

Barrytown Minerals Project Fast-track application

Expert Report of Brian Leonard McGlynn on behalf of the Coast Road Resilience Group

WETLANDS AND HYDROLOGY

28 September 2026

Introduction

1. My full name is Brian Leonard McGlynn.
2. I am a Hydrologist and Biogeoscientist affiliated with e³Scientific, Arrowtown, New Zealand (former full-time employee) and an Adjunct Professor of Hydrology and Biogeosciences in the Nicholas School of the Environment, Duke University, USA.
3. I am a PhD Hydrologist with 33 years of expertise in watershed and stream hydrological, ecological, and biogeochemical processes. I have extensive experience investigating natural and disturbed watersheds, stream networks, and groundwater systems. From 2012–2019, I was a Professor of Hydrology and Biogeosciences at Duke University and Chair of the Division of Earth and Ocean Sciences from 2014–2016. From 2002–2012 I was an Assistant Professor then Associate Professor of Watershed Hydrology at Montana State University. I have been a member of the New Zealand Hydrological Society, the American Geophysical Union (Hydrology and Biogeosciences sections),

and the Society for Freshwater Science, the European Geophysical Union, and the Geological Society of America.

4. I hold the following tertiary qualifications; a Bachelor of Arts in Environmental Studies and a Bachelor of Arts in History from Gettysburg College (USA) and a Master of Science in Hydrology and a PhD in Hydrology from the State University of New York College of Environmental Science and Forestry at Syracuse (USA).
5. I have extensive experience working in hydrology, biogeochemistry, wetlands, ecology, soil and geological science, and water quality that began in 1993. I have worked across a wide range of environments from the Arctic to the Amazon including Westland, NZ, where my PhD research focused on stream water sources, runoff flow paths, water age, and resultant water chemistry in cooperation with Landcare and NIWA in the Maimai catchments on the east side of the Paparoa Mountains. I have additionally performed hydrological, biogeochemical, and landscape analysis projects for the US National Science Foundation, US Environmental Protection Agency, US Department of Agriculture, Montana State Department of Environmental Quality, US Forest Service, and a number of non-governmental organisations.
6. I have taught >13 different university courses focused on water science and management, river and catchment hydrology, wetlands, water quality, ecohydrology, hydrogeology, and spatial analysis to many hundreds of undergraduate and graduate students while individually mentoring dozens of students through research training and experiential learning. I have served as the primary mentor and advisor for more than 9 MS students and 12 PhD students, and 6 post-doctoral professionals who have gone on to successful careers at leading international academic institutions, consulting firms, and state and federal agency employment in the water arena.
7. I have numerous years of US National Science Foundation sponsored experience as project director and investigative scientist focussed on the

hydrological and biogeochemical effects of mining related critical zone disturbance highly relevant to this proposal. I co-authored 5 published papers in top international scientific journals from this work. **In short, we found that hydrologic and biogeochemical recovery trajectories during and following post mining reclamation go far beyond our lifetimes and could persist on geologic time scales.**

8. I began working with wetland assessment and delineation in the USA in 1994. New Zealand adopted and modified its wetland assessment and delineation from the USA system. I became familiar with the NZ system starting in 2021 and have provided training to NGOs and local government since then. I started performing NZ specific wetland assessment and delineation in 2022 on a variety of consulting projects and reviews (including mining) across Southland, Otago, and the West Coast.
9. Recognition of my scientific contributions are partially reflected in my impact on international hydrological and biogeochemical sciences. These are indicated by: >12,657 Google Scholar article citations to >100 peer reviewed scientific research papers, H-index of 58 (58 of my papers cited by at least 58 other papers), i10 index of 103 (103 papers cited at least 10 other papers). <http://scholar.google.com/citations?hl=en&user=c2iow7sAAAAJ>.
10. I have a strong understanding of hydrological processes and how water flow paths, streamflow source areas, and landscape characteristics impact water chemistry and stream and groundwater quality in ecosystems around the world, including mountain front hydrologic and wetland systems. I have brought this experience and expertise to consulting work in New Zealand and have become familiar with freshwater and wetlands regulations and policies over the last five years.
11. I am familiar with the catchment hydrology, meteorology, climate, and groundwater hydrology of the West Coast area around the Paparoa Range. I completed my PhD research in the Maimai catchments located between

Reefton and Greymouth. I have a first-hand understanding of the dynamic nature of rainfall and runoff in this highly responsive landscape. I have published numerous articles on the topic of West Coast of NZ hydrology and biogeochemistry in peer reviewed international scientific literature.

12. I have reviewed the current Barrytown Minerals Project – Southern Block Fast-track application files and this evidence pertains to that application. The files reviewed include but are not limited to:

- Barrytown-Minerals-Project-Southern-Block-Substantive-Application.pdf
- Appendix-K-Maps-and-plans.pdf
- Appendix-L3-Hydrological-Assessment.pdf
- Appendix-L4-Ecological-Effects-Assessment.pdf
- Appendix-L4A-Statement-of-Evidence-Dr-Bramley-Terrestrial-Ecology.pdf
- Appendix-M6-Rehabilitation-Management-Plan.pdf
- Appendix-M7-Water-Management,-Monitoring-and-Effects-Management-Plan.pdf

13. As part of the TiGA application in 2024, I visited the Central block site for an on the ground assessment and walked the creeks, wetlands, lagoons, springs area, pastures, and shoreline to gain on-the-ground verification of observations made with remote data including mining application materials and maps, available remote sensing, LiDAR data, drone imagery and footage, wetland maps, and other available GIS layers.

14. I have not received nor sought compensation from any parties involved in this application or its assessment. To date, my time has been donated by me to the community in the spirit of independent assessment and informed decision making. Given the complexity and volume of the application materials supplied by Tāiko Critical Minerals Ltd. and its consultants, the lay community might not be able to fully assess the technical aspects of the application and

the hydrology of the area. This evidence seeks to support independent assessment otherwise unavailable.

15. While I have read the application materials related to hydrology, water quality, modelling, water management, and ecology, I do not critique them in detail due to their length, complexity, unknown assumptions, data availability, and inability to replicate analyses. Instead, this evidence provides an overview of likely impacts of the proposed activities on local subsurface hydrology, streams, and wetlands with a focus on the current extent of wetlands in the area, the reasons for their current and historic existence, and potential for post mining land restoration to its semi-natural state.

Code of conduct

16. I have read the Expert Witness Code of Conduct contained in the High Court Rules 2016 and agree to be bound by it.

Scope of Evidence

17. I have been asked to provide evidence on the following matters: general landscape hydrology of the Barrytown Flats area, likely historic and current wetland extent, and consideration for potential wetland reconstruction and restoration should mining proceed in the Barrytown Flats area under consideration in this Fast-track application.

Executive Summary

18. The coastal margin between the Paparoa Mountains and the Tasman Sea along Barrytown Flats occupies a landscape position characterised by ground water tables near or at the ground surface and extensive natural and farmed wetlands covering much of the area.

19. The Barrytown Flats occupies an ecologically critical zone between the mountains and the sea that has supported extensive wetlands systems for millennia that still dominate much of the Barrytown Flats area. Since early European settlement, extreme efforts have been undertaken to drain wetlands, lower water tables, and make natural wetlands more arable for farming/grazing, and for access to mineral resources. Despite these concerted efforts over more than 100 years and near constant drainage ditch maintenance, surface contouring (e.g. humping and hollowing), and regular tilling and reseeded with non-native grasses, much of the area remains wetlands. This means that wetland hydrology still exists despite best efforts to the contrary, wetland soils persist, and wetland vegetation could be supported in left undisturbed.

20. **If the Barrytown Flats were not wetlands, then there would be no need for extensive and regularly deepened drainage ditch networks, humping and hollowing of large sections of land in an attempt to dry soils and lower water tables, and regular tillage and reseeded of pasture grasses to suppress native wetland vegetation regrowth.** *A clear indicator of the extent and persistence of wetlands present in the Barrytown Flats are the great lengths taken in an attempt to make the land more arable or useable as animal agriculture support land.*

21. Informed decision making relative to this massive change in the landscape and subsurface conditions from agriculture to mining is critical because of the associated geologic timescale of the disturbance to the subsurface across the flats. To this end, it is critical that the full extent of natural wetlands across the Flats be appreciated and considered in post-mining attempts to reduce this geologic time-scale disturbance of this environmentally critical section of coastline and mitigate, at least a little bit, its far-reaching negative impacts on the region. If mining is going to happen, how can the landscape be left to lessen the massive negative impacts on the local environment given that its impacts will last millennia and its off-site benefits in years (currently estimated to be 14 years of mining within a 35 year consent timeframe)?

Hydrology and Landform Overview

22. Due to the low gradient landscape setting of the Barrytown Flats and the proposed mine sites lying at the base of the Paparoa Mountains and next to the Tasman Sea, the area is characterised by extensive historic and current wetlands. The high groundwater levels at or near the ground surface have promoted poorly draining soils that support extensive wetlands systems across the Flats. Since European habitation in the area, vegetation clearance, dredging and ditching, and humping and hollowing have been undertaken in ongoing attempts to drain the extensive wetlands with limited success. Most of the area under consideration is now actively farmed and the current surficial land condition reflects regular drainage efforts (e.g. humping and hollowing and ditch excavation and widening) and tillage and reseeding to promote pasture grasses and inhibit wetland vegetation.

23. This naturally extensive wetland setting is caused by:

- the Flats proximity to the heavy rainfall in the Paparoa mountains and locally;
- numerous perennial rivers and streams and many more intermittent and ephemeral streams and their associated alluvial fans feeding the Flats coastal groundwater system;
- direct surface and subsurface flow into the Flats from the adjacent mountains not focused via rivers and streams;
- deeper discharge contributions from the mountain front / mountain block; and
- relatively low rates of evapotranspiration relative to precipitation and water accumulation in this region.

Wetlands – Manifestation of Environmental Setting

24. Wetlands are the environmental manifestation of landscape hydrology, geology, and landforms and can modify their own environments and growth in depth and area (e.g. peatlands). Drainage efforts for arable land extension

can be effective at managing wetland hydrology and vegetation but destroy wetland soils that require thousands of years to develop. The Flats landscape is destined to contain extensive wetlands that can either be heavily managed for marginal animal agriculture or be helped in reverting to ecologically invaluable wetlands at the coastal interface between the mountains and the sea.

25. Much of the Flats were mapped (Figure 1) circa 1907 as swamp and native bush (likely wetlands given location) and water races and ditches were already present. The native bush landcover does not indicate upland vegetation, rather more likely it indicates forested wetlands that were once widespread along the West Coast but are now rare with swamp and peatland forests likely in this area. The historic map below gives additional confirmation of the extensive wetland complex that comprised the Barrytown Flats at the turn of the 19th century.

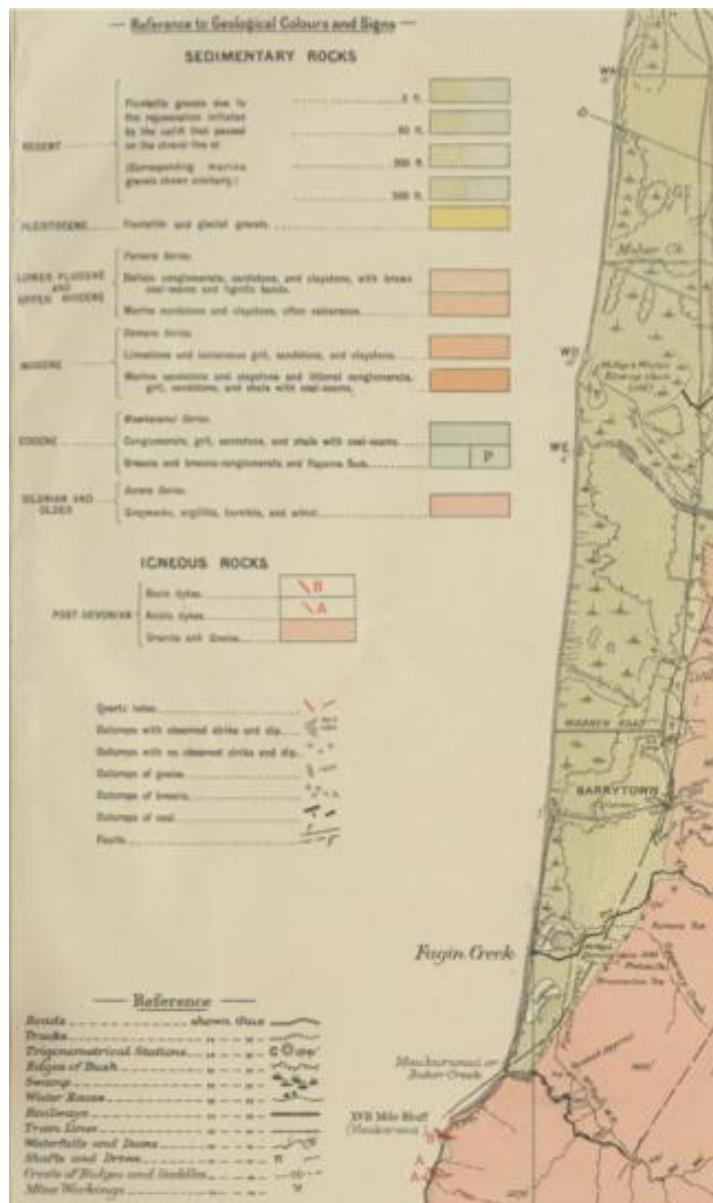


Figure 1 Barrytown Flats was primarily mapped as swamp (wetland) and native bush which was also likely wetlands. It should be noted that this area was actively drained before this map was produced (see mapped drainage ditches). Additional areas were mapped as fluvial and glacial deposits associated with rivers and streams and the mountain-flats transition zones. Map: New Zealand Geological Survey Branch. 9016 Geological map of Waiwhero and Temiko Survey Districts [cartographic material] / compiled and drawn by G.E. Harris, 1916. Ref: 830caq 1907-. Alexander Turnbull Library, Wellington, New Zealand. /records/21221

Human Attempts to Drain Wetlands – A Battle Against the Setting and Landscape Hydrology

26. The Barrytown Flats area under consideration for mining was characterised by extensive wetland complexes prior to human intervention and still is today. Hump and hollow mechanical contouring and historic mine pits made by people did not create these wetlands. Rather those landforms (e.g. hump and hollow) were constructed in attempts to drain wetlands. Instead of an entire paddock being poorly drained wetlands, humping and hollowing attempts to raise parts of the land above the water table and lower other parts of the land below the water table in an effort to further drain the landscape. Wetland vegetation can be difficult to eradicate in the hollows and thus can sometime visually assessed as induced wetlands because they are a side effect of the contouring process. The humps can often remain wetlands despite efforts to dry them but can often require closer vegetation, soils, and hydrology assessment due to disturbance and active vegetation suppression. Humping and hollowing would not be applied widely here if the area was not wetland at the outset.

27. These land manipulation features are not artificial wetlands (therefore not subject to the regulations in the National Policy Statement for Freshwater Management (NPS- FM) and National Environmental Standards for Freshwater (NES-F)), rather they are relics of the once extensive wetland complex that came before. For them to be classified as artificial wetlands, they would need to have been created intentionally as wetlands, and maintained as such, according to MfE (2021). This is not the case because they are relic / induced wetlands within a once extensive wetland complex. Regardless of whether they are considered relic or induced wetlands, they are subject to the policies and regulation in the NPS- FM and NES-F, respectively.

28. Following on DOC comments to this application, *“there are no calculations in the Ecological Effects Assessment or the Rehabilitation Management Plan to demonstrate that the proposed wetland reconstruction is sufficient to offset the*

loss of the existing wetlands". DOC suggests that "the true area of wetlands is higher than presented (due to misclassification of most wetlands as artificial), it is important to demonstrate that the reconstructed wetland is sufficient to offset wetland loss".

29. I suggest that both estimates are inadequate and an independent investigation into the full extent of current and historic wetlands across the area under consideration should be undertaken. This would logically include all areas in agricultural management and detailed ground investigations of hydrology, soils, and emergent vegetation and perhaps even seedbanks, given active vegetation suppression.

Wetland Agricultural "Exclusion"

30. Humans have gone to great lengths in their attempt to drain and dry this area for agricultural (and some historic mining) activities. This is true across the flats and intensively in the area under consideration (e.g. relatively recent hump and hollow drainage manipulation). These efforts have been marginally successful such that whilst groundwater tables remain high, soils are typically saturated or near surface saturated; pastoral use and cultivation has been possible at least seasonally.

31. Without active management and drainage, much of the previous wetland area could revert to wetlands that fully meet the NZ hydrology, soils, and vegetation wetland criteria. In fact, much of it would likely be assessed and mapped as natural inland wetland but would be exempt from full protection under the "pasture exclusion". Essentially this exclusion means that it can remain in pasture even though it is potentially natural inland wetlands. However, this exclusion does not apply to any change from active pasture to other land uses such as mining. It also does not support a change in land use from any other land use (such as mining) to agriculture or pasture.

32. As described above, exempt does not mean it's no longer a wetland, rather it indicates that New Zealand law has permitted it to remain in its current agricultural land use. For example, it can signify that it can still be grazed / farmed, however a change in land use should not carry the exemption into a new non-exempt land use. It is still a wetland.
33. A wetland is indicated by wetland hydrology (saturated soils and/or high water table for an extended period), wetland soils (hydric soils indicative of prolonged saturation e.g. peat or gleysols), and wetland vegetation (plants adapted to wet conditions). Because vegetation is easily managed on short time frames (e.g. tillage and seeding or burning), seed banks and what vegetation grows after lying fallow would be more indicative of the historic seed bank and wetland conditions on a site.
34. This proposed mining activity and post mining plan is an example of how New Zealand continues to lose wetland extent and not make headway in recovering lost wetlands. The NPS-FM (2020) Policy 6 states: "*There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.*" The intent of Policy 6 is that the extent of all individual natural inland wetlands is maintained, regardless of their ecological state or size.
35. This is to prevent fragmentation of remaining wetland habitat. The NPS-FM (2020) and Freshwater NES-F (2020) apply to areas of any size that meet the 'natural wetland' and 'natural inland wetland' definitions (respectively). This is because damage or loss of many small wetlands would add up to a large net loss. Exceptions to the rule result in continued degradation and loss.

Mitigating Impacts on Barrytown Flats Wetlands

36. If this mining proceeds as proposed, it will be a wholesale reworking and restructuring of the surface and subsurface of the area far beyond most other extreme environmental disturbances. It would be challenging to disturb the

area more without using extreme heat, explosives, vulcanism, or similar. Mining is often not a form of land use, rather it is a form of land destruction or land change that bears little resemblance to what came before, setting landscape back on geologic or glacial timescales in terms of soils and hydrologic development. Mining can restart the geologic and geomorphic process of landform evolution and soil development.

37. In this case, mining will likely result in resetting a nearly 10,000-year-old clock of soil and subsurface hydrology, geochemistry, and ecosystem development. In this case, adverse impacts are difficult to quantify when what existed before will be gone and replaced by a slurry of mixed materials that once had structure and history and functional relationships in 3-D to the areas and materials within around them.

38. A simplistic analogy: mining this area as proposed would be analogous to taking a car, grinding it up and removing some parts then sticking it back into the shape of a car. It might have many of the same materials as the original car (e.g. metal, plastic and glass), but it will no longer function as the car you once drove.

39. As proposed, the mining will result in a near total loss of wetlands in the area to be mined or used for mining, and potentially wetlands will be lost or certainly adversely impacted in adjacent areas too. Unless wetland reconstruction is undertaken with wetland science expertise and foresight and understanding of the complexity of the area they could be lost forever. Regardless, what comes after mining will bear little to no resemblance to what came before without major effort, expertise, and financial resources.

40. It is not clear if and how the effects management hierarchy was applied in this proposal or even how it could be applied, when the area in question containing wetlands would, post mining, bear little to no subsurface or surface resemblance to what came before. In this case it appears to be proposed that the general surface topography will be recreated using a slurry consisting of

many of the same geologic materials now reconstituted. This is highly problematic and will likely result in unintended consequences in terms of water movement, water accumulation, biogeochemistry, and the resulting ecosystem.

41. Therefore, remediation, reconstruction, and restoration should be a primary component of this project before or if mining begins and given this, the project should be about managing what will follow mining as much as it is about what will be extracted. Contouring the slurry into farm paddocks is not restoration of once extensive natural wetlands.
42. Given the possibility of mining going ahead as proposed, what mitigation can be done 1) pre-emptively, 2) progressively, and 3) conclusively as sections of mining become inactive?
43. Pre-emptive conservation (1) would entail wetland restoration, enhancement, and protection in perpetuity for areas not to be mined but as an act of good faith to get ahead rather than behind of the environmental mitigation.
44. Progressive rehabilitation (2) is related to what is being proposed but instead of returning to wetlands being used for agriculture, returning to wetlands resembling their natural state since the pasture/agricultural exclusion should no longer apply and the land will be heavily abused at this point. This would be another attempt to partially mitigate impacts of the mining project on the area. Much of this area is likely wetlands so perhaps mining could be a vehicle to return it to its more natural, less managed state.
45. Historic and current agricultural modification including humping and hollowing and networks of drainage ditches and straightening and deepening and widening streams are attempts to make the land more arable or useable as animal agriculture support land.

46. It was historically wetlands and wants to be wetlands again. It should be returned to wetlands since this is what the landform supports. If it is set on a recovery trajectory and not farmed or mined, then it would revert to its natural wetland state.
47. As mining moves to new sections and past ones are retired, conclusive restoration (3) could include ensuring and enhancing connectivity across the existing and newly reconstructed wetlands to return the Flats to a wetland system rather than pockets of wetland relics.
48. Rehabilitation and reconstruction should bring the landscape back to pre-disturbance states and to “natural” streams and wetlands as much as possible rather than the managed and drained landscape that was exempted from wetland regulations prior to the land use change to mining.
49. Specifically, the areas should not be re-grassed but rather be returned to wetland vegetation and wetland hydrology and soils as much as possible. Simple large open water ponds are not the likely natural wetland state in this setting and should not be the target for constructed wetlands on post mining lands. The landscape complexity likely present before modification should be the target in post mining rehabilitation.
50. It is important to note that vegetation is often the surface expression of a wetland, but it is not the only element. If the hydrology and substrate are well reconstructed the vegetation will be supported. Non-native pasture grass is not a sustainable or natural state in this environment.

Bonds and Reconstruction

51. Restoration initiation before day one is critical. After the fact “trust us” and insufficient bonds have left local communities elsewhere around the world with environmental liabilities when markets or fortunes change. It appears that the bonds described in the Fast-track application and review materials are minor

relative to the scope of the impact, resources spent on the extraction, and the profits described by the mining company.

52. These bonds would not cover much impact or restoration if the economics of the industry or fortunes of the company change. Therefore, they could be strongly reconsidered and perhaps subject to an order-of-magnitude increase if effective wetland restoration is to occur.

53. The environmental legacies of mining are long lasting, and bonds should cover the worst-case scenario in unforeseen changes in fortunes and plans. Restoration / mitigation that lags or only follows mining activities risks remaining as an afterthought.

54. Large scale mining and relatively superficial farming activities are not equivalent. "Highly modified" does not describe agricultural activities in the context of subsurface material sand mining. There is no comparison between farming and mining. Earthworks and subsurface disturbance / destruction associated with mining is of an entirely different magnitude.

55. Significant per hectare and per 200m of stream bonds are critical and plans could be verified by independent wetland and stream construction and restoration professionals to ensure their adequacy. In the Barrytown Flats, who will oversee reconstruction? Who will sign off on reconstruction activities? Who will assess restoration efficacy? Do future mining activities depend on initial reconstruction being performed adequately?

56. Little of this expertise appears to exist in New Zealand and therefore reconstruction failure is a high likelihood even despite best intentions. Wetland restoration and rehabilitation could be a much more significant bond and local community-selected wetland specialists could have oversight and approval powers to increase the likelihood of reconstruction success.

57. Much of the discussion in this document pertaining to wetlands also pertains to perennial rivers and streams as well as those that are ephemeral and intermittent. In addition, stream restoration is more than just planting vegetation and should be undertaken by professions with adequate fluvial geomorphology and restoration knowledge and experience. Riparian vegetation and buffers are also a critical part of restorations / reconstruction and should be tens of meters in width in keeping with international best practices.

58. The overarching environmental question that appears to need more significant attention should this Fast-track proposal be approved/granted is **“If mining is going to happen in this area, how can it be done and how can the landscape be left to lessen the massive environmental impacts that will last millennia while the mine’s benefits will largely last years and largely be felt off-site?”**

Role of Proposed Mining Area and Coastal Wetlands and Hazard Mitigation

59. It is well recognised inside and outside of New Zealand that the extent and characteristics of the coastal environment vary from region to region and locality to locality and that the issues that arise may have different effects in different localities. This includes areas where coastal processes, influences or qualities are significant, including coastal lagoons, coastal wetlands, and the margins of these.

60. While perhaps outside of the specific regulatory coastal management area, the areas proposed to be mined are undoubtedly coastal wetlands with coastal vegetation indigenous coastal species habitat including for migratory birds. These critical coastal wetlands occupy and largely dominate the relative narrow strip of land between the Paparoa ranges and the Tasman Sea and their open spaces and wetland features are the natural character of the landscape.

61. These coastal wetlands have bi-directional coastal management area/zone influences due to their adjacency and the bi-directional movement of water, sediment, biogeochemical constituents, and biota including flora and fauna, and especially avifauna. These coastal wetlands are also both at risk from coastal hazards as well as serving as a buffer from coastal hazards (such as storm surges) for more inland landscape areas including areas of human habitation and where the Great Coast Road runs.

Groundwater Contamination

62. Groundwater contamination due to disturbance and reworking of sedimentary deposits is likely due to physical disturbance and enhanced weathering. It is well established that soil disturbance can mobilise nitrogen and phosphorous and changes to redox conditions and weathering surfaces can mobilise heavy metals. If the post mining slurry contains radioactive material, this can also be liberated and mobilised. Radon gas is one example that can be problematic for local households and water supplies since Radon gas readily dissolves in and moves with groundwater. This can be particularly problematic for household wells and household water use and subsequent human inhalation associated with washing and showers etc.

63. It does not appear that the applicant has provided adequate information about these risks. If not, the Panel likely does not have enough information to make a decision in this regard.

Conclusions and Recommendations

64. Barrytown Flats occupies an ecologically critical zone between the mountains and the sea that has supported extensive wetlands systems for millennia that still dominate much of the Barrytown Flats area. Since early European settlement, extreme efforts have been undertaken to drain wetlands, lower water tables, and make natural wetlands more arable for farming/grazing, and for access to mineral resources.

65. Despite these extreme efforts over more than 100 years and near constant drainage ditch maintenance, surface contouring (e.g. humping and hollowing), and regular tilling and reseeding with non-native grasses, much of the area remains wetlands. This means that wetland hydrology still exists despite best efforts to the contrary, wetland soils persist, and wetland vegetation could be supported if set on a recovery trajectory and left undisturbed.

66. **If the Barrytown Flats were not wetlands, then there would be no need for extensive and regularly deepened drainage ditch networks, humping and hollowing of large sections of land in an attempt to dry soils and lower water tables, and regular tillage and reseeding of pasture grasses to suppress native wetland vegetation regrowth.** A clear indicator of the extent and persistence of wetlands present in the Barrytown Flats are the great lengths taken in an attempt to make the land more arable or useable as animal agriculture support land.

67. Informed decision making relative to this massive change in the landscape and subsurface conditions from agriculture to mining is critical because of the associated geologic timescale of the disturbance to the subsurface across the flats. To this end, it is critical that the full extent of natural wetlands across the Flats be appreciated and considered in post-mining attempts to reduce this geologic time-scale disturbance of this environmentally critical section of coastline and mitigate, at least a little, its far-reaching negative impacts on the region.

68. If mining is going to happen, how can the landscape be left to lessen the massive negative impacts on the local environment given that its impacts will last millennia and its off-site benefits a few years?

What can be done? I recommend that:

- True wetland extent and restoration potential should be assessed across the Barrytown Flats by an independent assessment team not selected by the mining company.
- If mining is to proceed as proposed and rivers and streams (including ephemeral and intermittent) are destroyed and moved, some semblance of natural stream patterns and fluvial dynamics should be constructed that connect streams to their floodplains and maintain groundwater-surface water connectivity.
- In addition, artificial surface drainage ditches should be removed to allow the land to return to its more natural wetland state and shallow groundwater dynamics.
- Naturally functioning wetlands should be constructed / restored in forms that reflect their landscape position and likely pre-drainage state for the greatest likelihood of restoration success and positive impact on hydrologic dynamics, water quality, and ecosystem health and function.

69. The wetland construction proposed is a shadow of what likely preceded drainage and alteration of this extensive wetland landscape. If the area is to be mined, the least that could be done is to help it revert back to its natural wetland state. The land “wants to be wetlands” despite human efforts to the contrary because of its location in the larger geomorphic and hydrologic landscape.

70. Farmed or agricultural wetlands are still natural wetlands. They have an exception to be allowed to keep operating and be actively managed because of current regulations, but it does not mean they are not wetlands. However, land use change does not convey a pass on the natural wetlands status and their protection.

71. This Fast-track application still proposes to destroy wetlands with mining activities, so the area should no longer be viewed as having a protected agricultural wetland exclusion. Therefore restoration / reconstruction should be to protected pre-agricultural wetlands status and not to an agricultural wetland state.

Prof Brian McGlynn