Expert Opinion
Chain Valley Colliery Consolidation Project (SSD-17017460)

Submitted to:
Environmental Justice Australia

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Burgess Environmental Ltd.
24 Strathlorne Crescent SW
Calgary, Alberta, T3H 1M8
[redacted]

Author:
Gordon J. Johnson, M.Sc., P.Eng. (AB)

Burgess Environmental

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1 INTRODUCTION

1.1 Background

This opinion (Report) has been prepared in response to a brief (the Brief, Appendix A) from Environmental Justice Australia (EJA) dated 18 November 2022. The Brief requests review of the Environmental Impact Statement (EIS) for the Chain Valley Colliery (CVC) Consolidation Project (Project) and to provide an expert report on the adequacy of how each of the following matters are addressed in the EIS:

a) water resources (including groundwater and surface water)
b) subsidence
c) mine closure and rehabilitation
d) biodiversity as related to potential surface water and groundwater impacts
e) greenhouse gas (GHG) emissions
f) compliance with the Secretary's Environmental Assessment Requirements for the Project (SEARs) as they relate to the matters addressed in the review

I confirm I am qualified to provide expert opinion on these matters. I have over 35 years of experience providing services to the mining and petroleum industries in the fields of environmental and regulatory consulting, and geotechnical engineering. This experience includes environmental assessment of mines and mining facilities. A copy of my C.V. is provided as Appendix B.

I have read and agree to be bound by Division 2 of Part 31 of the Uniform Civil Procedure Rules 2005 (UCPR), and the Expert Witness Code of Conduct (Code of Conduct) contained in Schedule 7 of the UCPR.

My opinions in this matter are stated in Section 2: Summary of Opinions of this report, and the technical bases of my opinions are described in subsequent sections of this report.

1.2 Understanding of Project

CVC and MC are underground coal mines, owned and operated by Great Southern Energy Pty Ltd, which trades as and is referred to as Delta Coal in this report as well as the EIS. Existing operations are currently approved through Consent SSD-5465 (CVC, as modified), and Approval MP 06_0311 (MC, as modified), which expire on 31 December 2027. While authorized under a separate Consent and Approval, Delta Coal states that the operations of CVC and MC are integrated.

These operations are approved to provide coal for both export and for domestic power generation; however, all product coal from the operations is currently supplied to the Vales Point Power Station (VPPS), which is owned and operated by Delta Coal's parent company, Delta Electricity Pty Ltd. Coal for the VPPS can be transported via rail, road and overland conveyor.

The objectives of the Project are to consolidate the authorizations for CVC and MC, extend the operations of CVC and MC by 2 years, and maximise the proportion of coal burned at VPPS that is supplied by CVC and MC. The EIS was prepared to assess the environmental and social impacts of the Project and accompanies a State significant development (SSD) application for the Project, under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

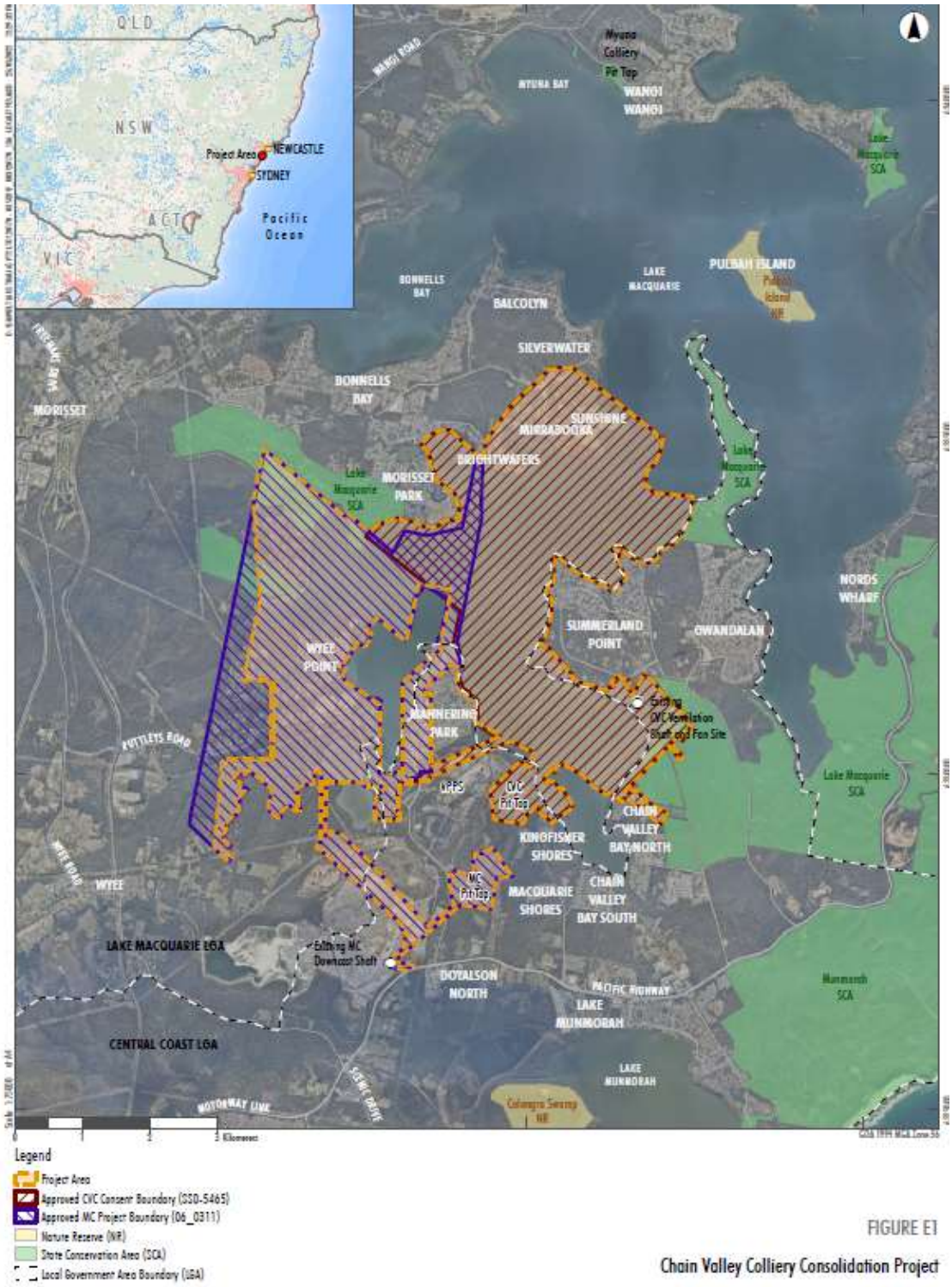
Delta is applying to consolidate the operations and consents for the existing CVC and MC, and to obtain approval for the following changes (see Figure 1-1):

- extend the mine lives for 2 years (from 2027 to 2029), which coincides with the planned closure of the VPPS
- increase the approved throughput at the MC pit top from 2.1Mtpa to 2.8 Mt ROM coal (within an overall complex cap of 2.8Mtpa ROM coal)
- allow secondary workings in parts of the approved MC mining area below Lake Macquarie consistent with existing approved operations under the CVC Consent

Delta Coal is also seeking to expand the extent of the approved underground mining works that are located primarily beneath Lake Macquarie.

Figure 1-1

Project Location



2 SUMMARY OF OPINONS

In my opinion, the EIS and its supporting assessments provide more of a cursory review of past performance monitoring than a forward-looking assessment of potential future impacts. While the review of past performance of long-standing operations is reasonable and informative, it should not be relied upon in near-entirety to predict future performance, or potential impacts not adequately addressed or predicted by past monitoring.

The following comments and opinions pertain to the EIS components that are the subject of this review:

Groundwater (Section 3)

The groundwater assessment does not adequately characterize the quality of groundwater extracted from the mining operations, which will impact surface water quality (see below). It also does not quantify the gases (carbon dioxide and methane) that will be liberated by depressurization of the coal seams, or consider the associated impacts, other than to estimate fugitive emissions captured in the mine ventilation systems. These fugitive emissions contribute to overall GHG emissions and potentially present a risk to ecological receptors (Lake Macquarie) and land occupants above the mines. It does not consider the potential long term impacts that could be caused by increasing the permeability of the formations underlying Lake Macquarie as a result of mining.

Surface Water (Section 4)

The surface water assessment does not adequately characterize the potential impacts to Swindles Creek and Lake Macquarie that could result from the discharge of large quantities of mine water, other than to state that no changes are anticipated. The surface water assessment should include a detailed analysis of the quality of the mine water that makes up most of the surface water discharges, and its potential impacts on Swindles Creek and Lake Macquarie. It does not include "*an assessment of any likely flooding impacts*" as required by the SEARs. The surface water assessment should evaluate the potential impacts that could be caused by a flood (e.g.: the 1 in 200 years flood event).

Subsidence (Section 5)

The subsidence assessment consists solely of a cursory review of past monitoring and performance measures. It does not include "*a detailed qualitative assessment of the potential subsidence effects and impacts of the development*" as required by the SEARs. The subsidence assessment should evaluate the adequacy and results of the past monitoring, and should consider the potential impacts to ecological receptors (Lake Macquarie) and land occupants above the mines, in the event that subsidence exceeds predicted levels.

Biodiversity (Section 6)

The biodiversity assessment consists of "*a desktop review of information relating to seagrass and benthic community monitoring conducted by CVC"* (EIS, Appendix 11, Section 2), and does not fulfill the SEARs for biodiversity, which state, "*an assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report*" (EIS, Appendix 2). Specifically, the EIS should address the potential impacts to the biodiversity of Swindles Creek and its discharge into Lake Macquarie because large volumes of mine-water are discharged into Swindles Creek.

Greenhouse Gas Emissions (Section 7)

The estimate of GHG emissions does not attempt to quantify gases liberated by the minedepressurization systems that are not captured by the mine ventilation systems. The feasibility of capturing and burning the fugitive methane emissions caused by mine depressurization should be evaluated to reduce GHGs.

Rehabilitation and Final Landform (Section 8)

The SEARs include "*the measures which would be put in place for the long-term protection and/or management of the site and any biodiversity offset areas postmining"* (EIS, Appendix 2), which does not appear to have been completed for the underground mine component of the Project. A program for ongoing monitoring of potential future subsidence should be described, and viable mitigations identified should the levels of subsidence in the future exceed predictions.

Cumulative Impacts Assessment

The SEARs require "*a detailed assessment of the cumulative impacts of the development, in combination with other existing and approved mining projects in the locality, with a particular focus on air quality, noise, traffic and social impacts, as well as impacts on water resources*". A detailed assessment of cumulative impacts on water resources has not been completed, and should be to satisfy the SEARs. The intense level of mining that has occurred in the area also warrants a detailed assessment of cumulative impacts.

3 GROUNDWATER ASSESSMENT

3.1 Scope of EIS

The groundwater assessment was completed by GHD (EIS, Appendix 9) and addressed the SEARs for the Project, which require the identification of any potential impacts to groundwater quantity and quality, aquifers, watercourses, riparian land, water-related infrastructure and water users as a result of the Project. The groundwater assessment also described the licensing requirements and/or approvals needed under the NSW Water Act 1912 and/or the WM Act and demonstrates that operations would be undertaken in accordance with the relevant Water Sharing Plan (WSP) (EIS, Section 6.5.1). The GHD groundwater assessment was also reviewed by Hydro Algorithmics.

The GHD review of licensing requirements and/or approvals needed under the *Water Act 1912* (NSW) and/or the *Water Management Act 2000* (NSW) appears to be accurate and reliable, although it was not independently checked as part of Burgess' review. The groundwater assessment relies primarily on the historical trends of groundwater pumping volumes from the mine, and the salinity of that water, to evaluate potential impacts and changes to those impacts, over the life of the CVC and MC mines. In general, the premise of the groundwater assessment is that the historical data is a reliable indicator of future performance and impacts. Only flow data are summarized in the groundwater assessment, and it is not clear that any new data analyses were completed as part of the groundwater assessment.

3.2 Impact Summary

The groundwater assessment concludes that the dewatering rate could increase the maximum pumping rate by up to 0.9 ML/day as a result of the Project. GHD considers this to be a short term impact related to the dewatering of rock above and below the Fassifern Seam in the zones of secondary extraction, and concludes that the total pumping rate will remain below the permitted limit. The groundwater assessment (EIS, Section 6.2) also concludes the following:

- No drawdown of alluvial groundwater or the water table is predicted as a result of the Project, and no impact on baseflow to ephemeral creeks is predicted.
- It is not expected that there will be a change in groundwater quality attributable to mining under proposed conditions.
- The Project will result in two additional years of dewatering of underground workings.
- Following the cessation of mining activities (and associated dewatering activities), groundwater pressures within the strata surrounding the mine will recover at a similar rate to currently approved operations.

- The Project is not predicted to result in additional leakage from Lake Macquarie to the underlying fractured and porous rock groundwater sources, and groundwater salinity is not expected to increase.

No rigorous analyses are included in the groundwater assessment to support these conclusions, which appear to be based primarily on monitoring the rate of mine-water pumping on a daily basis, and GHD's judgment.

Based on the response to a Delta Coal community mail-out, GHD concludes that there is limited use of groundwater in the area.

3.3 Mitigations and Monitoring

No mitigations relating to groundwater impacts are proposed. Mine-related monitoring includes daily metering of total underground mine water input and output. Water sampling and quality testing are also undertaken as part of the surface water monitoring program (see Section 5). The CVC Groundwater Management Plan identifies a number of private bores for inclusion in the groundwater monitoring program. Monitoring of these bores is required at least once before and once after mining of the relevant miniwall is completed, although it is not clear from the assessment report that monitoring of private bores has occurred due to access constraints (EIS, Appendix 9, Section 4.2).

3.4 Review Comments

I would characterize the groundwater component of the EIS as a cursory assessment that rationalizes, 'because groundwater impacts have not yet been observed, additional impacts are not anticipated through the duration of the Project'. While that may be the case, these conclusions are not based on any rigorous analysis; they simply rely on historical data trends. In my opinion, mining, and subsequent collapse of bedrock above mine cavities will increase the permeability of the bedrock overlying the mine cavities, which will result in increased flows of seawater from Lake Macquarie into the brackish aquifers underlying Lake Macquarie. The groundwater assessment does not include analysis of the potential increase of flows into brackish aquifers, or sensitivity analyses in the event that these bedrock collapses are larger than is anticipated. Predictive analyses should be included to assess the potential consequences of events that have not been observed to date but could occur, such as a sudden increase in groundwater inflow to the CVC and MC mines.

Further, the groundwater assessment does not include a compilation of the data on which it is based, so it is not possible to check or verify. The EIS should contain sufficient information and data to allow regulators and stakeholders to independently verify the proponents conclusions.

Depressurization of the coal seams and adjacent strata will result in the dissolution of gases dissolved in that groundwater under the pre-mining pressures. A portion of those liberated gases will be collected and released to the atmosphere by the mine ventilation systems. Over time, the remaining liberated gases will work their way upwards (under buoyant conditions) through flooded mine works and permeable strata as methane and carbon dioxide bubbles. These fugitive emissions contribute to overall GHG emissions and potentially present a risk to ecological receptors (Lake Macquarie) and land occupants above the mines.

The peer-review did acknowledge that the GHD assessment was simplistic and limited to a review of historical trends in monitoring groundwater pumped from the mines. The peer-review also acknowledged the role of fracturing and did estimate the degree of fracturing that could be anticipated. It also referred to an existing, numerical groundwater model that GHD may or may not have relied upon in completing its assessment. The groundwater assessment should include a detailed analysis of these factors, which should include a sensitivity analysis that evaluates impacts in the event that their assumptions regarding fracturing and permeability are not accurate.

4 SURFACE WATER ASSESSMENT

4.1 Scope of EIS

The surface water assessment completed by GHD (EIS, Appendix 10) addresses the SEARs and describes the permitting and licensing requirements associated with surface water. The scope of the surface water assessment reportedly includes the following (EIS, Appendix 10, Section 1.3):

- Review existing assessments and data relevant to the Project;
- Review relevant statutory requirements;
- Establish the existing and/or approved conditions for the surface water systems;
- Determine the water management requirements for the Project;
- Undertake an assessment of the potential impacts of the Project on:
    - Water and salt balance;
    - Surface water quality;
    - Downstream water users, including licensed water users and basic landholder rights.
- Undertake an assessment of the cumulative impacts of the Project in association with other operations in the region;
- Identify licensing requirements;
- Develop measures to avoid, minimise and mitigate potential impacts of the Project and provide recommended management, monitoring and reporting requirements.

4.2 Impact Summary

Table 4.1 summarizes the mine water release criteria for CVC and MC, as specified in their environmental protection licences. This water is released into Swindles Creek and subsequently into Lake Macquarie.

A site model was developed to estimate/predict the volumes of water in the management system and the discharges to the environment. The groundwater pumped from the mine coupled with the potable water used for spraying into the mine for dust control represent by far the largest proportion of the water handled by the system. Discharges are reduced by evaporation and reuse, but these proportions are very small in comparison. In essence, the mine water is pumped into sedimentation structures that discharge to Swindles Creek, which in turn discharges into Lake Macquarie.

Table 4.1

Surface Water Release Criteria (Tables 4.1 and 4.2, EIS Appendix 10)

CVC

Pollutant	Unit	100th percentile concentration limit
Faecal coliforms	colony forming 200 units per 100 millilitres	200
pH	pH units	6.5 to 8.5
Total suspended solids	mg/L	50

MC

Pollutant	Unit	100th percentile concentration limit
Oil and Grease	mg/L	10
pH	pH units	6.5 to 8.5
Total suspended solids	mg/L	50

4.3 Mitigations and Monitoring

Treatment for this water involves a series of sedimentation basins to reduce the concentrations of suspended solids. Mine water, water that has come into contact with coal, and other industrial runoff water are directed to these systems. There are also procedures in place to reuse some of this water for dust control to reduce discharge volumes. These existing mitigations are to be continued, unchanged, through the duration of the Project. All of the dissolved salts are discharged into Swindles Creek, along with whatever contaminants are dissolved in the water or associated with the residual suspended solids.

Grab samples of the discharges are reportedly collected on a monthly basis in accordance with conditions on the separate Environment Protection Licences that applies to both CVC and MC, and are analyzed for the parameters indicated in Table 4.2.

Table 4.2

Surface Water Quality Monitoring (Table 7.1, EIS, Appendix 10)

Site	Monitoring location	Description	Analytes	Period of record reviewed
CVC	CVC LDP001	EPL 1770 Licensed discharge point 1 Dam 10 piped discharge	pH*, total suspended solids (TSS)*, biochemical oxygen demand (BOD), faecal coliforms*, Enterococci, oil and grease, electrical conductivity (EC), total nitrogen, total phosphorus, Anionic surfactants (MBAS).	07/01/2015 - 20/01/2021
	OTC	Outlet where discharged water enters Swindles Creek		
	USSP	Upstream reference location on Swindles Creek	Aluminium [1], Arsenic [1], Arsenic (total), Beryllium [1], Cadmium [1], Chromium [1], Cobalt [1], Copper [1], Lead [1], Mercury [1], Molybdenum [1], Nickel [1], Nickel[2], Selenium [1], Silver [1], Vanadium [1], Zinc [1]	12/04/2011 - 17/03/2021
	RW1	Downstream reference location on Swindles Creek		
MC	MC LDP001	EPL 191 Licensed discharge point 1 Pond B overflow	Aluminium [1], Aluminium (total), Antimony, Arsenic [1], Arsenic [2], Barium, Beryllium [1], Beryllium [1], Boron, Cadmium [1], Cadmium [1], Calcium, Chromium [1], Chromium [2], Cobalt [1], Cobalt [2], electrical conductivity, Copper [1], Copper [2], Iron, Lead [1], Lead [2], Lithium, Magnesium, Manganese [1], Manganese [2], Mercury [1], Mercury [2], Molybdenum [1], Molybdenum [2], Nickel [1], Nickel [2], Nitrogen (ammonia), Oil and Grease*, pH*, Phosphorus, Potassium, Selenium [1], Selenium [2], Silica, Silver [1], Silver [2], Sulfur, Tin, Titanium, Total suspended solids*, Vanadium [1], Vanadium [2], Zinc [1], Zinc [2]	13/01/2014 – 20/01/2021
	MC Downstream	Downstream reference location on an unnamed creek		

Default guideline values (DGVs) were derived for selected parameters in accordance with the Australian and New Zealand Environment and Conservation Council (ANZECC) 2018 guideline, and the historical water quality values were compared to these reference criteria. These DGVs and site specific guidelines were not independently verified.

The surface water assessment acknowledges that Swindles Creek is entirely changed as a result of the mine water discharges (EIS, Appendix 10, Section 7.2). Exceedances are noted for salinity parameters, nitrogen compounds, fecal coliform, and some dissolved metals (Al, Ba, Fe, Mn and Zn) in samples collected from the facility discharge and Swindles Creek. High concentrations of nitrogen compounds are attributed to the groundwater source of the water. Fecal coliform levels are attributed to Mannering Park sewage treatment plant, although CVC operations were recognized as a potential source.

The assessment considered dissolved metals "given their bioavailability to aquatic marine species" (EIS, Appendix 10, Section 7.2). A high measurement of dissolved manganese was attributed to laboratory error. GHD concluded that, "*elevated dissolved metal concentrations may reflect natural surrounding geology*" (EIS, Appendix 10, Section 7.2), which is presumably an indirect reference to the source of the vast majority of this discharged water being groundwater pumped out of the coal-producing formations.

4.4 Review Comments

The fundamental basis of the water management plan is to discharge large quantities of mine water into Swindles Creek, and subsequently Lake Macquarie, using only sedimentation as a treatment method. The basic question that should be answered is whether this is protective of the aquatic environment of Swindles Creek and Lake Macquarie. Based on my review of the GHD surface water assessment, this question is not answered because the assessment does not include a detailed assessment of potential contaminants. The following quotation is provided for perspective:

> "*The intercepted groundwater is expected to have similar water quality to that currently extracted under approved conditions and the receiving water body of Lake Macquarie. Inorganic nitrogen compounds and dissolved metals exceeding respective SSGVs or DGVs will likely have a greater pollutant mass load discharging into Swindles Creek via CVC LDP001 and MC LDP001, however concentrations, and therefore the level of ecotoxicity, are expected to remain similar*" (EIS, Appendix 10, Section 8.3).

In my experience, total metals concentrations are typically used to evaluate surface water quality, and dissolved metals concentrations are typically used to evaluate groundwater quality. The reasoning behind this approach is that aquatic receptors are exposed to all metals in surface

water. GHD's assessment implies that the dissolved metals represent the fraction that is bioavailable, but this assumption is not technically supported by the surface water assessment. Elevated concentrations of heavy metals are commonly associated with mine water, including coal mines, and should be assessed in detail as part of the EIS, including total metals concentrations.

In my experience, elevated concentrations of phenolic compounds may also be associated with coal mining operations, and groundwater sourced from coal deposits. These compounds should be included in the surface water assessment as they are potentially toxic to aquatic receptors.

The SEARs for water assessment also requires "*an assessment of any likely flooding impacts of the development*" (EIS, Appendix 2), which does not appear to have been completed. Only a statement that flood risk will not change is included in the surface water assessment.

An assessment of cumulative impacts to surface water in general, and Lake Macquarie in particular, does not appear to have been completed. This was specifically included in the SEARs (EIS, Appendix 2).

5 SUBSIDENCE ASSESSMENT

5.1 Scope of EIS

The assessment of subsidence is summarized in Section 6.2 of the EIS and is presented in greater detail in Appendix 3. The assessment of subsidence relies entirely on past predictions of subsidence, and the existing performance measures. It also relies on the existing monitoring programs to quantify subsidence, which includes bathymetric monitoring, fixed foreshore monitoring surveys, remote LiDAR monitoring and visual inspection.

No new subsidence assessment is included in the EIS. The following rationale for this approach was provided, "*as a detailed assessment of potential subsidence impacts is required as part of the Extraction Plan approval processes should secondary extraction be proposed in this area in the future, and the Consolidation Project does not propose any changes to currently approved first workings mining methods or areas where these can be undertaken, no additional assessment of subsidence impacts has been undertaken (or is considered to be required) in relation to the extended Zone B or the Zone A areas*" (EIS, Section 6.2.4). In short, Delta argues that subsidence has already been addressed, or will be addressed elsewhere, so it is not required as part of the EIS.

The EIS also states, "*the extension of Zone B into the currently approved MC mining area below Lake Macquarie provides a consistent approach to managing underground mining operations below lake areas and avoids arbitrary restrictions on mine design which may limit future resource extraction in this area*" (EIS, Section 6.2.4). Delta's position in this regard is not explained or supported in the context of an environmental assessment process, which is meant to consider and quantify potential impacts.

The impact assessment for subsidence relies on previous predictions of subsidence (Strata, 2020), subsidence monitoring (Delta Coal, 2022), and the performance measures summarized in Section 2.2.4 of the EIS. The SEARs for assessment of subsidence require, "*a detailed qualitative assessment of the potential subsidence effects and impacts of the development*" (EIS, Appendix 2), which does not appear to have been completed.

5.2 Impact Summary

Two significant potential negative impacts that may be caused by subsidence are identified: (1) to biodiversity, with focus on the foreshore, seagrass, and benthic organisms; and (2) to manmade structures, infrastructure and surface facilities.

No subsidence impact assessment is included to support the Project EIS, and a summary of the methodology and predictions for subsidence is not included in the EIS. The EIS reiterates the existing acceptable subsidence limits, which are as follows:

- Maintaining long-term stable underground workings for the Zone A (bord and pillar) mining beneath the shoreline and foreshore, where subsidence is expected to be less than 20 mm.
- Maintaining subsidence of less than 780 mm for Zone B (secondary, miniwall mining), which is constrained to deeper coal-bearing layers beneath Lake Macquarie. This aspect of mining and subsidence prediction is subject to an Extraction Plan process that is not fully explained in the EIS, although NSW (2022) provides guidance in this area.

Strata (2020) estimated subsidence and impacts resulting from Herringbone bord and pillar, and miniwall mining in the Northern Mining Area and for the Fassifern Seam. It is assumed that this methodology and the general conclusions of the Strata (2020) report were relied upon for the subsidence impact assessment. The bord and pillar designs rely on the strength and spanning capabilities of conglomerate layers in the geological profile, as well as pillars to spread load into the softer underlying claystone. The strength formula for the mine pillars is based on experience gained in South Africa and Australia, and factors of safety are based on potential consequences of failure, which is an accepted approach.

The quantification of impacts relies on compliance with the performance measures that are in place for CVC, and the results of subsidence monitoring, which is summarized in Annual Reports (Delta Coal, 2022). The subsidence impact performance measures are summarized in Table 5.1 below.

Review of the subsidence monitoring completed in 2021 indicates the following:

- With the exception of survey results for Summerland Point, measured subsidence along the shoreline and foreshore were typically less than 20 mm.
- Regarding Summerland Point, "*The foreshore along Summerland Point has been monitored since 1994, after secondary extraction was undertaken in the Wallarah beneath the south-western point (corresponding to mark S63 – 74). A maximum of 145mm of subsidence was measured (Point S71) since 1994*". Additionally, for Line 40 the report states, "*Minor ground movement along the line is limited to ±5mm and appears seasonal, subsidence appears to be limited to negligible subsidence (<20mm)*".
- Bathymetric survey results indicate measured subsidence varying between <200 mm and 550 mm. Measured subsidence varied up to 50% above and below the predicted amounts

of subsidence, and the highest levels of subsidence were measured in the areas where mining was completed four years prior to the survey.

The high levels of subsidence at Summerland Point reportedly occurred prior to 2008, but there is no explanation as to why high amounts of subsidence occurred at this location, whether or not it was caused by the CVC mine, or what adverse surface impacts may have occurred.

Review of the data generated for Line 40 indicates that subsidence is approaching the 20 mm limit. The uncertainty associated with Delta's statement that, "*subsidence appears to be limited to negligible subsidence*" is not explained. Further, review of the graphical representations of subsidence indicates that subsidence is generally increasing over time for the shoreline monitoring data as a whole. It appears that bathymetric surveys over Zone B mining areas are discontinued 3 years after mining in the underlying area is complete. The rationale for discontinuing the bathymetric surveys is not included in the Annual Report or the EIS.

Table 5.1

CVC Subsidence Impact Performance Measures (EIS, Table 6.1)

Aspect	Performance Measures
Vertical Subsidence	
Land Areas	<20 mm vertical subsidence (Zone A).
High Water Mark	<20 mm vertical subsidence (Zone A).
Zone B (excluding seagrass beds)	<780 mm vertical subsidence.
Seagrass Beds	<20 mm vertical subsidence (Zone A and Zone B).
Biodiversity	
Threatened species or endangered populations	Negligible environmental consequences.
Seagrass beds	Negligible environmental consequences including: • negligible change in the size and distribution of seagrass beds • negligible change in the functioning of seagrass beds • negligible change to the composition or distribution of seagrass species within seagrass beds.
Benthic communities	Minor environmental consequences, including minor changes to species composition and/or distribution.
Mine Workings	
First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible environmental consequences	To remain long-term stable and non-subsiding (Zone A and Zone B).
Second workings	To be carried out only in accordance with an approved Extraction Plan (Zone B only).
Built Features	
Trinity Point Marina Development Other built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repaired, replaced or fully compensated.
Public Safety	
Public Safety	Negligible additional risk.

5.3 Mitigations and Monitoring

Commitments to mitigations related to subsidence include the following:

- performance measures as specified in Table 5.1
- mining in accordance with an approved extraction plan
- predictive modeling and mine design to comply with performance measures

Monitoring completed to quantify subsidence and to assess the potential impacts of subsidence include the following:

- bathymetric monitoring for three years after mining
- fixed foreshore monitoring surveys
- remote LiDAR monitoring
- visual inspection
- seagrass survey (annual)
- benthic survey (annual)

5.4 Review Comments

The EIS does not include predictions of subsidence, assessment of related impacts, or an evaluation of potential mitigations other than those that are in place. In my opinion, these are important components of "*a detailed qualitative assessment of the potential subsidence effects and impacts of the development*" (EIS, Appendix 2). The EIS relies entirely on the existing approvals and measures being implemented to predict, control, and measure subsidence, and its potential impacts.

In my opinion, the methods implemented to design the mine workings to comply with the subsidence performance, and the monitoring programs being implemented to quantify subsidence, are appropriate. However, there is considerable uncertainty associated with predicting subsidence associated with underground coal mining, and there are many instances of damaging subsidence occurring long after mining has been completed (Australian Coal Alliance, 2010; Canmore Commons, 2021). In my opinion, these uncertainties and potential adverse effects are not given sufficient consideration in the EIS.

Additional, specific comments regarding the assessment of subsidence are as follows:

- The high levels of subsidence measured in the past at Summerland Point warrant further analysis and explanation. More specifically, was this subsidence caused by the CVC mine, and if so, what has changed to prevent this sort of subsidence for reoccurring?

- The measured amounts of subsidence appear to be increasing over time. A detailed temporal assessment of the data appears to be warranted to evaluate and extrapolate these trends.
- It appears that bathymetric surveys are discontinued three years after mining has been completed. As the highest levels of subsidence as measured by the bathymetric surveys was made in 2020, over areas mined in 2017, discontinuing the bathymetric surveys after 3 years may not be appropriate.
- The assessment and reporting of mine rehabilitation and closure does not include assessment of the long-term risks of subsidence, which have the potential to adversely affect benthic and aquatic biota. Appropriate programs for monitoring subsidence and biota should be proposed for the period following closure of the mines.

6 BIODIVERSITY

The focus of the biodiversity assessment is on "*the potential impacts to seagrass and benthic communities associated with ongoing operations. A desktop review of information relating to seagrass and benthic community monitoring conducted by CVC was undertaken*" (EIS, Appendix 11, Section 2). This contrasts with what is required by the SEARs for the EIS as it relates to biodiversity, which are as follows (EIS, Appendix 2):

- *"accurate predictions of any vegetation to be cleared on site;*
- *an assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report; and*
- *a strategy to offset any residual impacts of the development in accordance with the offset rules under the Biodiversity Offsets Scheme;"*

Clearly, a desktop review of past benthic and seagrass surveys does not fulfill the Biodiversity SEARs for the Project EIS because the SEARs related to biodiversity do not limit the biodiversity assessment to desktop review of past seagrass and benthic surveys.

Further, there is the potential for impacts to aquatic, benthic and riparian communities that could result from the large-scale pumping of groundwater from the mine and the release of that groundwater, and other industrial water, into Swindles Creek and subsequently into Lake Macquarie. This should be included in the biodiversity assessment.

No detailed assessment of the potential impacts to these ecological communities is provided in the Biodiversity Assessment, in fact it is not even mentioned. Only the surface water assessment makes passing mention of the ecology of Swindles Creek (EIS, Appendix 10, Section 7.2).

7 GREEN HOUSE GAS ASSESSMENT

7.1 Scope of EIS

The greenhouse gas and energy assessment was completed by Umwelt (EIS, Appendix 14). The following emissions were included in the scope of the assessment of GHG emissions:

- Scope 1: fuel combustion and fugitive emissions associated with coal mining, processing and transportation.
- Scope 2: emissions associated with electricity use.
- Scope 3: emissions resulting from combustion of the coal produced by the CVC and MC mines.

The emissions were calculated in accordance with Australian standards published by the National Greenhouse Accounts (NGA) and emissions factors published by the Australian Department of Industry, Science, Energy and Resources (DISER, 2021). The GHG quantification estimates were reportedly completed in accordance with these standards and guidance, although a detailed checking of the calculations was not made.

This review focuses on the calculation component of the GHG emissions, and not the potential impacts of those emissions.

7.2 Impact Summary

Planned GHG emissions are summarized in Table 7.1. The Planned Scenario is forecast to generate an additional approximately 1,971,372 t CO2-e Scope 1 emissions over the life of the Project relative to existing approved operations. Scope 3 emissions associated with the additional combustion of coal from the Project will generate an additional 23,157,149 t CO2-e relative to the Approved Operations (EIS, Section 6.9.2.2). The EIS claims that these Scope 3 emissions are associated with the combustion of coal at the VPPS and would be generated irrespective of the source of coal; however, CVC, MC and VPPS are ultimately owned by the same organization and are fully integrated.

The forecast energy use intensity associated with the additional coal generated by the Project is approximately 121 MJ/product tonne, which is reported to be lower than the industry average. The EIS claims that the GHG emissions associated with the Project are consistent with the Australian and NSW commitments with respect to GHG emissions targets. This is because the Project is scheduled to end prior to the onset of these commitments in 2030 and 2050 (EIS, Section 6.9.3).

The primary contributor to the Scope 1 GHG emissions is caused by fugitive emissions of methane that occurs as groundwater within the coal seams is depressurized and the mined coal is exposed to atmospheric conditions. Scope 1 emissions account for 13% of the total Project GHG emissions, and of those Scope 1 emissions, the vast majority results from the emission of mine gases, primarily methane. The basis of this aspect of the GHG calculation from the active mining operation is shown in Table 7.2, and from the legacy operations is shown in Table 7.3 below (EIS, Appendix 14). The technical bases of these fugitive emissions calculations should be properly explained.

Table 7.1

Summary of Additional GHG Emissions (EIS, Appendix 14, Table 3.2)

Stage	Scope	Source	Source Totals ($t CO_2$-e)	Scope Totals ($t CO_2$-e)
Operation	Scope 1 (Direct)	Diesel use	11,262	1,971,372
		Fugitive emissions (historical mining)	929,413	
		Fugitive Emissions (ROM Coal)	1,030,697	
	Scope 2 (Indirect)	Electricity	221,637	221,637
	Scope 3 (Indirect)	Product use	23,111,850	23,157,149
		Domestic product transport	16,943	
		Export product transport	0	
		Associated with energy extraction and distribution	21,356	
Additional operational greenhouse gas emissions associated with the Planned Scenario				**25,350,157**

Table 7.2

Summary of Calculation Inputs (EIS, Appendix 14, Appendix A)

Gas Component	
Gas Content Fassifern Seam - CVC Mining Area (m^3/t ROM Coal)	5.30
Methane (CH4) percentage of Fassifern Seam Gas	97%
Carbon Dioxide (CO2) percentage of Fassifern Seam Gas	3%
Methane Global Warming Potential factor	28

Table 7.3

Summary of Fugitive Emissions (EIS, Appendix 14, Appendix A)

Domain	Activity Data	Emission Factors	
		CO_2	CO_2/CH_4
	ROM Coal Tonne	t CO_2-e/ ROM t	
Project	13,422,983	0.098	
Additional	9,488,627	0.098	
Fugitive Emissions attributable to ROM	Project	1,314,784	
	Additional	929,413	

7.3 Review Comments

The calculations of direct and indirect emissions associated with the Project appear to have been completed in accordance with Australian standards, although insufficient detail is included in the EIS to check these calculations independently. The actual calculations should be included in the EIS so that they can be independently verified.

Delta Coal claims that the Scope 3 emissions will be incurred irrespective of the Project; however, the VPPS is owned by the same company that owns Delta Coal and the two operations are reported to be integrated and interdependent (see Section 1.2). The two year continuance of these mining operations will result in increased GHG emissions because the coal will be used for power generation.

An important aspect of the GHG emissions associated with the Project is the fugitive methane emissions. This calculation appears to be based on the methane and carbon dioxide content of the coal within the Fassifern seam, and the amount of coal mined as part of the Project. The methane and carbon dioxide are primarily dissolved in the groundwater within the coal seams, and overlying and underlying strata. The solubility of methane and carbon dioxide in groundwater increases with pressure; hence, these gases will come out of solution when the groundwater is depressurized in support of mining. The quantifications presented by Umwelt appear to be based on the volume of coal mined and not the total mass subject to depressurization in support of the mining operation, which could underestimate of the volumes of these gases that are emitted.

The technical bases of the fugitive GHG emissions calculations should be fully explained. For example, the starting point of the fugitive GHG emissions calculation is the 5.3 m^3/tonne of ROM coal, which is of fundamental importance to this calculation.

The GHG assessment does not consider possible mitigations. For example, lower intensity power generating alternatives, such solar and wind power, could likely be implemented in the Project time frame to reduce GHGs. The practicality of collecting and incinerating the fugitive methane should also be assessed to reduce GHGs.

8 MINE CLOSURE AND REHABILITATION

The rehabilitation plan presented in Section 6.16 of the EIS primarily focuses on the rehabilitation of the surface developments associated with the mines, and making the lands safe and secure. It also refers to currently approved rehabilitation and land use plans for CVC and MC as the basis for closure. The measures summarized for rehabilitation of surface facilities appear to be appropriate. Delta Coal plans to close and secure all access portals and vent shafts associated with the mines, which is standard practice for closure of underground mines.

The two most significant long-term risks associated with the closed, underground mines are the potential for contaminated groundwater to impact groundwater users and/or surface receptors, and the potential for surface impacts to be caused by collapse of the mine. Neither of these issues are addressed in any detail in the rehabilitation and closure summary. The plan states that "*a detailed Groundwater Impact Assessment will be undertaken to identify any post-mining impacts and determine required mitigation/management measures*" (EIS, Section 6.16.1); however, the specifics of this assessment are not provided and should be. It is also possible to complete this assessment now, while the mine is operating, and the opportunity is available to implement mitigating measures that may be identified by the groundwater assessment.

Regarding the potential for future subsidence, a program for ongoing monitoring of potential future subsidence should be described, and viable mitigations identified should higher levels of subsidence occur in the future.

The SEARs for rehabilitation and final landform include "*the measures which would be put in place for the long-term protection and/or management of the site and any biodiversity offset areas postmining*" (EIS, Appendix 2). This requirement does not appear to have been addressed, in the EIS and should be before the document is considered complete.

9 REFERENCES

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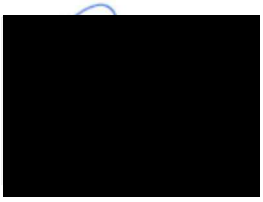
10 CLOSURE

This report has been prepared for Environmental Justice Australia. The text contained herein documents the review of the Chain Valley Colliery Consolidation Project Environmental Impact Statement carried out by Burgess Environmental Ltd. This report represents the opinions of Gordon J. Johnson, M.Sc., P.Eng. (AB) based on information generated by Delta Coal and provided by Environmental Justice Australia, which has not been independently verified, publicly available information, and the experience and judgment of the Author. No other warranty is expressed or implied.

All data contained herein has been reviewed and interpreted by, or under the direct supervision of Gordon J. Johnson, M.Sc., P.Eng., P.Eng.

"original signed and sealed by author"



December 8, 2022

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Gordon J. Johnson, M.Sc., P.Eng.
President
Burgess Environmental Ltd.