE/PSA considers that as our client you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared to help you interpret and understand the limitations of your report.

## Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requiirements as understood by TCE/PSA and applies only to the site investigated. Project criteria typically include the general nature of the project: its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking TCE/PSA to assess how factors that changed subsequent to the date of the report affect the report's recommendations. TCE/PSA cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.



## Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult TCE/PSA to be advised how time may have impacted on the project.

## Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of TCE/PSA through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

## Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only TCE/PSA, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and TCE/PSA cannot be held responsible for such misinterpretation.

## Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with TCE/PSA before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

PHIL STYLES & ASSOCIATES

TAYLOR CONSULTING ENGINEERS

# Important information about your TCE/PSA Report

## Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain TCE/PSA to work with other project design professionals who are affected by the report. Have TCE/PSA explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

## Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

## Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.

Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact TCE/PSA for information relating to geoenvironmental issues.

## Rely on TCE/PSA for additional assistance

TCE/PSA is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with TCE/PSA to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

## Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from TCE/PSA to other parties but are included to identify where TCE/PSA's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from TCE/PSA closely and do not hesitate to ask any questions you may have.

For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters, Canberra, 1987.

## Appendix B - DoTP Letter Dated 14/12/2023

Department of Transport and Planning



GPO Box 2392
Melbourne, VIC 3001 Australia
www.dtp.vic.gov.au

Ref: PA2□02644



Buller Ski Lifts
C/- Edward Mahon
PO Box 1
MT B□LLER VIC □72□
ed.mahon□ skibuller.com.au

Dear Edward Mahon

**APPLICATION FOR PLANNING PERMIT PA2302644**
**MT BULLER SKI FIELD MT BULLER VIC 3723**

I refer to the above matter submitted to the Minister for Planning on 7/12/202□.

A preliminary assessment of the application has revealed that further information pursuant to section 54(1) of the *Planning and Environment Act 1987* is re□uired in order to properly consider your application.

**Further Information**

The further information re□uired is:

1. A □uantitative or Semi □uantitative Risk Assessment in accordance with the re□uirements of Section 4.2 of Schedule 1 to Clause 44.01 Erosion Management Overlay of the Alpine Resorts Planning Scheme (the Scheme). (Refer to item 1 in the Preliminary Assessment section).
2. The architectural plan or 'Design' plan of the snow factory building amended to include:
   a) A notation to nominate the colours and materials of the external cladding.
   b) Extent of earthworks (measured from natural ground level), if applicable.
   c) A site plan, at scale, that provides the precise siting of the building and provides relevant setbacks to an existing building or structure that is fixed on land nearby.
   d) Elevations to include north, south, east and west of the building.
□. Whether the proposed building will re□uire connection to reticulated services and which ones. (Refer to item 2 in the Preliminary Assessment section).

This re□uest for further information is made pursuant to section 54 of the *Planning and Environment Act 1987* and must be received **on or before 13/02/2024**.

If you do not provide all re□uested information **on or before 13/02/2024**, your application will lapse. You may extend this date by re□uesting an extension on or before the due date specified in this correspondence. The Minister for Planning must then either decide to extend the time to give the re□uired information or refuse to extend that time. The Minister for Planning will give you written notice of its decision. Appeal rights apply to any refusal of an extension of time.

**Preliminary Assessment**

I have undertaken a preliminary assessment of the application and the following matters are raised:

1. The submitted Preliminary Geotechnical and Foundation Assessment report, prepared by Taylor Consulting Engineers and dated 21 November 202□ indicates that there is a risk to property that is greater than low. The EMO re□uires a □uantitative or Semi □uantitative Risk Assessment be prepared and submitted that contains all items in Section 4.1 of Schedule 1 to the EMO and examines risks to property in accordance with the general methodology set out in the AGS Guidelines.
2. Please confirm whether the installation of the snow making building will re□uire to be connected to any reticulated services. It is assumed that it will be connected to electricity and water however need confirmation whether it will need gas. This is relevant as Clause 66.04 of the Scheme re□uires referral of an application to the relevant utility service provider for any development which re□uires connection to reticulated services.

Please note that these are preliminary issues only. Once a full assessment is undertaken, additional issues may arise that will re□uire further discussion / resolution.

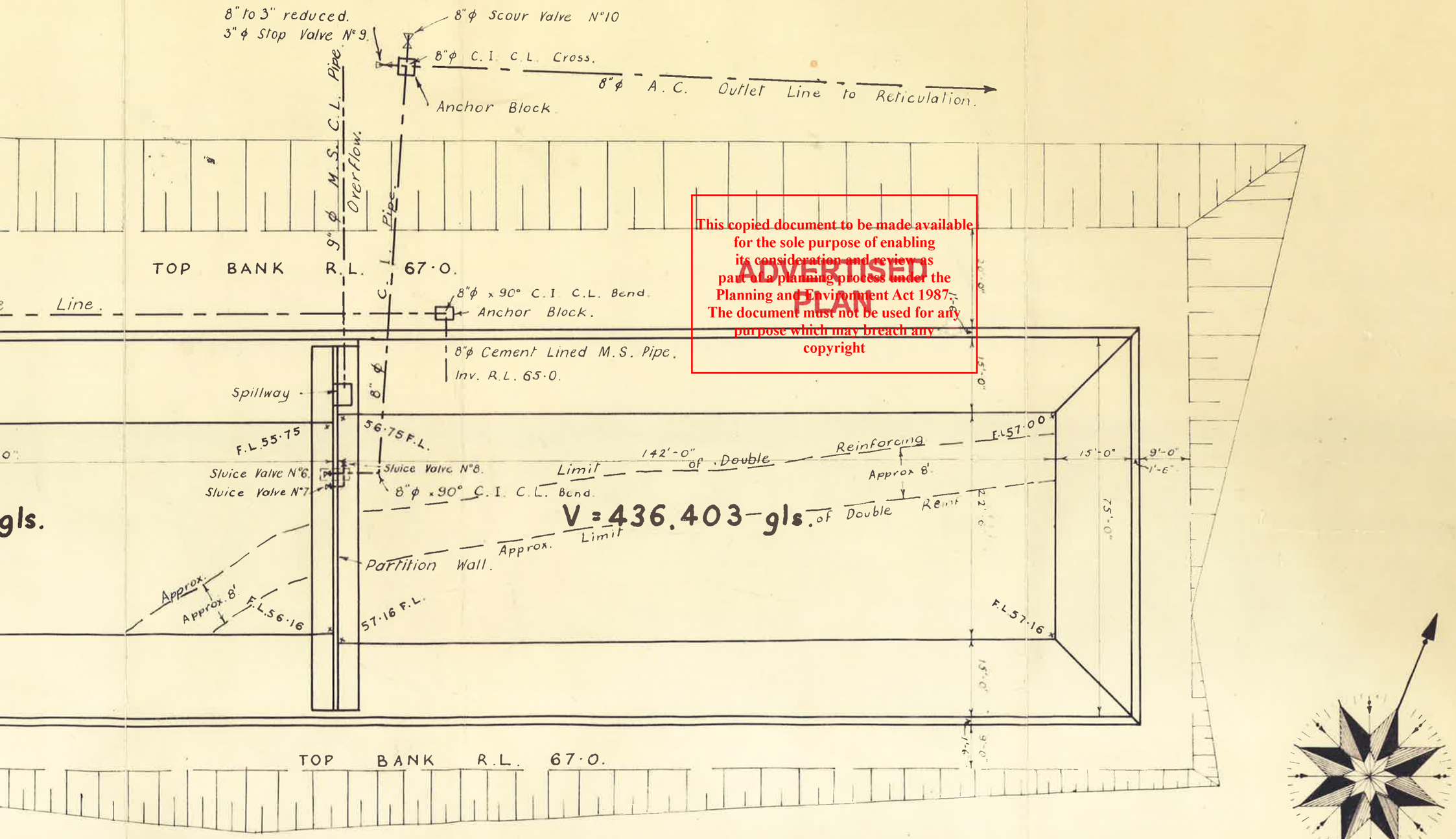
If you have any □uestions, please contact me on 0409 512 642 or email michael.dafnomilis□ delwp.vic.gov.au.

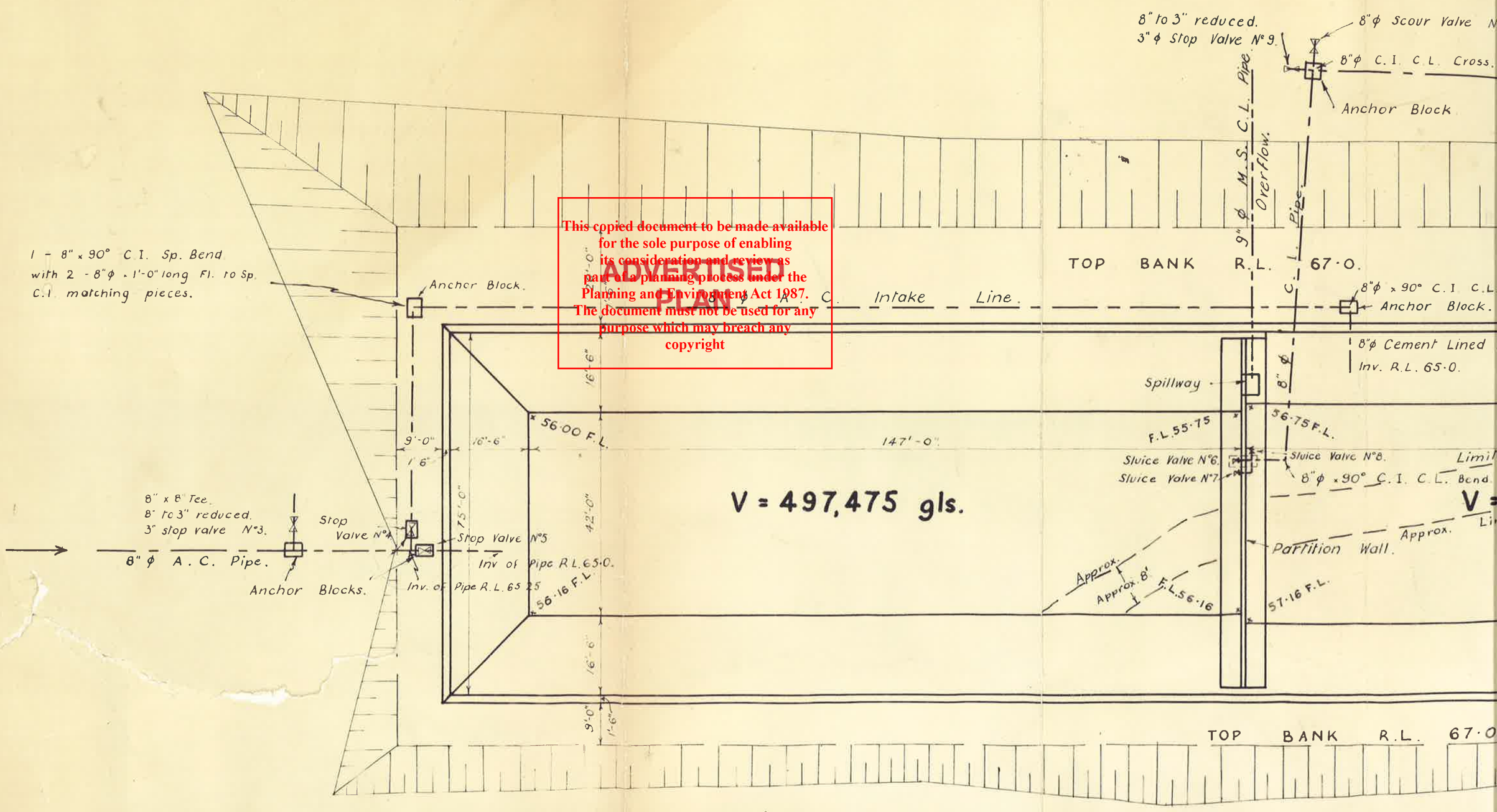
Yours sincerely

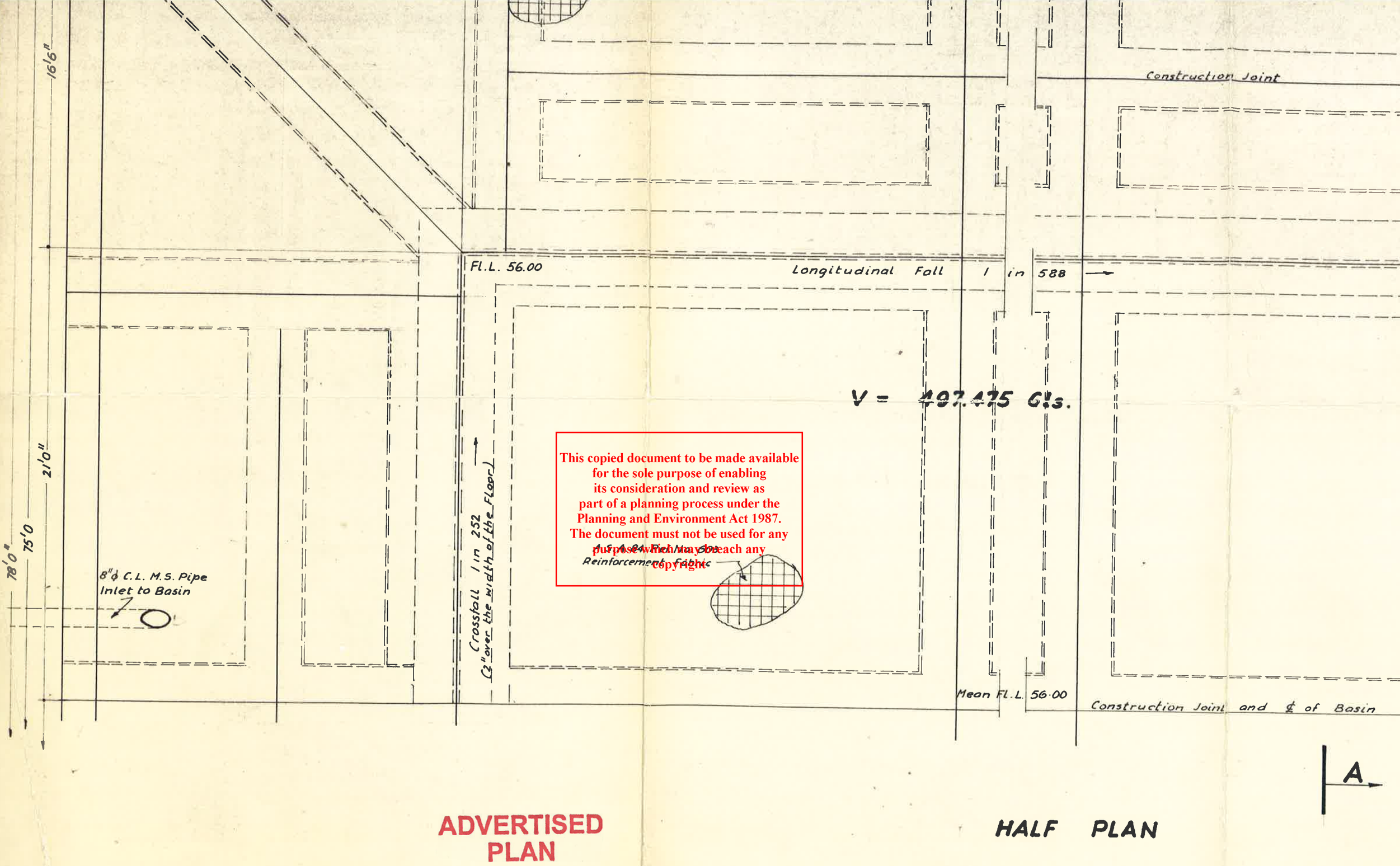
**Michael Dafnomilis**
Senior Planner - Alpine, Development Approvals and Design

14/12/202□

## Appendix C – Burnt Hut Reservoir Construction Drawings 1963



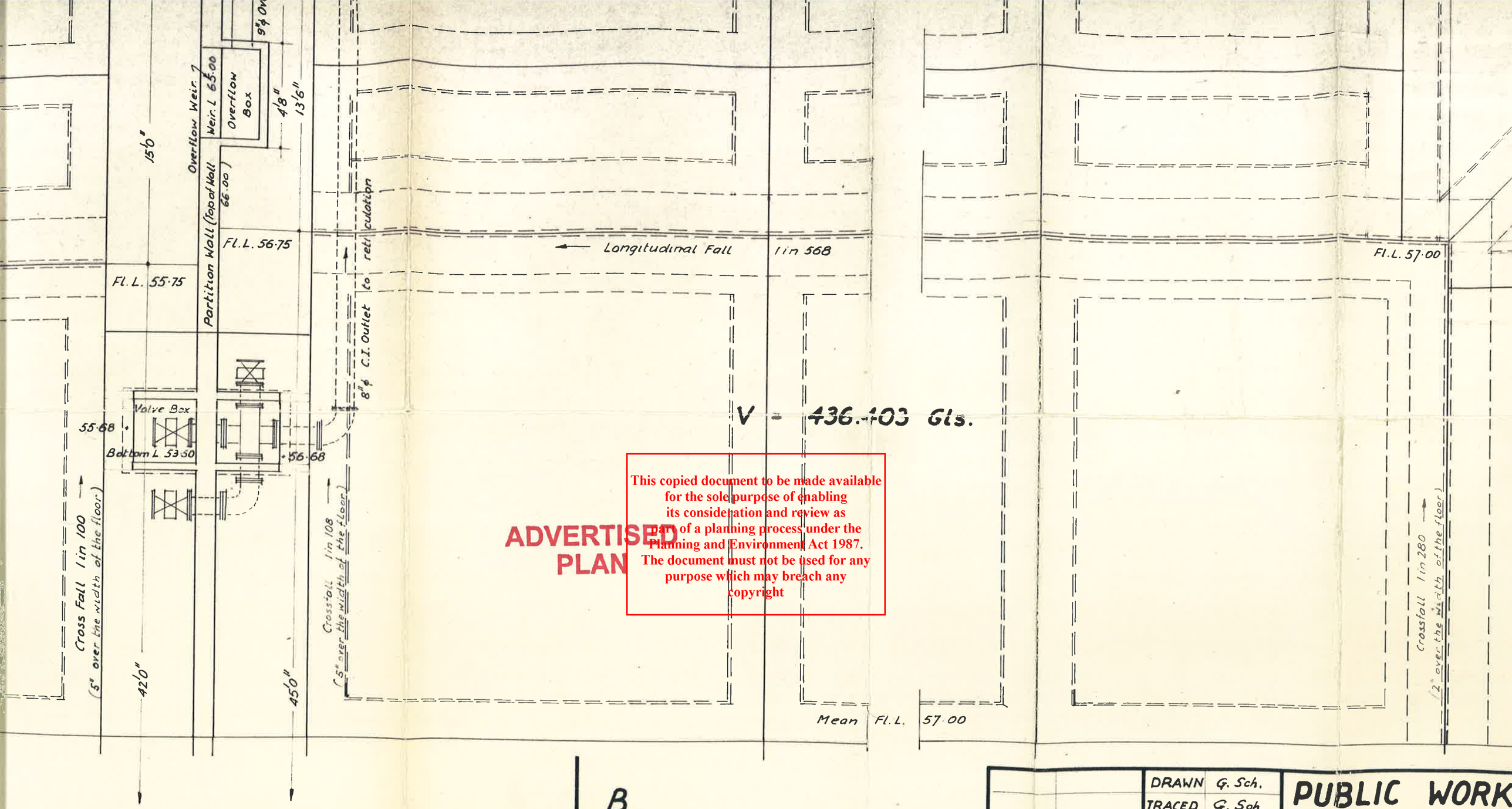









HALF PLAN






| | |
|---|---|
| 62/631 | Layout of Supply Line & Basin |
| 62/215 | Cross-sections of Storage Basin |
| 62/520 | Collector Pit & Spillways |
| 62/568 | Lower Pit offtake |
| 63/392 | Details of Access Road |
| 63/78 sheet 4 | Security Fence at Reservoir |
| 63/78 sheet 3 | Partition Wall & Joints |
| 63/78 sheet 2 | Outlet Box and Valves arrangement |

REFERENCE

DRAWN G. Sch.
TRACED G. Sch.
CHECKED
DATE: 26.7.63.

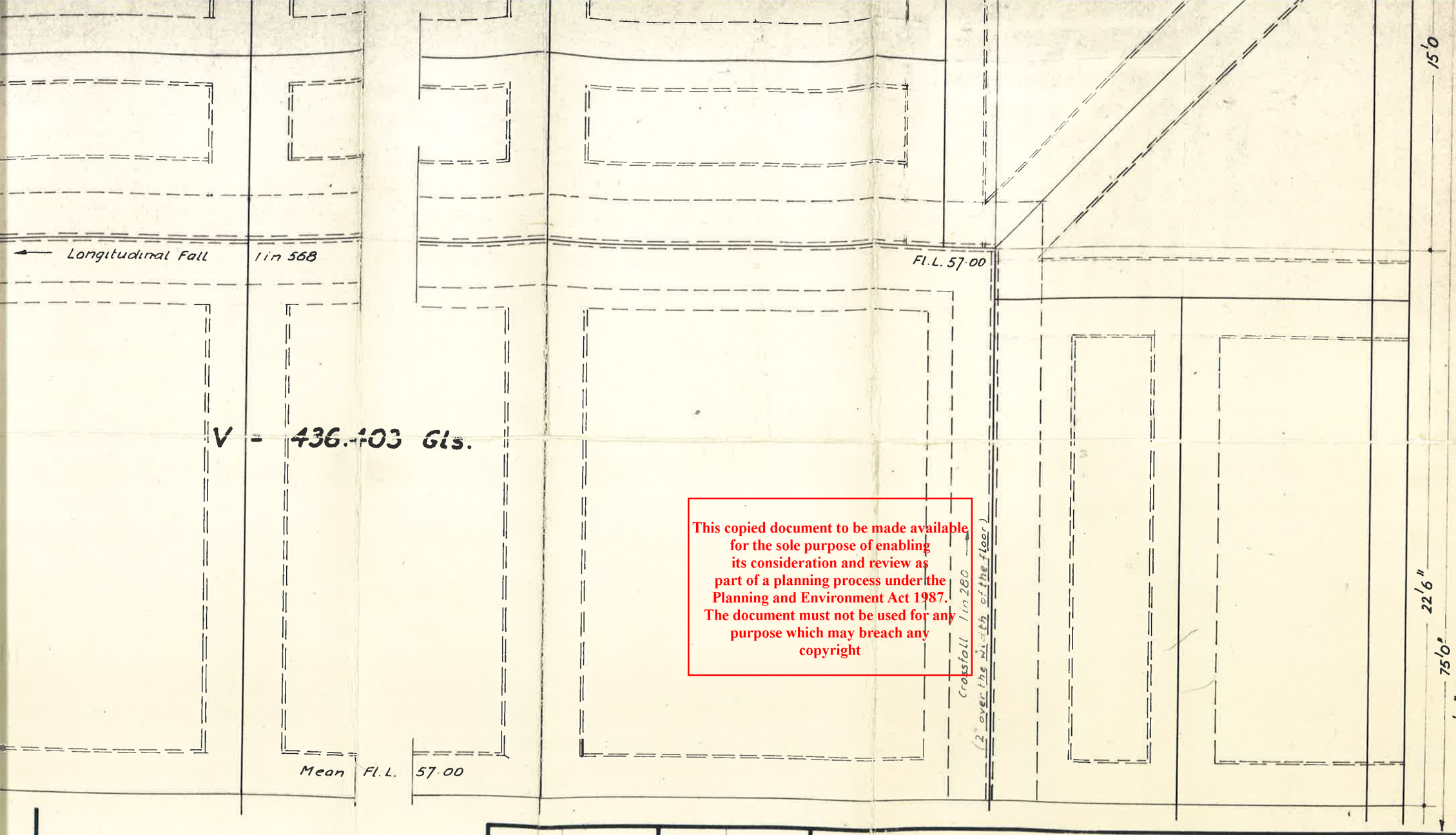
ENGINEER

CHIEF ENGINEER

PUBLIC WORK
CIVIL ENG

Mt. BULLER ALP
WATER S
STORAGE
GENERAL

SCALE: ¼ inch =






B

| | |
|---|---|
| 62/631 | Layout of Supply Line & Basin |
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| 62/520 | Collector Pit & Spillways |
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REFERENCE

DRAWN G. Sch.
TRACED G. Sch.
CHECKED
DATE: 26.7.63.

ENGINEER

CHIEF ENGINEER

# PUBLIC WORKS DEPARTMENT-VICTORIA

CIVIL ENGINEERING BRANCH

## Mt. BULLER ALPINE VILLAGE
## WATER SUPPLY
## STORAGE BASIN
## GENERAL PLAN

B

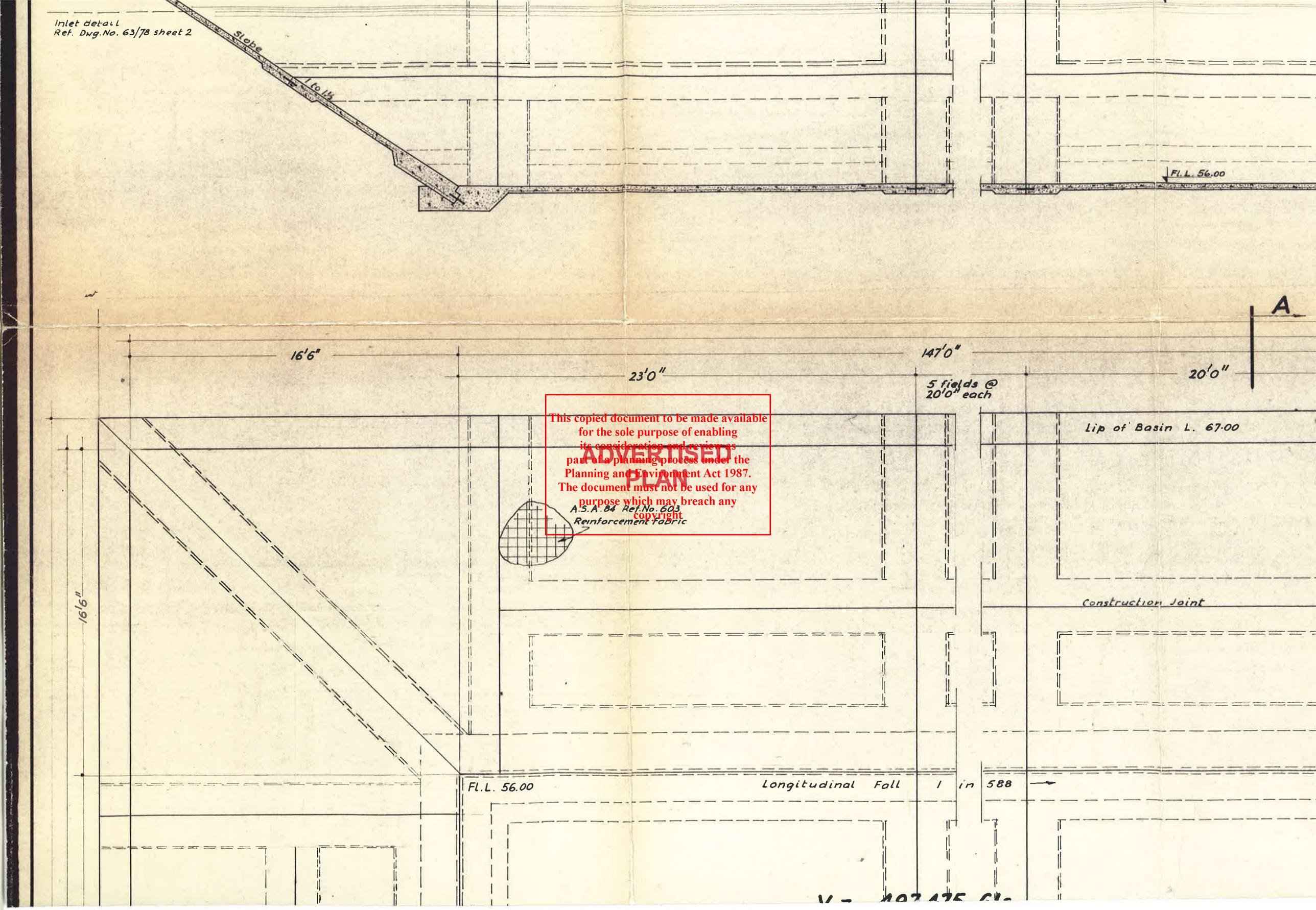
63/78

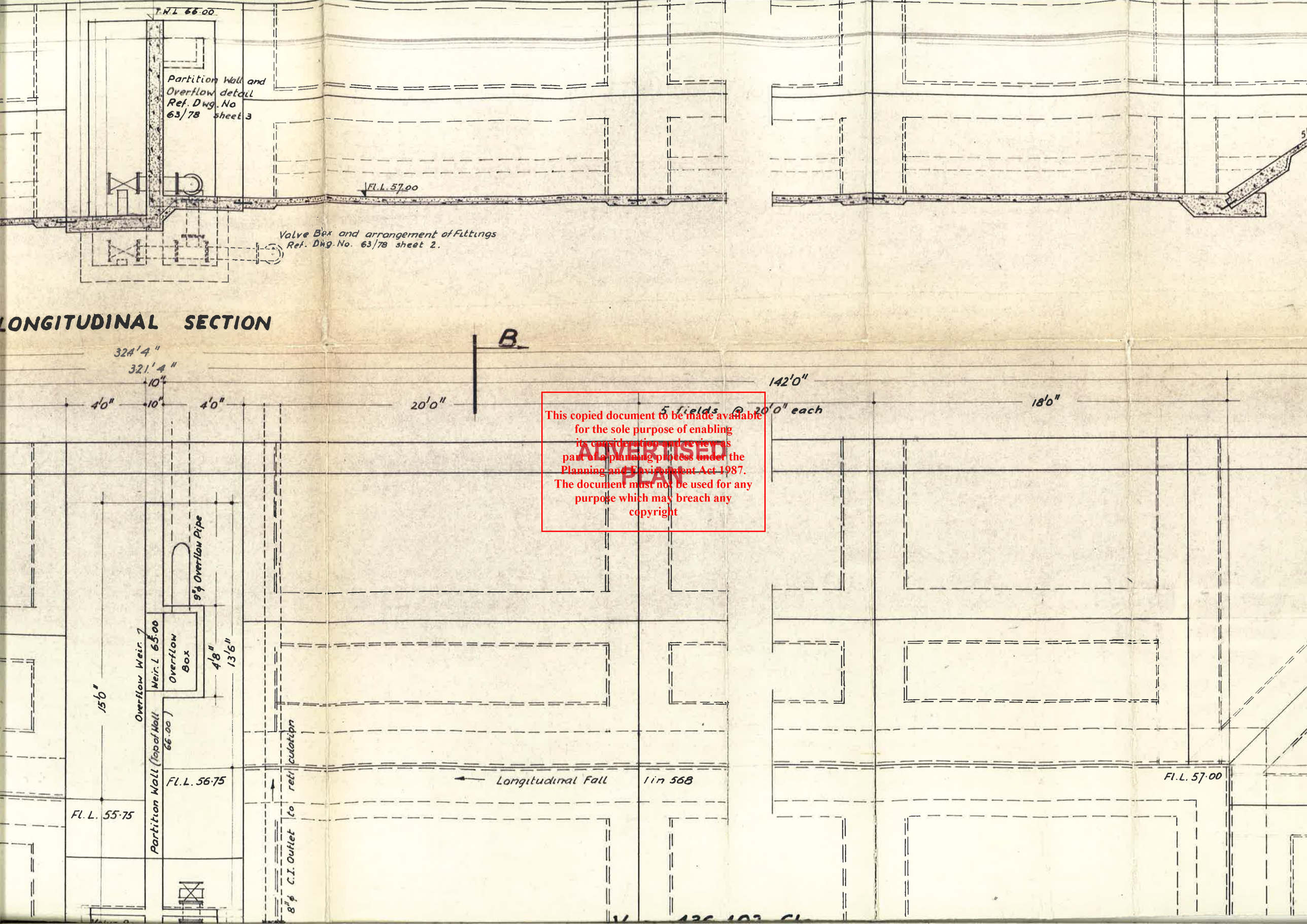
SCALE: 1/4 inch = 1 ft.

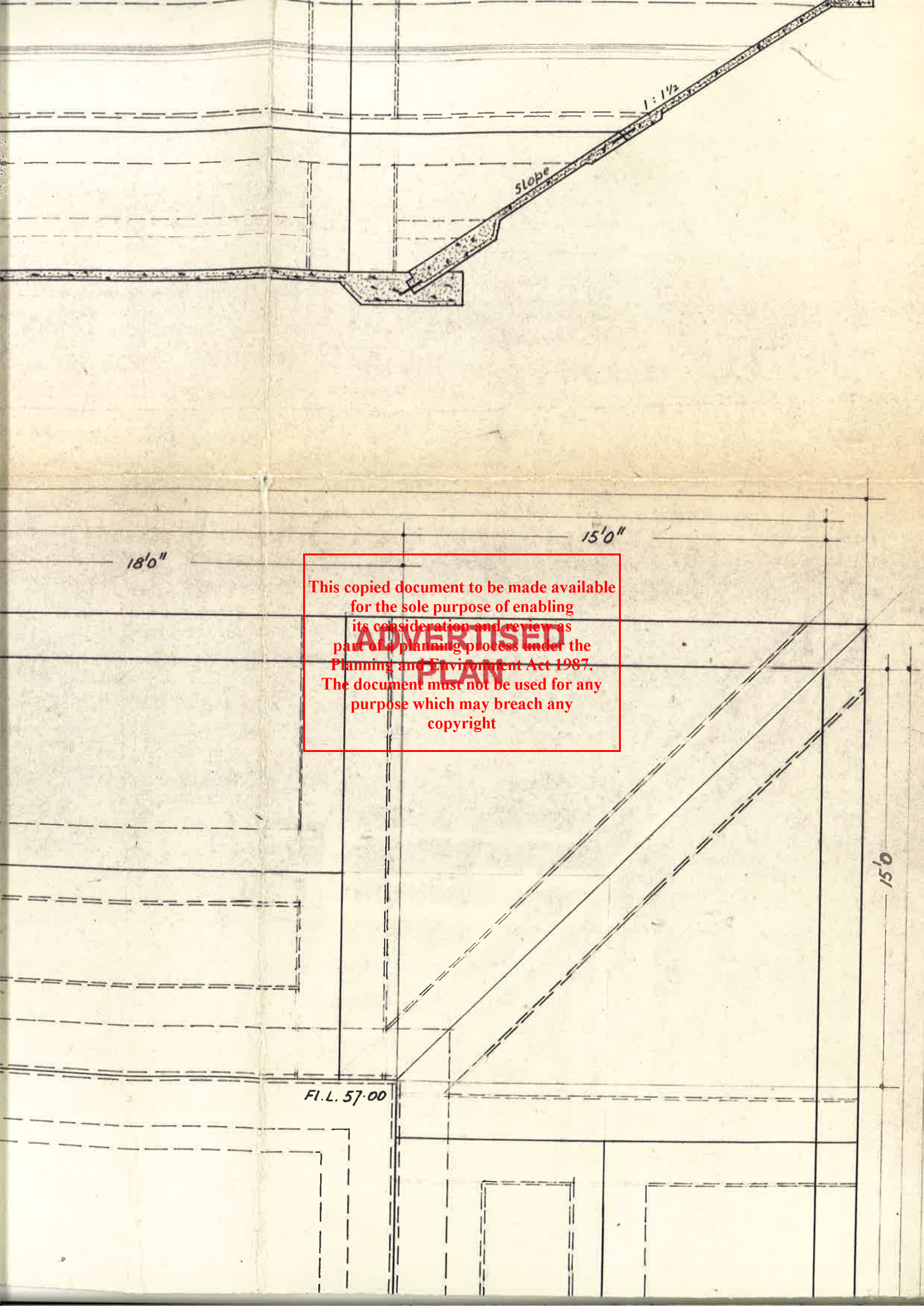
SHEET 1.

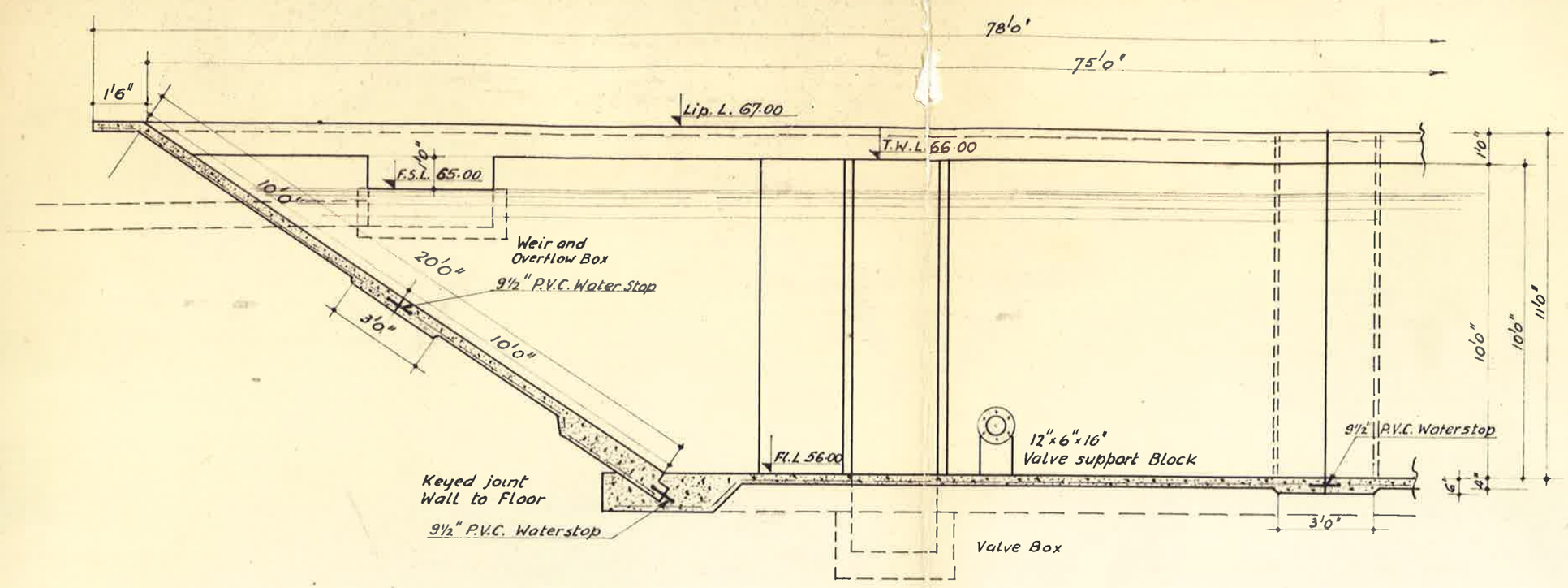
ADVERTISED PLAN

211002





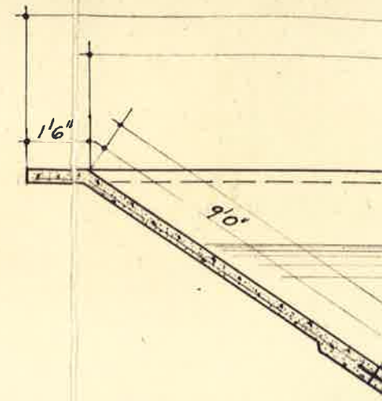




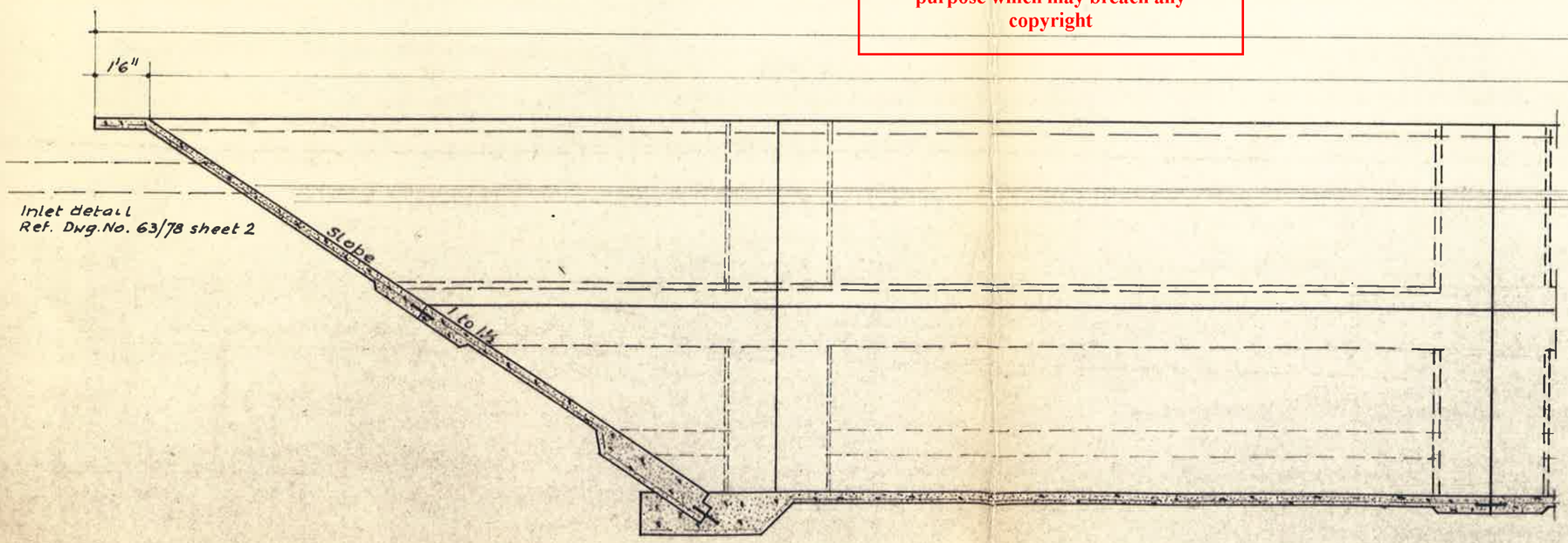

SECTION A-A

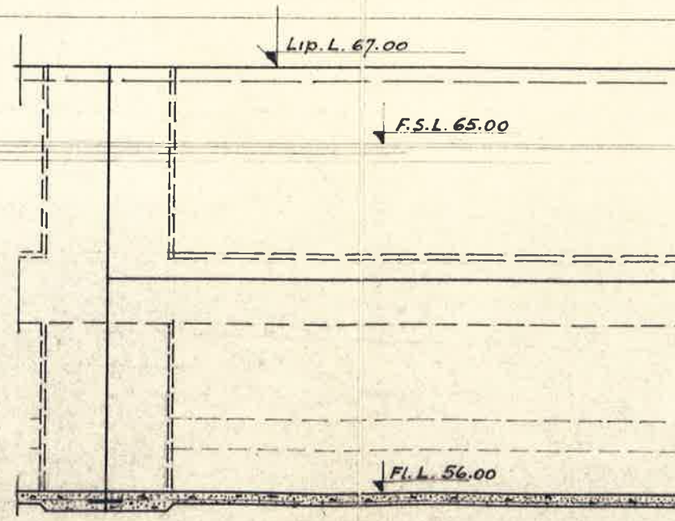







Wall & Floor Joint
Refer. Dwg.No. 6

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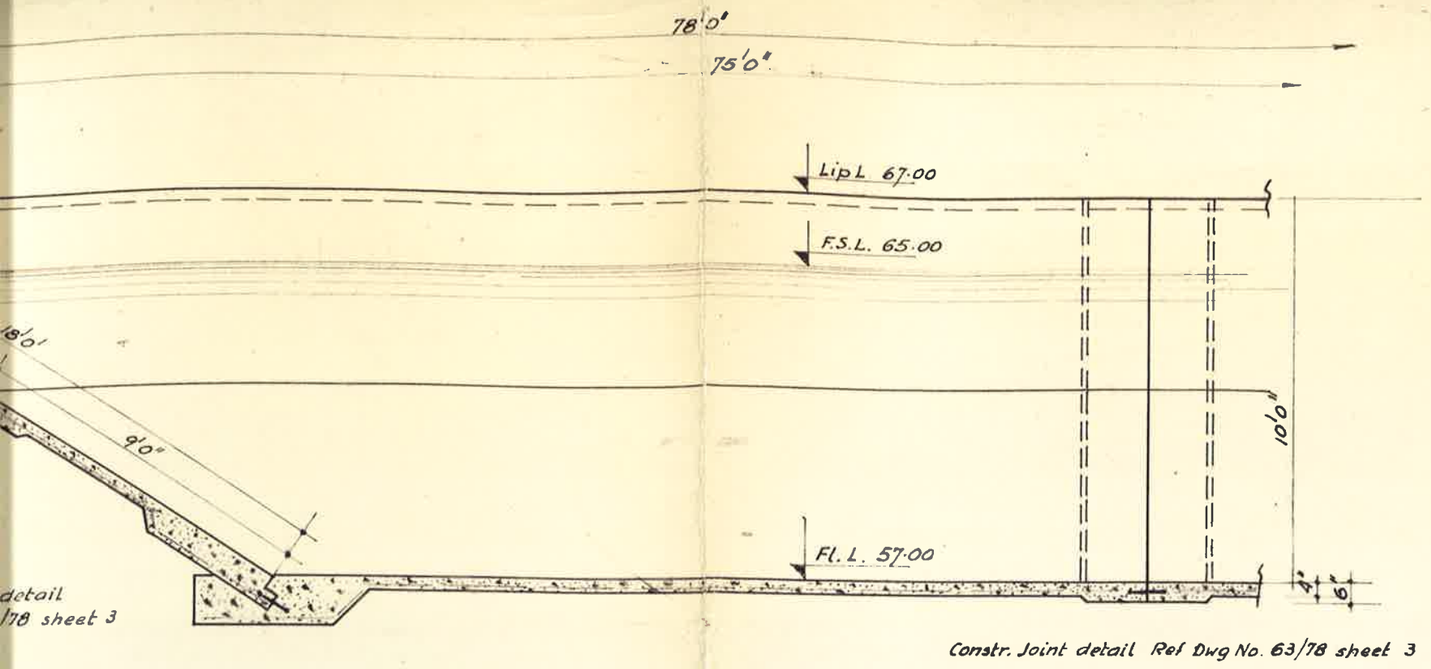
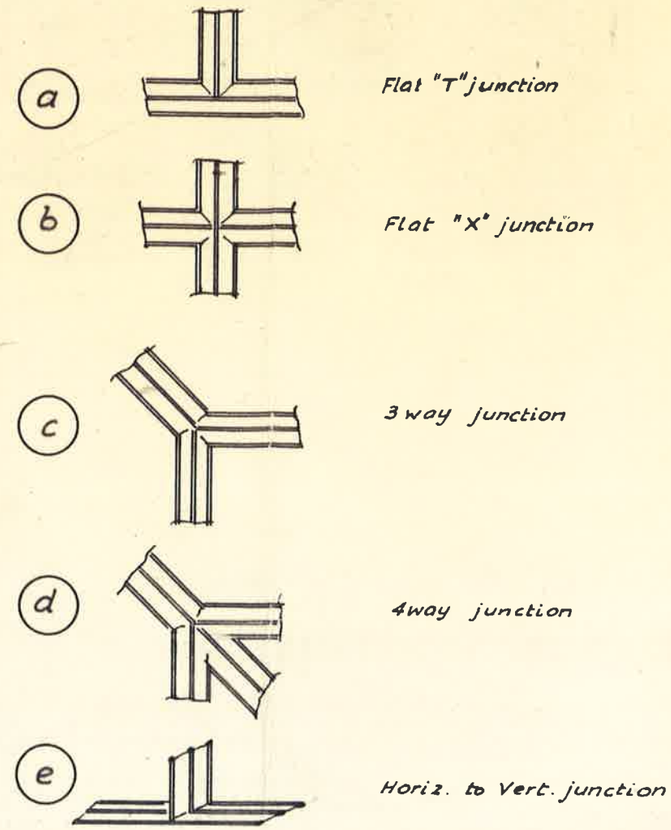
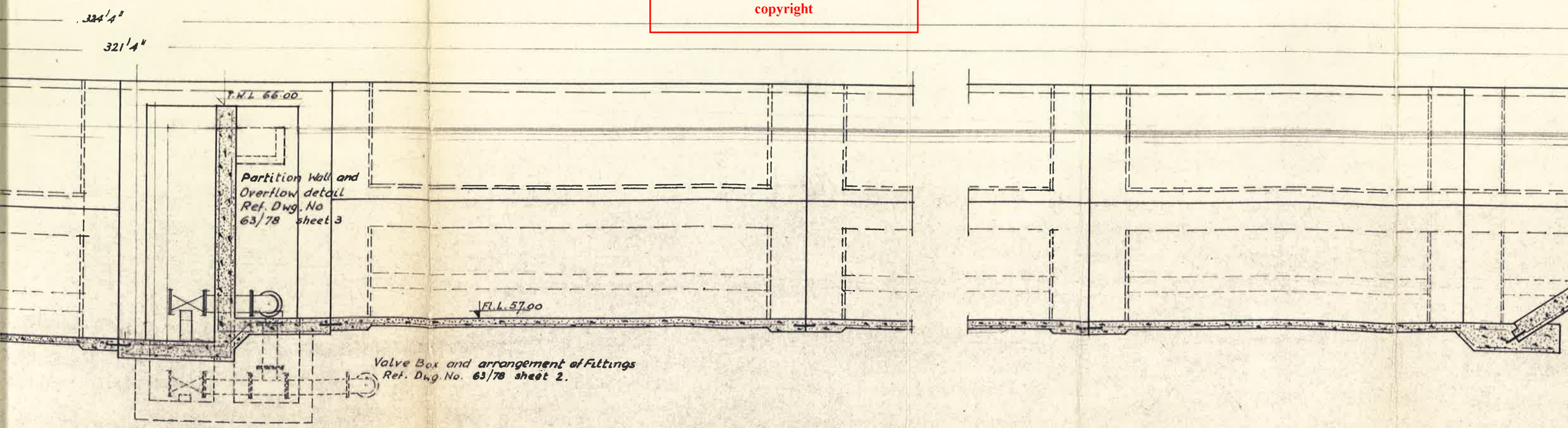



SECTION B-B




FACTORY MADE P.V.C. JUNCTIONS






LONGITUDINAL SECTION

B

Flat "T" junction

Flat "X" junction

3 way junction

4way junction

Horiz. to Vert. junction

## /C. JUNCTIONS