Six Mile Creek Dam Safety Upgrade Project

Request for Project Change - Construction

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Document control

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Abbreviations

Abbreviation	Meaning
AHD	Australian Height Datum
AMP	Adaptive Management Plan
CGER	Coordinator-General's Evaluation Report
CNVIA	Construction Noise and Vibration Impact Assessment
CPESC	Certified Professional in Erosion & Sediment Control
CS	Construction Scenario
CSM	Community & Stakeholder Manager
CSS	Cooroy State School
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DESI	Department of Environment, Science and Innovation
DOR	Department of Resources
ESCP	Erosion and Sediment Control Plan
EPBC	Environmental Protection and Biodiversity Conservation
EMP	Environmental Management Plan
ESM	Environment and Sustainability Manager
FSL	Full Supply Level
HDPE	High density polyurethane
IAR	Impact Assessment Report
LMDIP	Lake Macdonald Dam Improvement Program
ML	Mega litres
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NSC	Noosa Shire Council
REE	Red Earth Engineering
RL	Reduced Level
TGS	Traffic Guidance Scheme's
TIA	Traffic Impact Assessment
TMR	Dep. Transport and Main Roads
TMP	Traffic Management Plan
SARA	State Assessment and Referral Agency
SDPWO	State Development and Public Works Organisation Act 1971

UCD	Upstream Coffer Dam
WTP	Water Treatment Plant
WQO	Water Quality Objectives
VMP	Vehicle Movement Plans

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Executive Summary

The Six Mile Creek Dam Safety Upgrade Project (the Project) (also referred to as the Lake Macdonald Dam Improvement Project) was declared a coordinated project requiring an Impact Assessment Report (IAR) in 2017. The Project IAR was subsequently prepared by Seqwater (the Proponent) and evaluated by the Coordinator-General in 2019. The Coordinator-General recommended the Project proceed, subject to conditions and recommendations. Since the publication of the Coordinator-General's evaluation report (CGER), the Proponent has applied for changes to the Project. A Coordinator-General's Change Report – Early Works was released on 4th November 2024 which regulates a package of site establishment works. Commencement of early works was also the commencement of the approved action under the EPBC Act and the Commonwealth Department of Climate Change, Energy, the Environment and Water has been notified accordingly.

Seqwater are proposing the following changes to the Project, which are subject to this request for project change:

- An increase in construction duration from a maximum of 2.5 years to a maximum of 5 years
- Design changes to the temporary cofferdam which necessitate haulage of additional construction materials to site and change the hydrological and ecological impacts of the Project – these refinements necessitate changes to an existing development approval for waterway barrier works
- Maintenance of the lake at 42 percent (%) of the Full Supply Level (FSL) (as opposed to the 5 % previously proposed).

The proposed project changes relate solely to the construction phase of the Project and there is no change to the proposed operation of the dam once commissioned as the design of the permanent dam remains unchanged.

The proposed design refinements will result in changed environmental effects which are the subject of this report and require the Coordinator-General's consideration. The key matters addressed by this report are:

- The environmental effects associated with prolonged construction timeframes, particularly noise, vibration and general impacts on amenity for nearby residents
- Traffic related impacts on sensitive receptors and the state-controlled road network associated with the prolonged construction timeframe and a greater overall traffic task
- Impacts on the aquatic ecology of Lake Macdonald and Six Mile Creek, including the management of safe downstream fish and turtle passage over the temporary cofferdam during spilling events.

Changes to existing Imposed Conditions are requested to clarify certain aspects of the approval and to streamline reporting and compliance activities. Seqwater also requests that the Coordinator-General assesses the proposed change to the design of the temporary coffer dam and amends the stated conditions for the waterway barrier works development approval which has already been granted, but which is not consistent with the stated conditions for this approval in the Coordinator-General's evaluation report and requires amendment in relation to the proposed design changes.

1.0 Introduction

1.1. Background

Lake Macdonald Dam Improvement Project (The Project) (formerly Six Mile Creek Dam Safety Upgrade Project) is a coordinated project for which an Impact Assessment Report (IAR) is required under the *State Development and Public Works Organisation Act 1971*. An IAR was submitted to the Coordinator-General on 30 April 2019. The Coordinator-General approved the Project IAR, and recommended the Project progress, subject to conditions and recommendations included in the Coordinator-General's Evaluation Report (CGER) released on 20 May 2019.

The preferred design option for the Project was initially delayed due to water security concerns, with drought declared in the region in 2020 and the construction program deferred to 2021 to avoid drawing down the lake to a level which would compromise water supply. During the procurement stage of the Project in 2020, it was determined that that project costs would be significantly higher than the approved $127 million budget.

Throughout 2021 and 2022, Seqwater worked with a Technical Review Panel to evaluate and short-list options for the Lake Macdonald Dam Improvement Project. In 2023, Seqwater worked to confirm the preferred design option and obtain the required state and federal approvals to proceed with the Project.

During design development, an opportunity was identified to enhance environmental, social and water security outcomes through a revised coffer dam design which retains a much higher lake level than that considered by the approved project.

The construction methodology for the Project has been updated since the IAR both in response to the final conditions of approval (which limit factors such as construction hours) and in response to design refinements, particularly for the temporary coffer dam. The refined construction methodology introduces changes to the approved project which require the Coordinator-General's consideration, including:

- an increase in construction duration from 2.5 to 5 years
- design changes to the temporary coffer dam
- maintenance of the lake at 42% of the Full Supply Level (as opposed to the 5% previously contemplated)

The proposed project changes relate solely to the construction phase of the Project and there is no change to the proposed operation of the dam once commissioned as the design of the permanent dam remains unchanged. The key project elements are unchanged and remain:

- staged and temporary lowering of the dam's water level
- construction of a temporary sheet pile coffer dam
- decommissioning and demolition of the existing spillway and embankments
- construction of a temporary concrete batching plant
- construction of the replacement spillway in the current dam footprint with new structure built to modern safety standards with the same capacity and area reconstruction of the right and left embankments.

1.2. The Project

The upgrade of Lake Macdonald Dam is required to achieve compliance with latest dam safety regulations and standards and ensures the dam can continue to function safely during extreme weather events. The Project is a priority within the Seqwater Dam Improvement Program as it currently has highest probability of failure of any Seqwater referable dam. The Project includes improving the spillway discharge capacity and earthquake stability while maintaining water supply security.

The design of the permanent spillway structure for the Project remains unchanged and has already been approved. The Project name was updated to better align with community and stakeholder engagement. This decision aims to simplify online access to project information, given that the water reserve is commonly known as Lake Macdonald.

Lake Macdonald Dam is primarily a water storage dam with no flood mitigation objectives; however, the dam provides some flood attenuation and the conditions of the Water Licence for the dam include environmental flow release requirements. The lake is also used as a recreation facility by the community, supporting rowing, paddling, fishing, and foreshore recreation, including the Noosa Botanic Gardens.

The Project comprises the removal of the existing spillway and embankments and the construction of a new spillway and embankments on weathered rock (**Figure 1**).

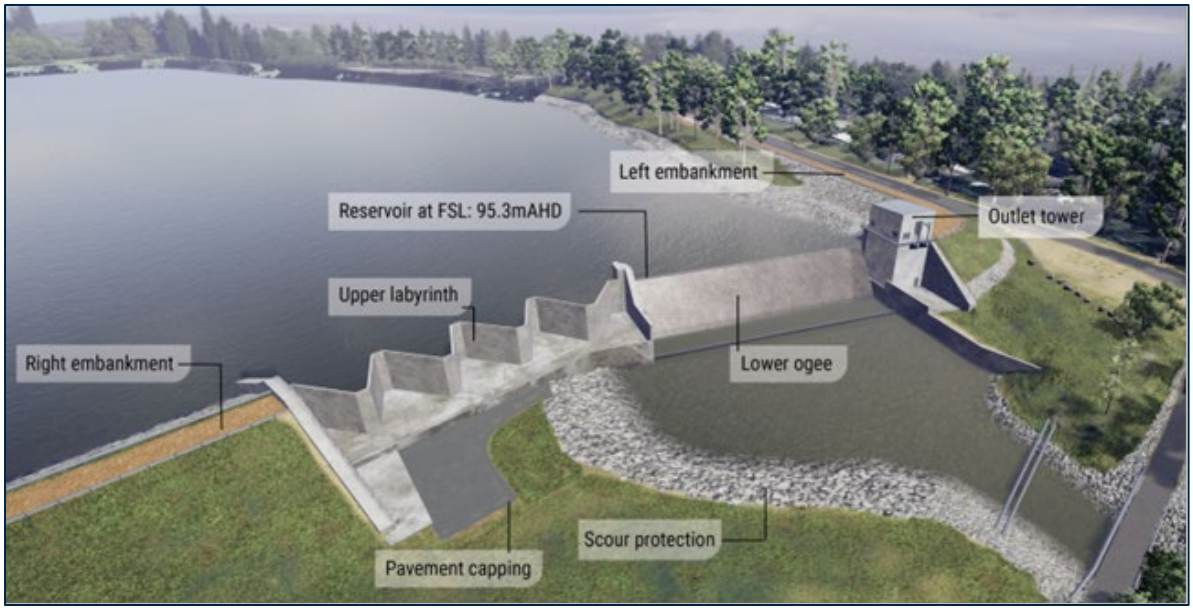


Figure 1: Upgraded Lake Macdonald Dam Design

This requires the lowering of water stored in Lake Macdonald to facilitate construction of a temporary cofferdam, demolition of the existing dam and construction of a replacement dam. The original temporary cofferdam design and location called for a lake lowering to 89.5m AHD (from the current full supply level (FSL) of 95.32m AHD), see **Figure 2**. Given the importance of the dam to the region's water supply needs, it is critically important that an adequate, reliable and efficient water supply is provided to meet increasing demand from the expected population growth in the Sunshine Coast region. The 2023

refined temporary cofferdam design enables a continuation of this critical water supply throughout construction. This design requires the water level to be lowered to RL 93.0m AHD (from the current full supply level (FSL) of 95.32m AHD) for the duration of construction — approximately 4 years (subject to inflows and weather). Lake Macdonald will continue to be relied upon for water supply during the construction period and operational related drawdowns will occur.

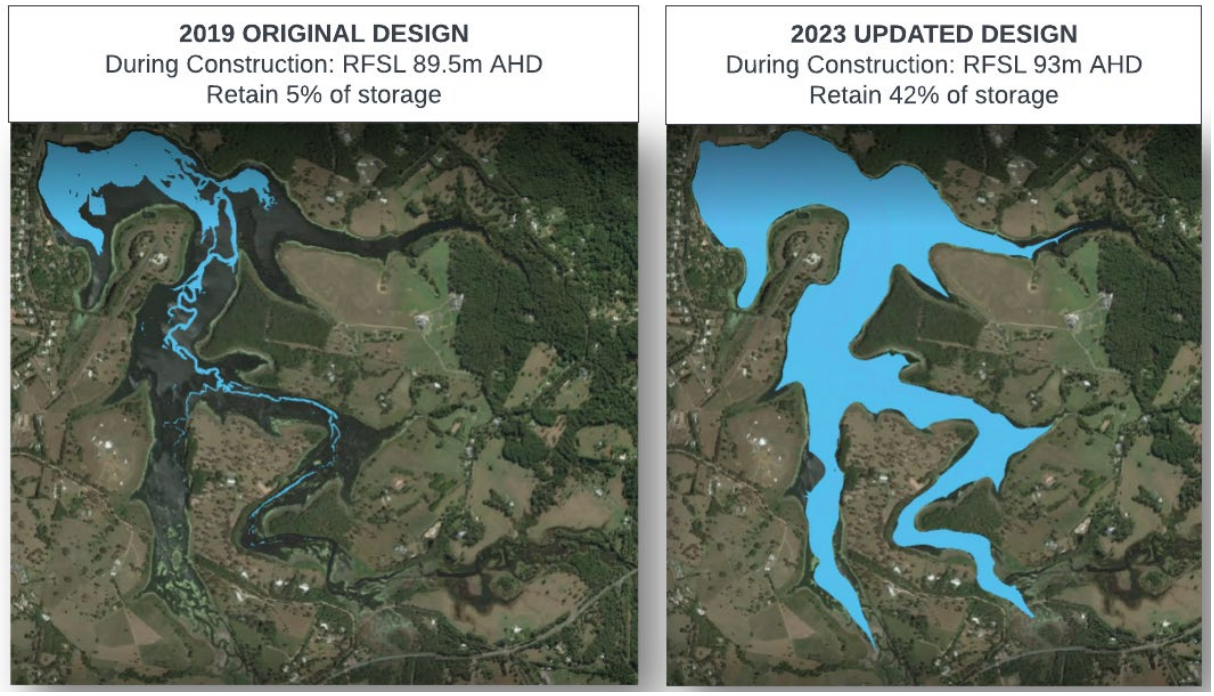


Figure 2: Lake Macdonald Dam Lowering

1.3. Change process

1.3.1. Assessment of project changes

Following the publication of the CGER, a project proponent may apply to the Coordinator-General to evaluate the environmental effects of the proposed change, its effects on the Project and any other related matters. The application for project change must contain:

- A description of the proposed change and its effects on the Project
- The reasons for the proposed change
- Adequate information about the proposed change and its effects on the Project to enable the Coordinator-General to make the evaluation.

In evaluating the proposed change to the Project, the Coordinator-General must consider:

- Nature of the proposed change and its effects on the Project
- The Project as currently evaluated under the CGER
- Environmental effects of the proposed change and its effects on the Project
- Any properly made submissions on the application for project change if public notification is required

- The draft IAR, any properly made submissions for the draft IAR and any other material to the extent the Coordinator-General considers it is relevant to the proposed change and its effects on the Project.

1.3.2. Public notification

The Coordinator-General will determine whether or not Seqwater will be required to publicly notify the Proposed Changes and their effects on the Evaluated Project. If required, public notices inviting submissions on the request will be published in local, regional and state newspapers.

The consultation period is determined by the Coordinator-General and stated on the public notification. If the request is publicly notified, any person, company or organisation may make a submission on the request. Agency consultation is typically undertaken by the Office of the Coordinator-General in parallel. A 'properly made' submission:

- Is made in writing to the Coordinator-General;
- Is received on or before the deadline for submissions;
- States the name and address of each submitter;
- Is signed by each submitter; and
- States the grounds of the submissions and the facts and circumstances relied on in support of the grounds.

1.4. Reasons for project changes

1.4.1. Design Process

The preferred design option for the Project Commencement of the Project was initially delayed due to water security concerns, with drought declared in the region in 2020 and the construction program deferred to 2021 to avoid drawing down the lake to a level which would compromise water supply.

During the procurement stage of the Project in 2020, it was determined that that project costs would be significantly higher than the approved $127 million budget.

Throughout 2021 and 2022, Seqwater worked with a Technical Review Panel to evaluate and short-list options for the Lake Macdonald Dam Improvement Project. In 2023 and 2024, Seqwater worked to confirm the preferred design option and obtain the required state and federal approvals to proceed with the Project.

1.4.2. Water Security

One of the key benefits of the refined project is that the Noosa Water Treatment Plant will remain operational during construction to ensure water security to the region. The approved Project relied on alternative water supply arrangements to supply the treatment plant during construction, including obtaining water from the Mary River and through the South East Queensland water grid's northern pipeline interconnector.

Lowering the lake in accordance with the conditions of the approved project (down to around 5% capacity) is almost five times more likely to lead to medium level water restrictions than the proposed project which maintains the lake level at 42%.

1.4.3. Enhanced Environmental Outcomes

The approved Project would have lowered the lake level to around 5% of the full storage level of the impoundment, requiring salvage of a substantial proportion of the fish and turtle biomass within the Lake and impacting the aquatic ecosystem more broadly. The aquatic species salvage operation is not without risk, although likely mortality is difficult to predict.

The refined temporary cofferdam design is expected to significantly reduce the environmental effects of the Project, with retention of 42% of the full supply volume and consequently, protection of the aquatic environment. By retaining 42% of the full supply volume in the Lake, a variety of lake depths and aquatic habitats will be maintained during construction, and it is expected that fisheries values within the Lake itself will subject to greatly reduced impacts when compared to the original project.

1.5. Status of Approvals

1.5.1. Commonwealth Approvals

The Project was approved under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) (subject to conditions) by a delegate of the Commonwealth Environment Minister on 7 September 2019. The EPBC approval has effect until 30 June 2035. The EPBC approval includes conditions which:

- Limit the extent of construction areas and the clearing footprint
- Restrict the period during which initial lake drawdown can occur, to protect the breeding ecology of MNES
- Preparation of an Adaptive Management Plan (AMP) primarily to manage lake drawdown
- Development of an Aquatic Fauna Salvage and Relocation Management Plan
- Require a Significant Residual Impact Assessment to be completed following the completion of lake drawdown and associated monitoring.

The AMP (incorporating an Aquatic Salvage and Relocation Plan) was approved by DCCEEW on 23 December 2020. The AMP has been updated to ensure that management measures are appropriate to the 42% drawdown scenario associated with the refined project. The updated AMP was reviewed by an independent expert then submitted to DCCEEW for approval on 10th October 2024. DCCEEW was notified of the commencement of the approved action on 6th November 2024.

1.5.2. State Approvals

1.5.2.1. Waterway Barrier Works

The Project received approval (development permit, operational work for waterway barrier works SARA Ref: 2009-18658 SDA) (WWBW Approval) on 9 April 2021 for the Six Mile Creek Dam Upgrade and a temporary cofferdam which will be in place for the duration of construction (Waterway Barrier Works Approval). The conditions of approval require that:

- The waterway barrier(s) and any associated infrastructure including, but not limited to intakes, walls, access structures, pipe works, spillways and dissipation devices, except for the emergency release outlet, are to be constructed and maintained to avoid fish injury, mortality and/or entrapment

- Fish passage provisions are retrofitted to Gympie Weir to improve fish passage at the catchment scale, given that upstream fish passage is not to be provided at Six Mile Creek Dam.

The WWBW approval requires amendment to allow the refined cofferdam design to be constructed in place of the design approved (noting that the design approved under the WWBW Approval was not the design required to under stated conditions of the CGER relating to waterway barrier works (Appendix 3, Schedule 1, Part A of the CGER). Following the Coordinator-Generals assessment of the Project changes, Seqwater will submit a change application to the State Assessment and Referral Agency (SARA) to amend the WWBW Approval to align with any new or updated stated conditions for the change to the design.

Division 4 of the State Development and Public Works Organisation Act 1971 (SDPWO Act) sets out the relationship with the Planning Act in relation to the proposed changes. To the extent the Coordinator-General's change report relates to the development to be assessed under the change to the Waterway Barrier Works Approval, and the Coordinator-General's change report is issued before a final decision on the. change to the WWBW Approval, the decision making period (if it has commenced) for the WWBW Approval must re-start on the date the change report is given to SARA, and otherwise the decision making period may not commence until the change report is given to SARA.

1.5.2.2. Environmentally Relevant Activities

The Project requires clay for construction activities, which will be sourced from the site itself. In accordance with the Environmental Protection Act 1994 (EP Act), the Contractor has obtained the relevant Environmental Authority (EA) (P-EA-100725517) for Environmentally Relevant Activity (ERA) 16 Extractive and screening activities 2(a). The EA becomes effective from 2 February 2026.

1.5.2.3. Status of CGER

The Coordinator-General's Evaluation Report (CGER) was released on the 20 May 2019, with a new lapse date of 20 May 2025 stated on 15 May 2023. The CGER includes conditions of approval and recommendations for decision makers involved with subsequent approval processes, as follows:

- Imposed conditions - conditions imposed by the Coordinator-General under section 54B of the SDPWO Act.
- Stated conditions – conditions which must be included by the Assessment Manager on subsequent approvals under *the Planning Act 2016* and *Environmental Protection Act 1994*. Note that that additional conditions of approval can be included by the Assessment Manager where they are not inconsistent with the stated conditions.
- Recommendations – recommended conditions for consideration by the Commonwealth Minister for the Environment in making a decision on the proposed action under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.5.2.4. Change reports

A Coordinator-General's Change Report was released on 4th November 2024 which amended the Imposed Conditions for the Project to allow the commencement of a package of pre-construction activities, referred to as Early Works. The Early Works commenced on 6/7 November 2024 and include the following activities:

- Construction activities between the approved hours of operation between 6:30 am to 6:30 pm Monday to Friday and 6.30 am to 4:00 pm Saturday.
- Limited vegetation removal and/or trimming and earthworks on Seqwater land to prepare stockpile areas and laydown areas for construction materials and equipment.
- Limited delivery of rock and aggregate materials for the purpose of the Early Works.
- Installation of pumps and pipes to enable lake drawdown.
- Establishment of site offices.
- Construction of internal access roads.

1.5.3. Local Government Approvals

1.5.3.1. Material Change of Use

The CGER included Stated Conditions for a Material Change of Use for “concrete batching” under the Noosa Plan 2006. As the concrete batch plant is not required within the first twelve months of construction activities, an application to Noosa Shire Council (NSC) has not been made.

Subsequent to the CGER, the planning scheme was updated to the Noosa Plan 2020 which has different assessment requirements (levels of assessment) for specific land uses within designated zones. When assessed against the Noosa Plan 2020, the proposed concrete batch plant does not require a development approval for material change of use. This has been confirmed with NSC.

2. Approved project

2.1. Project Footprint

The Project construction footprint is located on Lot 118 SP305289 & Lot 1 RP800331 which are owned by Seqwater. The project location is presented in **Figure 3**.

The CGER approved project footprint and clearing boundary is presented **Figure 4**. Both the CGER and the Project's approval under the EPBC Act defined a maximum clearing extent for the overall project which includes around 3.5ha of vegetation, although neither the CGER nor the EPBC Approval include conditions which specify clearing limits for specific matters.

2.2. Project Design

2.2.1. Temporary Cofferdam

The proposed temporary cofferdam will comprise a single row of sheet piles driven into the upstream slope of the existing spillway embankment, with:

- A low flow crest, no lower than RL 89.5 m AHD, that will channel low flows through the construction site.
- An upper flow level, no lower than RL 90.5 m AHD, that is designed to overtop during a flood event
- A no-overflow level, no lower than RL 92.0 m AHD, to protect embankment excavations

The CGER approved a concept cofferdam design composed of sheet piles and rock fill at a level of RL89.5m AHD. This required drawing down the lake to approximately 2-5% of its FSL.

Table 1 - lists the cofferdam drawings listed in Stated Condition 2(b), Appendix 3, Schedule 1, Part A of the CGER.

Table 2 - lists the cofferdam drawings stated in condition 4 of the WWBW Approval (2009-18658 SDA) issued on 9 April 2021. It should be noted that these drawings are more recent than the 2017 drawings referenced in Stated Condition 2(b) of the CGER. The 2017 drawings were not imposed as conditions of the Waterway Barrier Works Approval by SARA.

Table 1: CGER stated condition cofferdam drawings

Temporary Cofferdam
Upgrade concept design 2017 – Site layout during construction, AECOM, 05/10/2017, 60542495-103, Revision 0
Upgrade concept design 2017 – Temporary works spillway demolition plan for working platform, AECOM, 05/10/2017, 60542495-107, Revision 0
Upgrade concept design 2017 – Temporary works sheetpile long section, AECOM, 05/10/2017, 60542495-109, Revision 0
Upgrade concept design 2017 – Temporary works working platform sections, AECOM, 05/10/2017, 60542495-110, Revision 0.

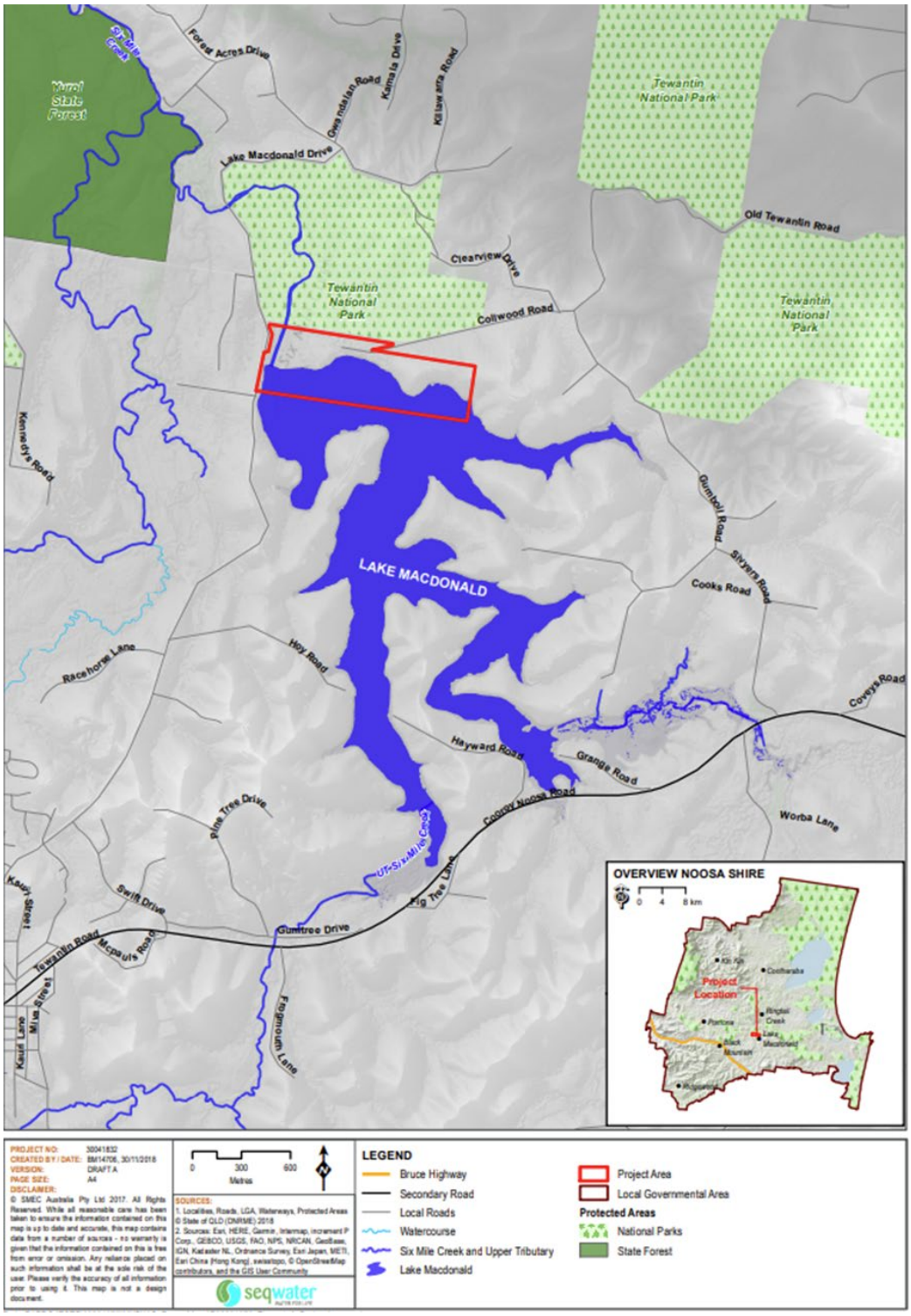


Figure 3: Project Location

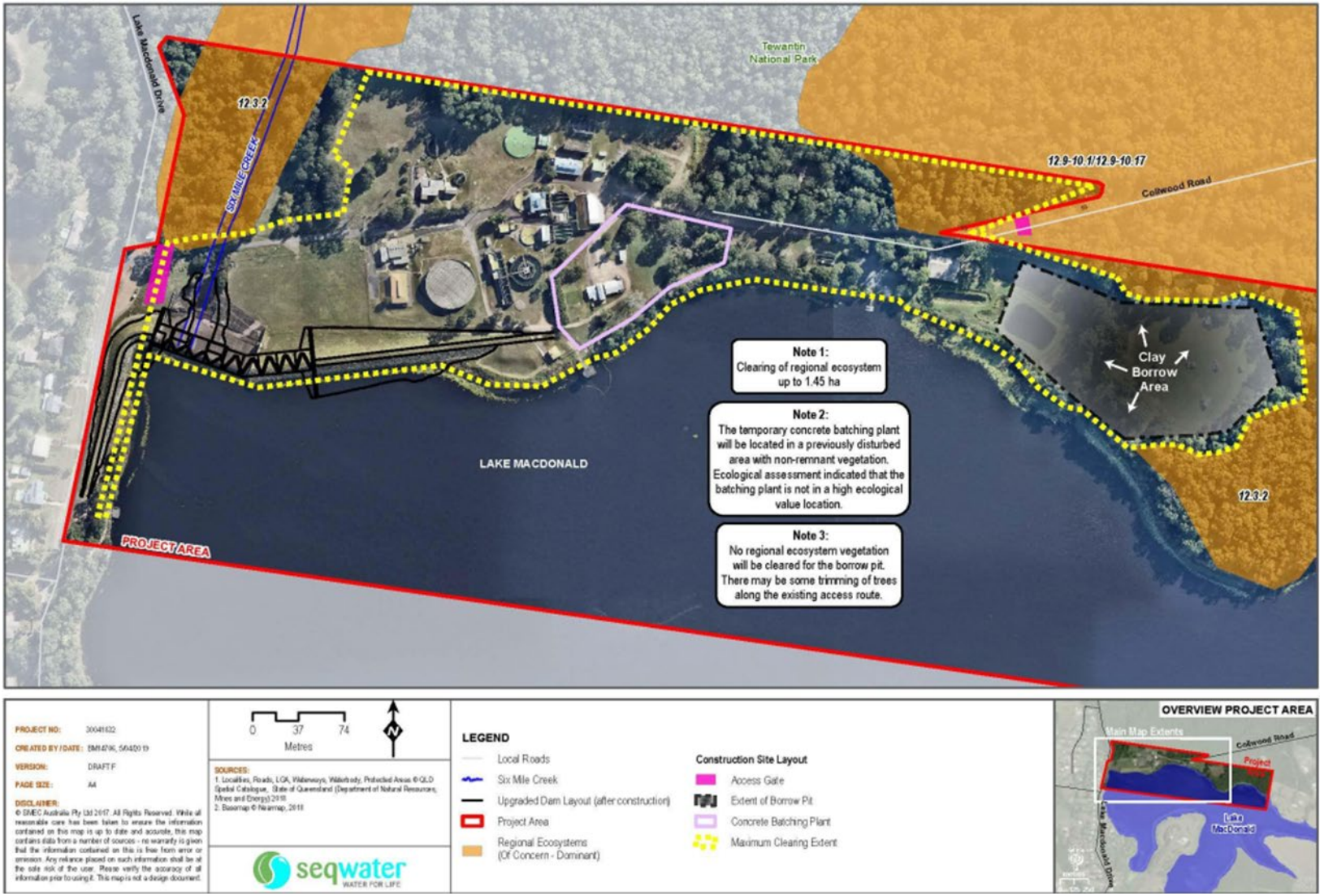


Figure 4: Approved Project Footprint

Table 2: WWBW Approval cofferdam drawings

Temporary Cofferdam
Temporary Sheetpile Plan, prepared by Aecom, dated 03/04/2020, referenced TMP-250, revision B
Temporary Sheetpile Sections – Sheet 1, prepared by Aecom, dated 03/04/2020, referenced TMP-251, revision B as submitted on 17/11/2020
Temporary Sheetpile Longitudinal Section, Control Point 1 to 17, prepared by Aecom, dated 03/04/2020, referenced TMP-254, revision B
Temporary Sheetpile Longitudinal Section, Control Point 17 to 23, prepared by Aecom, dated 03/04/2020, referenced TMP-255, revision B
Temporary Mobile Flood Barriers and Working Platform Extension, Plan, prepared by Aecom, dated 03/04/2020, referenced TMP-300, revision B
Temporary Mobile Flood Barriers Long Section & Details, prepared by Aecom, dated 03/04/2020, referenced TMP-301, revision B

2.2.2. Main Spillway

The labyrinth spillway structure will comprise of new foundations of secant pile cells filled with mass concrete and socketed into bedrock. The spillway structure above ground will be a concrete crest control structure consisting of a dual height labyrinth weir as shown in Appendix D. The dual height layout of the spillway provides a lower level weir for flows up to 1:100 Annual Exceedance Probability (AEP) floods, which will closely mirror the way the current ogee weir passes these events. A wider upper level weir section will provide for larger flood flows. The spillway, in total, has been sized to pass a Probable Maximum Precipitation Flood (PMPF) event (100% Acceptable Flood Capacity).

Proposed changes to the Project will not increase the approved footprint or involve additional land parcels.

The Project will involve the removal of the existing dam structures and construction of a dual-height labyrinth weir, reconstructed left and right embankments, and a new saddle dam to the east of the dam wall and Noosa Water Treatment Plant (WTP) along Collwood Road. Preliminary designs were assessed in the CGER, with subsequent detailed designs submitted to SARA as part of a development application for operational works waterway barrier works.

Table 3 - shows a comparison of the key parameters of the existing dam and the upgraded dam structures.

Table 3: Key parameters of the existing and upgraded dam

	Existing Structure	Upgraded Structure
Spillway type	Uncontrolled fixed ogee crest	Uncontrolled dual height labyrinth
Spillway description	Concrete slab broad crest weir	Mass concrete dual height, multiple cycle labyrinth weir
Spillway crest elevation (low level)	Notch/initial: RL 95.32 m AHD Full width: RL 95.35 m AHD	Initial: RL 95.32 m AHD Full width: RL 95.40 m AHD

	Existing Structure	Upgraded Structure
Spillway crest elevation (high level)	Not applicable	RL 97.1 m AHD
Stilling basin floor elevation	RL 83.5 m AHD	RL 84.0-86.0 m AHD
Energy dissipation method	Plunge pool/stilling basin	Plunge pool/stilling basin
Full supply level	8,018 ML	8,018 ML
Dead storage	RL 87.7 m AHD	RL 87.7 m AHD
Historical No Failure Yield	7,118 ML/y	7,118 ML/y
Maximum depth	10.5 m	10.5 m
Area inundated at FSL	260 ha	260 ha

The CGER approved the construction of a permanent dam incorporating a hybrid ogee crest and labyrinth spillway within Six Mile Creek to be undertaken generally in accordance with the approved plan: Dam safety upgrade spillway General plan and sections, Seqwater, 12/03/2019, SK-1000, Revision A.

However, designs were subsequently progressed and submitted as part of the WWBW Approval process. **Table 4** - lists the drawings stated in the SARA decision notice (2009-18658 SDA) dated 9 April 2021.

Table 4: Main spillway drawings approved by SARA

Six Mile Creek Dam
Dam General Arrangement, prepared by Aecom, dated 03/04/2020, referenced GEN-011, revision C
Spillway General Arrangement, prepared by Aecom, dated 03/04/2020, referenced GEN-012, revision C
Spillway Typical Sections, prepared by Aecom, dated 03/04/2020, referenced SPL-102, revision E
Spillway Dividing Wall Concrete Details – Sheet 1, prepared by Aecom, dated 03/04/2020, referenced SPL-140, revision C
Creek Erosion Protection Final Placement Plan, prepared by Aecom, dated 14/04/2020, referenced SPL-701, revision D
Creek Erosion Protection Sections – Sheet 1, prepared by Aecom, dated 14/04/2020, referenced SPL-702, revision D
Creek Erosion Protection Sections – Sheet 2, prepared by Aecom, dated 14/04/2020, referenced SPL-703, revision D

Along with the main spillway additional permanent approved infrastructure includes erosion protection, left and right embankments, which are described below.

2.2.2.1. Stilling Basin Erosion Protection

The labyrinth weir performs as a straight drop spillway and the issuing flow plunges onto the downstream apron/plunge pool, with energy dissipation occurring in a similar way to that of a plunge basin. The spillway arrangement includes a base slab that extends 2 m and 3 m downstream of the

lower level and upper level labyrinth cycles, respectively, providing space for the water flow (jet) to impinge upon the concrete slab for lower flows before the tailwater levels rise.

The base slab for the labyrinth is at an elevation of RL 89.5 m AHD with the downstream river channel bed at approximately RL 84 m AHD. An intermediate stilling basin was incorporated on the concrete spillway cell structure at base RL 86.0 m AHD to allow for the energy dissipation of low flows before being directed into Six Mile Creek.

2.2.2.2. Right Embankment

The right embankment will be at a dam crest level of RL 99.5 m with embankment slopes of 2.5H:1V.

2.2.2.3. Left Embankment (along Lake Macdonald Drive)

The left embankment will be at a dam crest level of RL 99.5 m with embankment slopes of 2H:1V and a crest width of 4m.

2.2.2.4. Saddle Dam

A saddle dam will be constructed to the east of the existing dam along the alignment of Collwood Road, between the Noosa WTP and Camp Cooroora, to prevent flood water discharging from the lake at this location during an extreme flood event. The saddle dam will be built on an existing road alignment and so will be trafficable.
The saddle dam crest will be a maximum of RL 99.5 m AHD and will incorporate the following key design features:

- Base width of approximately 3 m at the residual soil or weathered rock foundation level.
- A 1 m wide filter trench through the centre of the earth fill core that extends approximately 2.5 m below the existing ground level.
- A downstream fine filter outlet.
- A downstream face with a 3H:1V slope that is covered by topsoil and grass for erosion protection.
- An upstream riprap face, with underlying filter, at slope of 1V:2.5H

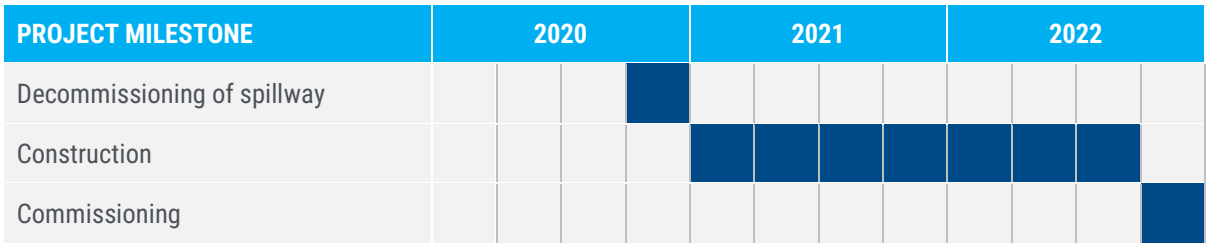
2.3. Construction Activities

2.3.1. Construction program

The CGER approved a construction program spanning 2.5-3 years and is summarised in the high-level sequencing below.

Table 5: Construction program at time of IAR preparation

PROJECT MILESTONE	2020				2021				2022			
Contract award and early works												
Lake drawdown												
Cofferdam Construction												



2.3.2. Lake drawdown

The CGER conditionally approved the drawdown of the lake to 89 m AHD. Full Supply Level (FSL) in Lake Macdonald is at an elevation of RL 95.3 m AHD. The report acknowledged that the lake drawdown would result in temporary removal of around 97 per cent of the water in Lake Macdonald, and a short-term increase in water flow downstream in Six Mile Creek.

The coffer dam will then maintain the maximum water level at RL 89.5 m AHD for 16-24 months during construction of the new spillway and embankments. This equates to retaining up to 226 ML (2.8% of capacity) of water in Lake Macdonald for 1-2 months, followed by up to 412 ML (5.0% of capacity) of water for the remaining construction period. Based on the program outlined in Section 2.3.1, drawdown of Lake Macdonald was to begin in May 2020.

2.3.3. Hours of operation

The CGER considered standard hours of operation during the Project as 6:30 am to 6:30 pm Monday to Friday and 6.30 am to 4 pm on Saturdays, with no work scheduled for Sundays or public holidays. There are no conditions imposed by the Coordinator-General which limit construction hours for the Project, although there was an intention to limit the hours of operation of the concrete batching plant via stated conditions which would sit on the material change of use approval from NSC. This approval is no longer required due to revisions to the planning scheme since the release of the CGER.

It was recognised that there would be the need for extended work hours from time to time for critical construction activities, such as demolition of the spillway where failure to complete quickly could risk public safety. It was envisaged that prior to these activities outside of normal work hours, there would be an assessment of the works and mitigation measures proposed to minimise the impact on surrounding residents, particularly with regards to noise, vibration and light impacts – and engagement with surrounding residents prior to the commencement of works. Noise and Vibration Impacts will be managed in accordance with a Noise and Vibration Management Plan which requires the Coordinator-General's approval prior to the commencement of construction.

2.4. Operation

After construction, the operation of the upgraded dam will not differ from the operation of the existing ungated dam. Following completion of construction, water will continue to be drawn from Lake Macdonald via the existing intake structure.

3. Changes to the Project

3.1. Design Changes

3.1.1. Refined Coffer Dam Design

The temporary cofferdam has been designed by experienced dam engineers, EDG Consulting, to meet both the Queensland State Dam Regulator guidelines and ANCOLD guidelines, as appropriate. The proposed temporary cofferdam will follow the guidelines acceptance criteria, in particular the Guidelines on Safety Assessments for Referable Dams.

The cofferdam will be constructed across the reservoir to allow subsequent removal and replacement of the embankments and spillway. The final detailed design for the cofferdam is at 90% and is not expected to differ significantly from that described in Appendix A. In essence, the refined cofferdam design delivers improved water security outcomes for the region and avoids or mitigates adverse environmental impacts on water, fauna and flora and the community. A summary of the changes to the temporary cofferdam scope is included in **Table 6**.

Table 6: Summary of changes to temporary cofferdam design plans

CGER - 2017	WWBW Approval - 2020	Updated Plans - 2014
Upgrade concept design 2017 – Site layout during construction, AECOM, 05/10/2017, 60542495-103, Revision 0	Temporary Sheetpile Plan, prepared by Aecom, dated 03/04/2020, referenced TMP-250, revision B	General Arrangement Drawing B01179-03-DWG-002 Rev_0 90% design - 12/09/2024 CD Cross-Section and Spillway Berm Drawing B01179-03-DWG-006 Rev_0 90% design - 23/05/2024 See Appendix A
Upgrade concept design 2017 – Temporary works spillway demolition plan for working platform, AECOM, 05/10/2017, 60542495-107, Revision 0	Temporary Sheetpile Sections – Sheet 1, prepared by Aecom, dated 03/04/2020, referenced TMP-251, revision B as submitted on 17/11/2020	
Upgrade concept design 2017 – Temporary works sheetpile long section, AECOM, 05/10/2017, 60542495-109, Revision 0	Temporary Sheetpile Longitudinal Section, Control Point 1 to 17, prepared by Aecom, dated 03/04/2020, referenced TMP-254, revision B	Complete Longitudinal Section Drawing B01179-03-DWG-003 Rev_0 90% design - 23/05/2024 See Appendix A
Upgrade concept design 2017 – Temporary works working platform sections, AECOM, 05/10/2017, 60542495-110, Revision 0.	Temporary Sheetpile Longitudinal Section, Control Point 17 to 23, prepared by Aecom, dated 03/04/2020, referenced TMP-255, revision B	

The general arrangement of the proposed temporary cofferdam, stilling basin and working platform is shown in **Appendix A – Revised Coffer Dam 90% design drawings**.

The design components are detailed on the Drawings and includes the following:

- Right Hand Abutment
- Left Hand Abutment
- Central Cofferdam
- Spillway
- Downstream Overtopping Protection
- Stilling Pond

These elements are described below.

Right Hand Abutment

The Right-Hand Abutment is a cantilevered sheet pile at crest elevation RL 95m with a rockfill working platform on its downstream side. Sheet piles will be driven through alluvial soils and to practical refusal in competent residual soil or bedrock.

Left Hand Abutment

The Left-Hand Abutment is an L-shaped rockfill platform at crest elevation RL 95m.

Central Cofferdam

The proposed design comprises of two parallel and offset rows of sheet piles with crest at elevation RL93.5m, with the space between the sheet piles backfilled with rockfill or coarse gravel and topped with rock bags for scour protection. Horizontal tie rods and walers near the top of the sheet piles connect the offset rows together. Sheet piles will be driven through alluvial soils and to practical refusal in competent residual soil or bedrock.

Floods will overtop the Central Cofferdam. The Central Cofferdam has been designed for overtopping during the flood events using Downstream Overtopping Protection for scour protection and a Stilling Pond at the toe. During flood events the Central Cofferdam does not require any operational intervention beyond monitoring. Up to the 1:100 Average Recurrence Interval (ARI) event, the Left and Right Abutments (higher sections) prevent water flanking the cofferdam. Beyond the 1:100 ARI event, the Left and Right Abutments (higher sections) will overtop. Scour protection at the abutments will be provided.

Spillway

The proposed Spillway is at elevation RL93.0m and is 10m in width; it is a section where the crest of the sheet piles is lower than the remainder of the Central Cofferdam. Under non-flood conditions, the lake level will self-regulate at a maximum of RL93.0m using the Spillway. Inflows will pass through the Siphon system and when this siphon system capacity is reached any further increases in inflow will overtop the Spillway, and downstream Overtopping Protection into the Stilling Pond.

The temporary cofferdam is also designed with a low flow slot to facilitate ongoing management of lake levels. The low flow slot will be 10m wide and cut to RL93.0m, the slot will be controllable via stoplogs (or similar).

Downstream Overtopping Protection

The Downstream Overtopping Protection is required to dissipate energy and prevent scour of the downstream alluvial soils. The top of the Downstream Overtopping Protection will be just below the waler on the Central Cofferdam. The typical geometry comprises from bottom up:

- Base lining of 200mm diameter maximum size rock fill.
- Remainder of Overtopping Protection constructed entirely of 8 tonne rock filled bags, flat placed with an offset pattern for interlock at typical slope of 3 horizontal to 1 vertical.
- A nominal flat bench at the top

Stilling Pond

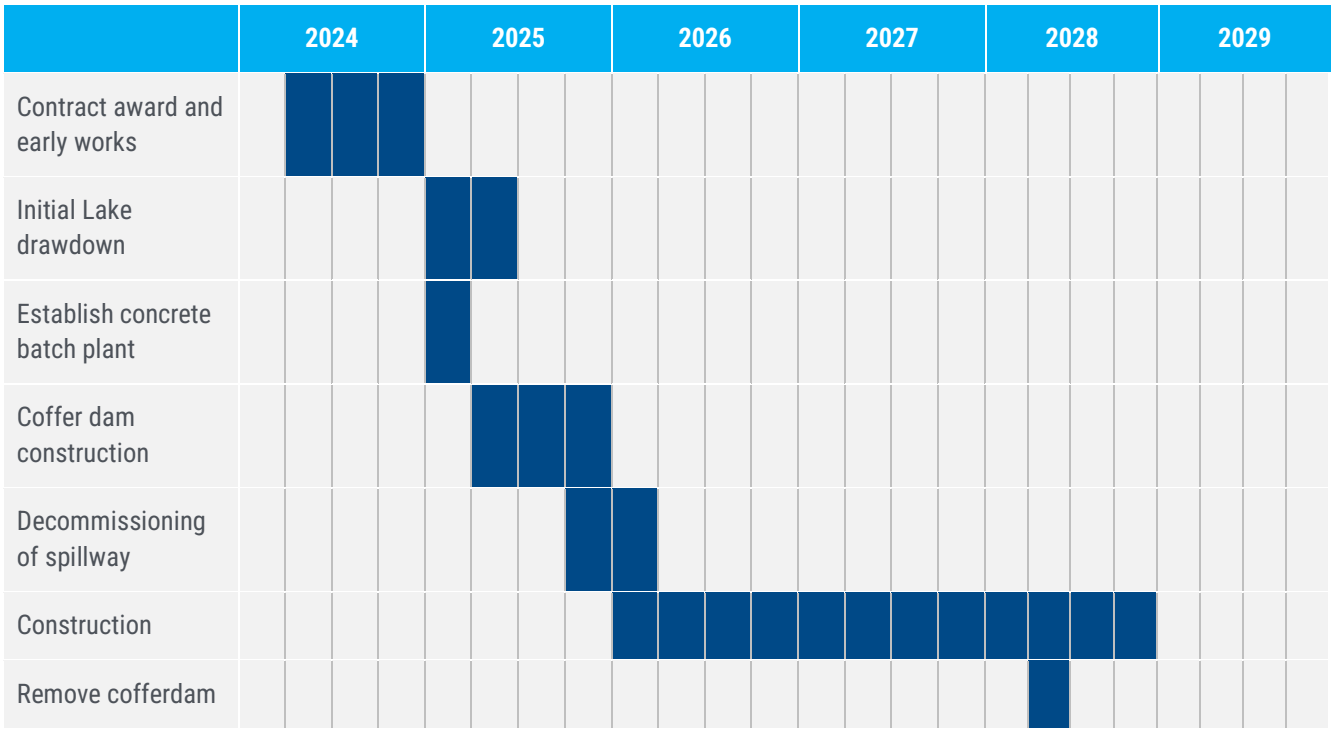
The Spillway will be directed into a temporary Stilling Pond with an operational water level of RL88.5m at the toe of the cofferdam. The proposed Stilling Pond has a downstream crest of RL89.5m

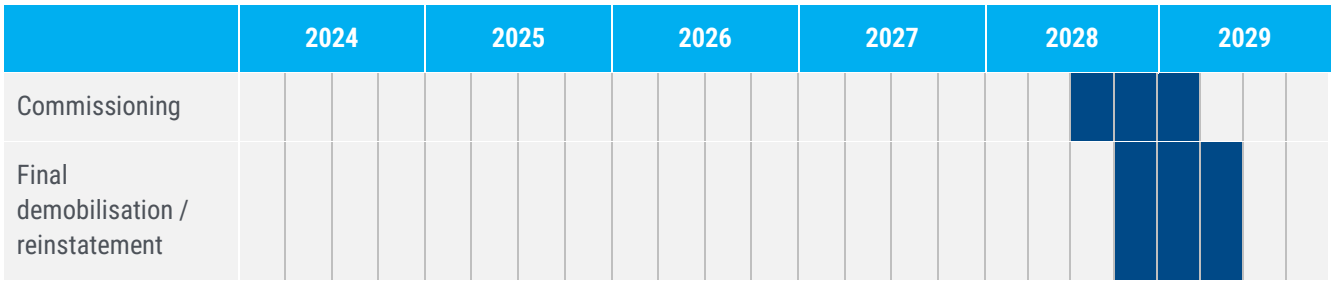
3.2. Changes to Construction Methodology

3.2.1. Duration of Construction Program

The Projects IAR envisaged a construction timeframe of between 2.5 and 3 years, inclusive of contract award and early works, with lake drawdown commencing in the second quarter of 2020. The project is now working towards a lake drawdown commencement date of 1st March 2025 with a package of site mobilisation activities scheduled for Q4 2024 as shown below in **Table 7**. The overall construction timeframe for the Project is expected to be around 4.5 years subject to climatic factors.

Table 7: Current Project Program





3.2.2. Lake Drawdown

The approved Project allows the Lake to be drawn down to a level of 89.5m AHD (from the current FSL of 95.32m AHD), The refined temporary cofferdam design enables a continuation of this critical water supply throughout construction. The proposed change is to lower the Lake water level to RL 93.0m AHD (from the current full supply level (FSL) of 95.32m AHD) for the duration of construction — approximately 5 years (subject to inflows and weather).

3.2.3. Hours of operation

The IAR described the standard hours of operation for the Project as 6:30 am to 6:30 pm Monday to Friday and 6.00 am to 4.00 pm on Saturdays, with no work scheduled for Sundays or public holidays. The IAR noted that there would be the need for extended work hours from time to time for critical construction activities, such as demolition of the spillway where failure to complete quickly could risk public safety.

The IAR included a preliminary noise impact assessment which identified a range of activities which were likely to occur outside of the standard hours of operation, including:

- Lake drawdown – Section 11.5.1 of the IAR notes that this may require pumps to operate for 24 hours a day.
- Spillway excavation (demolition) - Section 11.5.1 of the IAR notes that this is likely to occur outside standard operating hours.
- Spillway construction - Section 11.5.1 of the IAR notes that this is likely to occur outside standard operating hours.
- Concrete batch plant – Section 2.4.8 of the IAR noted that there was likely to be the need for extended work hours from time to time for critical mass concrete pours.

The construction noise modelling presented in the IAR was based on two scenarios: "*standard hours*", that is, core construction work conducted during the time period 6.30 am to 6.30 pm, and "*non-standard hours*", typically reduced intensity, as-required work outside of the standard hours.

With design maturation and development of the Project's construction program in consultation with the construction contractor, specific timeframes for construction activities to be undertaken outside of standard working hours have been identified. The Project will schedule as many activities as possible within the approved standard hours of operation detailed in Section 2.3.3 however it is critical for the Project that certain works be conducted outside of standard hours including:

- Lake drawdown over a period of 43 days, 24/7
- Spillway and dam crest demolition (High impact approx. 5 weeks 24/7)

- Concrete batching and pouring (Low impact ongoing through to project completion).

The timing of the cofferdam construction and spillway demolition is critical to ensure works are completed during times of expected low-flows and to maximise the safety of workers during the demolition period. The approved project only required construction of a single Sheet pile structure with some rockfill embankments designed to maintain the lake water level at a maximum of RL 89.5m. Comparatively the refined cofferdam design comprises two parallel and offset rows of sheet piles with crest at elevation RL93.5m, with the space between the sheet piles backfilled with rockfill or coarse gravel and topped with rock bags for scour protection. Rock bags will also form a downstream spillway to prevent scouring. Horizontal tie rods and walers near the top of the sheet piles connect the offset rows together. Sheet piles will be driven through alluvial soils and to practical refusal in competent residual soil or bedrock.

The demolition of the existing spillway and excavation of adjacent embankments needs to be done in a controlled and timely manner such that the dam safety risk associated with potential catchment inflows or flood events is reduced as quickly as practical. For safety and logistical reasons, the demolition works must be completed over as short a period as possible, necessitating 24/7 works for a period of approximately 6-8 weeks.

To enable commencement of concrete pours early in the day, the batch plant will need to be started in the early hours of the morning from time to time.

Table 8 outlines the standard hours of operation as previously assessed and proposed non-standard working hours required to achieve the construction schedule for the Project.

Table 8: Proposed hours of operation

Work Period	Time
Standard hours	Monday – Friday 6:30 am to 6:30 pm Saturday 6:30 am to 4:00 pm
Non-Standard hours – day/evening	Monday – Friday 6:30 pm to 10:00 pm Saturday 4:00 pm to 10:00 pm Sunday All day
Non-Standard hours – night-time	Monday – Sunday 10:00 pm to 6:30 am

Table 9 summarises each construction scenario and the proposed working hours required to meet the construction schedule.

Table 9: Summary of work activities and construction scenarios for the noise assessment

Construction Scenario (CS)	Activity	Proposed Period			Change since IAR
		Day	Evening	Night	
CS1	Clearing and grubbing	Yes	No	No	No change.
CS2	Site gravel road construction	Yes	No	No	No change.

Construction Scenario (CS)	Activity	Proposed Period			Change since IAR
		Day	Evening	Night	
CS3a	Cofferdam vibration sheet piling	Yes	No	No	No change.
CS3b	Cofferdam impact sheet piling	Yes	No	No	No change.
CS3c	Cofferdam rock fill	Yes	No	No	No change.
CS4	Reservoir lowering	Yes	Yes	Yes	No change. IAR noted pumps may be required to operate for 24 hours a day.
CS5a	Dam crest demolition & excavation	Yes	Yes	Yes	No change. IAR described that this activity was likely to occur during reduced activity non-standard hours.
CS5b	Spillway demolition & excavation	Yes	Yes	Yes	No change. IAR described that this activity was likely to occur during reduced activity non-standard hours.
CS6a	Concrete batching & pouring activities	Yes	No	Yes	No change. IAR identified that time critical concrete pours were likely to occur outside of standard operating hours.
CS6b	Other dam construction activities	Yes	No	No	No change.

3.3. Traffic and Transport

3.3.1. Haulage Routes

The IAR described several potential access routes for construction traffic, including direct access to the Project site will be via public roads, specifically the western access road (Lake Macdonald Drive) and eastern access roads (via Cooroy Noosa Road, Sivyers Road, Gumboil Road, and Collwood Road).

Lake Macdonald Drive has been confirmed as the access route for construction traffic for the Project. This road is a critical corridor for transporting construction materials, machinery, and workers to and from

the site. Lake Macdonald Drive connects to Elm Street for distributions north to/from the Bruce Highway and east/west via Cooroy - Noosa Road. The heavy vehicle routes are as follows:

- Lake Macdonald Drive controlled by NSC from Elm Street to the site i.e. Collwood Road.
- Elm Street / Cooroy Connection Road which is State Controlled Road 145 from Lake Macdonald Drive to the Bruce Highway (10A) Exit 237 (Cooroy Bypass northern interchange).
- Diamond Street / Tewantin Road / Cooroy - Noosa Road which is section State Controlled Road 142 from Elm Street past Sivyers Road towards Noosa.

Construction vehicles are *not* permitted to travel via the following routes:

- Eastern light vehicle access routes, particularly the Sivyers Road and Collwood Road (E) access route.
- Bruce Highway interchange link to Myall Street as there are access and capacity concerns with regards to the Myall Street / Elm Street, and Elm Street / Diamond Street priority intersections.

There are three local quarries which may be utilised by the Project, which would access the site via the following transport routes:

- Boral Moy Pocket - Moy Pocket Road, Eumundi Kenilworth Road, Bruce Highway to exit 237, Cooroy Connection Road, and travel to/from the site via Elm Street and Lake Macdonald Drive.
- Corbets - Bruce Highway to exit 237, Cooroy Connection Road and travel to/from the site via Elm Street and Lake Macdonald Drive.
- Kin Kin Quarry - Sheppersons Lane, Gympie Kin Road, Pomona Kin Kin Road, Factory Street, Hill Street, Yural Forest Drive, to/from the site via Elm Street and Lake Macdonald Drive.

Further detail is provided in the Traffic Impact Assessment and Traffic Management Plan, included as **Appendix B and C** respectively.

3.3.2. Heavy vehicle movements

The IAR described heavy vehicle movements during peak construction periods. Based on the assumption of a five-day work week and hours above, the estimated peak hour flow for heavy vehicles was 21 two-way movements (rounded up to be conservative).

The 2024 Traffic Impact Assessment (TIA) found that, based on the assumption of a five-day work week and vehicle movement hours, the estimated peak hour flow for heavy vehicles is 21 two-way movements (rounded up to be conservative) or 11 movements entering and 11 movements exiting the site. This equates to one heavy vehicle entering and one existing the site every 5.5 minutes.

A summary graph of the daily average trucks per day (per month, two-way) is provided in **Figure 5** based on data provided by the construction contractor. As shown in **Figure 5**, a peak of 94 heavy vehicle (two-way) movements is estimated to occur during the construction peak in early 2028. The 3-monthly rolling average is also shown, which equates to 85 heavy vehicle (two-way) movements.

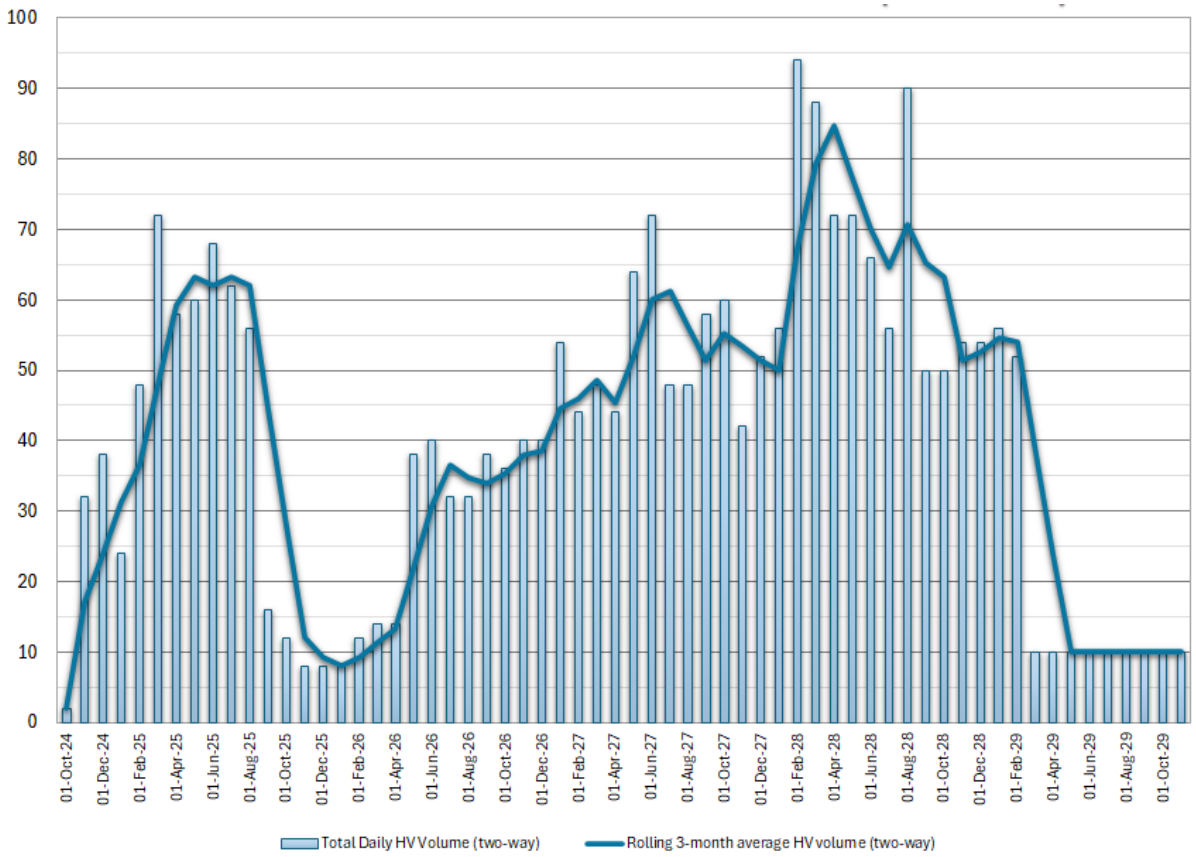


Figure 5: Heavy vehicle two-way flow by month

Figure 6 provides the daily average heavy vehicle movements (two-way) per day with the split between the northern and eastern routes and for reduced or restricted school hours.

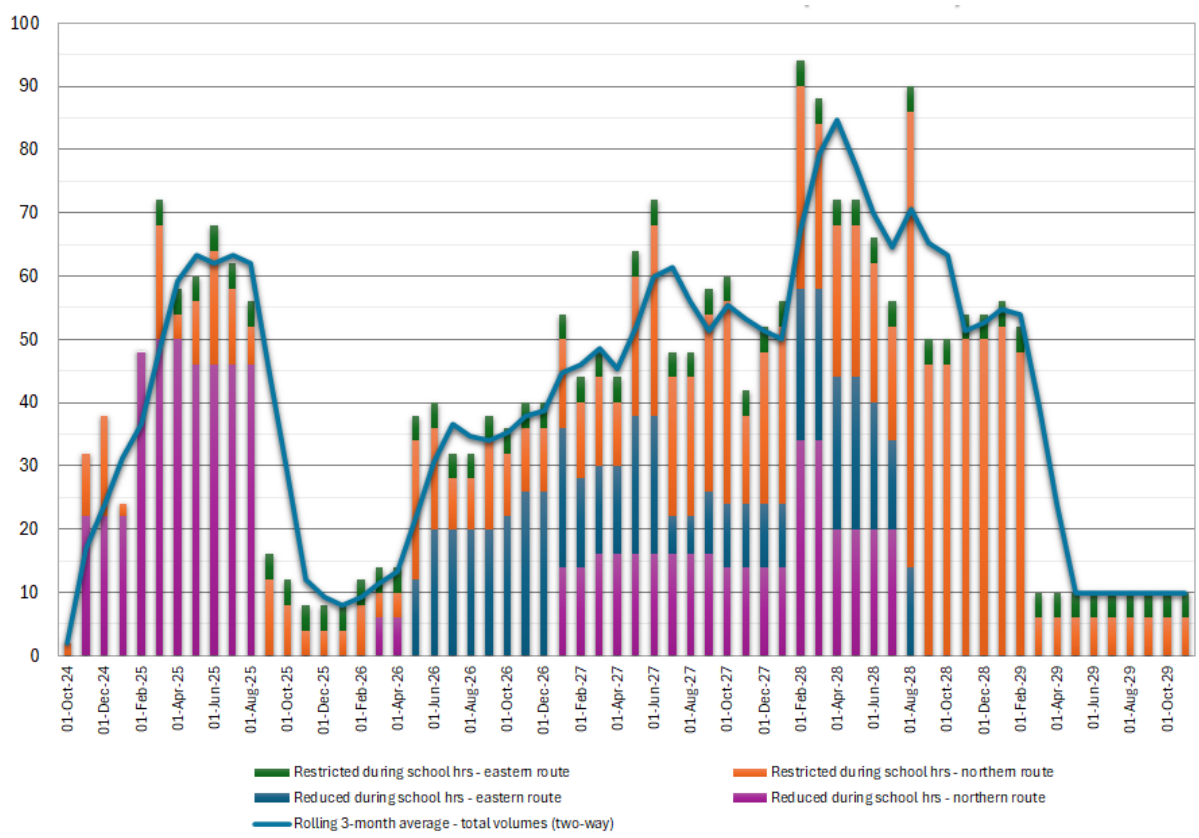


Figure 6: Heavy vehicle flows two-way by month by route and reduced or restricted school hours

Based on the assumption of a five-day work week and vehicle movement hours, the estimated peak hour flow for heavy vehicles is 21 two-way movements (rounded up to be conservative) as shown in **Figure 7**, or 11 movements entering and 11 movements exiting the site. This equates to one heavy vehicle entering and one existing the site every 5.5 minutes.

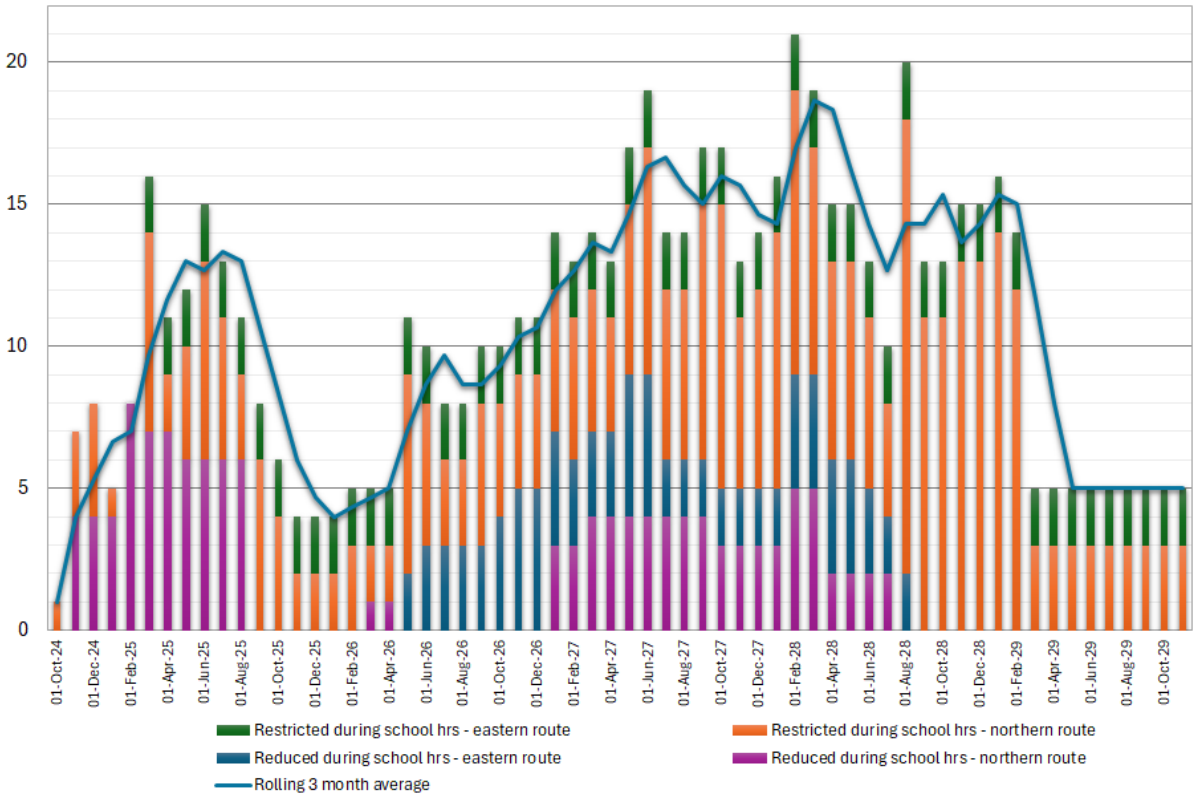


Figure 7: Peak hour heavy vehicle two-way flows (rounded up)

For work elements requiring continuous heavy vehicle movements during school peaks, the estimated heavy movement will be minimised to a maximum of six two-way movements or three movements entering and three movements exiting the site. This equates to one heavy vehicle entering the site every 20 minutes and one existing the site every 20 minutes noting split between the northern and eastern routes as shown in **Figure 8**.

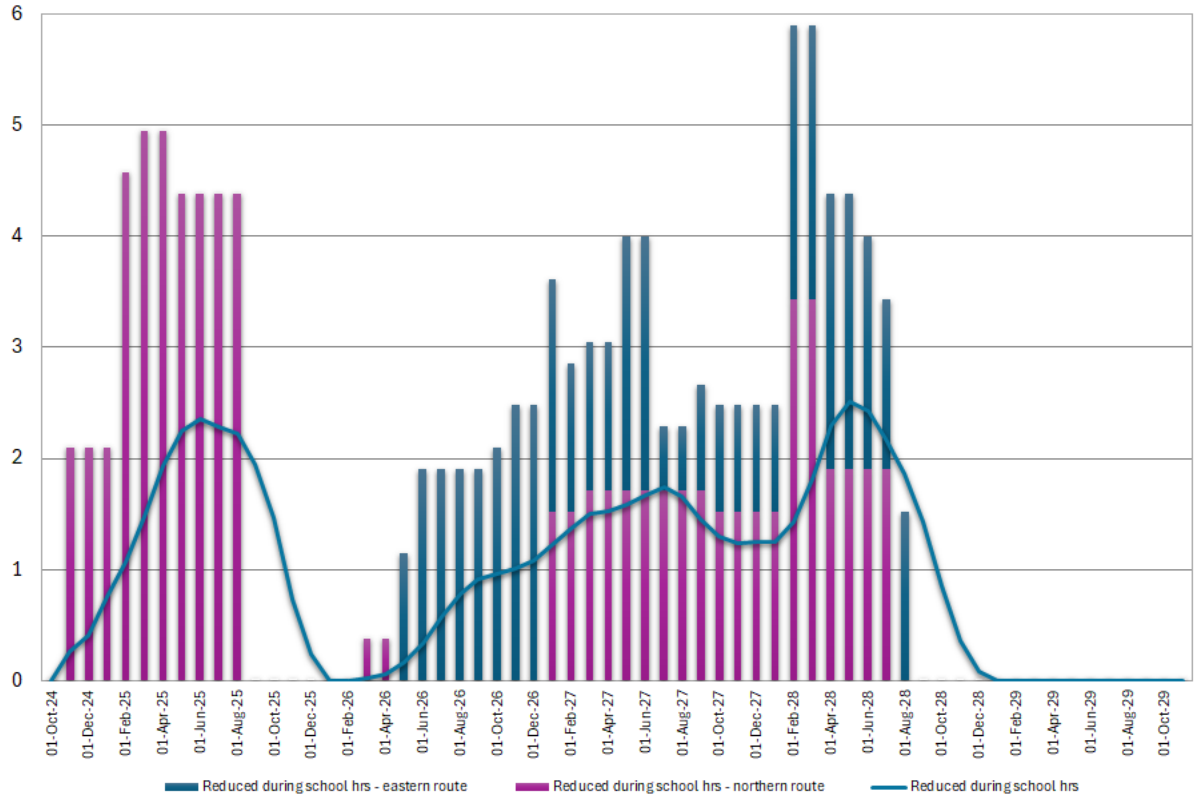


Figure 8: Reduced heavy vehicle two-way flows during school peaks

3.3.3. Light vehicle movements

In addition to heavy vehicles, there will be an increased number of light vehicle movements associated with construction workers commuting to and from the site in comparison to that described in the IAR. The IAR forecast a total of 110 light vehicle movements in the peak hour of the peak construction period.

The 2024 TIA estimates an average of 72 light vehicle trips per day one-way on average for the construction program. The TIA found an expected peak of 148 workers is expected in early 2028 and increase of 30 movements per day over that described in the IAR.

Table 10: Project workers arrival and departure times, peak numbers

Worker Type	Arrive	Depart	Peak Month	Peak 3-month Average	Project Average
Project Staff (white collar)	6:00-6:30AM	6:00 - 6:30 PM	29	31	25
Project Workforce (blue collar)	5:30 - 6:30 AM	5:00 - 6:00 PM	18	18	14
Sub-Contractor Personal (blue collar)	6:00 - 6:30 AM	5:00 - 5:15 PM	101	91	34

Worker Type	Arrive	Depart	Peak Month	Peak 3-month Average	Project Average
Total			**148**	**140**	**72**

It is expected that construction workers travelling to and from the site will be distributed as follows:

- 60% (~78 workers) from Sunshine Coast (entering site locally via Elm Street south, and Lake Macdonald Drive).
- 20% (~26 workers) from Noosa (entering site locally via Cooroy - Noosa Road and Sivyers Road).
- 20% (~26 workers) from Gympie (entering site locally via Elm Street north, and Lake Macdonald Drive).

4. Effects of proposed Changes

4.1. Traffic and Transport

4.1.1. Effects of the proposed change

A TIA was completed as part of the IAR for the Project in 2019. The TIA was updated in November 2024 in consideration of construction traffic volumes, work hours and travel routes associated with the refined construction program (**Appendix B**). The TIA concluded that the construction phase of the Project is predicted to have minimal traffic capacity impacts on the local road network.

A Signalised Intersection Design and Research Analyss (SIDRA) has been completed based on existing base flows and a growth rate of 1.5% compound per annum applied to generate 2028 without project flows as the Project has a peak in mid-2028. It evaluated four intersections reviewing performance parameters such as degree of saturation (DoS), queue length, level of service (LoS), and delays.

The analysis confirmed that the intersections will maintain satisfactory traffic flow, ensuring minimal disruption to local traffic and road users throughout the construction phase during peak worker and construction vehicle periods.

The construction of the LMDIP will significantly increase movements of heavy and light vehicles over the construction period. However, due to the movement of workers generally outside peak times and heavy vehicles movements being low but regular hourly flows, the assessment found Project vehicles will have minimal impact on the operation and performance to the road network.

It should be noted that the assessment was also very conservative as it assessed the peak construction period in Mid-2028 and not the average for the whole Project which as noted is approximately half the construction peak.

There are three distinct peaks in construction related traffic for the Project:

March-August 2025, associated with construction of the temporary coffer dam, including the importation of rock fill;

April-August 2027, associated with peak construction activities for the new permanent dam;

February-June 2028, associated with the decommissioning of the temporary coffer dam and removal of rock fill.

4.1.2. Mitigation measures

To manage the impacts of project traffic, several mitigation measures have been identified in the TIA and Traffic Management Plan (**Appendix C – Traffic Management Plan**) as follows:

- Development of Traffic Guidance Scheme/s (TGS's).
- Intersection works at Elm Street / Lake Macdonald Drive (Extent of works to be coordinated with DTMR and NSC.
- Reduced heavy vehicle movements during school peaks.

4.1.2.1. Traffic Guidance Scheme's

The TGS is a critical component of managing traffic flow and safety during the construction period. It involves the arrangement of temporary traffic control devices to direct, guide, and inform road users through or around a worksite or temporary hazard, ensuring minimal disruption to traffic and enhanced safety for both workers and the public.

A concept TGS for Lake Macdonald Drive is included in Appendix G-1 of the TMP which will need to be developed further by the Contractor. Additional TGS's will be required for all proposed construction road switches and configurations such as the reduction of Lake Macdonald Drive to a one-way lane arrangement for the demolition and construction of the left embankment.

Key control measures which will be outlined further in the TGS for approval by the Department of Transport and Main Roads (DTMR) will include:

- Compliance and Approvals: All TGSs will be compliant with AS 1742.3 and the MUTCD Part 3 standards. These schemes will be submitted to DTMR with applications for Road Occupancy Licenses (M994) for shift-by-shift activities (short-term works).
- Advance Warning Devices: To notify road users of changes to traffic conditions ahead, signage and pavement markings will be installed at strategic points before the work zone. The advance warning area allows drivers sufficient time to adjust their speed and behaviour, contributing to safer transitions through the work area. This may include dynamics signage such as Variable Message Signs (VMS) for information on the Project and key information such as upcoming traffic changes.
- Real-time traffic controllers: To be deployed to manage traffic flows and minimise delays at key intersections, particularly during peak construction periods.
- Traffic Control Devices: These include portable traffic signals, safety barriers, and delineation devices to separate traffic from the work zone and create a safe working environment. The use of devices such as VMS helps convey real-time information about road conditions, diversions, and speed limits to road users. All equipment for TGSs will be installed in accordance with the Traffic Control Procedure and will be supported by relevant toolbox talks and traffic instructions.
- Speed Control: Temporary speed limits to be implemented along Lake Macdonald Drive (covering accesses/egresses at Collwood Road and Hardstand Area 3) to reduce traffic speed in and around the work zone. This helps to mitigate the risk of accidents and ensures both worker and road user safety. These speed limits are clearly marked and enforced through signage placed in the warning and work areas.
- Pedestrian and Vulnerable User Safety: The TGS includes provisions for safe crossings and alternative pathways for pedestrians, cyclists, and other vulnerable road users, ensuring that they can navigate around the construction area without undue risk. The key risk for the TSG is to consider and implement is a safe route for walks/hikers on the Noosa Biosphere Trail Network. This is proposed to be on the western verge with safe and appropriately located crossing locations.
- Heavy Vehicle Management: The scheme incorporates Vehicle Movement Plans (VMPs) that describe access routes, entry and exit procedures for the heavy vehicles involved in the Project. These VMPs help prevent conflicts between construction traffic and general traffic, ensuring smoother transitions and minimising delays.

- Training and Instructions: John Holland's nominated Traffic Representative will ensure that frequent face-to-face instructional meetings are held with all traffic management team members, including subcontractors. These meetings will provide training on contemporary issues and reinforce formal procedures and systems already in place. Safe work methods and best safe practices will be discussed during these meetings, with Activity Management Statements (AMS) drafted to incorporate recent learnings.
- Communication and Updates: Day-to-day information will be exchanged during pre-start briefings at the commencement of every shift. Toolbox talks will be held weekly, led by the field supervisor or traffic foreperson, to discuss ongoing safety and traffic management issues. The nominated Traffic Representative or their delegate will attend these weekly toolbox talks to ensure consistent communication and adherence to safety protocols.
- Continuous Monitoring and Adjustment: The TGS is regularly reviewed and updated based on the evolving conditions at the site, traffic patterns, and feedback from road users. This ensures that the scheme remains effective throughout the construction phase, intending to maintain traffic flow, ensure safety, and minimising disruption.

4.1.2.2. Elm Street / Lake Macdonald Drive Intersection Works

Intersection works at Elm Street / Lake Macdonald Drive are expected to be required for safe manoeuvring of semi-trailers turning into and out of Lake Macdonald Drive so not to cross over the Lake Macdonald Drive centreline. As a minimum the works are expected to include the installation of additional signage on Elm Street. The signage shall communicate that south bound semi-trailers may straddle both lanes when turning left into Lake Macdonald Drive.

4.1.2.3. Heavy vehicle movement restrictions

Heavy vehicle movements required to be minimised during school pick-up/drop-off times and associated school bus route running times should the route transverse Elm Street to and along Lake Macdonald Drive.

Accordingly, heavy vehicle movements are recommended to be minimised, where possible, during school term dates during the following times based on the TIA assessment of school bus times and traffic flows at the Elm Street / Lake Macdonald Drive intersection (considering both October 2020 and October 2023 traffic surveys):

- 7:20 - 8:45am
- 2:30 - 3:45pm.

Based on the above restricted periods and a finishing time of 5:00pm for heavy vehicle movements to be conservative, this equates to a total heavy vehicle movement/delivery window of 7 hours 50 minutes.

During School Holidays: Monday to Friday: 6:30 am to 6:30 pm.

It should be noted, it is not practical for critical works such as concrete pours to have heavy vehicles restricted during the above times as they need regular movements to / from the site. Further, to reduce the length of the program and duration of impacts key work elements are proposed to continue during school peak times but with reduced flows.

During school peak traffic times, heavy vehicle movements will be minimised to a maximum of six two-way movements to reduce impacts with school traffic. This equates to one heavy vehicle entering the

site every 20 minutes and one exiting every 20 minutes during this period. Access to the site will be split between the northern and eastern routes.

4.1.2.4. Road Maintenance

The Project will generate increased stress on the local road network due to the frequent use of heavy vehicles and construction-related traffic. Maintaining road conditions throughout the Project is crucial to ensuring safe travel for both construction vehicles and the general public, as well as preserving the integrity of the road infrastructure. A well-structured road maintenance program will be implemented to address wear and tear, prevent road failures, and ensure that disruptions to the community are minimised.

4.2. Noise and Vibration

4.2.1. Effects of the proposed change

The proposed increase to the construction program from 2.5 years to 5 years will likely result in additional noise and vibration impacts on nearby sensitive receptors, including residents from the increased duration, as well as change to hours of operations.

Exceedances of noise targets are expected on 100 days of the 1,825-day construction program (5% of days), and in some instances, activities will impact a single residence. Dam Crest and Spillway demolition remain the highest impact activities from a noise perspective and will be undertaken over a 27-day period in April and May 2026.

A Construction Noise and Vibration Impact Assessment (CNVIA) for the Project was prepared in 2018. Noise monitoring was undertaken at two sites adjacent to the Project from 29 May to 7 June 2018 to quantify the existing acoustic environment and to provide context to the predicted construction emissions. Construction scenarios with the potential to generate noise impacts were assessed using typical plant items and areas of operation defined across the entire Project area.

Following the update to the temporary cofferdam design in 2023, Seqwater engaged Virid IFC to undertake a revised CNVIA (March 2024) (**Appendix E – Construction Noise and Vibration Impact Assessment (CNVIA)**. The potential noise impacts associated with construction activities for the Project have been assessed against the Acoustic Quality Objectives (AQOs) set out in the Environment Protection (Noise) Policy 2019 (EPP Noise) – as per A01.1. Vibration impacts have been assessed against British Standard 7385-2 Evaluation and measurement of vibration in buildings and DIN 4150-3:1999 Effects of vibration on structures.

A three-dimensional noise model accounting for the ground terrain has been developed for each construction scenario, for both standard and non-standard working hours where relevant, as well as the respective default weather conditions. Given the scale of the Project area, airborne noise from construction activities was then predicted at identified noise sensitive receptors. The predicted noise levels were then compared to the Project construction noise targets.

It is not feasible to eliminate the noise exceedances given the logistical and safety constraints associated with the critical noise generating activities (i.e. cofferdam piling, and spillway demolition works). All reasonable efforts will be made to undertake the loudest work activities during the least sensitive times of day (daytime/Evening).

Activities expected to result in noise exceedances are:

- Clearing and grubbing over a 20-day period which will exceed noise targets at four residences in March/April 2025.
- Reservoir lowering over a 43-day period, which will exceed noise targets at one residence in March and April 2025.
- Dam crest demolition over a 12-day period which will exceed noise targets at 45 residences in April/May 2026.
- Spillway demolition over a 25-day period which will exceed noise targets at 12 residences in April/May 2026.

The construction of the new dam is the longest running construction activity over a period of 3.5 years. No exceedances of noise targets are expected at any residence as a result of this activity.

No adverse impacts are expected to come from vibration generated by project activities.

4.2.2. Mitigation measures

The mitigation measures proposed for noise and vibration in the IAR remain appropriate for both standard and non-standard operating hours, however, an updated Construction Noise and Vibration Impact Assessment (CNVIA) has been prepared (**Appendix E**) which describes management and mitigation measures for the entire construction program, including evening and night-time activities.

Generic noise mitigation that would be deployed across all construction scenarios (CS) include:

- Operate plant efficiently to minimise the time the equipment is operational to undertake required works.
- Turn plant/equipment off when not in use.
- The use of acoustic curtains and buffers at noise source.
- Minimising vehicle movements / turning trucks and other heavy machinery off when not in use.

Despite best efforts to minimise noise impacts, current modelling suggests that exceedances with the Project noise targets will be unavoidable. **Table 11** summarises these modelled exceedances and lists the proposed mitigation measures to be deployed across each CS along with the expected timeframes.

It's important to highlight the following regarding CS3 - the noise from CS3 (a & b) is likely to cause nuisance as the works include high impact noise generated by the operation of two sheet piling cranes and hydraulic hammers. Two hammers are proposed for the piling activities – a Vibrodriver and Hydrohammer. The sheet pile is to be vibrated in from a height of 10m (above waterline) to approximately 2.5m. The noise generated from the Vibrodriver is considerably less than the Hydrohammer at 95dB vs 108 dB respectively. Additionally, the Hydrohammer will typically only be used at lower elevations which will further limit the amount of noise generated.

If necessary, the piles may be driven home to 0.5m using a Hydrohammer. The use of the Hydrohammer will only occur if the pile does not reach the required depth via vibration. It is likely, but cannot be guaranteed, that many of the piles will require much less hammering than described above, even none in some cases. Under worst case assumptions, impact driving will be active for no more than 25% of the time piling is being undertaken.

In relation to CS5, although this activity is expected to take approximately 6 weeks, the bulk of high-impact noise generation will occur within the initial 2 weeks when the hydraulic hammers (rock breakers) and concrete saws are deployed to break up the dam crest (CS5a and CS5b).

Table 11: Construction-Scenario specific noise impacts and mitigation measures

Activity	Distance, Residences, Duration	Proposed Mitigation Measures
CS1 - Clearing and grubbing	**Distance from receptor**: 30m **Residences where exceedances expected**: 4 **Expected duration**: 20 days (March 2025)	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Use of battery chainsaws where possible. 3. Undertake chainsaw works during non-noise sensitive time periods for those properties which are predicted to exceed the criteria. 4. The relocation of the chipper work activities to an area of the site further away from sensitive receivers – e.g. borrow pit area. 5. Provide a temporary noise fence to block the noise between the chipper and noise sensitive receptors. Only required if a noise complaint is raised. 6. Turn chipper and chain saws off when not in use.
CS2 - Site gravel road construction	**Distance from receptor**: 77m **Residences where exceedances expected**: 0 **Expected duration**: 5 days	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Minimise high noise plant/equipment operations. 3. Operate plant efficiently to minimise the time the equipment is operational to undertake required works.
CS3a – Cofferdam piling vibration **CS3b** Cofferdam piling-impact **CS3c** Cofferdam, construction and removal, and rockfill	**Distance from receptor**: 28m **Residences where exceedances expected**: 0 **Expected duration**: 154 days (20-May-25 to 02-Jan-26)	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Limiting piling activities to daytime only. 3. Maximising the pile penetration using vibratory as opposed to impact piling. 4. Providing periods of respite between high noise (i.e. hammering) activities. 5. Minimising truck and excavator movements. 6. Operate plant efficiently to minimise the time the equipment is operational undertaking required works. 7. Choose the quietest sheet piling equipment that can supply the required power load with auto start, so it only runs when required. 8. Investigate the use of acoustic curtains around impact hammer.

CS4 - Reservoir lowering	**Distance from receptor**: 47m **Residences where exceedances expected**: 1 **Expected duration**: 43 days (May-June 2025) 24 hrs / 7 days works.	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Minimising pump use. 3. Locate a temporary acoustic fence on the dam wall adjacent to Macdonald Drive. 4. Relocate pumps to locations further from sensitive receivers. 5. Throttle-back pumps during evening and night (if schedule permits). 6. Use of syphon hoses during night periods.
CS5a - Dam crest demolition & excavation	**Distance from receptor**: 28m **Residences where exceedances expected**: 45 (predominantly night works, with 7 exceedances during daytime works) **Expected duration:** 12 days (April-May 2026) 24 hrs/ 7 days works. Demolition dam to construct 30m slot	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Scheduling noisiest activities to occur during normal construction hours. 3. Complete the use of the concrete demolition, using the hydraulic hammer, of existing spillway as quickly as practicable. 4. Review the use of acoustic curtains around breaker where practicable. 5. Locate generator so the site office blocks view to residential properties.
CS5b - Spillway demolition	**Distance from receptor:** 28m **Residences where exceedances expected:** 12 (all nightworks) **Expected duration:** 25 days (April-May 2026) Excavation / Demolition	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Scheduling noisiest activities to occur during normal construction hours. 3. Complete the use of the concrete demolition, using the hydraulic hammer, of existing spillway as quickly as practicable. 4. Review the use of acoustic curtains around breaker where practicable. 5. Locate generator so the site office blocks view to residential properties.
CS6 - Dam construction	**Distance from receptor:** 28m **Residences where exceedances expected:** 0 **Expected duration:** 3.5 years	1. Community consultation with sensitive receivers with adequate notice of upcoming activity. 2. Scheduling noisiest activities to occur during normal construction hours.

		3. Locate generator and other equipment so the site dam wall block's view to residential properties.

Table 12: Summary of severity of noise impacts to local residents

Category	Definition	Estimated No. properties impacted & location	
1. Significant	4 or more incidents of CS noise exceedance	4	4 properties along Lake Macdonald Dr. (NB. Seqwater own 2 of these)
2. Moderate	2-3 incidents of CS noise exceedance	8	5 properties on Lake Macdonald Dr, 3 properties on Highland Dr.
3. Minimal	1 incident of CS noise exceedance	19	17 properties on Highland Dr, and 2 properties on Lake Macdonald Dr.
4. Zero Exceedance	0 incidents of CS noise exceedance	31	Refer Annexure B of CNVIA

On-site noise levels will be monitored regularly by a suitably qualified person in accordance with *AS 2436 2010 – Guide to noise and vibration control on construction, demolition and maintenance sites.* Noise monitoring will be undertaken at a sensitive receptor to the east and west of the Project site at a minimum of two locations throughout the construction period. A third noise logger would also be proposed across floating locations based on work activities and any complaints received. Noise logging will be conducted in accordance with procedures outlined in *AS1055-1997 – Acoustics – Description and measurement of environmental noise.*

The updated CNVIA (March 2024) details which dwellings are likely to be impacted by construction noise and Seqwater has commenced consultation with these residents through a dedicated stakeholder engagement management team. Seqwater will continue to consult with residents who are likely to experience excessive noise levels during project construction to determine suitable management measures which take their individual circumstances into account. It's noted that Seqwater own 2 of the properties identified as being impacted.

Seqwater has been engaging one-on-one with local sensitive receptors since the Project approval in 2019. During this time, at least 4 residents have agreed and accepted a financial assistance package designed to allow residents to manage impacts on their own properties, for example installing air conditioning, double glazing, increased insulation, screening blinds, fencing or temporary relocation.

Seqwater will continue these discussions throughout the planning phase of the Project to ensure a balanced solution is reached for all impacted residents. To ensure a fair and equitable approach is applied to this process, Seqwater has developed a Mitigation Guideline for Impacted Residents from Construction Noise and Vibrations. The purpose of this Guideline is to provide a framework for the Contractor and Seqwater Project team to address queries and complaints regarding noise and vibration issues in a consistent manner that is both practicable and appropriate. The guideline proposes that where construction mitigation measures implemented by the contractor are unable to reduce noise impacts to within the applicable AQOs then additional mitigation measures are to be considered such as:

i. **Noise Reducing measures** – items such as noise cancelling headphones and ear plugs, will be offered to residents upon request and considered on a case-by-case basis subject to Table 1 Mitigation Measure index.

ii. **Respite offer** - residents subjected to extended periods of exposure to construction activities expected to exceed the applicable criteria will be provided with respite offers (e.g. pre-purchased dinner, entertainment or relaxation vouchers).

iii. **Temporary accommodation** - temporary relocation (short and long) will be offered to residents subjected to substantial periods of exposure to construction activities expected to exceed the applicable criteria for 'off-site' mitigation as described in Table 1 Mitigation Measure index.

iv. **In-house acoustic treatment -** residents subject to prolonged and regular periods of construction noise, will be assessed for in-house mitigation of noise sensitive rooms. This may include the installation of acoustic curtains to reduce the noise coming into a room and the addition of noise absorbent material to reduce noise reflecting onto different surfaces within the room.

The Guideline then outlines a Mitigation Measure index as seen below in **Table 13.**

Table 13: Impacted Residents Mitigation Measure index

Time Period		30-40dB(A)	40-50dB(A)	>50dB(A) -
Standard working Hours (external facade)	Mon-Fri: 6.30am – 6.30pm Mon-Fri: 7.00am – 6.00pm	No treatment	No treatment	Works notification Individual briefings Phone calls Specific notification Noise reducing measures
	Sat: 6.30am – 4pm Sat: 8.00am – 1pm			
	Sun/Pub Hol: nil Sun/Pub Hol: nil			
Non-Standard Evening / Weekend Hours (external facade)	Mon-Fri: 6.30pm – 10pm Mon-Fri: 6.00pm – 10pm	No treatment	No treatment	Works notification Individual briefings Phone calls Specific notification Noise reducing measures Respite offer
	Sat: 4pm – 10pm			

Time Period		30-40dB(A)	40-50dB(A)	>50dB(A) -
	Sat: 1pm – 10pm			
	Sun/Pub Hol: 7am – 10pm Sun/Pub Hol: 7am – 10pm			
Night Hours (internal) i.e. in-house	Mon-Sun: 10pm – 6.30am Mon-Sun: 10pm – 7.00am	Works notification Individual briefings Phone calls Specific notification Noise reducing measures Respite offer Temporary accommodation (short)*	Works notification Individual briefings Phone calls Specific notification Noise reducing measures Respite offer In-house acoustic treatment Temporary accommodation (long)	

Seqwater will keep a Complaints Management Plan (CMP) at the construction site to document any complaints received about the activity.

The CMP forms part of the LMDIP Communications & Stakeholder Engagement Plan (CSEP) and includes a dedicated phone line to enable the community to contact a central project representative, a process to ensure a response to a complainant within 48 hours of the complaint being received, complaints register that captures details about the complaint and protocol for investigating and resolving complaints. The process is consistent with Australian Standard AS ISO 10002-2006, 'Customer Satisfaction — guidelines for complaints handling in organisations.'

Community enquiries and complaints will generally be received via:

- Seqwater's 24-hour community hotline: 07 5472 1565
- Seqwater's email: projectinfo@Seqwater.com.au
- Seqwater's webpage - https://www.Seqwater.com.au/contact-us

The 24-hour community hotline, email address and webpage are maintained by Seqwater and in some instances will be responded to by the Principal Contractor, who will investigate and respond following the required response timeframes. All written project communications will include the community hotline, email, and web address.

All calls to Seqwater's project info line – (07) 3432 7000, will be answered by Seqwater (Monday to Friday 9am to 5pm). Calls to the community hotline (07 5472 1565) will be answered by the Principal Contractor 24 hours a day, seven days a week.

The project team will respond to a complaint within 48 hours of the complaint being received. The initial response to the stakeholder will be an acknowledgement to the complaint, with an internal task then set to a team member to close out the complaint. The second response the stakeholder will receive will be the formal response to the complaint with any associated actions that the Project team will take, included.

If a complainant remains unsatisfied, the complaint will be escalated to a relevant Project Team Manager. Complaints that Contractor cannot resolve will be further escalated to Seqwater. All stakeholder interactions will be recorded in Seqwater's customer database, Consultation Manager in a timely manner and the following information must be recorded:

1. Date and time the complaint was received
2. Name and contact details of the complainant when provided and authorised by the complainant.
3. Nature of the complaint
4. Investigations Undertaken
5. Responsible team member to action complaint
6. Conclusions formed
7. Actions taken to resolve

In addition to the mitigation measures outlined above, the following mitigations will be included in the LMDIP Construction Environmental Management Plan (CEMP).

Table 14: Noise and Vibration management and mitigation strategies

No.	Actions	When
General		
1.	Works outside of standard construction hours, must: • Be pre-approved in writing by Seqwater and the relevant regulatory agency where applicable (e.g. Department of Transport and Main Roads, Noosa Shire Council, Department of Environment, Tourism, Science and Innovation (DETSI) etc.) • Have been subject to appropriate community consultation prior to works.	Throughout construction
2.	Community consultation with sensitive receivers will be undertaken prior to commencing the following noise intensive activities: • Pump operations during nighttime. • Sheet piling of the cofferdam. • Demolition of the existing dam structure. • Clearing and grubbing and gravel road construction on the east and west embankment. • Mobilisation and demobilisation of heavy plant and equipment. • Any activity that will be undertaken outside of standard construction hours.	Prior to commencing noise intensive activities
3.	Adopt the use of temporary acoustic screens that will break the line-of-site of the construction works towards noise sensitive locations. Temporary acoustic screens can include: • Purpose built barriers. • Materials stockpile.	Workplace Planning

No.	Actions	When
	• Site sheds, buildings or other structures. • Natural topographical barriers.	
4.	Maintain a site activity log, recording the type of activities taking place during various times of the day to assist with the retrospective investigation of community complaints relating to noise or vibration complaints.	Throughout construction
5.	Prior to commencement of works, undertake dilapidation surveys at the following properties: • 389 Lake Macdonald Drive • 395 Lake Macdonald Drive • 403 Lake Macdonald Drive • 407 Lake Macdonald Drive • 411 Lake Macdonald Drive • 415 Lake Macdonald Drive • 419 Lake Macdonald Drive Undertake post construction dilapidation surveys at the above-mentioned properties upon completion of the Project.	Workplace Planning / Post completion of works
6.	Entry and departure of heavy plant and equipment to and from the site are restricted to the standard construction hours.	Mobilisation / Demobilisation
Planning		
7.	Contractor must notify any potentially impacted stakeholders if delivery of significant equipment will be required out of hours - **Minimum 5 days** prior to activity.	Workplace Planning
8.	Positioning loading and unloading points away from sensitive and critical receptors. Minimise drop height of materials when transferring (for example, dumping fill)	Workplace Planning
9.	Equipment with directional noise characteristics (emits noise strongly in a particular direction) are to be orientated so that the noise is directed away from the sensitive receptors.	Workplace Planning
Inductions and Training		
10.	Site inductions will include the following specific components for noise and vibration management: • The close proximity of noise and vibration sensitive properties on Lake Macdonald Drive. • Lists of plant items and construction activities that potentially could cause noise and vibration annoyance. • Potential impacts of excessive noise and vibration on sensitive receivers and the importance of managing noise, and vibration at the source. • Noise, and/or vibration monitoring that will be carried out during the Project. • Approved Project working hours	Workplace Planning
11.	The Project Team will regularly educate site staff (such as during toolbox/pre-start meetings) to maximise awareness of Project noise and vibration objectives and noise and vibration generating activities, and encourage minimisation of these activities, including: • Unnecessary or overuse of horns and engine idling.	Throughout construction

No.	Actions	When
	• Use of compression air brakes adjacent to sensitive areas. • Shouting and swearing at shift start/end. • Use of radios or stereo outdoors where neighbours may be affected • Efficient material handling procedures to reduce unnecessary loud banging sounds.	
Plant and Equipment		
12.	All vehicles, plant and equipment will undergo a Plant Hazard Assessment (PHA) prior to gaining access to the site. Plant with the lowest noise rating that meets the requirement of the task shall be used. For works in close proximity to sensitive receptors, where practicable, use electric motors in preference to combustion motors. Where enclosures are fitted to equipment, ensure doors and seals are in good working order and that doors can be closed properly against the seals.	Throughout construction
13.	Vehicles, plant and equipment will be regularly inspected and maintained to ensure optimal operation. Daily pre-start inspections and plant/vehicle logbooks will be used to record and determine inspection and maintenance suitability and schedules. Any unusually noisy equipment will be tagged out of service and maintenance undertaken to rectify the cause of the noise. If the source of the noise cannot be repaired, then equipment will be demobilised from the Project.	Throughout construction
14.	Where reversing alarms are required for mobile equipment such as dozers, scrapers, cranes, graders, excavators, trucks, loaders etc., their acoustic range should be limited to the immediate danger area. Traditional reverse beepers must not be used on site. Reversing alarms must be “Smart Alarms” which adjust their volume depending on the ambient level of noise. The alarms, furthermore, must be low frequency “quacker” alarms.	Throughout construction
15.	All plant and equipment (including trucks) are to minimise any idling and shall be turned off (or throttled down if appropriate) when not in use.	Throughout construction
16.	• Acoustic enclosures or localised noise screens could be incorporated and maintained around fixed plant or over individual pieces of equipment where possible.	Throughout construction
17.	Reduce the potential for impacts from construction traffic (particularly on Lake Macdonald Drive) by: • Undertaking regular site road maintenance (and inspections) to minimise impact noises from trucks travelling over irregularities in the road surface (such as potholes, washouts or ruts). • Limiting vehicle speeds in critical areas both on and off site. • Allowing for one-way traffic flow through the site to minimise the use of reversing alarms as much as practicable and minimise traffic delays. • Ensuring trucks are fully loaded so that the volume of each delivery is maximized. • Plan to minimise the potential for trucks to queue on Lake Macdonald Drive.	Throughout construction & Workplace Planning

No.	Actions	When
18.	All deliveries will occur during standard construction hours. Loading and unloading carried out as far as practicable away from sensitive receptors.	Throughout construction
19.	The use of noisy hand tools such as grinders, impact wrenches and hammers are to be used as far away as practicable from sensitive receptors. Temporary barrier screens may be erected where necessary.	Throughout construction
20.	All noise attenuation required to protect the amenity of sensitive receptors must be installed prior to commencement of construction within a specific area.	Workplace Planning
21.	The following measures will be implemented when undertaking construction works on the east and west embankment: • Use of battery-operated chainsaws where possible • Undertake chainsaw works during non-noise sensitive time periods for those properties which are predicted to exceed the criteria • Locate chipper work activities to an area of the site further away from sensitive receivers – e.g. borrow pit area • Provide a temporary noise fence to block the noise between the chipper and noise sensitive receptors or place the chipper behind a building to provide screening between the receptors and the chipper • Attended noise monitoring only required if a noise complaint is received • Turn chipper and chain saws off when not in use • Minimise high noise plant/equipment operations • Operate plant efficiently to minimise the time the equipment is operational to undertake required works	Throughout construction
22.	The following measures will be implemented when undertaking cofferdam construction works: • Limit piling activities to standard construction hours. • Use vibratory piling opposed to impact piling. • Lower-impact Vibrodriver to be utilised as much as possible. Higher-impact Hydrohammer to be deployed only as necessary. • Provide periods of respite between high noise (i.e. hammering) activities. • Operate plant efficiently to minimise the time the equipment is undertaking required works. • Choose the quietest sheet piling equipment that can supply the required power load with auto start, so it only runs when required. • Impact hammers will be fitted with acoustic screens at hammer head and top of pile. • Attended noise monitoring at the neared noise sensitive receptor will be required to confirm that the AQOs are not exceeded.	During cofferdam construction
23.	The following measures will be implemented when undertaking existing dam demolition works: • Scheduling noisiest activities (hydraulic hammer operations) during daytime hours. • Complete the use of the concrete demolition, using the hydraulic hammer, of existing spillway as quickly as practicable, albeit only use the hydraulic hammer during daytime hours.	During the dam demolition works

No.	Actions	When
	• Use acoustic curtains around breaker • Position the generator in a location that does not have a line of site with the residential properties	
24.	The following measures will be implemented when undertaking dam lowering (i.e. pump operations): • Locate a temporary acoustic fence on the dam wall adjacent to Macdonald Drive. • Locate pumps as far as practicable from sensitive receivers. • Throttle-back pumps during evening and night (if schedule permits). • Use of syphon hoses during non-standard hours.	During dam lowering activities
25.	The following measures will be implemented when undertaking works to minimise vibration impacts: • Where vibratory plant is being utilised near to sensitive receptors, judicious selection of plant and equipment will be necessary. Vibratory rollers within the Project will operate at the low amplitude, high frequency setting to ensure minimal vibratory impacts and be sized as recommended above. • Avoid turning the vibration mode on/off when stationary or moving too slowly, or when close to buildings or underground assets. • Use a flat edge bucket when excavating and have a spotter present at all times around utilities.	Throughout construction
26.	Metal surfaces subject to impacts from heavy objects (such as rock dropping into empty truck trays, or metal grates on road ramps etc.) will be lined with rubber impact protection to minimise impact noise.	Throughout construction
27.	When using pneumatic equipment, silenced compressors or quieter hydraulic equipment will be used.	Throughout construction
28.	A flat edge bucket will be used when excavating and a spotter will always be present around utilities	Throughout construction

4.3. Air Quality

4.3.1. Effects of the Proposed Change

A qualitative risk assessment of the Project, using the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (IAQM 2014), was undertaken for the IAR. This method has been used to identify the level of dust control anticipated to be required for the Project to minimise the risk of adverse health or nuisance impacts for surrounding residents. The risk assessment identified:

- The sensitivity of the surrounding area is classified as 'low' for health effects and 'medium' for dust soiling.
- The dust emission magnitudes for the various construction phase activities (demolition, earthworks, construction and track out) are all classified as 'large.'

The Project's IAR found that the most significant emissions to air associated with the proposed project activities would be emissions of particulate matter from the excavation, handling and transport of soil and rocks, as well as from wind erosion of disturbed soils. The potential impacts of emissions of particulate matter on air quality include health impacts, dust settling on surfaces and possessions and dust settling on vegetation.

The increased duration of the construction program is not expected to increase the nature or the magnitude of impacts on air quality. For almost all construction activity, the IAR noted that the aim should be to prevent significant effects on receptors through the use of effective mitigation.

Increasing the duration of works would not change the findings of the IAR in relation to construction dust emissions and associated air quality impacts. The nature of the construction activities which generate dust emissions has not changed since the initial assessment in the IAR:

- The sensitivity of the surrounding area has not changed.
- The dust emission magnitudes for construction activities were assessed as 'large' in the IAR, which is the highest dust magnitude available under the IAQM methodology.

4.3.2. Mitigation measures

A Dust and Air Quality Management Plan has been developed for the Project and sets out key management and mitigation measures, these are summarised in Table 15 below.

Table 15: Dust and air quality mitigation measures

No.	Actions	When
Workplace Planning		
1.	During construction planning and programming: • Plan to sequence the works to keep the size of cleared areas to a minimum to limit exposed areas available for dust emissions by wind erosion. • Retain existing vegetation, where practical, between construction activities and sensitive receptors to reduce particulate concentrations and dust deposition rates at receptors. • Incorporate dust management wherever required.	Workplace Planning & Design
2.	Implement a wheel washing system (or similar) to minimise carriage of residual dust and mud onto public roads.	Workplace Planning
3.	Minimise the use of diesel- or petrol-powered generators and pumps. Use mains electricity or battery powered equipment where practicable. Ensure any exhaust emissions are discharged away from areas where workers or members of the public would be exposed to the plume.	Workplace Planning
4.	Set up meteorological station on site for continuous weather monitoring at least one month prior to the commencement of construction works. The weather station will be sited at a nearby location representative of the general area and be away from obstructions such as buildings and trees. Additionally, set up PM_{10} and deposited dust monitoring, at least 1 month and 3 months, before commencing construction works, respectively, to measure baseline levels.	Workplace Planning

No.	Actions	When
5.	Ensure community contact signage is clearly visible on-site boundary fencing to enable community feedback / complaints.	Throughout construction
6.	Diesel-powered dewatering pumps are located a suitable distance from sensitive receptors to ensure no impact and ensure the exhaust emissions are discharged away from areas where workers or members of the public would be exposed to the plume.	Workplace Planning
Avoidance and Suppression		
7.	Where dust-generating activities are unavoidable, dust-suppression techniques to protect vegetation, worker health and amenity must be applied. This would generally include: • Spraying down unsealed traffic areas with water trucks. • Vegetation clearing. Dust suppressant additives may be used to increase effectiveness and to reduce the volume of water required.	Throughout construction
8.	Consider prevailing wind speed and direction when carrying out earthworks, such as surface excavation. Cease works if high winds are blowing in the direction towards sensitive receptors.	Throughout construction
9.	Impose a maximum speed limit of 10 km/hour within Project boundaries.	Throughout construction
On Site Haul / Access Road Management		
10.	Where practicable, heavy use haul roads will be sealed or have a low dust capping layer during the construction phase of the Project.	Throughout construction
11.	For unpaved roads, periodically apply water for dust suppression, for example with a light application at Level 1 watering (<2 litres/m^2/h). The frequency of application will be dependent on weather conditions and traffic volumes. Further measures for high-volume traffic areas, such as temporary gravel cover or dust suppression polymer, will be applied as required.	Throughout construction
	Haul truck loads are to be covered when travelling on public roads, the load must be lower than the sides of the truck and the truck is to be free of loose mud and dirt before entering public roads.	Throughout construction
12.	Site access will be via designated access points only. These points will be stabilised through gravel pad or similar means.	Throughout construction
13.	Public roads adjacent to construction area are to be kept free from tracked materials and cleaned daily as required. Visual inspections to be undertaken daily of Lake Macdonald Drive. Accumulated material will be removed from roadways by spray trucks equipped with brushes and/or by personnel with hand equipment (e.g. shovels, bristle brooms).	Throughout construction
14.	Hydro-mulch, mulch, hydro-seed or stabilisation spray will be applied to batters adjacent to haul roads, as per the approved Water Management Plan, to stabilise these areas and minimise wind-blown dust.	Throughout construction
15.	Install barriers alongside internal construction roads or use some other suitable form of delineation to deter driving off nominated access roads.	Throughout construction
Stockpile, Borrow Pit, Spoil and Laydown Area Management		

No.	Actions	When
16.	Stockpiles controls include: • Stabilising long-term (>3-months) stockpiles with a soil binder or revegetating with hydromulch • Stockpile heights will be maintained at <1.5m for topsoil and <4m for subsoil • Position away from sensitive receptors or where the nearest sensitive receptors are upwind Stockpile management will be in accordance with the requirements of the Water Management Plan.	Throughout construction
17.	Implement dust suppression measures such as water, polymers, or surfactants during material extraction and handling activities.	Throughout construction
18.	Minimise drop heights when offloading or handling materials. Use chutes, screens, enclosures, sprays, covers, dust guards or dust extraction systems as appropriate to reduce dust generation.	Throughout construction
19.	Remove silt and other materials from around any erosion control structures, where practicable, following any significant rain event (>10 mm) to ensure deposits do not become a dust source.	Throughout construction
20.	Controls for materials handling include: • Minimise multiple handling of soil and rock materials. • Regularly water, stabilise and/or cover all permanent stockpiles onsite or those left over one week. • Water or cover loads transporting soil, aggregate or other dust generating materials.	Throughout construction
Vehicle, Equipment, Machinery and Vessel Emissions		
21.	All vehicles and machinery will be fitted with appropriate emissions-control equipment, will be maintained frequently and will be serviced to the manufacturer's specifications. Pre-start checklists and equipment maintenance logs indicating maintenance schedule shall be completed.	Throughout construction
22.	Where practicable, low-sulphur fuel will be used to minimise emissions from plant and equipment.	Throughout construction
23.	Regularly maintain diesel exhaust equipment and ensure compliance with appropriate design emission standards for in service vehicles.	Throughout construction
24.	Ensure all vehicles switch off engines where idling time on-site is likely to exceed two minutes.	Throughout construction
25.	Conduct regular visual inspections of vehicle and machinery. Implement corrective measures when there are indications of high levels of particulate matter and other pollutants, such as dark, thick smoke.	Throughout construction
Atmospheric Emissions		
26.	Cutting, grinding or sawing equipment will be fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	Throughout construction

No.	Actions	When
27.	Burning of vegetation is not permitted for the Project.	Throughout construction
28.	Water suppression will be used during demolition operations. An appropriate method of directing water mist to the point of demolition where dust is generated will be applied, including misting equipment fitted to demolition machinery or handheld sprayers positioned in a safe location.	Demolition Works
Odour Emissions		
29.	Recover and dispose of promptly any dead fish or other aquatic macro-fauna from the reservoir to minimise potential for odours relating to decomposition of aquatic fauna.	Throughout fish salvage program
30.	Monitor, and if required, promote vegetation growth on the exposed banks as per the Erosion and Sediment Control Plan to encourage drying out of the sediments /mud and promote aerobic conditions that may minimise offensive odour generation.	Throughout construction
Monitoring		
31.	A monitoring program will be implemented for the Project to ensure emissions from the Project do not exceed the following performance criteria: 1. PM_{10} concentrations a. 24-hour average concentration - 50 µg/m^3 2. Dust deposition a. Monthly average - 120 mg/m^2/day	Throughout construction
	Visual inspection for airborne dust and dust deposition will be undertaken daily to assess the effectiveness of dust-suppression controls.	Throughout construction
32.	Quarterly audits of the Project's performance against the CEMP will be undertaken.	Quarterly

4.4. Aquatic Ecology

4.4.1. Effects of the proposed change

4.4.1.1. Lake MacDonald

The IAR provided an assessment of potential impacts on aquatic ecology during the construction of the Project. The previous design required the temporary removal of around 97 % of the water in Lake Macdonald and a short-term increase in water flows downstream in Six Mile Creek. To mitigate the impact to aquatic species within the lake during the construction period, it was proposed to capture aquatic species that would not be able to move away from the Project area and transfer them into neighbouring areas as part of the fauna salvage program for the duration of the construction period.

As the change to the Project no longer requires the lake to be drawn down to a level that requires aquatic species to be relocated, it is anticipated that impacts to aquatic ecology will be reduced as a result of this project change.

Potential impacts to aquatic ecosystems in response to the changes to the Project, have been comprehensively considered in a water quality risk assessment which also considers impacts on aquatic ecological values within Lake MacDonald and downstream in Six Mile Creek (**Appendix F**).

The drawdown of Lake MacDonald and the construction phase of the Project has the potential to impact on aquatic flora and fauna, although these impacts are expected to be less than those evaluated in the CGER. During the drawdown phase, aquatic fauna might suffer injuries from pumping equipment, which could lead to increased susceptibility to pathogens and disease or result in fatal injuries. They may also become trapped and drown. Additionally, injuries could occur in the low flow notch during construction and over the spillway during the refill and operation phases.

As water levels decrease, aquatic fauna in Lake MacDonald may become stranded in small, isolated pools. This could happen both during the drawdown phase and after large flow events during construction, when water levels rise and then fall. Stranding increases the risk of predation by larger fish or birds and can lead to crowding. Crowding may reduce dissolved oxygen levels, increase competition for food and shelter, and heighten stress on the fauna. As pools dry up or areas are dewatered rapidly, fauna may end up stranded on dry land and potentially perish. Turtles and platypuses might struggle to reach available water due to exposed sediments and vegetation. Some turtle species may attempt to leave the waterbody as levels drop, but they might not find nearby water sources or could encounter hazards like roads during their movement.

Other potential impacts include the spread of aquatic biosecurity issues such as pest species and the stranding of biota in areas created by the coffer dam, leading to exposure to poor water quality. Injury or mortality from pumping equipment could cause fauna to become susceptible to pathogens or drown. As Lake MacDonald is lowered, stranding in shallow pools could lead to increased predation and competition, though the risk is minimized due to controlled dewatering rates.

Turtles might be injured or killed in construction areas and on the dam's spillway, which they might use for basking. They could also be affected during downstream movements during spilling events. The release of water into Six Mile Creek could impact aquatic flora and fauna by altering water quality, flow conditions, and spreading biosecurity issues. High flow events created by the release could transport fauna downstream or trigger unusual behaviour, but limiting the drawdown period to a minimum of four weeks reduces this risk. Contaminated water from the cofferdam could also adversely affect downstream aquatic biota. Habitat conditions and availability may be affected by erosion, sedimentation, disturbance of habitat structures, and changes in flow patterns. This in turn could affect the breeding capabilities of aquatic fauna.

4.4.1.2. Downstream

There may also be potential adverse impacts to aquatic habitat downstream of the lake due to sedimentation and hydrological changes during the drawdown and construction phases. Fine sediments that accumulate on the bed of reservoirs could be mobilized and deposited downstream during these phases, leading to sedimentation. This sedimentation can smother benthic habitats, including infilling pools and interstitial spaces of coarse substrate such as gravels and cobbles, causing cascading impacts to primary producers (i.e., aquatic plants and benthic algae), macroinvertebrates, and fishes.

The release of water downstream to Six Mile Creek during the drawdown of Lake Macdonald may impact aquatic flora and fauna via impacts to downstream water quality, changes in downstream flow conditions, and the spread of aquatic biosecurity matters such as pest species, weeds, and disease.

The release of water into Six Mile Creek during the drawdown may impact aquatic fauna through the creation of a high flow event that could transport fauna downstream or trigger behaviour that would usually occur at another time, such as breeding migration. However, limiting the initial drawdown to a minimum four-week period ensures that this potential impact has a low risk. The release of contaminated water from the cofferdam waterbody could adversely impact aquatic biota in downstream Six Mile Creek. Habitat condition and availability may also be impacted where water released from Lake Macdonald leads to erosion or sedimentation, disturbance of physical habitat structures, and high flows or prolonged inundation at times when they would not otherwise occur, all of which have a low level of risk.

4.4.2. Residual risk assessment

The risk assessment in **Table 16** discusses the risk of residual impact for each major aquatic habitat impact criteria after mitigation measures are in place.

Table 16: Risk Assessment for aquatic habitat

Residual Impact	Risk Assessment	Overall Residual Risk
Aquatic Habitat		
Temporary loss of aquatic habitat	The temporary loss of aquatic habitat in Lake Macdonald is assessed as high in consequence. This is due to the presence of non-breeding habitat for Mary River cod and habitat for platypus within the lake. However, the impact on habitat is reversible, and efforts will be made to enhance long-term habitat values during the Project. The likelihood of this temporary habitat loss is possible, with an expected loss of approximately 58% of the lake's aquatic habitat (42% FSL - measured by volume). This results in a moderate level of overall residual risk, therefore requiring additional mitigation measures, specifically: An aquatic fauna salvage plan. An aquatic salvage plan is included in the Adaptive Management Plan for the lake drawdown which has been submitted to DCCEEW for approval.	Moderate
Changes to downstream flows	After the mitigation measures are in place, the impact of changes in downstream flows is considered *minor* in *consequence*. The most significant hydrological change will be a short-duration event during the drawdown phase, which is planned to occur outside the breeding season of Mary River cod and Australian lungfish, the MNES species found in Six Mile Creek downstream of the dam. The *likelihood* of altered hydrology is *possible* due to a sustained 4-week release during drawdown and potentially increased flow frequencies past the construction site, which may temporarily benefit the downstream environment.	Low
Sedimentation	The impact of water release on the downstream creek is reversible, with large flows expected to naturally flush out sediment after construction. With the addition of using a pontoon-based pump station to reduce disturbance and downstream sediment transfer, non-invasive grasses, and managing erosion with an ESCP and physical barriers, the *likelihood* of impacts caused by sedimentation is considered *unlikely*. Furthermore, the *consequence* of impact is considered *moderate*.	Low
Aquatic Fauna		

Residual Impact	Risk Assessment	Overall Residual Risk
Fauna Injury and Mortality	The *likelihood* of such injury or mortality is *unlikely when* appropriate mitigations are implemented, as they help prevent species from becoming trapped in equipment, reduce the risk of stranding, and minimize the potential for injury or death over the spillway and in plunge pools. The *consequence* of injury or mortality to aquatic fauna is considered *moderate* with the proposed mitigation measures in place. These measures are designed to prevent significant harm, such as the death of large numbers of threatened and other aquatic species in Lake Macdonald. The overall *residual risk* of fauna injury and mortality is considered **low**.	Low
Stranding of Fauna	The *consequence* of fish and turtle stranding is *high*. Appropriate mitigation measures will minimize significant stranding of aquatic fauna. The lake will be drained over a period of 4-weeks giving aquatic fauna time to adapt to the new levels and a fish salvage plan will be utilised to relocate any stranded fauna. It will also be ensured that refugial habitat will remain throughout the construction period. The *likelihood* of stranding is *unlikely* when these measures are in place.	Moderate
Facilitated Impacts to Breeding	The initial drawdown should avoid releases during the breeding seasons for Mary River cod, platypus, and giant barred frog by conducting the initial drawdown between March and October. The *likelihood* of impact is therefore mitigated, and considered *rare*, whilst the *consequence* of impact is still considered *high*.	Low
Aquatic Flora		
Loss of aquatic flora	To mitigate loss, water will be maintained in Lake Macdonald above 93 m AHD, and aquatic plants have strong dispersal abilities that will facilitate their recolonization during the refill and operation phases. The likelihood of impact from dewatering is unlikely, with the adjoining consequence of impact considered moderate after implementing mitigation measures. While some native plants can survive in saturated sediments, several species will die in dewatered areas. However, this impact is expected to be reversed once refilling begins and during the operational phase.	Low
Biosecurity issues		
Spread of Restricted Biosecurity Matters	Management measures to prevent the spread of restricted biosecurity matters include monitoring water levels, designing a cofferdam to block pest fish movement, and actively managing the lake's water during construction. Efforts also involve humane euthanising of pests, rigorous vehicle and equipment hygiene protocols, and training personnel in pest identification. Additional steps include installing cane toad traps, removing invasive aquatic plants, and ensuring that relocated fauna do not spread diseases or pests. The *likelihood* of impact is considered *rare* after implementation of mitigation measures. The *consequence* of impact is considered *high*. The overall *residual risk* rating is considered **low**.	Low
Introduction of New Biosecurity Matters	The consequence of establishing or spreading biosecurity matters is *high*, as it would result in significant environmental impact and non-compliance with the *Biosecurity Act 2014*. Establishment of invasive species is typically irreversible. However, the *likelihood* of this	Low

Residual Impact	Risk Assessment	Overall Residual Risk
	occurring is *rare* when appropriate mitigation measures are implemented	

4.4.3. Mitigation measures

The Project's aquatic ecology mitigation measures are detailed in the LMDIP AMP which has been submitted to DCCEEW for approval. A summary of some key mitigations are outlined below.

4.4.3.1. Lake Macdonald

Before Drawdown

Before the drawdown of Lake Macdonald, an evaluation survey will be conducted with a focus on the upper reaches. This survey will include assessments of large-bodied fish, specifically MNES species, with the salvage of;

- small-bodied fish - recording species and their abundance.
- platypus - initially using eDNA sampling to inform locations for setting up camera traps in and around active burrows to monitor ongoing presence.
- turtles - both MNES listed and common species, using methods outlined in DSEWPC (2011) Impact assessment Report LMDIP Water Quality Impact Assessment 2024 Prepared for Seqwater.
- tadpoles - identifying and recording the abundance of barred frog tadpoles (genus Mixophyes) caught incidentally using fish and turtle survey methods.

If Mixophyes tadpoles are detected, species determination will be undertaken. The evaluation survey may be modified to include activities such as the evaluation of biomass and pre drawdown commencement of aquatic fauna salvage and relocation.

During Drawdown

The initial lowering of the lake from FSL (RL 95.3 m AHD) to approximately 42% FSL (RL 93 m AHD) will occur gradually over a period of no less than four weeks to allow fauna to adapt to the reduced water level. The drawdown program will begin outside the platypus breeding season (August to October) and avoid hot conditions, such as summer months.

Water quality will be managed as described in the AMP (SMEC, 2024) and intake exclusion screens of suitable design (less than 20 mm aperture) will be used to prevent aquatic fauna from being entrained into drawdown equipment, ensuring the approach velocity is no more than 0.1 m/s. A salvage plan will be implemented to prevent crowding and stranding, with platypus not being relocated unless necessary. The existing destratification unit will be maintained and on standby to respond to water quality triggers or signs of fish distress. Frogs will not be handled unless relocation is necessary or they appear stranded, and if handling is necessary, protocols in section 8.2.4 of the AMP will be followed.

During Construction

During construction, where physical conditions in the lowered lake are suitable, habitat and waterholes for platypus within their home range in the Lake Macdonald footprint will be maintained, considering natural behaviours. Aquatic biota salvage from the cofferdam waterbody will be implemented as needed. The presence of turtles basking in the workspace and dam spillway areas will be monitored, and if deemed to present an issue, specialist advice will be sought on how to best manage their exclusion. Frogs will not be handled unless relocation is necessary or they appear stranded, and if handling is necessary, the protocols in section 8.2.4 of the AMP will be followed.

4.4.3.2. Downstream

During Drawdown

During the drawdown of Six Mile Creek downstream, the release rate will be tailored to achieve the initial drawdown over a period of not less than four weeks to minimize artificial impacts associated with elevated flow velocity and depth. The initial drawdown will avoid releases during the breeding seasons for Mary River cod, platypus, and giant barred frog, which are known to be in Six Mile Creek downstream of the dam, by conducting the initial drawdown between March and October. Water quality and aquatic habitat will be managed as described in Sections 3 and 6 of the AMP respectively (SMEC, 2024). A visual monitoring of sites will be conducted weekly where fauna have been relocated, including observations of mortality and measurement of in situ water quality, focusing on dissolved oxygen.

During Construction

During construction, inflows will be allowed to pass downstream, and water quality and aquatic fauna will be managed as described in Section 5.4.3.1. These measures are aimed at preventing or reducing potential impacts to aquatic fauna, particularly listed threatened species, and ensuring the effective management of aquatic habitats throughout the Project.

4.5. Fish passage impacts

4.5.1. Effects of the proposed change

The behaviour of the refined coffer dam is different to that described in the IAR because it holds back a substantial proportion of water in Lake MacDonald. At the approved drawdown level of 5%, the temporary coffer dam would not have spilled. At the proposed drawdown level of 42%, the temporary coffer dam would occasionally spill, introducing a risk of harm to fish and turtles.

The refined coffer dam design requires an “other change” application for the existing waterway barrier work approval. As part of the application to SARA, the application must demonstrate alignment with the objectives of the State Development Assessment Provisions, State Code 1, 6 and 18.

As this request for project change is relevant to the change application for the development approval, assessments against the relevant State Codes have been provided in **Appendix E**.

4.5.2. Fish passage

The approved cofferdam did design did not contemplate the need for safe fish and turtle passage, as the Lake was to be drawn down to around 5%, with most fish and turtle biomass salvaged and

relocated. The intended construction of a larger coffer dam which retains a substantial volume of water (and aquatic biomass) in the Lake introduces a new risk – fish and turtles may spill over the temporary coffer dam during flow events. This was not previously the case. In addition, fish and turtles may now move across the construction site via a stilling basin, ultimately reaching Six Mile Creek downstream.

Upstream fish passage has never been available given the current dam design. During the planning phase of the Project, it was determined that provision of upstream fish passage would not provide an overall environmental benefit; in summary, a fishway at Six Mile Creek Dam would provide limited benefit due to operational limitations and a relatively small upstream catchment, as well as potentially leading to non-compliance with General Biosecurity Obligations under the Biosecurity Act 2014, due to the presence of Mozambique tilapia downstream of the dam. To counter this, the Project has decided to install the Gympie weir fishway as a project offset.

Downstream fish passage currently only occurs during spill events. This aspect will remain unchanged with the new permanent dam & spillway design as there is no proposed change to the height of the dam wall.

To minimise fish harm, downstream passage will be temporarily prevented throughout the LMDIP construction period (approx. 40 months) using a siphon system that will maintain the lake level below RL93 minimising to the greatest extent possible flow events that would attract fish movement. This is further expanded on in Section 4.5.3.

4.5.3. Siphon System

Post initial reservoir lowering the lake level will be actively managed to negate the need for installing a downstream fishway on the Upstream Coffer Dam (UCD). Seqwater commissioned Red Earth Engineering (REE) to perform an engineering options analysis to determine the best way to minimise harm to fish during the construction of the Lake MacDonald Improvement Project. The analysis looked at 6 options:

1. UCD with no siphons or fish passage (refer **Figure 9**).
2. UCD with no siphons and a 10m wide fish passage with invert level at RL 93.0m (refer **Figure 10**).
3. UCD with 5 siphons and no fish passage (refer **Figure 11**).
4. UCD with 5 siphons and a 10m wide fish passage with invert level at RL 93.0m (refer **Figure 12**).
5. UCD with 7 siphons and no fish passage (refer **Figure 13**).
6. UCD with 7 siphons and a 10m wide fish passage with invert level at RL 93.0m (refer **Figure 14**).

The following assumptions were applied to the options analysis:

- UCD Spillway width of 150m, at RL93.5 m
- Siphons operate when reservoir water level is above RL93.0 m
- Siphons comprise nominally of 360m long OD710 HDPE pipes routed around the Right Embankment
- Reservoir inflows are as provided by Seqwater (IQQM daily inflows)
- Model is run for 120 years covering the period January 1890 to June 2011
- No losses are allowed for (e.g. evaporation, pumping, seepage). This means that when the modelled reservoir levels are reduced close to the spillway/fishway inverts, the model overestimates the number of flow days in scenarios without siphons. This is because the spillway/fishway is the only discharge mechanism available in these scenarios, and there is not enough driving head to force a large outflow rate. This is deemed conservative for the purposes of this assessment.

- Cases where Fish Passages are in place, it has been assumed that they are operational for the full period of the assessment. The actual percentage of days that a fish passage may be in operation are expected to be reasonably less than those presented below.
- It's assumed that a minimum of 100mm flow depth over the spillway / fishway is required to attract fish species.

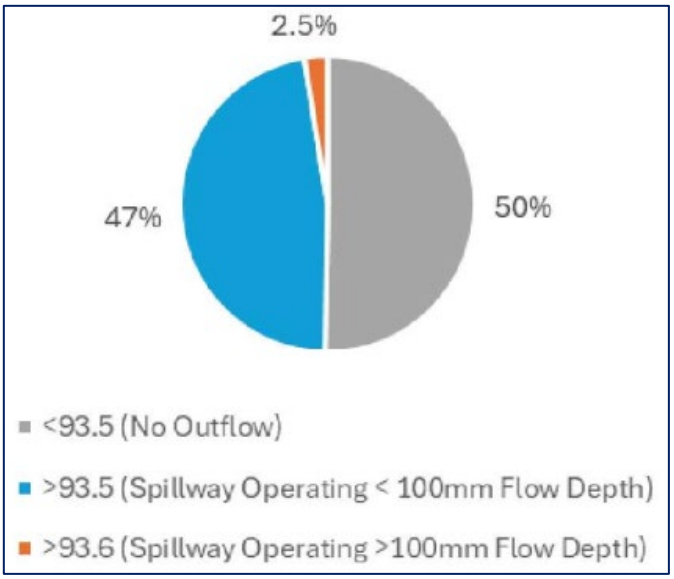


Figure 9: Modelled outflow breakdown by % days – UCD with No siphons & No fish passage

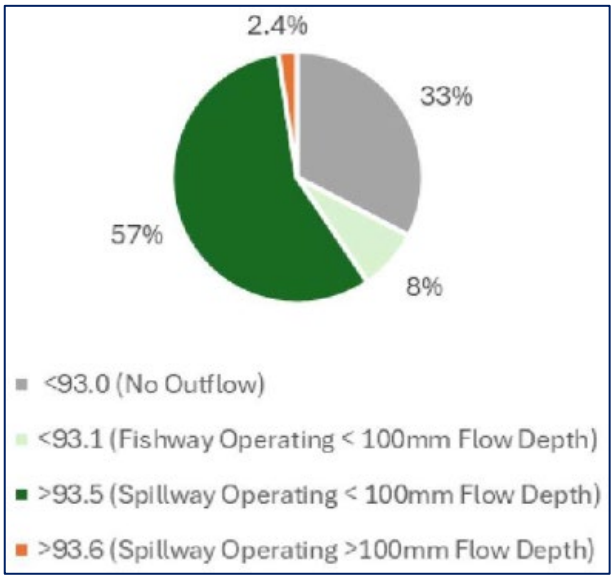


Figure 10: Modelled outflow breakdown by % days – UCD with No siphons & 10m fish passage

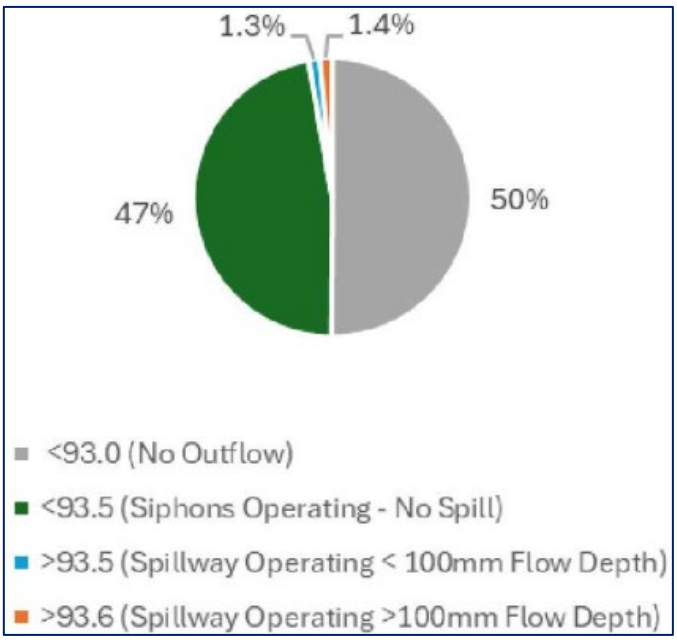


Figure 11: Modelled outflow breakdown by % days – UCD with 5 siphons & No fish passage

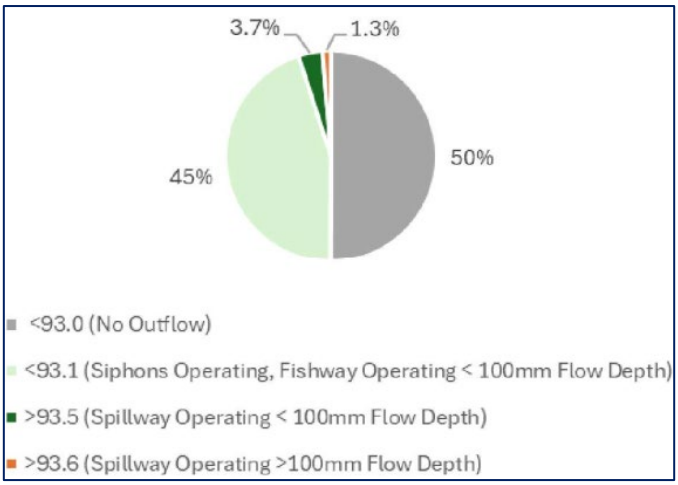


Figure 12: Modelled outflow breakdown by % days – UCD with 5 siphons & 10m fish passage

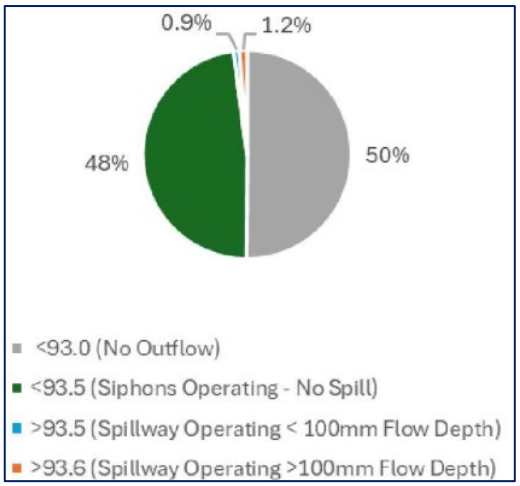


Figure 13: Modelled outflow breakdown by % days – UCD with 7 siphons & No fish passage

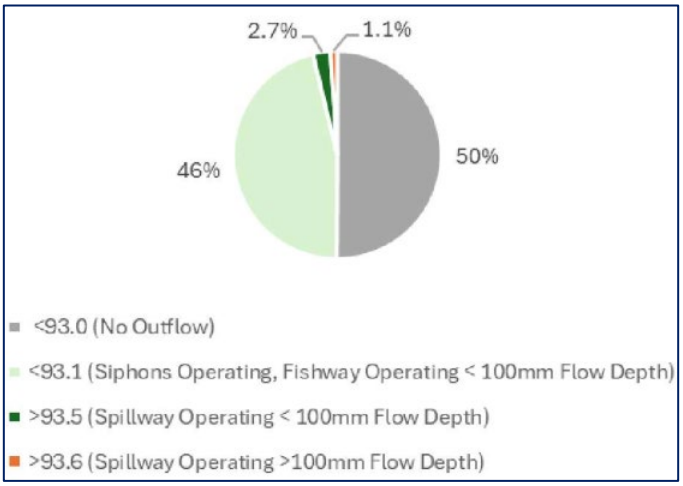


Figure 14: Modelled outflow breakdown by % days – UCD with 7 siphons & 10m fish passage

The REE modelling presented in the charts above can be further summarised as follows:

1. The outcome of the assessment found that over the 120-year time series, 3% of days had flows which overtopped the UCD spillway at a depth of at least 100mm (minimum flow depth that attracts fish passage) assuming the UCD is built without a fish passage or dewatering siphons (refer **Figure 9**).
2. The inclusion of a fish passage was demonstrated to have a significant reduction on nuisance flows and with the current input assumptions, would have been in operation for ~60% of data series days as illustrated in **Figure 10**.
3. The inclusion of 5 dewatering siphons (and no fish passage) was also demonstrated to be very successful in managing nuisance flows and had an improved ability to reduce spills of 100mm

depth, or more, over the UCD spillway (from 3% to 1%) when compared to the introduction of a fish passage (refer **Figure 11**).

4. The coupling of a fish passage with 5 dewatering siphons also provides a negligible improvement to UCD spill risk (refer **Figure 12**) and provides little opportunity for downstream fish passage.
5. Furthermore, increasing the dewatering siphons from 5 to 7 was demonstrated to offer very little benefit to that already achieved by 5 siphons (refer **Figure 13** and **Figure 14**).

The assessment suggests that there is minimal reduction in risk of fish being washed over the UCD spillway following the introduction of a fish passage. Furthermore, the introduction of a fishway provides opportunity for fish passage over an additional 60% of days during lower flow events. In the event that even a small risk of fish injury/mortality exists by passing through the fish passage, the potential for harm to fish could inadvertently increase through the inclusion of a fish way due to the significant increase in fish passage opportunities. Additionally, this would increase the amount of salvage & relocation handling required from the stilling basin which adds further risk to fish safety.

Table 17 below shows the operational day counts / year for the 5-siphon option with and without a fishway, showing that the number of days where fish are at risk of going over the spillway remains the same (5 days per year).

Table 17: Day Count where water level is in a given range from 120-year modelled timeseries

Water Level Range (mRL)	Without Siphons or Fishway			With 5 Siphons, No Fishway			Water Level Range (mRL)	With 5 Siphons, 10m Fishway		
	Day Count	% Days	*Average Days Per Year*	Day Count	% Days	*Average Days Per Year*		Day Count	% Days	*Average Days Per Year*
<93.01 (No Siphons Operating)	NA	NA	NA	22,225	50%	183	<93.01 (No Siphons Operating)	22,225	50%	183
93.01 - 93.5 (No UCD Spill)	22,308	50%	183	20,940	47%	172	93.01 - 93.1 (Fishway Operating <100mm Depth)	19,949	45%	164
93.5 – 93.6 (Spillway Operating <100mm Depth)	20,947	47%	171	585	1.3%	5	93.1 – 93.6 (Fishway Operating >100mm Depth)	1,628	3.7%	13
>93.6 (Spillway Operating >100mm Depth)	1,120	3%	11	625	1.4%	5	>93.6 (Spillway Operational >100mm Depth)	573	1.3%	5
Total	44,375	100%	365	44,375	100%	365	*Total*	44,375	100%	365

Figure 15 shows the proposed alignment of the siphon system around the right embankment.

Figure 15: Proposed alignment for the pump & siphon system

The proposed siphon comprises a series of OD710 HDPE pipes. It's anticipated that the system would comprise of 5 x siphons with a total flow capacity of nominal 4.5 - 5m^3/s.

Siphon inlets have been nominated with bell mouth style designs with anti-vortex plates attached to reduce head losses and minimise inlet flow velocities. Diamond mesh nylon netting (9mm x 9mm apertures) has been designed to attach to a float around the inlets at a distance where flow velocities do not exceed 0.1m/s to prevent fish attraction.

4.5.4. Fish passage through the working platform

The siphon system will also reduce the risk of harm to fish passing over the existing spillway during construction (which forms the downstream extent of the working platform). Flows over the existing spillway will only start once the siphon system reaches capacity at 5m3/sec, at which time the tailwater in Six Mile Creek has already risen by 1.64m. This increase in tailwater depth at the toe of the spillway at commencement to spill provides safer fish passage than the existing arrangement. This improvement in tailwater depth will ensure that Performance Outcome #6 (PO6) of State Code 18 is met i.e. 30% of the head difference.

A low-flow channel will be maintained through the dam wall working platform. The elevation difference between the receiving waters in Six Mile Creek and the stilling basin will be too high to allow for upstream fish passage past the temporary coffer dam during the construction period.

The 30m wide low flow channel will be about EL 88.5 m AHD with the remainder of the working platform about EL 89.5 m AHD.

4.5.5. Fish harm mitigation options analysis

Three scenarios were assessed by Seqwater's engineering consultant REE to determine the best-for-project pathway to minimising overall fish harm. These included siphons, a downstream fish passage on

the UCD, and a fish bypass channel. Advantages and disadvantages for each option are summarised below in **Table 18.**

Table 18: Advantages and disadvantages across the 3 fish protection options assessed by REE

Option	Advantages	Disadvantages
Siphons	Reduction in fish harm by significantly reducing the flow occurrences that fish passage could occur. Allows for better management of elevated upstream reservoir levels and construction flow management. Minimises impact on permanent spillway construction (nuisance flows and footprint). A siphon would be required for initial reservoir draw down so has minimal additional cost to the Project. Significantly reduces the need for catch and release of fish from an intermediate water body.	Current siphon design does not allow for fish passage, only a reduction of flow occurrences that fish passage could occur
UCD Fish Passage	Fish passage is feasible for the range of flow conditions anticipated for reservoir levels between RL 93.2 m and RL 93.6 m	Constructability constraints for the passage between the Working Platform and Six Mile Creek. Note that whilst there are considerable challenges achieving the design acceptance criteria of 200 mm between the Working Platform and Six Mile Creek, this situation already exists for the current spillway. Flow depth and velocity of the structure is highly dependent on the surface roughness. Minor changes in roughness from the conditions assumed in the calculations could reduce flow depths and increase velocities beyond the values obtained during the assessment. The inclusion of a fish passage provides only slight reduction (from 3% to 2%) in spills of 100mm depth or more over the UCD spillway. Has a minor impact on permanent spillway construction as passage needs to be accommodated across the Working Platform. Has a moderate cost impact to the Project. Requires catch and release of fish from an intermediate water body in accordance with the Adaptive Management Plan LMDIP-05327-GNL-ENV-MPL-00002.

Option	Advantages	Disadvantages
Bypass Fish Passage	Fish passage is feasible for the range of flow conditions anticipated for reservoir levels between RL 93.2 m and RL 93.6 m Does not requires catch and release of fish from an intermediate water body	Introduces dam safety issues which pose risk to life downstream due to scour related failure modes during the construction period. These issues are unlikely to be able to be resolved satisfactorily. Target flow depths of min. 200mm are dependent on over excavation of Spillway Demolition cuts. Requires active management of the bypass alignment to avoid waters entering the Bypass Fish Passage when flow over the UCD spillway exceed 200mm depth (i.e. there is an upper limit to allowable flow rate and the inlet will need to be closed off). Flow depth and velocity of the structure is highly dependent on the surface roughness. Minor changes in roughness from the conditions assumed in the calculations could reduce flow depths and increase velocities beyond the values obtained during the assessment The inclusion of a fish passage provides only slight reduction (from 3% to 2%) in spills of 100mm depth or more over the UCD spillway. Has a significant impact on permanent spillway construction sequencing and workspace. Significant challenges with regards to constructability, site access, interaction with permanent/other temporary works are unlikely to be resolved.

This analysis has been further summarised into a traffic-light options evaluation in **Table 19.**

The Project requires an adaptive approach to drawdown methodology, because inflows are unpredictable. Following high flow events, as well as for small inflow events or ongoing catchment inflows, it is expected that the lake water level may continue to spill for long periods of time. Allowing long-term low/trickle flows over the cofferdam crest and through the spillway construction area is not ideal for construction efficiency, safety, and preventing contamination of water flowing downstream. As such, the ability to use a bypass arrangement encompassing mechanical drawdown infrastructure to manage lake water level and bypass low flows around the UCD is deemed essential for both the initial drawdown and ongoing reservoir level maintenance to minimise fish harm.

Table 19: Options Evaluation – Fish passage

Criteria	Option 1: Dewatering Siphons	Option 2: UCD Fish Passage	Option 3: Bypass Fish Passage
Reduction in UCD Spillway Operating >100mm Flow Depth	1.1% of days	0.1% of days	0.1% of days
Operational Duration	Operable for most of the 4 year construction period	Operable for circa 2 years out of the 4 year construction period	Operable for circa 1 year out of the 4 year construction period
Environment	Can be used to bypass low flows around the cofferdam. No change to current condition (i.e. fish passage not allowed for in existing LMD Spillway design)	Is capable of providing safe fish passage following UCD construction and prior to commencement of LMD Spillway construction (i.e. during spillway foundation works only)	Is capable of providing safe fish passage following UCD construction and prior to commencement of Left Embankment works (i.e. during spillway foundation works only)
Regulatory	Subject to Water Way Barrier Approval	Subject to Water Way Barrier Approval	Subject to Water Way Barrier Approval
Constructability	Minimal impact (required for lake lowering)	Moderate impact on permanent and other temporary works	Significant impact on permanent and other temporary works
Resources	Minimal implementation impact. Minimal additional resourcing to manage upstream reservoir levels	Minor additional resourced required to construct. Periodic fish catch and transport also required	Major scope change requiring significant increase in resources to install & remove
Schedule	Minimal implementation impact	Similar installation schedule	Unlikely to affect critical path activities however introduces complexity to staging
Operational Complexity	Minimal crew to man during operations. Low complexity operation	Periodic fish catch and transport also required	Standby crew during periods when UCD forecast to spill to block fish passage inlet
Cost	Low impact	Moderate cost impact	Significant cost impact
Further Studies	50% Design	30% Design	30% Design

From the REE analysis the Project has concluded that it is not practically feasible to construct a fish bypass. The use of siphons to divert the majority of inflows around the construction site is considered the best option in regard to:

- Preventing fish going over the spillway and through the working platform
- Minimising fish handling from the stilling basin
- Minimising nuisance flows through the worksite
- Cost and constructability

4.5.6. Mitigation measures

4.5.6.1. Spill reduction

As discussed above, a siphon system will be installed to minimise the number of days when the temporary coffer dam spills as a depth that might attract fish. The inclusion of 5 dewatering siphons (and no fish passage) will reduce spills of 100mm depth, or more, over the UCD spillway to less than 5 days per year. By minimising the number of spill events per year, impacts on fish and turtles will be reduced. Downstream movement of fish and turtles will not be completely prevented, with occasional movement during high flow events likely to occur, ensuring connectivity between the upstream (Lake MacDonald) fishery and Six Mile Creek Downstream.

4.5.6.2. Upstream bubble curtain

A bubble curtain, also known as a pneumatic barrier, is an aquatic system that produces bubbles in a specific arrangement. This technique involves releasing air bubbles beneath the water surface, usually at the bottom, using air compressors to propel them through hoses or nozzle pipes. A bubble curtain may be effective as a barrier to fish movement in some circumstances although there are no published data around the effectiveness of this approach in an Australian context. Seqwater will investigate the potential application of a bubble curtain upstream from the temporary coffer dam in consultation with industry experts.

4.5.6.3. Fish passage

As fish and turtles may move across the coffer dam during spill events and ultimately across the working platform and downstream int Lake Macdonald, there is a risk of injury which was not present under the approved project.

In recognition of new risks to fish and turtles the coffer dam design has been further refined to ensure that safe downstream movement occurs. The following design parameters will be met:

- Both the cofferdam and working platform will achieve a minimum tailwater depth of 30% of the spillway height
- CFD modelling has confirmed adequate depth of tailwaters to ensure turbulence and shearing forces do not cause harm to aquatic species
- Construction surfaces will be non-abrasive to aquatic species
- The design will eliminate any potential impact points
- The design will not incorporate any free-fall sections over the spillway considered preferable that the risk to these species be reduced by minimising the number spill events.

4.6. Water quality

4.6.1. Effects of the Proposed Change

4.6.1.1. Lake MacDonald

Potential water quality impacts for the refined project have been comprehensively considered in a water quality risk assessment (Appendix G).

The IAR described the installation of a temporary sheet pile cofferdam upstream of the existing dam to maintain a reduced impoundment level at 89.5m AHD during construction. This equated to a lowering of 5.8m and retaining up to 226 ML (2.8% of capacity) of water in Lake Macdonald for 1-2 months during construction of the cofferdam, followed by up to 412 ML (5.0% of capacity) of water for the remaining construction period.

The refined cofferdam design involves the installation of a temporary double wall sheet pile cofferdam upstream of the existing dam to maintain a reduced impoundment level at RL 93.0m AHD and retaining up to 4,410 ML during construction (42% of capacity) for a period of 7.5 months.

The drawdown of waterbodies can adversely impact water quality both at the discharge sites and downstream, as well as within the lake itself. Bathymetric modelling does not indicate isolation of discrete waterbodies within the wider impoundment in a 42% drawdown, with the new water level remaining relatively contiguous.

Some minor contractions around the fingers and banks of the lake are noted, relative to the FSL. Construction earthworks and runoff from soil stockpiles during construction can potentially impact water quality. Additionally, the submersion of decomposing organic matter during the dam refill phases can lead to water quality deterioration and eutrophication.

Increased turbidity and total suspended solids can occur via the disturbance of bed sediments and erosion of beds and banks during drawdown and construction, as well as from the disturbance of earth and runoff from soil stockpiles during construction. Increased turbidity can negatively impact fish and macroinvertebrates by reducing respiratory and feeding efficiency, and it can adversely affect submerged aquatic plants by reducing light penetration required for photosynthesis. While small and brief increases in turbidity (consistent with natural flow events) are unlikely to have significant impacts, substantial increases, especially from fine silt and clay particles, could adversely affect the health, feeding, and breeding ecology of aquatic fauna.

A reduced pH can result from exposing or disturbing acidic soils during drawdown and construction, or from decomposing organic material (e.g., aquatic plants) reducing the pH of water. Reduced pH can harm fish health by causing diseases (e.g., lesions and ulcers) and impacting metabolism and reproduction, with very low pH potentially causing fish kills. While the lower Mary River Basin's waterways are naturally acidic and stained with tannins, Six Mile Creek is not naturally acidic. Some variation in pH is tolerated by the aquatic biota of Six Mile Creek, but significant reductions in pH may adversely affect ecosystem health. A reduced dissolved oxygen concentration can occur in the lake and downstream in Six Mile Creek if the waterbody becomes stratified or eutrophic, such as through the submersion of decomposing organic matter (e.g., decomposing *Cabomba caroliniana* (Cabomba)) during the refill phase.

Dissolved oxygen is essential for respiration and metabolism by aquatic biota, and reduced levels can cause stress and potentially mass mortality. While some regional waterways naturally experience low dissolved oxygen, sustained periods of low dissolved oxygen will cause mortality in aquatic fauna.

There exists a probability of increased nutrient concentrations if drawdown exposes deep sediments below approximately 93 m AHD, which have higher nutrient content, and during refill if the lake becomes eutrophic from decomposing organic matter. High nutrient concentrations can lead to increased growth of phytoplankton, depleting dissolved oxygen, and promoting excessive algae and aquatic plant growth, which reduces in-stream habitat quality for some biota. Increasing dissolved metal concentrations can occur during drawdown, construction, and refilling phases due to the mobilization and oxidation of lake sediments, lateral transport of sediment pore water, and ebullition fluxes.

Drawdown exposing deep sediments below approximately 93 m AHD, which have higher metal content, increases the risk of adverse water quality impacts. Spills of fuels, oils, or other chemicals from pumping equipment or other machinery/vehicles during drawdown and construction can be toxic to aquatic flora and fauna. Significant fuel spills can have a locally significant impact on both flora and fauna, with the size of the spill and the volume of water in the creeks influencing the length of the stream impacted. These potential impacts necessitate robust management measures, including enhanced erosion and sediment control, continuous ecological monitoring, and stringent protocols for chemical management, as outlined in the AMP.

4.6.1.2. Downstream

Potential impacts on water quality values within the lake are also relevant to downstream environments. Construction earthworks and runoff from soil stockpiles during construction can further degrade water quality. Additionally, the submersion of decomposing organic matter during the dam refill phases can lead to water quality deterioration and eutrophication. A reduced dissolved oxygen concentration can occur downstream in Six Mile Creek if the waterbody becomes stratified or eutrophic, such as through the submersion of decomposing organic matter during the refill phase.

4.6.2. Water Quality Residual Risk Assessment

An independent risk assessment was conducted on the refined construction methodology across the predominant environmental risks including water quality, aquatic habitat and aquatic flora and fauna. The full report is available in Appendix G and a summary of the findings is presented below in **Table 20.**

The risk assessment below discusses the risk of residual impact for each major water quality impact criteria after mitigation measures are in place.

Table 20: Risk Assessment for water quality

Residual Impact	Risk Assessment	Overall Residual Risk
Turbidity and Total Suspended Solids (TSS)	Management measures include the implementation of an adaptive monitoring program with clear trigger values and corrective actions and focus on limiting disturbance of sedimentation during extraction. After these measures are implemented, the likelihood of turbidity and TSS impacts is considered unlikely. Subsequently, the consequence of impact is considered minor.	Low

Residual Impact	Risk Assessment	Overall Residual Risk
Dissolved Oxygen Levels	Aeration units and real-time monitoring systems will be deployed to ensure oxygen levels remain within acceptable limits. After these measures are implemented, the *likelihood* of dissolved oxygen impacts is considered *unlikely*. Subsequently, the *consequence* of impact is considered *moderate*. The overall *residual risk to* dissolved oxygen is considered *low*.	Low
Nutrient Concentrations	Active removal of decomposing organic matter and careful management of nutrient inputs is required and continued ongoing water quality monitoring of site. After these measures are implemented, the *likelihood* of nutrient concentration impacts is considered *unlikely*. Subsequently, the *consequence* of impact is considered *moderate*.	Low
Mobilisation of metals	Prevention measures recommend avoiding lowering the water in Lake Macdonald below 93 m AHD to prevent exposure of sediments with high metals. Ongoing water quality monitoring of site will also be conducted. After these measures are implemented, the *likelihood* of impacts caused by the mobilisation of metals is considered *unlikely*. Subsequently, the *consequence* of impact is considered *low*.	Low
Introduction of contaminants from construction activities	Prevention measures highlight the appropriate storage of contaminates and ongoing water quality monitoring of site. After these measures are implemented, the *likelihood* of impacts caused by the introduction of contaminants is considered *unlikely*. Subsequently, the *consequence* of impact is considered *moderate*.	Low
Reintroduction of poor water quality from stilling basin	Prevention measures recommend regular dewatering and treatment of poor water quality will be conducted when detected in the stilling basin and ongoing water quality monitoring of site. After these measures are implemented, the *likelihood* of impacts caused by the reintroduction of poor water quality from stilling basin is considered *unlikely*. Subsequently, the *consequence* of impact is considered *moderate*.	Low

4.6.3. Mitigation Measures

Water quality mitigation measures associated with the reservoir drawdown are detailed in the LMDIP AMP. All other water quality measures associated with earthworks, groundwater, concrete batch plant & borrow pit will be detailed in the LMDIP CEMP which includes a Water Management Plan. A summary of some key mitigation strategies is provided below.

4.6.3.1. Lake MacDonald

During Drawdown

The arrangement of dewatering equipment intakes will be such that suction does not disturb sediments on the lakebed. Intakes of dewatering equipment will be positioned to extract water from within the top half of the water column. Additionally, pontoon-based pump stations will be used to minimize disturbance of unconsolidated bed sediments.

Biodegradable oils and lubricants will be utilized for mechanical equipment. Refuelling will be performed on land with suitable containment, and if refuelling near the lake is necessary, appropriate spill kits will be available to contain any spills.

Fuels, oils, and other chemicals will be stored in bunded areas in accordance with *AS 1940-2004 – The storage and handling of flammable and combustible liquids*.

A risk-based assessment will be implemented for any exceedances of water quality trigger values to determine the potential for environmental harm. Where risk of environmental harm is identified, additional mitigations, such as aeration using the existing destratification unit, will be applied if the concentration of dissolved oxygen becomes concerning.

Water quality monitoring will be implemented as per the AMP which defines several periodic and continuous water quality monitoring locations within the upper, mid and lower sections of the lake as well as up to 4 monitoring locations within Six Mile Creek.

During Construction

During construction biodegradable oils and lubricants will be used for mechanical equipment. Refuelling will be done on land with suitable containment, and spill kits will be available for any necessary refuelling near the lake.

Fuels, oils, and other chemicals will continue to be stored in bunded areas in accordance with the relevant standards.

The construction erosion and sediment control plan (ESCP) and stormwater management plan will be implemented. During periods of high flow, water will fill the area between the cofferdam and main worksite. Dewatering will be conducted to ponding of water in the area. Water will be treated where it does not meet discharge criteria described in Project's management plans. Dewatering to downstream Six-Mile Creek will be avoided and controlled dewatering into the reservoir will be prioritised.

Dissolved oxygen levels will be maintained by using aeration units and ensuring turbulent release to the existing concrete apron.

4.6.3.2. Downstream

During Drawdown and Construction

Release rates must comply with the mitigation measures outlined in the Project's management plans.

Aeration of water and erosion mitigation through energy dissipation, such as armoured discharge points or sprays, will be provided. A certified ESCP will be implemented in accordance with industry standards, and the efficacy of sediment and erosion control measures will be monitored. The siphon discharge into Six Mile Creek will be stabilised with a rock bag scour protection arrangement within the bed and banks of the creek.

Refuelling or chemical use will be undertaken away from Six Mile Creek and areas that drain towards surface water or stormwater systems, in accordance with the Water Management Plan (WMP). Fuels, oils, and other chemicals will be labelled and stored in bunded areas in accordance with *AS 1940-2004 – The storage and handling of flammable and combustible liquids*. By implementing these mitigation measures, the Project can effectively manage and reduce potential impacts on water quality, ensuring the protection of aquatic ecosystems in Six Mile Creek and Lake Macdonald.

The WMP will detail specific management procedures for the various types of impacted waters associated with the construction. A detailed and targeted water quality monitoring schedule will be outlined in the WMP. This will include:

1. **Construction Impacted Water:** is any surface water runoff that comes into contact with the Project's active construction footprint and is discharged through approved release points associated with Erosion and Sediment Control (ESC) structures installed in accordance with the ESCP.
2. **Retained Waters:** any Construction Impacted Water held onsite in depressions, open excavations, sumps or ESC structures that do not discharge.
3. **Construction wastewater:** Any waters used for other construction activities such as washdown facilities / tool washing / concrete washout.
4. **Concrete batch plant wastewater:** Generally high pH waters associated with batch plant operation.

Water quality could be impacted by increased turbidity, decreased pH, reduced dissolved oxygen, elevated nutrient levels, and the mobilization of metals. These changes have the potential to harm aquatic life, leading to potential disease and oxygen depletion. Unmitigated risks are medium to high, particularly for dissolved oxygen and nutrient concentrations. To mitigate these risks, measures include minimising sediment exposure, real-time monitoring of water quality, removing decomposing organic matter, and preventing chemical spills. After implementing these measures, residual risks to water quality are considered low.

4.6.3.3. Groundwater

Groundwater will be intercepted and actively dewatered during the course of construction activities. Groundwater will require management, testing and potential treatment prior to discharge. Prior to commencement of works, a Dewatering Management Plan will be prepared to manage potential impacts. The Dewater Management Plan will consider the following control strategies:

- Re-use to meet construction water requirements.
- Disposal to a licensed facility.
- Discharge to the environment - extracted groundwater will be collected and tested and if groundwater does not meet discharge criteria, water will be stored in a borrow pit, treated to the discharge criteria detailed in the Water Management Plan.

5. Requested changes to conditions

The existing imposed conditions in the CGER for the Project require revision to reflect changes to the Project, including a refined coffer dam design, and changed environmental effects of the Project associated with a longer overall construction program. Specific imposed conditions that require amendment for the Changed Project are set out below. Minor, or consequential changes, may be required to other imposed conditions.

5.1. Imposed Conditions

5.1.1. Imposed Condition 6 - Construction vehicle haulage

Imposed condition 6 currently requires that Construction vehicles must not arrive at the site prior to the approved operating hours and must not leave the site with either a full or partial load after the approved operating hours. The CGER does not impose conditions which specify operating hours for the Project, but does note that:

- The IAR confirms that hours of operation for the construction phase are 6:30 am to 6:30 pm Monday to Friday and 6:30 am to 4:00 pm Saturdays, with extended work hours required for approximately one to two weeks during demolition of the current spillway.
- The IAR confirms that hours of operation for the construction phase are 6:30 am to 6:30 pm Monday to Friday and 6:30 am to 4:00 pm Saturdays, with extended work hours occasionally required during critical construction activities.

There are multiple construction activities which will be required to be undertaken outside of the standard construction hours for the Project. The IAR was underpinned by technical studies which envisaged standard and non-standard construction hours, however, there is no flexibility afforded by Imposed Condition 6(c) as it is currently worded. It is therefore requested that Imposed Condition 6 be amended to allow for some activities to be undertaken during non-standard construction hours, where undertaken in accordance with an approved management plan.

This could be given effect through a minor amendment to the existing condition.

5.1.1.1. Imposed Condition 7 – Road Impact Assessment

The CGER gives jurisdiction over Condition 7 to Noosa Shire Council. Condition 7(b) requires that a road impact assessment must be provided to Noosa Shire Council for approval at least two months prior to commencement of any on-site project works.

Condition 7(d) currently requires that detailed engineering plans of all road upgrades or road works must be submitted to Noosa Shire Council for approval prior to commencement of project activities.

The Road Impact Assessment forms part of the Site Environmental Management Plan for the Project, which requires approval from the Coordinator-General. As currently worded, the imposed conditions require both Noosa Shire Council and the Coordinator-General to approve the Road Impact Assessment. To streamline approval requirements and minimise timeframes, it is requested that Imposed Condition 7 be amended to require the Coordinator-General's approval only.

5.1.2. Jurisdiction for Imposed Conditions

The CGER nominated several entities to have jurisdiction for the conditions in Schedule 1 (Imposed Conditions). These entities are shown in **Table A1** of Schedule 1 (included below) which lists the organisations/agencies responsible for monitoring compliance of each of the Coordinator-General's imposed conditions.

Table A1 Entities with jurisdiction for Coordinator-General imposed conditions

Part	Approval	Condition no.	Entity with jurisdiction
Schedule 1	Construction Environmental Management Plans	Condition 3, 6 and 7	Noosa Shire Council
Schedule 1	Flora and fauna management plan	Condition 5(a)	DAF
Schedule 1	Flora and fauna management plan	Condition 5(b)	DES
Schedule 1	Flora and fauna management plan	Condition 5(c)	DNRME

Noosa Shire Council currently has jurisdiction for Construction Environmental Management Plans (CEMPs), including the Traffic Impact Assessment for the Project, although the Coordinator-General is ultimately responsible for approving the Site Environmental Management Plan which includes the CEMPs. To streamline future reporting and compliance activities, it is requested that jurisdiction for the CEMPs is given to the Coordinator-General rather than Noosa Shire Council.

5.1.3. Proposed changes to imposed conditions

The table below sets out the proposed changes to the imposed conditions, as shown in mark up against the current condition.

Table 21: Summary of proposed changes to Imposed Conditions

Proposed changed Imposed Condition
Condition 3. Construction environmental management plans *The entity with jurisdiction for this condition is ~~Noosa Shire Council~~ the Coordinator-General.* In accordance with Condition 1, the following adaptive construction environmental management plans (CEMPs) are to be prepared: (i) stormwater management plan (ii) vegetation management plan (iii) lighting and associated light spill (iv) traffic management plan (v) noise, dust and vibration management plan. (b) The CEMPs must be prepared and implemented for all aspects of the Six Mile Creek Dam Safety Upgrade project, and must incorporate: (i) specific performance measures (e.g. release criteria, setbacks as relevant) to minimise impacts on nuisance sensitive places from construction activities (ii) actions that will avoid or mitigate and manage adverse environmental impacts on waters, traffic and

Proposed changed Imposed Condition

the community

(iii) appropriate adaptive management practices and details of how and when the practices will be implemented to address any non-compliance with performance measures

(iv) relevant monitoring and auditing requirements.

(c) The approved CEMPs must be provided to Noosa Shire Council with any development application for a material change of use associated with the Project.

Condition 6(c). Construction vehicle haulage

The entity with jurisdiction for this condition is ~~Noosa Shire Council~~ the Coordinator-General.

(a) Construction vehicle site access is limited to a single access route in and out of Lake Macdonald Drive. 'Construction vehicle' does not include light motor vehicles such as cars, utes and motorbikes (including mopeds and tricycles), or specialist vehicles where prior approval from Noosa Shire Council has been obtained (e.g. vehicles required for site establishment and demobilisation works, and salvage and relocation).

(b) Any laden construction vehicle must have its load fully covered and secured.

~~(c) Construction vehicles must not arrive at the site prior to the approved operating hours and must not leave the site with either a full or partial load after the approved operating hours.~~

(c) Construction vehicles must not arrive at the site prior to the standard operating hours and must not leave the site with either a full or partial load after the standard operating hours, other than for the following activities:

i. Lake drawdown

ii. Spillway and dam crest demolition

iii. Concrete batching and dam construction

Condition 7. Road impact assessment

The entity with jurisdiction for this condition is ~~Noosa Shire Council~~ the Coordinator-General.

(a) The proponent must undertake a detailed road impact assessment that confirms any upgrades or other road works required to be undertaken because of the Project and its traffic, including to Lake Macdonald Drive, and the Lake Macdonald Drive-Seqwater access road intersection.

(b) The road impact assessment must be provided to ~~Noosa Shire Council~~ the Coordinator-General for approval at least two months prior to commencement of any on-site project works.

(c) ~~Any road upgrades or road works required by the approved road impact assessment must be incorporated into the traffic management plan required under Schedule 1, Condition 3.~~

(c) Any road upgrades or road works required by the approved road impact assessment must be agreed in principle with Noosa Shire Council and incorporated into the traffic management plan required under Schedule 1, Condition 3.

(d) ~~Detailed engineering plans of all road upgrades or road works must be submitted to Noosa Shire Council for approval prior to commencement of project activities. The road upgrades and works must be designed in accordance with the relevant Austroads standards and the Department of Transport and Mains Roads standard drawings and specifications.~~

(d) Detailed engineering plans of all road upgrades or road works must be submitted to Noosa Shire Council for endorsement prior to commencement of the road upgrades or road works. The road upgrades and works must be designed in accordance with the relevant Austroads standards and the Department of Transport and Mains Roads standard drawings and specifications.

Schedule 1, Table A1

Proposed changed Imposed Condition

Part	Approval	Condition no.	Entity with jurisdiction
Schedule 1	Construction Environmental Management Plans	Condition 3, 6 and 7	~~Noosa Shire Council~~ Coordinator-General
Schedule 1	Flora and fauna management plan	Condition 5(a)	DAF
Schedule 1	Flora and fauna management plan	Condition 5(b)	DES

5.2. Stated Conditions

5.2.1. Waterway Barrier Works

The CGER included Stated Conditions under section 39 for the Waterway Barrier Works Approval, requiring construction of the cofferdam generally in accordance with stated drawings from 2017. However, the Waterway Barrier Works Approval as issued by SARA on 9th April 2021 referred to more recent drawings from 2020, and not the 2017 drawings required to be imposed under the CGER Stated Conditions.

Seqwater requests that the Coordinator-General assesses the proposed change to the design of the temporary coffer dam, so that once the change report is issued, SARA can issue a changed Waterway Barrier Works Approval that is consistent with the Coordinator-General's stated conditions.

In evaluating this change request, the Coordinator-General may (among other things):

(a) state conditions of a type mentioned in section 39, 45, 47C, 49B, 49E or 49G of the SDPWO Act that are relevant to the proposed change, its effects on the Project or any other related matter; and

(b) amend any conditions or recommendations for the Project stated or made under section 34D (3) or 34L (3) of SDPWO Act.

The table below sets out the proposed changes to the stated conditions, being the update of the cofferdam plans referred to in stated condition 2(b).

Table 22: Summary of proposed changes to Stated Conditions

Proposed changed Stated Condition
Condition 2. Construction (b) The construction or raising of waterway barrier works that is a temporary cofferdam incorporating sheetpiling and a temporary working platform within Six Mile Creek must be undertaken generally in accordance with the following plans: ~~(i) Upgrade concept design 2017 – Site layout during construction, AECOM, 05/10/2017, 60542495-103, Revision 0~~ ~~(ii) Upgrade concept design 2017 – Temporary works spillway demolition plan for working platform, AECOM, 05/10/2017, 60542495-107, Revision 0~~ ~~(iii) Upgrade concept design 2017 – Temporary works sheetpile long section, AECOM, 05/10/2017, 60542495-109, Revision 0~~ ~~(iv) Upgrade concept design 2017 – Temporary works working platform sections, AECOM, 05/10/2017, 60542495-110, Revision 0.~~ (i) General Arrangement Drawing B01179-03-DWG-002 Rev_0 90% design - 12/09/2024 (ii) CD Cross-Section and Spillway Berm Drawing B01179-03-DWG-006 Rev_0 90% design - 23/05/2024 (iii) Complete Longitudinal Section Drawing B01179-03-DWG-003 Rev_0 90% design - 23/05/2024

Appendix A - Revised Cofferdam 90% Design Drawings

Appendix B – Traffic Impact Assessment

Appendix C – Traffic Management Plan

Appendix D – SDAP State Code 1, 6 and 18 Assessments

Appendix E – Construction Noise and Vibration Impact Assessment (CNVIA)

Appendix F – Water quality Impact Assessment