Appendix B10

M6S1-CGU-NWW-ENPE-MPL-000435

Leachate and Landfill Gas CEMP Sub-Plan

M6 Motorway Stage 1

March 2022

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Contents

Document control

Approval and authorisation

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Signed	Derek Low
Dated	25/03/22
Approved on behalf of Transport for NSW by	Gareth Thomas
Signed	G Thomas
Dated	27/03/22
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Signed	Craig Gibson
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This Leachate and Landfill Gas CEMP Sub-plan (LLGSP) as part of the CEMP is available to all personnel and sub-contractors via the Project document control management system. An electronic copy can be found on the Project website.

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Glossary/ Abbreviations

Abbreviations	Expanded text
ASS	Acid Sulfate Soil
CEMP	Construction Environmental Management Plan
CGUJV	CPB Contractors Ghella UGL Engineering Joint Venture
CM	Construction manager
CoA	Conditions of Approval
CQA	Construction quality and assurance
C&SM	Community & Stakeholder Manager
CSSI	The Critical State Infrastructure, as described in Schedule 1, the carrying out of which is approved under the terms of the SSI 8931 approval
CoPC	Contaminants of Potential Concern
D&C Deed	Design and Construction Deed
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DPIE / DPIE Water	NSW Department of Planning, Industry and Environment (former NSW Department of Industry – Lands and Water, and former NSW Department of Primary Industries including DPI Agriculture, DPI Biosecurity and Food Safety, DPI Land and Natural Resources, DPI Water and DPI Fisheries)
DRS	Disaster Recover Site
EIS	F6 Extension Stage 1 – Environmental Impact Statement
EM	Environment manager
EMM	Environmental Management Measures
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPL	Environmental Protection Licence
ER	Environmental Representative for the CSSI
EWMS	Environmental Work Method Statements
F/S	Foreman / supervisor

Abbreviations	Expanded text
GDEs	Groundwater Dependent Ecosystems
GWMP	Groundwater Monitoring Plan
GWQ	Groundwater Quality
HEPA	Heads of EPA Australia and New Zealand
HGG	Hazardous ground gas
HIR	Hydrogeological Interpretive Report (M6S1-COF-NWW-ENEV-RPT-680440)
HFR	Hydrogeological Factual Report (M6S1-COF-NWW-ENGE-RPT-680520)
IAA	Interim audit advice
ITP	Inspection test plan
LEL	Lower Explosive Limit
LFG	Landfill gas
LLGSP	Leachate and Landfill Gas CEMP Sub-plan
LLGMP	Leachate and Landfill Gas Monitoring Program
LTEMP	Long-Term Environmental Management Plan
m AHD	Elevation in metres with respect to the Australian Height Datum
MOC	Motorway operation complex
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
OU	Odour units
PAHs	Polycyclic aromatic hydrocarbons
PFAS	Per- and polyfluoroalkyl substances
PID	Photoionisation Detector
PIR	The Preferred Infrastructure Report submitted to the Planning Secretary under section 5.17 of the EP&A Act
PIRMP	Pollution Incident Response Management Plan
PM	Project manager
POEO Act	*Protection of the Environment Operations Act 1997*
RAP	Remedial Action Plan
RMS	Roads and Maritime Services
SAS	Site audit statement
SCR	Site Contamination Report (M6S1-COF-NWW-ENCT-RPT-670250)

Abbreviations	Expanded text
SE	Supervising engineer
SWTC	Scope of Works and Technical Criteria
TfNSW	Transport for NSW
TRH	Total recoverable hydrocarbons
µS/cm	Micro-Siemens per centimetre
WHS	Work Health and Safety
WTP	Water Treatment Plant

1 Introduction

1.1 Context

This Leachate and Landfill Gas CEMP Sub-plan (LLGSP or Plan) and accompanying Leachate and Landfill Gas Monitoring Program (LLGMP) (Appendix A) form part of the Construction Environmental Management Plan (CEMP) for the Project.

This LLGSP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the environmental management measures (EMM) listed in the Environmental Impact Statement (EIS) Submissions Report, Scope of Works and Technical Criteria (SWTC) and other applicable legislation.

1.2 Background and project description

The Project comprises a new twin motorway tunnel (around four kilometres (km) in length) between the M8 Motorway at Arncliffe and President Avenue at Kogarah with a tunnel portal and entry and exit ramps connecting the tunnels to the surface, as shown in Figure 1. Works will include a connection to the M8 Motorway, line marking of additional travel lanes between the St Peters interchange to the M6 Stage 1 tunnels, an intersection with President Avenue (including widening and raising of President Avenue), and intersection improvements at the President Avenue/Princes Highway intersection. Mainline tunnel stubs are to be constructed to allow for connections to future stages of the M6 Extension.

The Project was declared Critical State Significant Infrastructure (CSSI) and approved by the Minister for Planning and Public Spaces on 18 December 2019.

Key features of the Project include:

- Mainline tunnels approximately 3 km in length, sized for three lanes of traffic and line marked for two lanes on opening of the motorway;
- Entry and exit ramp tunnels approximately 1.5 km in length and a tunnel portal connecting the tunnels to a surface intersection with President Avenue;
- Provision of a new intersection at President Avenue including the widening and raising of President Avenue at this location;
- Upgrade of the President Avenue and Princes Highway intersection to improve capacity and network integration;
- Provision of a new shared cycle and pedestrian pathways;
- Mainline tunnel stubs for a future connection to extend the Project to the south;
- Two motorway operation complexes (MOCs) as follows:
    - Arncliffe: including mechanical and electrical fit-out of the ventilation facility built by the New M5 Motorway project, and provision of a new water treatment plant (WTP) and substation.
    - Rockdale (south): including a ventilation building, Disaster Recover Site (DRS), substation and power supply, deluge tanks.
- A tunnel ventilation system, including ventilation facilities located at Marsh Street, Arncliffe and West Botany Street, Rockdale, and in-tunnel ventilation systems (jet fans and ventilation ducts);
- New Utility Services, and modifications and connections to existing Utility Services;
- A permanent power supply connection to the Rockdale Ventilation Facility Site MOC from Ausgrid's Canterbury Sub-Transmission Substation;
- Emergency access and evacuation facilities, including pedestrian and vehicular cross, long passages, fire and safety life systems;

- Ancillary infrastructure for motorway operations including operations management and control systems, permanent power supply, communications, lighting, electronic toll collection system, toll gantries and traffic control and signage (both fixed and variable signage);
- Drainage infrastructure to collect surface water and groundwater inflows for treatment;
- Reinstatement of Bicentennial Park and recreation facilities;
- Reinstatement and rehabilitation of construction leased areas within the Arncliffe Site;
- Minor adjustments to local roads in the Project area;
- Development and implementation of systems integration and operating procedures with WestConnex Motorways to ensure safe operation of the interfaces between the Project and the WestConnex Motorways; and
- Any other works as required under the D&C Deed and the SWTC.

The following six surface compounds will facilitate construction of the Project:

- Arncliffe construction ancillary facility (C1), an existing construction site which was used for the construction of the M8 Motorway;
- Rockdale construction ancillary facility (C2), within an existing Transport for New South Wales (TfNSW) depot;
- President Avenue construction ancillary facility (C3) at Rockdale, within Rockdale Bicentennial Park and an industrial area west of West Botany Street;
- Construction ancillary facilities (C4 and C5) near Muddy Creek to support construction of the Active Transport Corridor; and
- Princes Highway construction ancillary facility (C6) on the corner of Princes Highway and President Avenue, Kogarah to support the intersection surface works.

The locations of the six surface compounds are shown in Figure 1.

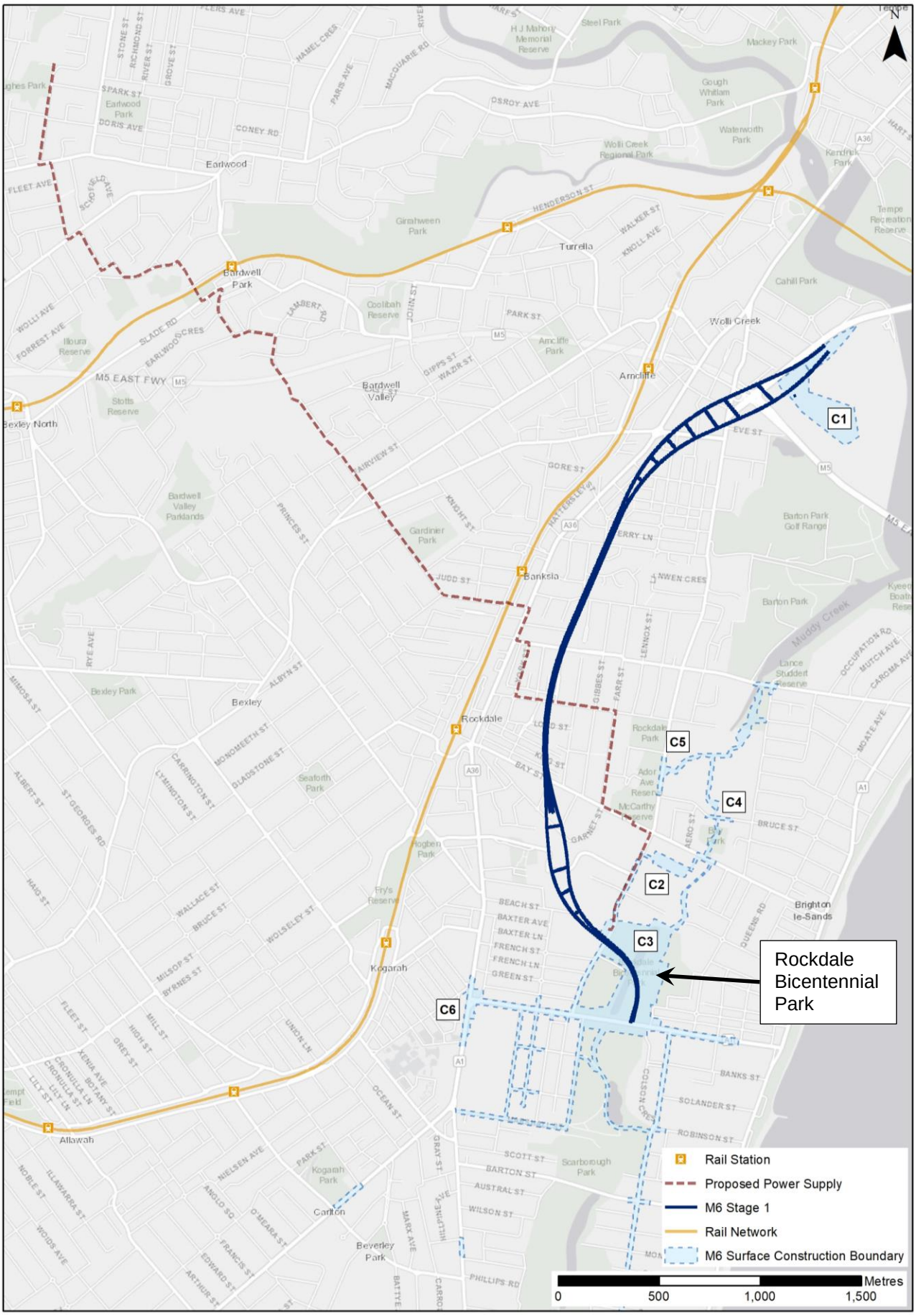

Figure 1 Project overview

1.3 Scope of the Sub-Plan

The scope of this LLGSP is to describe how CPB Contractors, Ghella, UGL Engineering Joint Venture (CGU) proposes to manage and monitor leachate and landfill gas (LFG) including odours during construction of the part of the M6 Motorway located at Rockdale Bicentennial Park, within the President Avenue construction ancillary facility (C3).

The LLGSP focuses on this part of the M6 Motorway because a portion of Rockdale Bicentennial Park is located on a legacy landfill where landfill leachate and LFG continue to be generated by buried waste.

The scope of the LLGSP covers:

- Purpose and objectives (**Section 2**);
- Environmental requirements to be met by the Plan (**Section 3**);
- Description of the existing environment (**Section 4**);
- Relevant environmental aspects and impacts (**Section 5**);
- Environmental control measures relevant to the management of leachate, LFG and odour at Rockdale Bicentennial Park (**Section 6**);
- Compliance management (**Section 7**); and
- Review and improvement of the Plan (**Section 8**).

1.4 EMS overview

The environmental management system is based on CPB Contractors Environmental Management System (EMS). An overview of the EMS is described in Section 1.5 of the CEMP.

1.5 Consultation for preparation of Sub-Plan

This Plan was prepared in consultation with the EPA and Bayside Council in accordance with CoA C4(i).

As required by C19 of the CoA, the associated Monitoring Program was developed in consultation with the relevant government agencies as identified in CoA C13, and identified information, including monitoring parameters, requested by a relevant agency to be included in a monitoring program.

Feedback and comments were received from the EPA and Bayside Council and these were addressed and incorporated where appropriate. Evidence of consultation for this Plan and the associated Monitoring Program has been collated into a register and provided to DPIE under separate cover.

CGU has satisfied the EPA concerns and queries, with the EPA to issue a variation to the Project EPL (refer to email dated 14 March 2022 included in A5) to ensure works are undertaken in accordance with the LLGSP.

Consultation with Bayside Council, the EPA and other relevant stakeholders, including any unique local receivers, will be ongoing.

Community feedback and complaints relating to odour will be managed in accordance with the Communication Strategy and Complaints Management System (refer to Section 3.7 of CEMP). In addition, community engagement processes related to these works will include:

- Provision of an Odour Fact Sheet to adjacent and nearby stakeholders prior to start of excavation.

- The development of a receiver contact list specific to Bicentennial Park site (containing email addresses and phone numbers of adjacent and nearby receivers) to enable immediate digital updates should there be an odour emission or other environmental emission affecting the community.
- Drop-in sessions/forums to inform the community of odour risks and to address relevant community concerns.

1.6 Approval by the Planning Secretary

Construction must not commence until the CEMP and all relevant CEMP Sub-plans (including the collection of all relevant baseline data) for such construction activities to which they apply have been approved by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. The approved LLGSP will be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.

Construction, which is required to be monitored under the LLGMP, will not commence until the LLGMP is approved by the Planning Secretary and all relevant baseline data for the specific construction activity has been collected.

2 Purpose and objectives

2.1 Purpose

The purpose of this LLGSP is to describe how CGU proposes to manage leachate, LFG and odour at Rockdale Bicentennial Park during construction of the Project. This LLGSP is not intended to remediate pre-existing contamination across the entire Park. The scope is only limited to managing leachate, LFG and odour risks to acceptable levels for relevant onsite and offsite receptors during construction, associated with areas that will be disturbed.

2.2 Objectives

The key objective of this LLGSP is to ensure the CoA, EMMs and licence/permit requirements relevant to leachate, LFG and odours during the construction stage at the legacy landfill in Rockdale Bicentennial Park are described, scheduled and assigned responsibility as outlined in:

- The Environmental Assessment prepared for the Project, including the EIS, the Response to Submissions on the EIS, the PIR and Response to Submissions on the PIR;
- CoA granted to the Project on 18th December 2019 (SSI 8931);
- Roads and Maritime specifications G36 and G38;
- Environmental Protection Licence (EPL) 21600; and
- Relevant legislation and other requirements described in Appendix A1 of the CEMP.

Another objective of the LLGSP is to effectively monitor and manage leachate, LFG and odour during construction work at Rockdale Bicentennial Park so that the relevant environmental performance outcomes adopted by the EIS are met. These performance outcomes listed in the EIS include:

- The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable;
- The project avoids or minimises adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety; and
- The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.

The LLGSP is a component of the CEMP that forms the basis for how the Project is to meet the environmental outcomes specified in Conditions A1 and C5 of the CoA.

2.3 Environmental performance outcomes and targets

Environmental performance outcomes for Leachate and Landfill Gas management, as outlined and addressed in the EIS are detailed in Table 1, which summarises how CGU will meet relevant to targets to achieve the required performance outcomes.

Table 1 Project performance outcomes

Performance Outcome	Project Outcome	Reference
Health and safety The project avoids or minimises adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety	Effective management of dust, odour and other emissions during construction would avoid human health impacts	This plan includes management measures related to odour from works at Bicentennial Park - Sections 5 and 6. Refer to the Air Quality CEMP Sub-plan for other emissions including particulate matter during construction.
Soils Environmental values of land, including soils, subsoils and landforms are protected. Risks arising from disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination	Risks arising from the disturbance of soil and groundwater contaminated and acid sulfate soils would be mitigated during construction and operation through investigation and identification during construction, with implementation of appropriate management measures. Acid sulfate soils and other contamination will be managed in accordance with good practice measures to protect environmental values and human health.	This plan includes management measures for risks related to contamination, specifically leachate and landfill gas at Bicentennial Park in Sections 5, 6 and 7. Also refer to the: Contamination CEMP Sub-plan and Acid Sulfate Soil Management Plan (Appendix to the Soil and Surface Water CEMP Sub-plan).

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

All legislation relevant to this LLGSP is listed in Appendix A1 of the CEMP. Legislation relevant to this LLGSP includes:

- Environmental Planning and Assessment Act 1979
- Protection of the Environment Operations Act 1997
- Contaminated Land Management Act 1997
- State Environmental Planning Policy No. 55 (Remediation of Land).

3.1.2 Guidelines and standards

The main guidelines, policy documents and specifications relevant to this plan include:

- Contaminated Land Guidelines: Assessment and Management of Hazardous Ground Gases (NSW EPA 2020)
- National Environment Protection Council (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines
- AS 3580.1.1-2007 Methods of Sampling Analysis of Ambient Air. Part 1.1 Guide to Siting Air Monitoring Equipment
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2017)
- Environmental Guidelines: Solid Waste Landfills. Second Edition (NSW EPA 2016)
- Australian & New Zealand Guidelines for Fresh and Marine Water Quality (ANZWQG 2018) at https://www.waterquality.gov.au/guidelines/anz-fresh-marine
- PFAS National Environmental Management Plan (HEPA 2020) (Version 2.0)
- Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom 2004) and Volume 2 DECC 2008) (the “Blue Book”).
- Roads and Maritime QA Specification G36 – Environmental Protection (Management System).
- Roads and Maritime QA Specification G38 – Soil and Water Management (Soil and Water Management Sub Plan).
- Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC 2006).
- Workplace Exposure Standards for Airborne Contaminants (Safe Work Australia 2019).

3.2 Minister’s Conditions of Approval – SSI 8931

The parts of the CoA relevant to this Plan are listed in Table 2, with cross references indicating where conditions are addressed in the Plan and how compliance was achieved.

Table 2 Conditions of Approval relevant to the LLGSP

CoA No.	Condition Requirements	LLGSP Section
A5	Where the terms of this approval require a document or monitoring program to be prepared, or a review to be undertaken, in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Planning Secretary with the document. The evidence must include: (a) documentation of the engagement with the party identified in the condition of approval that has occurred before submitting the document for approval; (b) a log of the dates of engagement or attempted engagement with the identified party and a summary of the issues raised by them; (c) documentation of the follow-up with the identified party where engagement has not occurred to confirm that they do not wish to engage or have not attempted to engage after repeated invitations; (d) outline of the issues raised by the identified party and how they have been addressed; and (e) a description of the outstanding issues raised by the identified party and the reasons why they have not been addressed.	Section 1.5 Evidence of consultation as required by parts a) through e) was collated and is managed in a separate register (provided to DPE)
C4	**CEMP Sub-plans** must be prepared in consultation with the relevant government agency(s) and council(s) as identified for each CEMP Sub-plan in Table 4 of the CoA in the Infrastructure approval for the Project.	Section 1.5
C5	**CEMP Sub-plans** must state how: (a) the environmental performance outcomes identified in the documents listed in Condition A1 as modified by these conditions will be achieved;	Section 2.3
	(b) the mitigation measures identified in the documents listed in Condition A1 as modified by these conditions will be implemented;	Section 6
	(c) the relevant terms of this approval will be complied with; and	Sections 5 to 8
	(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.	Sections 4 & 5 Section 3.2 of CEMP
C7	The **Leachate and Landfill Gas CEMP Sub-plan** must include the following: (a) measures to manage LFG emissions and odours generated from Rockdale Bicentennial Park during construction, including site-specific action criteria and notification to all potentially affected receivers of the potential for odour generation;	Section 6 (measures) Section 5.4 and Appendix A (action criteria) Section 1.5 (notification)

CoA No.	Condition Requirements	LLGSP Section
		Section 5.2 (temporary stockpiling)
	(b) measures to prevent LFG accumulating in buildings, basins and subsurface trenches and pits associated with the CSSI;	Table 7 (LGM1-2) Appendix A (Section 3 outlines accumulation monitoring)
	(c) the closure and stabilisation of the impacted area of landfill so it is suitable for its intended uses;	Table 9
	(d) methods for the management of leachate including analysis, treatment and disposal as well as measures for minimising and/or preventing leachate migration;	Table 6 (mitigations) Section 5.2 (this plan) and Section 4.4 in Appendix A (minimising leachate migration) Sections 4.2 & 4.3 in Appendix A (leachate analysis, treatment & disposal)
	(e) reporting triggers and contingency actions in the event that unacceptable levels of odours or contaminants in the leachate are reached or reported above safe thresholds;	Section 5.4 and Appendix A (Sections 4.3, 5.3, 5.4 & 6.3 of LLGMP)
	(f) community engagement processes in the event that nuisance odours emanate beyond the construction boundary;	Table 8 (OM12) and Section 2.4 of Appendix A (LLGMP)
	(g) evidence that an EPA accredited site auditor has reviewed the Leachate and Landfill Gas CEMP Sub-plan and has issued an interim audit advice regarding the appropriateness of the Sub-plan; and	Section 3.4
C7	(h) evidence that the Leachate and Landfill Gas CEMP Sub-plan and any interim audit advice issued by the Auditor has been submitted to the EPA and the EPA has no further concern.	Sections 1.5 and 3.4
C10	The CEMP Sub-plans must be endorsed by the ER and then submitted to the Planning Secretary for approval no later than one (1) month prior to the commencement of the construction activities to which they apply.	This plan
C11	Any of the CEMP Sub-plans may be submitted to the Planning Secretary along with, or subsequent to, the submission of the CEMP.	This plan
C12	Construction must not commence until the CEMP and all relevant CEMP Sub-plans for such construction activities to which they apply have been approved by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary, including any minor amendments	This plan

CoA No.	Condition Requirements	LLGSP Section
	approved by the ER, must be implemented for the duration of construction. Where construction is staged, construction of a stage must not commence until the relevant CEMP and CEMP Sub-plans for that stage have been endorsed by the ER and approved by the Planning Secretary.	
C13	The Leachate and Landfill Gas Monitoring Program must be prepared in consultation with the EPA.	Section 1.5 of this LLGSP and LLGMP
C14	**Construction Monitoring Programs** must provide: (a) details of baseline data available;	Sections 3.1 and 4.4.1 of Appendix A (LLGMP)
	(b) details of baseline data to be obtained and when;	Baseline data collected and presented in Sections 3.1 and 4.4.1 of Appendix A (LLGMP)
	(c) details of all monitoring that will be undertaken;	Monitoring programs in Sections 3 (LFG), 4 (leachate) and 5 (odour) of Appendix A (LLGMP)
	(d) the parameters of the project to be monitored;	Sections 3.2.1, 3.2.2, 3.2.3 & 3.3 (LFG); Sections 4.3.1 & 4.4.2 (leachate); Section 5.2.3 (odour) of Appendix A (LLGMP)
	(e) the frequency of monitoring;	Sections 3.2.4 & 3.3 (LFG); Sections 4.3.1 & 4.4.2 (leachate); Section 5.2.1 (odour) of Appendix A (LLGMP)
	(f) the location of monitoring;	Sections 3.2.1, 3.2.2, 3.2.3 & 3.3 (LFG); Section 4.3.1 & 4.4.2 (leachate); Section 5.2.1 (odour) and Attachment A (figures) of Appendix A (LLGMP)
	(g) the reporting of monitoring and analysis results against relevant criteria, including details of the timing and frequency for reporting the results to the Planning Secretary and relevant government agencies;	Section 6.3 of Appendix A (LLGMP)
	(h) details of the methods that will be used to analyse the monitoring data;	Section 6.3 of Appendix A (LLGMP)

CoA No.	Condition Requirements	LLGSP Section
	(i) procedures to identify and implement additional mitigation measures where results of monitoring indicate adverse impacts or levels above relevant criteria;	Section 3.6 (LFG), Section 4.4.3 (leachate), Section 5.4 (odour) of Appendix A (LLGMP)
	(j) any consultation to be undertaken in relation to the monitoring programs; and	Section 1.5
	(k) any specific requirements as required by Conditions C15 to C18, as relevant.	See below
C15	The **Leachate and Landfill Gas Monitoring Program** must include, but not be limited to: (a) methods for monitoring landfill gas emissions within construction areas where such emissions are likely to occur, as well as methods for odour monitoring at the construction boundary and in areas outside of the construction boundary where there is a potential for nuisance odours;	Section 3.3 (LFG at workzone) and Section 5.2 (odour at boundary) in Appendix A (LLGMP)
	(b) a monitoring bore network to monitor leachate movement;	Section 4.4 in Appendix A (LLGMP)
	(c) reporting trigger and contingency actions in the event that unacceptable levels are reached or reported above safe thresholds; and	Sections 3.5 & 3.6 (LFG) and Section 4.4.3 (leachate) in Appendix A (LLGMP)
	(d) detail how the results of the monitoring program will inform the management measures in the following CEMP Sub-plans required by Condition C4 – Leachate and Landfill Gas, Groundwater, Soil and Surface Water, and Contamination.	Objective of monitoring to ensure a comprehensive management regime outlined in Section 2.1 in Appendix A (LLGMP) Monitoring to inform corrective actions outlined in Section 3.6 (LFG), Sections 4.3.2 & 4.4.3 (leachate) and Section 5.3 (odour) in Appendix A (LLGMP) 6-monthly reports to recommend amendments to management measures outlined in Sections 6.3 & 7.1 in Appendix A (LLGMP)
C19	The **Construction Monitoring Programs** must be developed in consultation with the relevant government agencies as identified in **Condition C13** of this approval, and must identify information, including monitoring parameters,	Section 2.4 in Appendix A (LLGMP)

CoA No.	Condition Requirements	LLGSP Section
	requested by a relevant agency to be included in a monitoring program.	
C20	The **Construction Monitoring Programs** must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month prior to the commencement of construction.	Section 2.4 in Appendix A (LLGMP) and Section 2 of CEMP
C21	Construction, which is required to be monitored under the **Construction Monitoring Programs**, must not commence until the Planning Secretary has approved all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 2.4 in Appendix A (LLGMP) and Section 2 of CEMP
C22	The **Construction Monitoring Programs**, as approved by the Planning Secretary and including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	Sections 1.1 & 2.3 in Appendix A (LLGMP)
C23	The results of the **Construction Monitoring Programs** must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. *Note: Where a relevant **CEMP Sub-plan** exists, the relevant **Construction Monitoring Program** may be incorporated into that CEMP Sub-plan.*	Section 6.3 in Appendix A (LLGMP) and Section 2 of CEMP
E1	Measures must be implemented to minimise and manage the emission of dust, odour and other air pollutants during construction and operation.	Landfill specific measures in Sections 5.2, 5.3 & Table 8, and in Section 5 of Appendix A

3.3 Environmental management measures

The EIS identified EMMs that would be adopted to avoid or reduce environmental impacts. Following consideration of issues raised in stakeholder and community submissions on the EIS, the EMMs were updated and set out in the EIS Submissions Report. Conditions listed in Table 3 below match those in the EIS Submissions Report.

Other conditions relevant to leachate and LFG are addressed in other management plans:

- Item SC1 which calls for the preparation of a Construction Soil and Water Management Plan (CSWMP) which will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including contaminated land.
- Item SC6 calls for development of a Leachate and Landfill Gas Management Plan, which is addressed in this Sub Plan.
- Item AQ3 calls for assessments and management of odorous material, described in this Sub Plan.

Relevant EMMs from the EIS Submissions Report are listed in Table 3. This includes reference to required outcomes, the timing of when the commitment applies, relevant documents or sections of the environmental assessment influencing the outcome and implementation.

Table 3 EMMs relevant to the LLGSP

Outcome	Ref #	Commitment	Timing	**LLGSP Section**
Landfill Gas and Leachate				
Landfill gas and leachate	SC6	Further detailed investigation and assessment will be undertaken in Rockdale Bicentennial Park in order to develop a LLGSP. The plan will be implemented to minimise nuisance odours to the surrounding area during excavation and to contain and treat LFG emissions from excavations. The plan will include measures such as excavation staging, leachate and gas management, gas and odour monitoring	Construction	Sections 4, 5 and 6. Further investigation data presented in Sections 3.1.2 and 4.4.1 in Appendix A (LLGMP). Monitoring is addressed in Sections 3 (gas) and 5 (odour) in Appendix A (LLGMP)
Odour	AQ3	Odorous material would be treated immediately on-site, and removed from site where necessary. Areas of odorous materials would be excavated in a staged process to allow for treatment and handling. Exposed areas of odorous material would be kept to a minimum to reduce the total emissions from the site. On-site odour measurements would be carried out during excavation works to determine odour emission rates. Results from the monitoring would be used to inform future excavation and treatment activities on site.	Construction	Section 6 (see OM2–OM9 and OM11 in Table 8) Section 5.2 (staging) Section 5.2 (temporary stockpiling) Section 5.3 in Appendix A (informing future excavations and treatment)

3.4 Audit advice

This Plan has been provided to and reviewed by an EPA accredited site auditor ('Site Auditor') in order to provide an interim audit advice (IAA) regarding the appropriateness of the Plan as required

by CoA C7(g). The Site Auditor subsequently issued an IAA advising that the LLGSP was appropriate for use by the Project.

The IAA issued by the Site Auditor for the LLGSP will be available with this plan.

3.5 Principal information sources

The primary documents supporting the preparation of the LLGSP are detailed below. Additional sources have been reviewed as necessary to support project design, environmental management and construction processes.

3.5.1 Environmental Impact Statement

The EIS for the Project (formerly known as the F6 Extension Stage 1 project) was published on 26 October 2018. Technical reports and data releases provide relevant leachate and LFG information. This information is available from the NSW Major Projects website at https://www.planningportal.nsw.gov.au/major-projects/project/10441 .

3.5.2 Information documents (INFO DOCs) and other sources

Previous leachate and LFG investigation data for this report was obtained from the sources shown in Table 4. For data sources which were provided as INFO DOCs by TfNSW to CGU, a reference to the relevant INFO DOC number/s is provided in the table.

Table 4 Data sources

Reference	INFO DOC	Report
Edison (2021)	n/a	Report on Landfill Gas Surface Emissions Monitoring, February 2021: Rockdale Bicentennial Park, New South Wales. (Ref: E19015-BSD-08-R, dated 3 February 2021)
Edison (2020)	n/a	Long-Term Site Management Plan, Recreational/Open-Space Land Use, Bicentennial Park, New South Wales (Ref: E19015-BSD-03-SMP Rev1, dated 31 March 2020)
Cardno (2019)	59	F6 Extension Stage One Reference Design Geotechnical Investigation – Contamination Data Report (Ref: 80019028-RPT002-GFR-Rev, dated 17 May 2019)
Cardno (2020)	315	M6 Stage One – Additional Contamination Investigation – Contamination Assessment Report – Indicative Waste Classification (Ref: Cardno-M6-S1-CDR-RPT07_Rev0, dated 18 May 2020)
SMEC (2018)	42 to 47	F6 Extension Stage 1 Geotechnical Investigations – Final Geotechnical Factual Report (Ref: 30012161-023-RevC-Final GFR, dated 4 May 2018)
Cardno (2019d)	124	F6 Extension Stage One Active Transport Corridor & Contamination Investigation – Geotechnical Factual Report. (Ref: 8001902801-RPT05-GFR-Rev0, dated 01 November 2019)
Cardno (2020a)	283 to 286	Geotechnical Factual Report – M6 Extension Stage One Pre-Tender Geotechnical Investigation (Ref: Cardno-M6E-S1-RPT05-GFR-Rev2, dated 1 May 2020)

Reference	INFO DOC	Report
Cardno (2020c)	282	F6 Extension Stage One Reference Design Geotechnical Investigation - Final Geotechnical Factual Report (Ref: 80019028-RPT01-GFR-Rev4, dated 13 May 2020)
Cardno (2020d)	556	M6 Stage 1, Pre-Awarded Geotechnical and Contamination Investigation – Geotechnical Factual Report (Ref: Cardno-M6S1-RPT08-GFR-Rev0, dated 17 December 2020)

3.5.3 Supplementary investigations

At the time this LLGSP was being prepared, pre-construction monitoring was continuing. Any revision to this LLGSP in light of findings made by these assessments will be incorporated using the procedures described in **Section 8**.

4 Existing environment (pre-construction)

4.1 Overview

A portion of Rockdale Bicentennial Park is located on a legacy landfill. A Long-Term Environmental Management Plan (LTEMP) prepared by Edison (2020) indicated that land filling occurred during the 1960s, 1970s (Bicentennial Park Central/North and South) and in the 1980s (Bicentennial Park East). Additional works took place between 2003 and 2009 for the redevelopment of sporting fields.

Previous investigations carried out by SMEC (2018) and Cardno (2019 and 2020) indicate that:

- The legacy landfill at Rockdale Bicentennial Park does not meet the rehabilitation standards specified in the EPA (2016) landfill guidelines.
- Fill (to approximately 6m thick) is likely to contain landfill material, including impacts associated with heavy metals, asbestos, polycyclic aromatic hydrocarbons (PAH), asbestos and total recoverable hydrocarbons (TRH).
- The immediate underlying alluvium (potentially the top 0.5 m of the layer) is impacted with heavy metals.
- Groundwater is impacted with heavy metals, ammonia, nutrients, TRH, per- and polyfluoroalkyl substances (PFAS) and sulfate.
- LFG exceedances have been reported for methane, hydrocarbon sulfide and carbon dioxide.
- Hydrogen sulfide concentrations exceeding aesthetic (odour) criteria have also been reported.

The following sections summarise what is known about factors influencing leachate and LFG within and adjacent to the Project corridor at Rockdale Bicentennial Park.

Existing data on the geological, hydrogeological and contamination conditions at Rockdale Bicentennial Park are provided in the key reference documents listed in Table 4. Additional Project-specific data is also presented in the Site Contamination Report prepared by Coffey and in the Groundwater CEMP Sub Plan.

4.2 Capping layer

The LTEMP (Edison, 2020) reported that the legacy landfill at Rockdale Bicentennial Park was constructed without engineering controls to manage potential contamination associated with the degradation of municipal waste and leachate generation. There is a distinct absence of a fully engineered capping layer and therefore the waste within Rockdale Bicentennial Park is currently covered with soil which varies in thickness and permeability. The available data indicates that the landfill at Rockdale Bicentennial Park does not meet the environmental standards specified in the EPA (2016) landfill guidelines.

4.3 Landfill leachate

The legacy landfill at Rockdale Bicentennial Park is not known to have a leachate barrier system (eg. base liner). Groundwater at Rockdale Bicentennial Park has been impacted by landfill leachate. Contamination in groundwater was reported to include heavy metals, ammonia, nutrients, TRH, PFAS and sulfate and migrates to the surrounding environment, including sub-surface and surface migration (noting that groundwater is a source of flows in the Bicentennial Park ponds which are not remediated through this project).

4.4 LFG

LFG monitoring wells were installed in Rockdale Bicentennial Park by SMEC in 2017 and Cardno in 2019. Three wells were installed by SMEC (TP1308, TP1309 and TP1310) and two wells were installed by Cardno (CH1418 and CH1419). The locations are shown in Figure 1 in Appendix A.

Investigations have detected hydrogen sulfide concentrations in these subsurface gas wells (that are not publicly or readily accessible) exceeding human health and aesthetic (odour) criteria. Additionally elevated concentrations of methane and carbon dioxide gas, and carbon dioxide have been detected exceeding workplace exposure limits. Results from a round of LFG monitoring undertaken by Cardno on 15 April 2020 indicated the presence of landfill gases in all LFG wells across the site, with methane up to 67.6%. Further information on historic LFG monitoring data is provided in Section 3.1.1 in Appendix A.

Edison (2021) reported that surface methane emissions were not detected at Rockdale Bicentennial Park above background concentrations, and that accumulation monitoring did not detect methane within the amenities building.

4.5 Odour

Previous investigations have reported hydrogen sulfide concentrations exceeding aesthetic (odour) criteria at TP1308 and TP1310 (i.e. in subsurface gas wells). However, there has been no other field monitoring carried out with respect to odour. As a park that has supported both passive and active recreation for three decades, odour has not been identified as an ongoing significant issue in its current configuration.

5 Factors influencing safety & environmental risk

5.1 Overview

Earthworks to be undertaken by the Project at Rockdale Bicentennial Park will expose and disturb parts of the existing landfill, including some waste buried under a soil veneer. Leachate, LFG and odour associated with this waste may pose safety hazards and environmental risks when disturbed by the Project. An objective of this LLGSP is to outline the environmental control measures that will be used by the Project to mitigate these risks.

The nature and scale of these risks will be influenced by the existing environment, which has been described in **Section 4**. These risks will also be influenced by the type of construction activities to be undertaken and environmental factors existing at the time work is undertaken.

5.2 Construction activities

Key features of the proposed construction activities will include (from south to north):

- The shallow section of the road near President Avenue (where the tunnel daylights and continues to a surface intersection) will be constructed using the open cut method
- As the tunnel dives down in the northwest direction, a cut and cover method will be utilised, with the following general sequence:
  - Pond diversion (separating the pond into north and south portions) will be installed. Temporary sheet piling will enable construction access
  - Diaphragm walls will be constructed around the cut and cover tunnel to form a watertight retention barrier
  - Dewatering will be carried out following construction of the diaphragm walls
  - Bulk excavation with ongoing dewatering
- Further northwest, the tunnel section within the sediments will be constructed using the soft ground tunnelling method by injecting grout to stiffen the ground thereby allowing tunnel excavations to proceed
- Binocular shafts have been proposed within the alignment of the soft ground tunnel, which will be constructed with the following general sequence:
  - Diaphragm walls will be constructed around the shafts to form a watertight retention barrier
  - Dewatering will be carried out following construction of the diaphragm walls
  - Bulk excavation with ongoing dewatering

A general conceptual construction sequence model has been developed by CGU and is reproduced in Appendix B.

Construction activities that will disturb landfill waste at Rockdale Bicentennial Park include:

- Waterway diversion (pipe installation)
- Bulk excavation and piling for cut and cover structures and temporary shaft excavation
- Bulk excavation to install drainage infrastructure to collect surface water and groundwater inflows for treatment
- Surcharging landfill areas (e.g. raising ground elevations or temporary stockpiling) that may cause ground consolidation potential alteration to existing LFG and leachate below ground flow paths.

Potential safety and environmental impacts attributed to these construction activities when disturbing landfill waste include:

- Potential safety hazards due to the explosive potential of methane
- Potential safety hazards due to carbon dioxide and toxic gas accumulations in confined spaces and poorly ventilated structures
- Potential health impacts associated with LFG
- Leachate impacts on water quality and the ecology of surrounding areas
- Potential odour impacts to surrounding receivers associated with exposed landfill wastes and leachate
- Complaints from the public due to nuisance odours
- Alteration to migration pathways for LFG and leachate below ground

Other construction-related factors may also influence leachate, LFG and odour impacts, such as construction sequence and practices, timing and duration of excavations, location and size of stockpiles. Stockpiling will be minimised to the greatest extent practicable by classifying materials for disposal in situ, and prior to the commencement of bulk excavation. However minor stockpiling may be required on occasions when unexpected or inconsistent material is encountered or for other reasons (e.g. disruption to offsite disposal from external factors), but the volume would be relatively small.

In rare circumstances where temporary stockpiling of landfill waste is required, the waste material would be dewatered (with leachate removed) prior to excavation. The excavated material would only be stored within a dedicated spoil holding bay (proposed locations shown in Appendix C) that includes a concrete pad with contained drainage for treatment or disposal (not direct discharge to any waterway). The temporary stockpiling of landfill waste at the spoil holding bay will be managed as follows:

- The duration of stockpiling would not extend beyond the time required for laboratory testing where practicable (typically not longer than 10 days)
- The volume would not exceed 200m^3
- Odour suppressant will be applied if required
- Spoil stockpiles will be managed to reduce potential impacts associated with dust generation, erosion and sedimentation by battering slopes and use of polymers and/or ground covers where reasonable and feasible

Specific mitigation measures relevant to LFG, leachate and odour are presented in Section 6.

The proposed construction approach offers the following benefits in managing/mitigating risks associated with leachate, LFG and odour impacts:

- A significant portion of the tunnel section will be constructed using the soft ground tunnelling method. This will avoid excavations through the landfill waste in an open cut setting. As such, exposure to landfill waste, leachate and the associated odour would not be required.
- In the shallower cut and cover section of the tunnel, diaphragm walls have been selected for the ground retention system. Diaphragm walls will form a watertight retention barrier which will significantly limit ingress of leachate/groundwater, a potential ongoing source of odour. This will allow dewatering and removal of potentially odorous and contaminated water for treatment and disposal prior to bulk excavation to commence. By the time bulk excavation commences, the potentially odorous groundwater would have been largely removed, not exposed.
- Bulk excavations within the diaphragm walls can then be carried out in a controlled/orderly manner in stages to minimise the amount of open work area. Excavation activities will be able to be broken down into discrete manageable areas, not subject to mixing/tracking of waste

materials outside the diaphragm walls. Given the diaphragm walls will represent side walls for the excavation (not exposing waste external to the walls), odour controls (eg application of temporary cover or odour suppressant spray) and isolation of individual work areas can be carried out more effectively.

- Waste material, facilitated by in-situ waste classification, would be loaded directly on to trucks for offsite disposal, eliminating odour and leachate runoff risks associated with temporary stockpiling.

Nevertheless, the potential for impacts from leachate, LFG and odours will be influenced by the nature, extent and magnitude of construction activities. Consequently, some environmental control measures will include adjustments to construction approaches used.

5.3 Environmental factors

The potential for impacts from disturbed landfill waste will be influenced by the nature, extent and magnitude of construction activities and their interaction with the natural environment. Environmental factors likely to affect leachate, LFG and odour impacts include:

- Barometric pressure - affects gas flow with lower/dropping pressure increasing the potential for LFG to flow out of landfill waste
- Temperature – increased temperatures may increase potential odour impacts
- Rainfall – rainfall affects the infiltration of water into the landfill and the generation of leachate
- Wind speed – impacts dispersion of landfill odours
- Wind direction – influences the migration direction of landfill odours

As a result, the nature and scale of environmental control measures implemented by the Project are influenced by environmental factors.

5.4 Site-specific Action Criteria

The site-specific Action Criteria adopted by this LLGSP are:

- Leachate: Action Criteria cover the various ways leachate may be collected and disposed:
  - Treatment at WTP: WTP treatment criteria as specified in EPL 21600 (subject to discharge impact assessment as per Condition U1)
  - Disposal to sewer: Trade waste criteria specified by Sydney Water
  - Removal by licensed wastewater contractor: Contractor’s licence conditions
  - Unexpected leachate finds: Screening level that triggers further actions (refer to Section 4.3 of the LLGMP in Appendix A)
  - Actions to address unexpected groundwater impacts: Triggers based on pre-existing background/baseline conditions (refer to Section 4.4.3 of the LLGMP in Appendix A)
- LFG: Action Criteria are specified for methane, carbon dioxide, carbon monoxide, hydrogen sulfide, petroleum volatiles for subsurface monitoring bores; accumulation in enclosed structures, breathing zone, and surface emission in the LLGMP (in Table 6, Appendix A).
- Odour: An offensive olfactory odour detected at a sensitive boundary location, will trigger a response including for mitigation measures to be re-assessed and applied (refer to Sections 5.2 and 5.3 of the LLGMP in Appendix A).

The triggers and actions are presented in the LLGMP in Appendix A, and summarised in Table 5 below.

Table 5 LFG and odour triggers and corrective actions

Gas Trigger	Corrective Action / Contingency Plan
Action Level exceeded in subsurface monitoring bores	Further investigation by project environmental consultant for review of further corrective actions (e.g. more detailed monitoring, installation of active ventilation, passive gas venting or ground gas cut-off structures). The environmental consultant will consider potential impacts from the implementation of additional mitigations (odour) and develop appropriate strategies for management where required.
Action Level exceeded in enclosed structure	Building evacuated immediately and erect warning signs. If an unoccupied structure (e.g. pit), isolate area, erect barricade and erect warning signs. Contact emergency services if fire/ explosive conditions are developed and ignition sources cannot be switched off. Continue monitoring until gas levels fall below the Action Level. Further investigate incident to establish cause. Implement daily monitoring to confirm Action Levels not exceeded for next two weeks.
Action Level exceeded in work zone	Stop work, make area safe, move to an alternative location or allow additional time for ventilation. Contact emergency services if fire/ explosive conditions are developed and ignition sources cannot be switched off. Continue monitoring until gas levels fall below the Action Level. Recommence work only when there is a low risk of gas levels exceeding Action Level at which point standard monitoring frequencies can be adopted.
Action Level exceeded in surface emission	Stop work, make area safe and barricade the area for further investigation by an environmental consultant for review of further corrective actions (e.g. increase ventilation, install cap and LFG control measures).
Leachate Trigger	**Corrective Action / Contingency Plan**
WTP / discharge related exceedances	To be managed under GMP and EPL for the WTP and subject to discharge impact assessment as per Condition U1
Unexpected leachate discharge, ponding or seep is identified based on field screening test	Pump out the identified leachate for treatment and disposal at WTP. Immediately investigate potential leachate finds including laboratory testing (if required). Identify source and pathway and recommend corrective actions.
Action levels exceeded in groundwater monitoring wells	Investigate the data and trends, and recommend corrective actions for implementation as per Section 4.4.3 in Appendix A.
Odour Trigger	**Corrective Action / Contingency Plan**
Construction related odour detected at boundary (with negative hedonic tone and intensity unit exceeding 2)	Investigate odour source. Apply mitigation and corrective actions relevant to the odour source, as per correction action options in Section 5.3 in Appendix A.
Moderately unpleasant strong odour detected at boundary (hedonic tone below -2 with intensity unit exceeding 3)	Undertake offsite monitoring immediately. Investigate odour source. Apply mitigation and corrective actions relevant to the odour source, as per correction action options in Section 5.3 in Appendix A. Continue monitoring until odour has subsided and prepare an incident report as per the CEMP.

In addition, these scenarios will trigger notifications to the EPA, in accordance with the conditions within EPL 21600:

- Methane detected above 500 ppm during gas accumulation monitoring within enclosed structures (EPL condition R4.5)
- Methane detected above 1% (v/v) in subsurface monitoring bores (EPL condition R4.4)

The EPL (condition U1) requires the licensee undertakes a water pollution impact assessment for the construction water treatment plant at C3 President Avenue construction ancillary facility. The water pollution impact assessment will be submitted to the EPA at least 8 weeks prior to commencing any discharges from the water treatment plant. The LLGSP will be updated with the requirements identified in the water pollution impact assessment prior to discharging.

5.5 Cumulative Impacts

Cumulative impacts to leachate and LFG are not anticipated to occur from staging of the Project or during construction of the Project. Where unexpected cumulative impacts are identified during works, they will be managed through compliance with relevant CoAs, coordination with external stakeholders including utility providers, and implementation of EMMs related to key environmental impacts. The mechanism for identifying any potential unexpected cumulative impacts will be through monitoring, inspections, reporting and auditing.

6 Environmental control measures

As presented in Section 5.2, the proposed construction approach will offer significant benefits in managing/mitigating risks associated with leachate, LFG and odour impacts, given (a) soft ground tunnelling will avoid exposure of landfill waste, leachate and the associated odour (b) diaphragm wall retention system will limit ongoing ingress of odorous leachate/groundwater and allow dewatering of odorous leachate/groundwater prior to bulk excavation (c) in-situ waste classification will facilitate landfill waste disposal without the need for temporary stockpiling (d) bulk excavation will be carried in stages and in discrete manageable areas to limit exposure of waste.

In-situ waste classification activities will be carried out in accordance with EPA (2014) Waste Classification Guidelines. Existing contamination testing data is available and presented in the Site Contamination Report as part of site characterisation. The data, along with statistical tools, will be utilised. In some cases, additional in-situ testing may be required to supplement the existing data. Waste classification reports will be reviewed and endorsed by the Site Auditor prior to offsite disposal.

Whilst the extent of disturbance has been limited to the extent practicable, earthworks required by the Project at Rockdale Bicentennial Park will still expose and disturb landfill waste, such that potential impacts associated with leachate, LFG and odour will need to be managed / mitigated through the use of environmental control measures.

Leachate management and mitigation measures to be implemented during construction at Rockdale Bicentennial Park are outlined in Table 6. LFG management measures to be implemented during construction at Rockdale Bicentennial Park are outlined in Table 7. Landfill odour mitigation measures to be implemented during construction at Rockdale Bicentennial Park are outlined in Table 8. Management measures to be implemented during closure and stabilisation of impacted landfill areas at Rockdale Bicentennial Park are outlined in Table 9.

For each environment management and mitigation measure, the tables identify:

- The type of measure;
- When the measure is to be implemented;
- The persons responsible for the implementation of the measure; and
- The documentary evidence that is to be produced to demonstrate implementation of the measure.

Implementation of some of the measures needs to commence during the Project planning and design stage, while most measures need to be implemented during the period of construction work at Rockdale Bicentennial Park.

The Plan identifies the most appropriate Project personnel responsible for implementing an environmental control measure. These include:

- Construction Manager (CM);
- Project Manager (PM);
- Environmental Manager (EM);
- Foreman / supervisor (F/S);
- Work Health and Safety (WHS) Manager;
- Supervising engineer (SE); and
- Community & Stakeholder Manager (C&SM).

The Plan specifies a range of documentation that will be used as evidence that environmental control measures have been implemented. These include:

- Project plans;
- Design drawings;
- Inspection records;
- SWMS and WHS documents;
- Work prestart records;
- Daily site records;
- Complaints register;
- Incident management register;
- Photo records;
- LFG monitoring reports;
- Monthly and biannual EPA / LLGMP monitoring reports;
- WTP records;
- Sewer disposal and monitoring records;
- Licensed liquid waste contractor dockets;
- Construction quality and assurance (CQA) data; and
- Site audit statement (SAS).

Table 6 Leachate management and mitigation measures

ID	Measure	When to implement	Responsibility	Evidence
LM1	Design and plan construction of works at Rockdale Bicentennial Park to minimise leachate inflows needing to be managed by the Project	Design and project planning	PM, CM, EM	Project plans, design drawings
LM2	Limit clean stormwater inflows into the excavation by diverting stormwater runoff around open/excavation areas into on-site stormwater infrastructure. Controls may include construction of stormwater retention ponds, temporary drains, diversion bunds or a combination of these. Any stormwater management structures are to be designed in accordance with the CEMP.	During earthworks	CM, SE, F/S	Erosion and sediment control plan, daily site records, photo records
LM3	Prevent leachate entering the stormwater system by inspection, review and maintenance of existing stormwater drains and structures on site.	During earthworks	CM, SE, F/S	Daily site records, photo records
LM4 (also LGM4, OM2)	Where practical and reasonable to do so, works will be progressed in stages to minimise the extent of former landfill area being opened/exposed and reduce the potential for infiltration in case of wet weather. Additionally, the weekly weather forecast will be reviewed by the Site Supervisor and Environmental team to identify higher risk weather conditions (e.g. wet weather).	During earthworks	CM, SE, S/F	Erosion and sediment control plan, work pack construction area plan, daily site records, photo records
LM5 (also LGM8, OM5)	Regular review of site conditions (e.g. exposed materials, capability of haulage) to determine if additional management and mitigation measures are required.	During earthworks	EM, CM	Daily site records, monitoring reports

ID	Measure	When to implement	Responsibility	Evidence
LM6 (also OM6)	Daily inspection of excavation work at Rockdale Bicentennial Park. Excavations to have no free-standing water. Where leachate is found to be ponding within excavations, it is to be pumped into the WTP or otherwise disposed of as soon as practicable.	Daily during exposure of landfill waste	SE, S/F	ITPs, daily site records, photo records
LM7	Regular review of areas to identify leachate seeps from exposed surfaces. If leachate seep is identified, determine appropriate removal method with Site Foreman (note- method may vary depending on potential risk). Measures could include installation of earth bund, sandbags, temporary sump/tank and pumping to WTP.	Activity based	EM, SE,	ITPs, daily site records, photo records
LM8	Leachate cannot be discharged onsite or offsite, but is to be managed in accordance with regulatory requirements. This may include treatment at the WTP and appropriate disposal, discharge to sewer in accordance with a trade waste agreement or disposal to a licenced facility.	During earthworks	EM, CM	WTP records, sewer disposal & monitoring records, licensed liquid waste contractor dockets
LM9	Regular review of data collected by the WTP, trade water testing, licensed wastewater contractors & groundwater monitoring program and adjust mitigation and management measures to account for changes in contaminant types, concentrations and discharge volumes. In addition to effluent testing (required under the Groundwater Monitoring Program), influent testing will be conducted at least monthly to monitor leachate concentration, as indicated by Ammonia concentration. Testing of leachate seeps may also occur to assist in determining mitigation and control.	During construction work	EM, CM, C&SM	WTP records, sewer disposal & monitoring records, licensed liquid waste contractor dockets, complaints register

ID	Measure	When to implement	Responsibility	Evidence
LM10	Design construction operations and landscaping of Rockdale Bicentennial Park to minimise consolidation of landfill waste in unexcavated areas and the potential for leachate to migrate off-site above existing levels	Throughout Project	CM, EM	Design drawings, project plans, monitoring reports, SAS

Table 7 LFG management and mitigation measures

ID	Measure	When to implement	Responsibility	Evidence
LGM1	Design and plan construction of works at Rockdale Bicentennial Park to minimise LFG emissions needing to be managed by the Project	Design and project planning	PM, CM, EM	Project plans, design drawings
LGM2	All buildings and below ground structures to be constructed by the Project at Rockdale Bicentennial Park and nearby areas (both temporary and permanent) are to be assessed for hazardous ground gas (HGG) risks and appropriate mitigation measures designed and constructed in accordance with the EPA (2020) HGG guideline. This work is to be subject to monitoring and validation by the Project Environmental Consultant and subject to review by the Site Auditor	Design and project planning, during construction work	PM, CM, EM	Project plans, design drawings, monitoring reports, CQA data, SAS
LGM3	Open excavations, piling, drilling, boring or service pits at Rockdale Bicentennial Park will be considered potential hazardous work zones with respect to LFG (potential risks of asphyxiation, explosion, toxicity). Staff involved with work at these areas will be inducted prior to work commencing on-site so the potential risks are known and appropriate work practices to be used are understood. Appropriate signage will be erected at each potential hazardous work zone. Appropriate training will be undertaken for personnel responsible for monitoring.	Prior to staff commencing work on site and ongoing during construction works	PM, CM, PM, WHS Manager	SWMS & WHS docs, work prestart records, daily site records, incident management register
LGM4 (also	Where practical and reasonable to do so, works will be progressed in stages to minimise the extent of	During earthworks	CM, SE, S/F	Work pack construction area plan, daily site

ID	Measure	When to implement	Responsibility	Evidence
LM4, OM2)	former landfill area being opened/exposed and reduce the potential for infiltration in case of wet weather. Additionally, the weekly weather forecast will be reviewed by the Site Supervisor and Environmental team to identify higher risk weather conditions (e.g. high temperature, low atmospheric pressure).			records, photo records
LGM5	Potential ignition sources across the work site to be kept to a minimum. Smoking will NOT be allowed within potential hazardous work zones.	During construction work	CM, WHS Manager	SWMS & WHS docs, work prestart records, daily site records, incident management register
LGM6	Each potential hazardous work zone will be assessed for LFG prior to commencement of work, following work breaks and then continuously (or at least hourly) to ensure ground gases are not creating a hazardous or potentially explosive atmosphere within the work zone. LFG monitoring to be undertaken in accordance with Section 3.3 of the LLGMP (Appendix A).	During construction work	SE, F/S, WHS Manager	SWMS & WHS docs, monitoring reports, daily site records, incident management register
LGM7	If LFG monitoring measures an exceedance of the Action Criteria, implement corrective actions given in the LLGMP (Section 3.6, Appendix A)	During construction work	CM, EM, WHS Manager, SE, F/S	SWMS & WHS docs, monitoring reports, daily site records, incident management register
LGM8 (also LM5, OM5)	Regular review of the current site conditions to determine if additional mitigation is required and the appropriate measures to be implemented.	During earthworks	EM, CM, C&SM	Daily site records, monitoring reports, complaints register

ID	Measure	When to implement	Responsibility	Evidence
LGM9 (also OM11)	Adjust mitigation and management measures to account for data collected by the LLGMP monitoring program.	During construction work	EM, CM, SE	Monitoring reports, daily site records, photo records
LGM10	Plan construction works and design landscaping of Rockdale Bicentennial Park to minimise consolidation of landfill waste in unexcavated areas and the potential for LFG to migrate off-site above existing levels	During construction	CM, EM	Design drawings, project plans, monitoring reports, SAS

Table 8 Landfill odour management and mitigation measures

ID	Measure	When to implement	Responsibility	Evidence
OM1	Design and plan construction of works at Rockdale Bicentennial Park to minimise leachate inflows and exposure of landfill waste needing to be managed by the Project	Design and project planning	PM, CM, EM	Project plans, design drawings
OM2 (also LM4, LGM4)	Where practical and reasonable to do so, works will be progressed in stages to minimise the extent of former landfill area being opened / exposed. Additionally, the weekly weather forecast will be reviewed by Site Supervisor and Environment team to identify higher risk weather conditions (e.g. temperature, wind direction)	During earthworks	CM, SE, S/F	Work pack construction area plan, daily site records, photo records
OM3	Limit exposure of landfill waste and leachate to as small as practicable surface area. Odorous material to be treated as soon as practicable on-site, and be removed from site where necessary. Landfill waste will be disposed of directly from site, with waste classification performed in-situ prior to excavation to reduce the need for stockpiling of putrescible waste.	During excavation work	CM, SE, F/S	ITPs, work pre-start records, daily site records
OM4	Prior to the commencement of each day's work during excavation in the landfill area, review site and weather conditions to assess mitigation requirements.	Daily during earthworks	CM, EM	ITPs, work pre-start records, daily site records
OM5 (also LM5, LGM8)	Regular review of current site conditions (e.g. exposed materials, capability of haulage) to determine if additional mitigation required and appropriate measures are to be implemented.	During construction work	EM, CM, C&SM	Daily site records, monitoring reports, complaints register

ID	Measure	When to implement	Responsibility	Evidence
OM6 (also LM6)	Daily inspection of excavation work at Rockdale Bicentennial Park. Excavations to have no free-standing water. Where leachate is found to be ponding within excavations, it is to be pumped into the WTP or otherwise disposed of as soon as practicable.	Daily during excavation work	SE, S/F	ITPs, daily site records, photo records
OM7	Use odour suppressant spray at odour source and/or along boundaries against sensitive receptors.	During construction as required	EM, CM, SE, C&SM	Daily site records, monitoring reports, complaints register
OM8	An overview of upcoming works within the former landfill area will be included in routine notifications to the community and will include the details of a community contact line to allow local community reporting of odour concerns.	During construction work	C&SM, EM	Communication plan, complaints register, monitoring records
OM9	Assess the potential for stockpiles of excavated landfill waste generating nuisance odours at Site boundaries and ensure appropriate mitigation measures are implemented to manage odours generated by stockpiled materials. This may include theoretical analysis and/or field trials. Results will be used to inform future excavation and treatment activities.	During construction work	C&SM, EM	Project plans, monitoring reports, daily site records, photo records, complaints register, SAS
OM10	Odour complaints to be managed in accordance with the CGUJV complaints procedures presented in the CEMP. Odour monitoring will be conducted following receipt of odour complaints as detailed in LLGMP.	Complaint / incident based	C&SM, EM	Communication plan, complaints register, incident register, daily site records
OM11 (also LGM9)	Adjust mitigation and management measures to account for data collected by the LLGMP.	During construction work	EM, CM, SE	Monitoring reports, daily site records, photo records, complaints register

ID	Measure	When to implement	Responsibility	Evidence
OM12	Residents will be provided with an Odour Fact Sheet prior to start of excavation. An impacted receiver contact list specific to the Bicentennial Park site (containing email addresses and phone numbers of adjacent and nearby receivers) will be collated (a subset of M6 Community Stakeholders) and used to send immediate digital updates should there be an odour emission or other environmental emission affecting the community. The project will also utilise and advertise drop-in sessions/forums to inform the community of odour risks and to address relevant community concerns.	During construction works, commencing prior to excavation	EM, CM C&SM	Notifications and minutes from forums

Table 9 Impacted landfill closure and stabilisation management and mitigation measures

ID	Measure	When to implement	Responsibility	Evidence
CM1	Assess design and construction plans and check that the potential for landfill waste to consolidate in unexcavated areas of the former landfill area is minimised so there is a low risk of increasing off-site migration of LFG and groundwater impacted by leachate above pre-construction levels	Design and project planning	PM, EM	Project plans, design drawings, monitoring reports, SAS
CM2	Backfill temporary excavations in landfill waste to minimise odours and risk of off-site migration of LFG and groundwater impacted by leachate	During earthworks and prior to landscaping	CM, EM, SE	Daily site records, photo records
CM3	Construct a compacted cap over landfill areas where temporary excavations extend into landfill waste or where landfill leachate occurred or where surface emissions were consistently measured during construction at concentrations exceeding the Action Criteria (Section 5.4). The cap is to be constructed such that risks are adequately managed for ongoing open space/recreational land use. Details of the cap are to be documented in the Remedial Action Plan (RAP), and endorsed by the Site Auditor.	During earthworks and prior to landscaping	CM, EM, SE	Project plans, RAP, design drawings, daily site records, monitoring reports, SAS
CM4	Leachate captured by the tunnel drainage system to be treated at the WTP and appropriately disposed	Design and project planning	PM, EM	Project plans, design drawings, monitoring reports, SAS

7 Compliance management

7.1 Roles and responsibilities

The CGUJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.4 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

7.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to leachate, LFG and odour issues as part of the environmental management training program. The induction training will address elements related to leachate, LFG and odour management including:

- Requirements of this plan;
- Applicable and relevant legislative requirements;
- Roles and responsibilities for leachate, LFG and odour management;
- Leachate, LFG and odour monitoring and management measures (refer to Table 6 to Table 9 and LLGMP in Appendix A);
- Construction activities that could impact landfill leachate, LFG and odour generation; and
- Incident management.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in landfill leachate, LFG and odour management. Before undertaking works on-site all subcontractors will be required to prepare their own Safe Work Method Statements (SWMSs) with reference to this LLGSP.

Further details regarding staff induction and training are outlined in Section 3.6 of the CEMP.

7.3 Leachate, LFG and odour monitoring

The LLGMP is presented in Appendix A. Additional requirements and responsibilities in relation to inspections are documented in Sections 3.9.1 and 3.9.2 of the CEMP. The LLGMP in Appendix A sets out:

- Leachate, LFG and odour monitoring to be undertaken, including the location and frequency of monitoring and parameters to be monitored;
- How monitoring data will be analysed and reported;
- How proposed mitigation measures may be revised if required, the identification and implementation of additional mitigation measures, where results of monitoring indicate adverse impacts beyond the predicted impacts; and
- Consultation to be undertaken in relation to the monitoring programs.

7.4 Licences and permits

A summary of legislative requirements is presented in Section 3.1.1. Project construction activities involving road construction in significant scale, are considered scheduled activities and have triggered the need to obtain an environment protection licence (EPL) under the Protection of the Environment Operations Act 1997 (POEO Act). EPL 21600 has been issued on 8 November 2021 which has conditions relevant to waste management including discharge requirements for WTP.

7.5 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 3.9.3 of the CEMP.

The Site Auditor will also undertake regular site inspections and data reviews sufficient to support the preparation of a Section A SAS for the part of Rockdale Bicentennial Park disturbed by construction work associated with the Project.

7.6 Reporting

Refer Section 6.3 of the LLGMP (Appendix A).

8 Review and improvement

Refer Section 7 of the LLGMP (Appendix A).

9 References

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ANZG. 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, August 2018 http://waterquality.gov.au/anz-guidelines.

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Edison. 2020. Long-Term Site Management Plan, Recreational/Open-Space Land Use, Bicentennial Park, New South Wales (Ref: E19015-BSD-03-SMP Rev1, dated 31 March 2020)

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Tetra Tech Major Projects Pty Ltd (Coffey). 2021b. Hydrogeological and Groundwater Interpretive Report – Project wide. M6 Motorway Stage 1. Report reference M6S1-COF-NWW-ENEV-RPT-680440.

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Appendix A – Leachate and Landfill Gas Monitoring Program

Document Reference: M6S1-CGU-NWW-ENPE-MPL000416

Appendix B – Construction Sequence

Conceptual model and snapshots provided by CGU

Summary of Excavation activities at C3

Site	Specified Excavation Site – Excavation Elements
C3	Bicentennial Park Shaft Bulk Excavation
C3	Bicentennial Park Shaft Dwalls/Piles
C3	Bicentennial Park Shaft Dwalls/Piles - Guide Walls
C3	Soft Ground Tunnels Between Cut and Cover and Shaft - Cut off & Slurry walls
C3	Soft Ground Tunnels Between Cut and Cover and Shaft - Cut off walls - Guide Walls
C3	Soft Ground Tunnelling Excavation Between C&C and Shaft
C3	Soft Ground Tunnels Excavation Between Shaft and MOC 3 - (no contamination)
C3	Cut and Cover Dwalls
C3	Cut and Cover Dwalls - Guide Walls
C3	Cut and Cover Barrette Piles
C3	Cut and Cover Bored Piles for Open Cut
C3	Cut and Cover Bored Piles for Open Cut - Guide Walls
C3	Cut and Cover Bored Piles for Open Cut - Tension Piles
C3	Cut and Cover Bulk Excavation from Existing Ground Level
C3	Cut and Cover Portal Sump Bulk Excavation
C3	Pond Piped Diversion Excavation
C3	Permanent Sedimentation Basin

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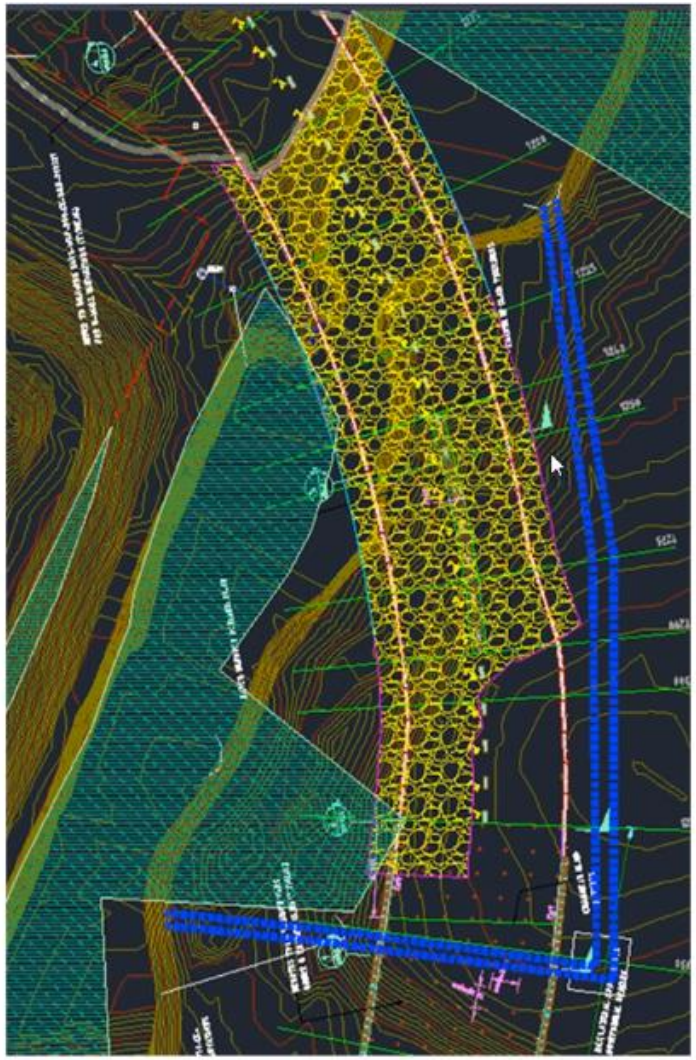
General construction methodology for bulk excavation

- Seal zone where bulk excavation is to occur by constructing diaphragm walls
- Dewatering of zone where bulk excavation is to occur
  - Water to be processed through WTP
  - Continues throughout bulk excavation
- Commence bulk excavation of landfill
  - Landfill material loaded into trucks and removed from site

Cut & Cover Tunnel
Construction Sequence

To complete the diaphragm walls around the cut and cover, CGU must undertake a Pond Diversion:

- The pond will be separated into two portions
- The diversion scheme is intended to take the overflow water in a rain or flood event from the north side to the south side
- Buried twin 1350mm pipes, 255m long
- The pipes will be installed with the invert at water level excess water to spill downstream
- 1/20years flood design criteria for pipes
- Working platform set at PMF level RL 5.2 ~ 4m higher than max flood level
- Sheet piles 5 meters each side of the alignment to allow for Dwall construction.



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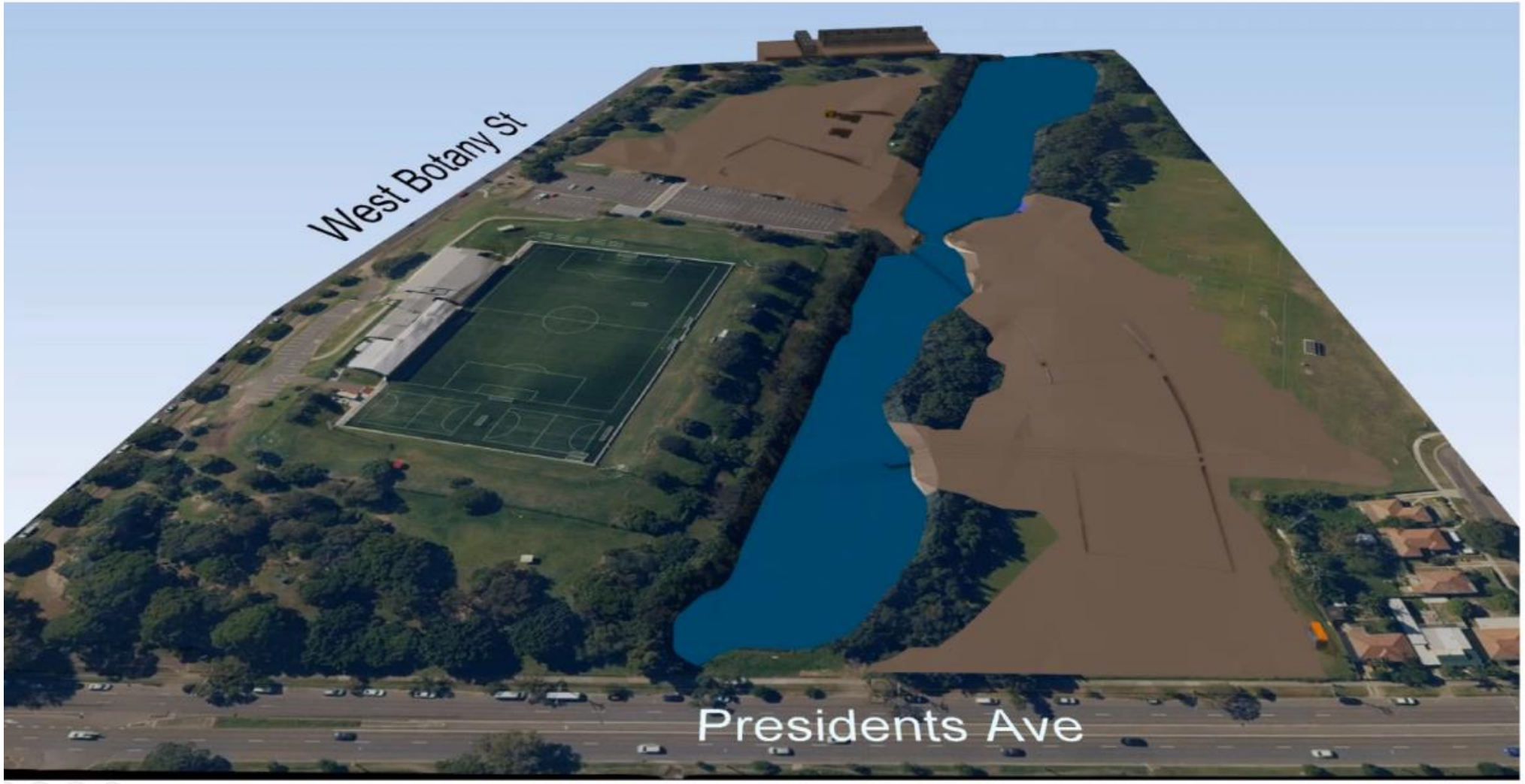
Cut & Cover: sheet piling within ponds

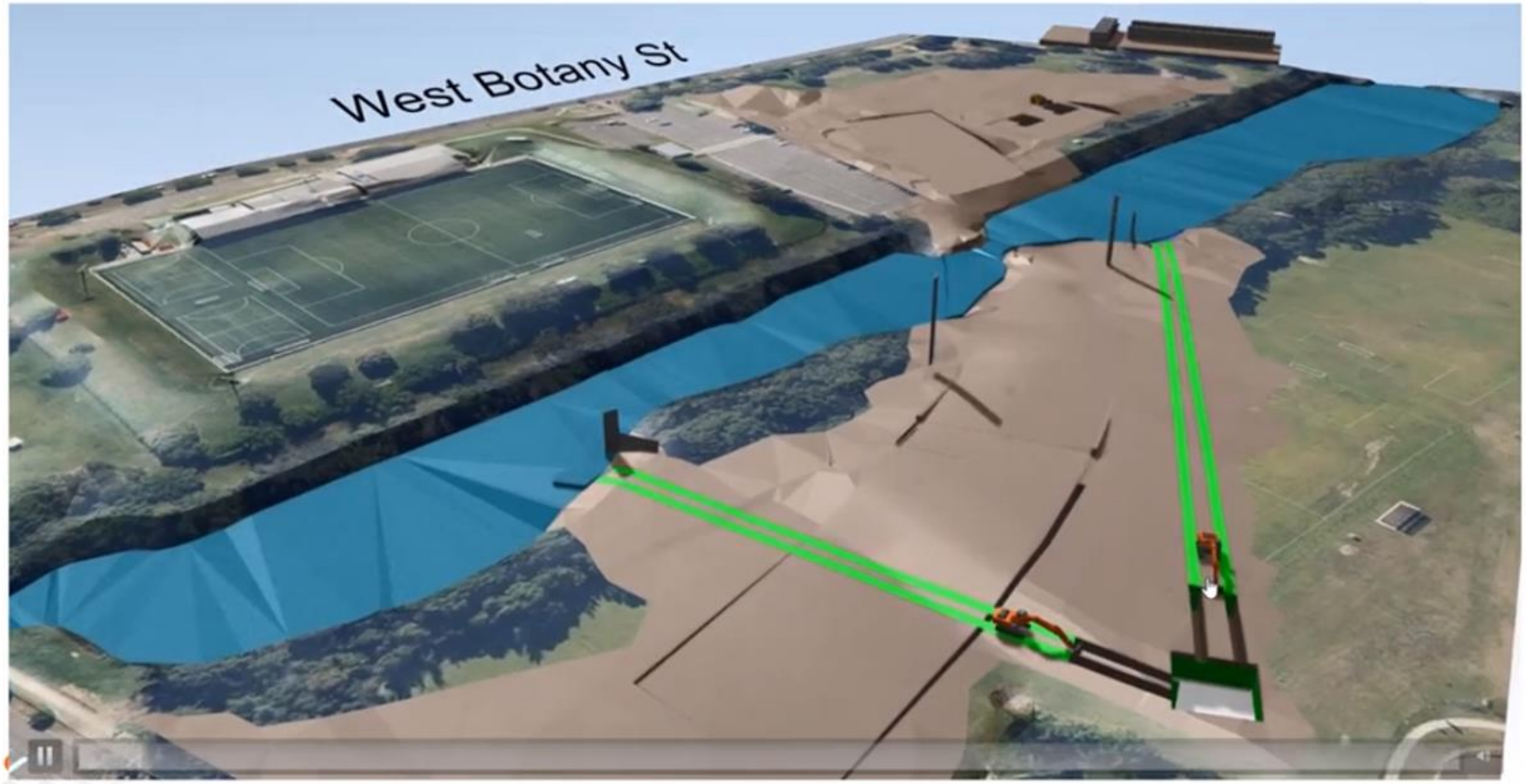
t & Cover Tunnel

nstruction Sequence 4D animation



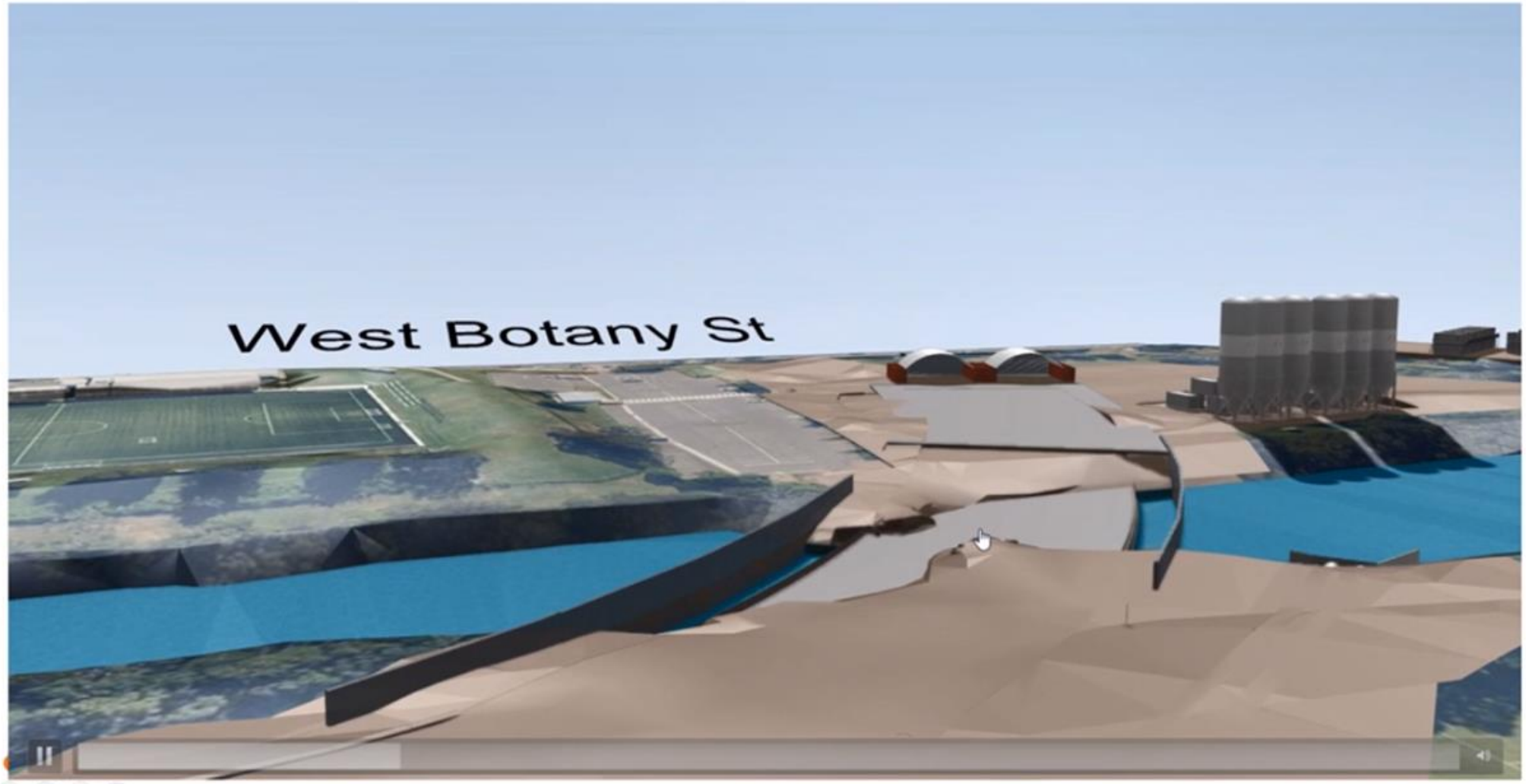
Cut & Cover Tunnel

Construction Sequence 4D animation



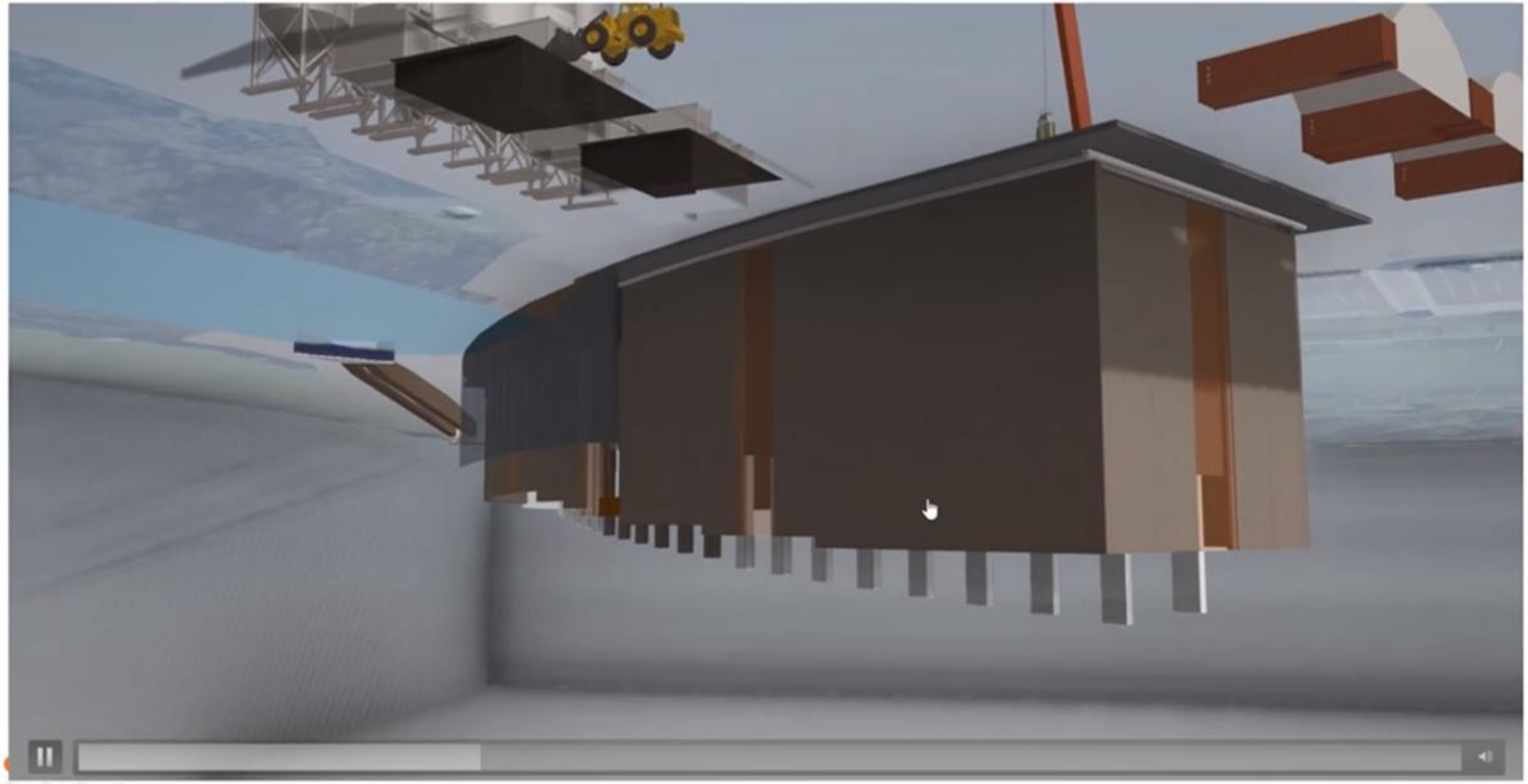
Cut & Cover Tunnel

Construction Sequence 4D animation



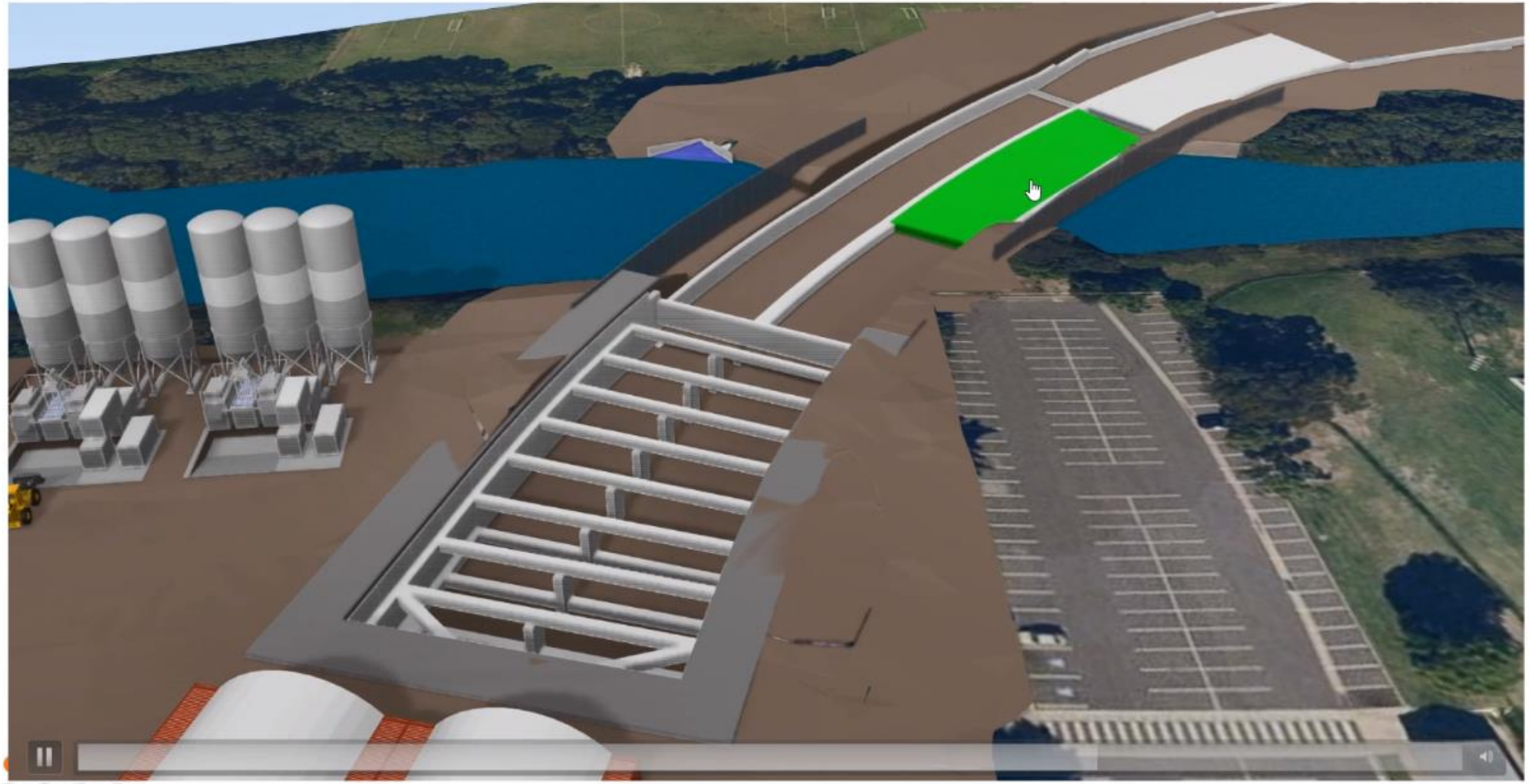
Cut & Cover Tunnel

Construction Sequence 4D animation

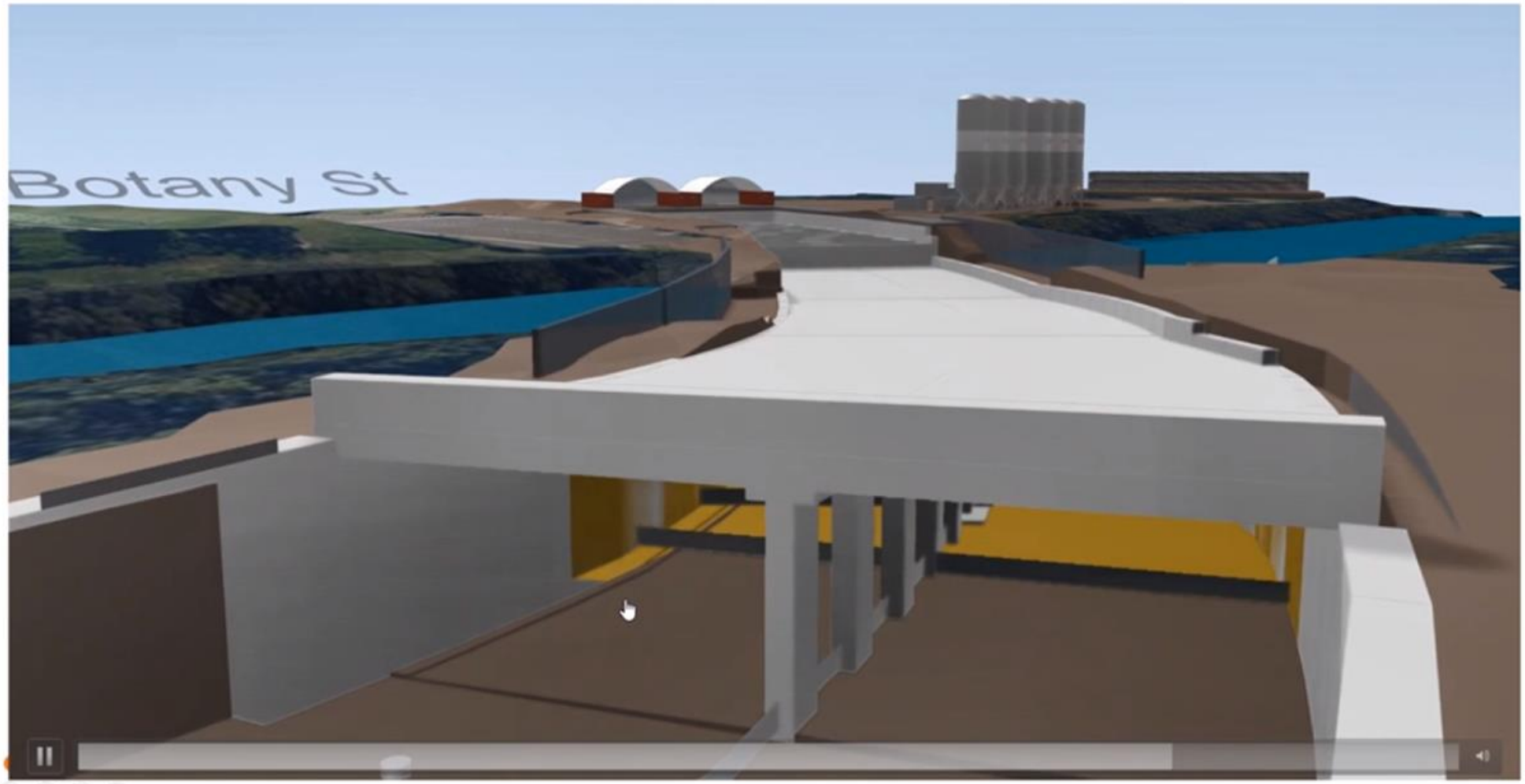


Cut & Cover Tunnel

Construction Sequence 4D animation

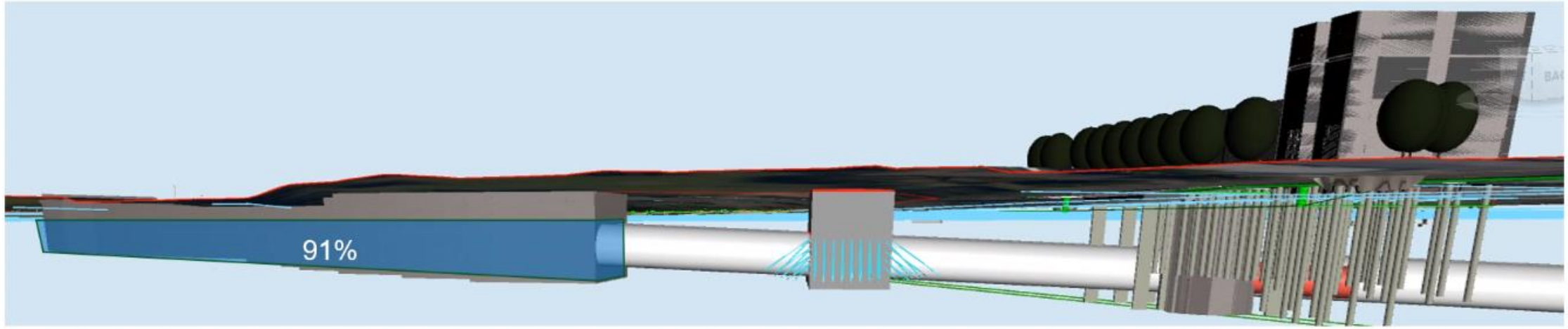


Cut & Cover Tunnel
Construction Sequence 4D animation



Excavated materials at C3

- Majority of material excavated in Binocular Shafts and Cut and Cover is ASS which is located beneath the landfill material.



Appendix C – Proposed Location of Spoil Holding Bay

Sketch provided by CGU

LEGEND

- C3 East site
- Pond Diversion Works Zone
- Haul Road
- Water treatment plant
- Environmental Exclusion Zone
- Piling Pad
- Piling Pad
- No Access Area

PHASE 3
Feb 22 - May 22

ACTIVITIES:
- CHANGE ACCESS TO GATE C3.1
- COMMENCE D WALL WORKS
- DEMOLISH EXISTING SKATE PARK
- CONSTRUCT PERMANENT HAUL ROADS
- CONSTRUCT WTP, HV BAY
- CONNECT PERMANENT DRAINAGE