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By email
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Dear Sir

Response to Kingston City Council

Preamble:

I understand City of Kingston (Kingston City Council) has engaged the services of an independent expert hydrogeologist, Christopher Smitt of EHS, to review the *groundwater impact assessment* (GWIA, September 2018) for the Mordialloc Bypass Freeway (Ref: Mordialloc Bypass – Groundwater Impact Assessment (Report), Appendix K to the Environment Effects Statement (EES) for the Mordialloc Bypass Project (Project), together with its accompanying Groundwater Modelling Report).

Please find responses to the queries posed by Christopher Smitt below:

Questions from Kingston City Council and Responses:

1. *The numerical model (Ground Water Model) boundary does not cover the entire project Domain and excludes the northern third of the project area. Considering the presence of landfills (a potential contamination source) in this northern area and groundwater observations indicating a north- south flow direction, why was this area not modelled/considered?*

   WSP Response:

   The primary objective of the groundwater modelling was to quantify impacts to groundwater resources and associated environmental values, in particular for the Edithvale Wetlands, Braeside Park Wetlands, Waterways Wetlands and Woodlands Estate Wetlands, in response to the proposed embankments for the Project. The potential impacts were conceptualised to arise from consolidation and permeability reduction effects from embankment construction proximal to the wetlands and the model boundary includes all relevant features.

   The risk of leachate migration from closed landfills in the northern section of the alignment and risks related to soil and groundwater contamination and acid sulfate soils are addressed by the expert evidence of Helen Jones in contaminated land.

2. *The Ground Water Model was classified as a Class 2 model. In order to satisfy that condition, numerous quantifiable indicators are required to define the confidence-level classification. From the initial review it appears the following characteristics and indicators*

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were not achieved and therefore shouldn't the Ground Water Model be considered a Class 1 model?

WSP Response:

WSP consider that the specific requirements, defined in the groundwater modelling guidelines (2012), for the model to be considered a Class 2 model, have been met.

The model has been independently peer reviewed by Dr Tony Smith of CDM Smith, who determined the model to be *fit-for-purpose* and to not contain significant technical flaws or errors. It is noted that Dr Smith also acted as Independent Peer Reviewer for the groundwater impact modelling assessment for the Level Crossing Removal project (LXRA) at Bonbeach-Edithvale, whose objectives were similar to those for the Mordialloc Freeway project. Dr Smith deemed that impact modelling to be fit-for-purpose, meeting the designated Scoping requirements for that project.

- *Model boundary does not cover the area to be modelled.*

The primary objective of the groundwater modelling was to quantify impacts to groundwater resources and associated environmental values in particular the Edithvale Wetlands in response to the proposed embankments for the Project. The model boundary includes all relevant features.

- *Use of metered groundwater extraction data.*

Licenced extraction of groundwater from five active pumping bores is included in the model.

- *Use of Streamflow data and baseflow estimates.*

Surface drainage features were included in the groundwater model. These features were digitised as shapefiles which contain attributes such as channel elevations, depths and widths, and an estimate of the hydraulic conductivity of the channel substrate (for calculation of drain or stream-bed conductance). A separate surface water balance model was also created.

- *Model Calibration statistics not spatially presented and or fall outside the range of that of a "calibrated model".*

The calibration achieved was considered to show good correlation between simulated and observed heads, with a scaled root mean squared (SRMS) value of less than 7.4%, which is below the 10% threshold and considered acceptable for a regional scale model. A map showing the calibration targets and residuals is presented in Figure 3.5 of the groundwater modelling report.

- *Transient calibration data not presented/undertaken?*

Transient calibration was undertaken for the period of groundwater monitoring and a few years prior (January 2015 to February 2018). Calibration statistics for the transient run are presented in Table 3.3 of the modelling report.

- *Seasonal fluctuations not adequately replicated/undertaken in all parts of the area.*

Seasonal fluctuation was incorporated in the transient calibration model.

- *No model validation presented/undertaken?*

A sensitivity analysis assessed the response of the transient model calibration to changes in the model input parameters. The objective of the sensitivity analysis was to rank the input parameters in terms of their influence on a model output. Results presented in Section 3.3.3 of the modelling report.

- *Model stresses and sensitivity analysis not presented/undertaken?*

Same response as previous dot point.

- *Temporal discretisation in the predictive model not presented/undertaken?*

Transient stress periods of monthly duration representing the proposed embankment running from March 2018 to March 2021 were simulated.

3. *The implications of a Class 1 (lower confidence model) versus a Class 2 model is a Class 1 model should only be used to provide an initial assessment of the problem. As per the guidelines, "A Class 1 model has relatively low confidence associated with any predictions and is therefore best suited for managing low-value resources (i.e. low-value groundwater dependent ecosystems) for assessing impacts of low-risk developments". Why hasn't a Class 2 model been used?*

   The numerical model is considered a Class 2 model (Refer to the statement of objectives for the model; and independent third party reviewed deeming model fit for purpose), as such, the model carries with it the required level of confidence commensurate with the objectives set for the assessment.

4. *Groundwater flow rates of 0.2 m/day are discussed. Please confirm if this value represents the Hydraulic Conductivity as opposed to a flux or velocity.*

   We confirm that this value is hydraulic conductivity (as per Section 9.1). Hydraulic conductivity within the QA and UTAF is similar in both aquifers with average value of 0.2 m/d and 0.3 m/d respectively.

5. *The average recharge values from Table 4.1 (Appendix K) is 1.57 mm/d and this equates to 573.6 mm/yr. This is roughly equal to 70% of annual rainfall and appears conceptually and physically incorrect. Please clarify.*

   Actual recharge (Moorabbin Airport) and evaporation rates for the previous year (March 2017 to February 2018) were used for the modelling scenario in section 4.3. Rainfall conditions during this time were below the long-term average.

6. *Considering the road alignment, direction of groundwater flow and likely proposed number of piles required, please clarify why upwards vertical hydraulic gradients were not considered in more detail.*

   Hydraulic gradients are discussed in Section 5.6.6 of the GWIA. Observed groundwater levels were used in the development and calibration of the groundwater model including all nested locations and as such vertical gradients are accommodated in the model.

7. *Please confirm if only one conceptual N-S and one conceptual E-W cross-section are provided across the entire project area. Are there other cross-sections available, in particular, cross-sections showing groundwater/surface water interaction in the vicinity of the wetlands?*

   A single N-S and single E-W cross-section were created for the GWIA. Groundwater-surface water interaction is varied and well understood between wetland cells and water bodies within the Project area. This has been described within several previous technical investigations (GHD 2006, SKM 2011, LXRA 2018) including Melbourne Water's Edithvale-Seaford Wetland Ramsar Site Management Plan (Ecology Australia 2016). These previous works were supported by geochemical/isotope analyses of water bodies and surrounding aquifers, and water and water balance modelling, as detailed in Sections 5.8.3 and 5.10.4 respectively.

8. *Please confirm the conceptual (and numerical model) provide a flux from the coast to the wetlands. This despite groundwater levels indicating a divide exists between the coast and the wetlands.*

   Flux to wetlands has been provided within the Mordialloc Bypass Edithvale Wetland Water Balance Modelling report (WSP, 2018. Mordialloc Bypass – Edithvale Wetland Water Balance Modelling. (Report number 2135645A-SE-26-WAT-REP-0008, 2018). The Mordialloc Freeway water balance modelling was developed from the existing LXRA's investigations into the wetlands under the data sharing agreement listed within Section 1.4 of the GWIA. The water balance model files were also independently reviewed during LXRA's EES process and has been deemed fit for purpose.

9. *The 95% protection of fresh water ecosystem criteria was adopted, however as the model domain includes aquatic reserves/wetlands with a high conservation value. Why wouldn't 99% ecosystem protection values be more applicable?*

As previously noted, the GWIA and the associated Groundwater Modelling Report (Sept 2018)) is not a contamination assessment (refer to the *Technical Impact Assessment Report (Contaminated Land and Acid Sulfate Soils)*. The 95th% percent protection level was used as screening level as it is most commonly applied in these guidelines to ecosystems that could be classified as slightly to moderately disturbed (ANZECC 2000). The ANZECC 95% protection criteria are also used within Melbourne Water's Edithvale-Seaford Wetland Ramsar Site Management Plan (Ecology Australia 2016), and this GWIA is consistent with that plan. This Management Plan states "The Edithvale-Seaford Wetlands are located within a highly urbanised area and the dominant water source for the system is stormwater and drainage water (SKM, 2011). Urban water sources are known to be high in nutrient and sediment loads, particularly carried in the first flushes after heavy rainfall (ANZECC and ARMCANZ 2000)".

It is also noted that the wetlands are largely recharged with runoff from the residential and industrial areas, this stormwater runoff being funnelled to the various wetlands surrounding the alignment. As such, the water bodies (Waterways, Braeside Park & Woodlands Industrial Estate wetlands) and drains can be defined as artificial assets by SEPP (Waters) as they are constructed, again acknowledging the disturbed environmental setting.

10. *Segment A2 was adopted, however Segment B or Segment C appears more reasonable. Only observation well GW17-26-03 (Brighton Group aquifer) and GW18-26-23S (Quaternary aquifer) had a TDS value within the Segment A2 range and that is likely influenced from the Dingley Drain. Please clarify.*

    EPA Victoria guideline requires the adoption of the precautionary principle and as such the most conservative Segment to be adopted. As such, we have adopted the most protective water quality classification. We are in agreement that GW17-26-03 appears to be an outlier, and note that no conclusive evidence of influences was observed from site inspections or geochemical review, and therefore have adopted the precautionary principal, requiring that A2 be adopted.

11. *It is stated that groundwater flow in the Brighton Group aquifer is to the coast therefore impacts could result in mounding on eastern side of the embankment and drawdown on the west. However, groundwater flow is to the south, not east to west. Please clarify.*

    Groundwater contour figures for linear infrastructure projects are often constrained by the narrow alignment of the groundwater monitoring network installed to assess and monitor the local groundwater setting, and the Mordialloc Bypass is no exception. The density and distribution of monitoring bores required to accurately contour the regional QA (shallow and heavily influenced by topography) and UTAF aquifers within a highly modified environment is considered above the requirements of the project.

    For the development and calibration of the numerical model, observed water level values from the LXRA project and registered groundwater bores within the model domain were used to supplement the existing groundwater monitoring network data. Figure 3.8 within the modelling report better represents the modelled groundwater table. Within the proximity of the Edithvale Wetlands at Springvale Road, the hydraulic gradient is observed as dropping east to west with the influences from Edithvale Wetlands and the Centre Main Drain observed as a groundwater sink. This is conceptually correct and the initial risks of mounding / and drawdown is relevant.

    The pattern of water level contours developed from the Mordialloc Freeway modelling assessment was very similar to that reported by the independent groundwater modelling effort conducted for the LXRA Edithvale Bonbeach EES. This work also replicates a local groundwater divide along the coast within the dunal ridge system located there, together with groundwater flows toward the Edithvale wetland system (see figure 42 of the LXRA EES GWIA).

Yours faithfully

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WSP Australia Pty Limited