Vickery Extension Project Response to Submissions (RTS)
Crawford review for DPIE consideration
Section 6.4 Flooding

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Executive Summary

Thanks go to the DPIE of NSW for allowing a review of the Flooding Section (6.4) of the RTS for consideration in the 'all of government report'. This is my area of expertise.

1. The problem with the location of the coal handling and preparation plant (CHPP), train load-out facility and spur rail line has not been adequately addressed. In the spatial context, the alignment does not directly cross the confined floodplain. Major infrastructure should be with the flow or directly across to ovoid illegal diversions, soil erosion and to comply with the water-spreading principles in the Water Management Act (2000). The safest option is to keep off the floodplain and cross at the Gins Leap Gap.

2. Furthermore, the proposed crossing is over the deepest and widest part of the hidden valley of unconsolidated sediments containing precious groundwater. This will lead to other problems of aquifer compaction and land subsidence. The spur rail line structure will place stress on the expansive clay fractions of the Narrabri Formation.

Over time the gravitational force of the heavy infrastructure and the continual vibrating loaded coal trains will compact the clay and dewater them to some extent. These clays have high shrink-swell characteristics which lose their physical structure when compacted. Storage capacity is reduced and aquifer interference is the outcome.

3. The Project RTS often refers to the Draft Flood Management Plan (2016) for assessment of location. This plan has not been gazetted. It is not law. There is much community consultation to take place and 'ground-truthing' before it will be considered.

There remains the legal question as to freehold landholder's rights and whether a subjective floodplain map will prejudice one farm against another; a floodplain map creating winners and losers. The principles in the Water Management Act (2000) remain a strong foundation for assessment and 'water-spreading', a key concept.

4. The Project RTS, like the Vickery Extension Project EIS has an over-emphasis on transient numerical modelling for future flood predictions. There are too many knowledge gaps in the data and the use of restricted boundary modelling is unsatisfactory. The Upper Namoi Valley catchment is far too complex to be treated this way and extreme weather events cannot be accommodated.

5. The 'bottleneck' at the Gins Leap Gap and the floodwaters of Cox's Creek, Rangari Creek and Collygra Creek seem to be ignored. The engineering solution is to keep off the Liverpool Plains and cross at The Gap. This is the northern extent of the Liverpool Plains and the narrowest place to cross as well as having adequate hydraulic capacity.

6. The Project RTS completely ignores extreme weather events and climate change in practice. Again it reverts to modelling in its defence. The alternative model equation using a regression formula based on catchment area is too simplistic. The heterogeneity and complexity of the Upper Namoi Valley Catchment cannot represent the real catchment. There is simply too much uncertainty. (KLC original written submission attached)

Introduction

The communities of the Liverpool Plains have a lot at stake with the coal mine extension and infrastructure proposal. They live and work on the land and have a deep connection with it. Family farms predominate.

Families have an appreciation of 'intergenerational equity'. In other words, they want to leave this land to their children in a better environmental state than they found it. They are committed to sustainable agriculture in the long term. Their succession plans are integral with looking after the land. They really care about this highly productive prime agricultural land.

There are many challenges on the land today. Not the least, of which, is the unprecedented drought. We know that drought is often followed by flooding. This happened in 1984 and was only one of many major floods in this area. The 1984 flood in this area was just an indication of what can happen in this 'confined valley' in the future.

There have been many bigger floods than the 1984. In 1864 the township of Gulligal was destroyed by flood and Boggabri became the new town centre. The 1750 flood changed the course of the Namoi River as recorded in the Ion Idriess classic 'The Red Chief'.

After witnessing the 1984 flood the Vickery coal mine withdrew its proposal to cross the plains at this location. The Project has a similar location of the spur rail should not be given 'development consent'.

Extreme weather events and climate change herald a new awareness of environmental risk where infrastructure location and design should be closely examined on confined floodplains such as this area of the Upper Namoi Valley.

On the grounds of non-compliance with the principles of ecological sustainable development (ESD) this Project should not be given development consent. In the spatial context of the surface/groundwater connectivity mapping there is no field investigation of the 'critical zone' in the spur rail proposed location.

The critical zone is the area above the ground surface and below the ground surface down to bedrock at this location. There should be geophysical investigation with drilling control to bedrock and lithologies recorded. RTK GPS survey of valley cross-section would give a clearer picture of the landscape. Groundwater is the 'hidden resource'.

This review is concerned with the **location** of the coal handling and preparation plant (CHPP), train load-out facility and rail spur line. Project RTS pages 50-70.

Flooding Section 6

6.4.3. Responses

1. Justification of rail spur design

The Project states that 'the objective of the flood modelling in the EIS was to demonstrate that the proposed location of the Project rail spur would comply with the Carroll to Boggabri Floodplain Management Plan 2006 (Dept of Natural Resources, 2006), which includes impacts to flood levels, velocities and distributions on privately owned land)' end of quote.

Transient numerical modelling can never justify **location** of infrastructure.
Numerical modelling used for predicting future flooding heights and velocities is very restricted because of knowledge gaps in the data and the extremely complex nature of the 22,800 square kilometers catchment to Boggabri. This statement is very relevant in our days of extreme weather events and climate change.

Future flood heights are simply unpredictable and viaduct rail bridges need large safety margins in calculations of hydraulic capacity. 1 in 100 design return periods simply will not do. The Gins Leap Gap rail viaduct bridge is a good example of major infrastructure with adequate hydraulic capacity.

Rail spur **location** must be assessed in the spatial context of our 'confined floodplain'.
The Project mapping clearly shows that the CHPP, train load-out facility and rail spur are far too close to the Namoi River. The river and Gulligal Lagoon ecology will be under threat The Namoi River must remain connected to its floodplain.

The western distributor of Deadmans Gully will be interfered with by concentrating surface flow of water and redirecting water away from the natural intake recharge beds of the floodplain. This will incise the landscape, increase soil erosion and reduce aquifer recharge.

Precious groundwater of drinking quality abounds in this area and must be protected. The small cross-sectional area and meandering gully is built up higher than the floodplain is designed by nature to gently spread the floodwater.

Rail viaduct bridge location necessitates a near straight line across the floodplain.
The Project alignment indicates two right angle bends and diagonal sections to the flood flow. As well as creating engineering difficulties, this design location is the worst case scenario for illegal diversion of water; soil erosion control and aquifer recharge interference.

2. Accuracy of flood modelling and predictions

a. Justification of application of Draft FMP assessment criteria

The Project states that 'Rural floodplain Management is currently in transition from rural floodplain management planning under Part 8 of the Water Act 1912 to the Water Management Act 2000. The Carroll to Boggabri Floodplain Management Plan was prepared under the Water Act, 1912 using the Floodplain Development Manual (NSW Government, 2005), OEH and DPI Water (now DI Water) have developed a Draft FMP pursuant to section 50 of the Water Management Act 2000. Therefore the management rules given in the Draft FMP have been used as a basis for assessing the infrastructure proposed as part of this Project' end of quote.

My written submission covers this section and is posted on the Dept Planning Industry and Environment page 9: :number 284611 12th October 2018. (A copy is attached for your convenience)

The Draft FMP cannot be used for the basis of assessment as the Project suggests. The argument put simply is this: The Draft FMP 2016 has not been gazetted and cannot be used to justify major infrastructure in this area. Ground-truthing is not yet complete and much more work needs to done before it becomes law.

There remains a serious legal question regarding the interpretation of the WA 1912 and the principles in the WMA 2000. This matter relates to prejudicing freehold landholders rights, one against another. In other words, winners and losers based on subjective flood mapping. Floodwater should be allowed to spread-out in a confined floodplain such as the Project case study area. It will be narrowed down soon enough when it combines with Cox's Creek and passes through the Gins Leap Gap.

b. Justification of 'extreme' flood event assessment

The Project seems to assume that the **location** of the CHPP, rail load-out facility and rail spur is already approved and given development consent. It is not! The process of assessment cannot pre-empt approval. As a matter of fact, approval or disapproval of the **location** makes this a Critical Control Point (CCP).

In environmental assessment this is the point beyond which no other argument can be used to prevent environmental damage if construction goes ahead. This is the point in the Multi-stage process where we are right now! As there appears to be no recourse to the Land and Environment court, your recommendation to the Independent Planning Commission is paramount. The 'precautionary principle' should apply.

Is this a good **location** for the Project infrastructure? Unfortunately, those most impacted will be the land, water and communities of the Liverpool Plains. It is classified as Prime agricultural land, only to be compared with the Central Valley of California. Australia

has very little of this class of country. This highly productive agricultural land with precious groundwater should be an exclusion zone for mining and mining infrastructure.

The Gins Leap Gap and the underground dam back to Gunnedah is the Seventh Wonder of the Hydrogeological World (Australia). This area from Gunnedah to the Gins Leap Gap is an area of national and international significance. Any risk to this natural wonder should be seriously assessed.

The major mining infrastructure will interfere with the surface flow and interfere with aquifer recharge and storage capacity through aquifer compaction and land subsidence. This will be discussed at the conclusion of this review.

Transient numerical modelling cannot be relied upon to predict extreme flood events in this catchment area. By definition they are 'extreme' precisely for the reason that they exceed previous floods by an unknown magnitude. The unknown unknowns, if you like. Sensitivity studies using percentages and probabilities of exceeding potential maximum floods does not adequately address future flooding in our days of extreme weather events.

c. Justification of flood model extent

The Project states that 'Flood model extent was designed to assess the relevant aspects of the Project to flooding, in particular:

- The potential impacts of Project infrastructure to flood levels, velocities and distribution:

-The immunity of the Project from flooding events.

The key flood regime relevant to the Project is the Namoi River, given the Project rail spur crosses the Namoi River floodplain and the model has been developed based on data available to define the Namoi River flood characteristics. The model also considers local creeks such as Collygra Creek, Deadmans Gully, Stratford Creek, South Creek, Driggle Draggle Creek and Bollol Creek.

The flood regime of other watercourses significantly upstream or downstream of the Project which are tributaries of the Namoi River, does not require specific consideration as they are not directly relevant to the Project and their contributions to Namoi River flooding are accounted for in the Namoi River data' end of quote.

Rangari Creek is left out and also the significance of Cox's Creek flooding and the bottleneck at the Gins Leap Gap. Restricted boundary modelling always has these limitations and the scope of modelling should have been extended. Extreme weather events in the future will make the discharge of Cox's Creek and the constriction at the Gap even more important and Rangari Creek should never have been left out.

d. Clarification of change in flow distribution for the 1% AEP event

The impact of the Project rail spur on peak flow distribution for the 5% Annual Exceedence Probability (AEP) flood event was assessed in the Flood Assessment (Section 6.4.3 of Appendix C of the EIS).

No further comment on this section as it involves transient numerical modelling which is inappropriate in this part of the valley at this time. (KLC written submission attached)

e. Clarification of cumulative flooding assessment

No further comment on this section.

f. Clarification of potential erosion impacts

Whitehaven has made a concession to elevate all sections of the of the Project rail spur west of the Namoi River on piers and/pylons. This is commendable.

g. Justification of predictions at privately-owned residences and properties

The principles in the Water Management Act (2000) should be used for assessment in our days of extreme weather events not the Draft FMP 2016. The Draft FMP has not been gazetted.

3. Design flood immunity of Blue Vale Road realignment

This section is outside my scope of the review. I have focused on the location of the CHPP coal handling preparation plant, train load-out facility and spur rail line.

4. Clarification of flooding impacts in the Project mining area

This section is outside the scope of this review and focuses on the location of the CHPP coal handling and preparation plant, train load-out facility and the spur rail line.

5. Coincident flooding of Namoi River and its tributaries

'the likelihood of the regional and local flood-producing events with the same AEP peaking at the Project site at the same time is very low' end of quote.

Intense and widespread rain depressions in this area have a habit of occurring quite often in the historical context. The catchment communities of the Liverpool Plains know this very well as they have experienced this happening over generations. There is a high risk of it happening again in our days of extreme weather events.

6. Justification of probable maximum flood assessment methodology

Again transient numerical modelling cannot be relied upon to predict future flooding in these days of extreme weather events. The alternative approach involving even a more simplistic approach cannot represent the real Upper Namoi Valley catchment. The heterogeneity and complexity of the catchment characteristics cannot be represented by so few numbers. The KLC written submission attached covers this in detail.

Other risks to groundwater recharge, aquifer compaction and land subsidence not addressed by Whitehaven Coal in the Project RTS

Aquifer compaction and land subsidence has not been addressed in the RTS. This is a major oversight. Over-pumping aquifers can cause a similar effect and that is one of the reasons why there is a Water Sharing Plan in place. Groundwater is highly regulated in Zone 4 of the Upper Namoi Groundwater Resource and there are depth restrictions on bore drilling.

Driving pylons into deep sediments as well as the continual vibration of heavy coal train movements can also cause a similar effect. Aquifer interference is affected by way of reduced storage capacity. Aquifers may not refill to the same extent.

As well as the explanation given in my original written submission regarding particle size analyses, the clay particle sections of the valley cross sections called aquitards can have the groundwater squeezed out of them causing aquifer compaction and land subsidence.

Clay minerals are hydrated aluminosilicates and have a high shrink-swell capacity. These clays are the breakdown regolith types of volcanic basalt parent material. Their physical structure changes as they are compacted and the moisture released causing subsidence.

This is in contrast to the zeolites which are also hydrated aluminosilicates but retain their physical structure when compacted and the moisture released. Furthermore, they do not swell when wetted-up again. This is called reversible rehydration.

It is important to understand that the clays in the Narrabri Formation are largely high shrink-swell types which are particularly subject to aquifer compaction and land subsidence. The Narrabri Formation overlies the Gunnedah Formation. The project rail spur infrastructure will pose an extreme risk to the land and water of the northern area of the Liverpool Plains by way of aquifer compaction and land subsidence.

It is quite likely that the rail viaduct bridge at The Gap has settled where it crosses the alluvial sediments. Nevertheless, the Gins Leap Gap crossing is the best place to cross for many reasons covered in my original written submission including the fact that it already exists.

There is a much lower environmental risk, particularly with potential extreme flooding. This is in contrast to the extremely high risk of environmental damage due to potential extreme flooding with the proposed Project rail spur location.

Whitehaven Coal, whilst it hasn't a commercial arrangement with Boggabri Coal, at this stage, according to the RTS it should be encouraged to do so. Alternatively, another viaduct rail bridge should be considered side by side at the Gap. This is the best location to cross the Liverpool Plains and the confined valley of the Namoi River.

This outcome would be a win/win solution: a geological engineering solution for mining and an environmental solution for the Liverpool Plains in keeping major infrastructure off the confined floodplain.

Yours Sincerely,

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