Expert Evidence

Mordialloc Bypass (Freeway) Environment Effects Statement (EES)

Prepared for:

Russell Kennedy Lawyers

Prepared by:

Christopher Smitt

February 2019

Document Control

PROJECT DETAILS

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(e) electronic file
(h) hardcopy

Table of Contents

List of Tables

List of Appendices

1 Expert Evidence Information

This report has been prepared in accordance with the Planning Panels Victoria (PPV) "Guide to Planning Expert Evidence". The content requested is outlined below:

(a) Name and address:

Christopher Smitt
c/o EHS Support Pty Ltd
17/31 Queen Street,
Melbourne VIC 3207

(b) Expert's qualifications, experience and area of expertise

Qualifications:
BSc (Honours) Majoring in Hydrogeology and Geophysics
Certificate in Advanced GIS Analysis and Modelling (Hydrology and Groundwater Modelling with GIS).

Experience:
I have 18 years of experience as a Hydrogeologist. My CV (**Appendix A**) details my experience.

Area of expertise
Hydrogeology (**refer to 1C**)

(c) Expertise to make this report

My areas of expertise relevant to my instructions include:

- Hydrogeology;
- Catchment health and water quality;
- Numerical modelling to determine the impacts of groundwater extraction for both the Natural Resource Management and heavy industry sector (including water resource assessment and well field design); and
- Investigating the role of climate change/variability on Australia's groundwater resources.

In addition to having expertise in the above areas, I have had considerable experience in developing hydrogeological conceptual and numerical models. I'm currently involved in other large-scale hydrogeological investigations involving the Brighton Group and Lower Tertiary Aquifer (LTA) (subject of this Expert Witness Statement) in other geographic areas. As a result, I have an understanding of the aquifers behaviors from a regional perspective.

I have visited the Subject area (10/02/2019).

(d) Reference to any private or business relationship between the expert witness and the party for whom the report is prepared

Nil, other than the current engagement.

(e) All instructions that define the scope of the report (original and supplementary and whether in writing or oral)

All instructions that define the scope of the report are written. These are presented in **Section 2** and attached in **Appendix B**.

(f) The facts, matters and all assumptions upon which the report proceeds

Provided in **Section 2** to **Section 4** of this report.

(g) Reference to those documents and other materials the expert has been instructed to consider or take into account in preparing his or her report and the literature or other material used in making the report

Referenced within **Section 3**

(h) The identity and qualifications of the person who carried out any tests or experiments upon which the expert relied in making the report.

I have relied on the published materials presented in **Section 3** as well as comments regarding the project background during a meeting via phone with Ray Hatley and Alistair Steward of WSP. This meeting was held from 10am to 10:30am on 11/02/2019.

(i) Statement of the expert

Provided in **Section 4** of this report.

(j) A signed declaration by the expert

See **Section 5**.

2 Instructions

I have been instructed by Russell Kennedy Lawyers (acting on behalf of Kingston City Council) to undertake the following:

1. Prepare a report in writing detailing your opinions in respect of:
    a. a peer review of the Mordialloc Bypass (Freeway) – Environmental Effects Statement (EES) and the EES Attachments and Appendices relevant to your areas of expertise;
    b. in particular, the potential impact on groundwater levels. We draw your attention specifically to chapters 17 and 21 of the EES and the relevant Attachments and Appendices;
    c. matters relevant to your experience raised in Council's submissions;
    d. responding to any (relevant) other submissions;
    e. recommendations for improvement and/or changes to the Project, including to Environmental Performance Requirements; and
    f. any other matters you believe relevant to the proceeding within your area of expertise.
2. Your report should take the form of a narrative. Further, your report should be expressed in a manner that is unemotional and non-partisan and that reflects the objectivity and independence you have brought to the completion of your tasks pursuant to your retainer as expert. However, in your report you should address the points specifically raised in this letter and answer the questions put to you.

3 Documents Reviewed

In constructing this advice, I have reviewed the project specific documents listed below:

1. Mordialloc Bypass (Freeway) – Environmental Effects Statement chapters:
    a. Chapter 1 Introduction
    b. Chapter 2 Project-Rationale
    c. Chapter 4 Framework-and-Approach
    d. Chapter 6 Project-Description
    e. Chapter 17 Groundwater
    f. Chapter 21 Cumulative-Impacts
    g. EES Summary
2. EES Appendix K - Groundwater Report. Prepared by WSP. Report Number: 2135645A-SE-26-WAT-REP-0006 REV0.

In addition to the reports above, I have also been supplied and undertaken an initial review where additional background information was sought:

1. EES Chapters, Technical Appendices and Attachments:
    a. Attachment I Environmental Risk Assessment.
    b. Chapter 16 Surface-Water.
    c. Chapter 18 Soils and Contaminated Land.
    d. Chapter 21 Cumulative Impacts.
    e. Appendix L Contaminated Land - Main-Report.
    f. Appendix L Contaminated Land - Appendix-A.
    g. Appendix L Contaminated Land - Appendix-B.
    h. Appendix J Surface Water.
2. EES Public Submissions:
    a. Submission_28_Mordialloc_Beaumaris_Conservation_League 7984781 v1.
    b. Submission_39_Senthuren_Mahendren 7984756 v1.
    c. Submission_47_Alan_Dow 7984766 v1.
    d. Submission_62_Waterways_Estate_Residents_3195_Redacted 7984826 v1.
    e. Submission_67_Peter_Steele 7984797 v1.
    f. Submission_69_Michelle_Giovas 7984799 v1.
    g. Submission_78_Melbourne_Water 7984853 v1.
    h. Submission_81_Dingley_Village_Community_Association 7984857 v1.
    i. Submission_84_Defenders_of_the_Green_Wedge 7984861 v1.
    j. Submission_87_Scott_Fothergill_Redacted 7984866 v1.
    k. Submission_89_Devcon_Group_Pty_Ltd_on_behalf_of_Lugeo_Anna_Nominees_Pty_Ltd 7984889 v1.
    l. Submission_90_Friends_of_Edithvale_Seaford_Wetlands_Inc 7984892 v1.
    m. Submission_92_Friends_of_Mordialloc_Catchment_Redacted 7984900 v1.
    n. Submission_97_Port_Phillip_Conservation_Council_Inc 7984881 v1.
    o. Submission_98_EPA_Victoria 7984882 v1.
    p. Submission_102_Kingston_Residents_Association_Redacted 7984885 v1.
    q. Submission_108_Julia_Smiles 7984915 v1.

4 Findings

With reference to my instructions in **Section 2**, my findings have been summarised in **Table 4-1** and **Table 4-2**. Where uncertainty in risk or omissions within an EES framework are thought to occur, recommendations and potential environmental performance requirements (EPR) to overcome these are discussed in **Table 4-3**.

Table 4-1 outlines my opinion regarding potential outstanding hydrogeological scoping requirements of the EES. **Table 4-2** presents a greater detail of my opinion. However, it should be noted that at the time of preparing this statement, a request for clarification regarding several questions remained outstanding. This request is attached as **Appendix C**.

Table 4-1 Scoping Requirements (Opinion if Met)

EES Scoping Requirements	**Was the Scoping Requirement Addressed**
Key Issues	
Potential for adverse environmental or health effects resulting from disturbance of or influencing the transport/movement of contaminated groundwater	No. Data gap in the north of the project area where existing groundwater contamination has not been assessed.
Priorities for characterising the existing environment	
Characterise the interaction between surface water and groundwater within the project site and the broader area	Partially, additional work required to define groundwater/surface water interaction for all surface water systems.
Characterise the physical and chemical properties of the project area groundwater, including the potential pre-existing contamination,	No. Data gap in the north of the project area where existing groundwater contamination has not been assessed.
Design and mitigation measures	
Identify methods to manage and, if required dispose of groundwater	No. However it will be assumed this will be in the WMMP
Approach to manage performance	
Describe and evaluate the approach to monitoring and the proposed ongoing management measures to be implemented to avoid adverse residual effects on the Edithvale-Seaford Wetland	Partially. Reference to WMMP however this has not been developed.
Environmental management framework (EMF)	
The EMF should describe the baseline environmental conditions to be used to monitor and evaluate the residual environmental effects of the project, as well as the efficacy of applied environmental management and contingency measures	Partially. Data gaps in baseline conditions and the WMMP has not been developed.
The EMF should include the proposed objectives, indicators and monitoring requirements, for managing groundwater	Partially. Reference to WMMP however this has not been developed

Table 4-2 Summary of Opinion/Review of the EES (Hydrogeological Related aspects)

Report Reference	Statement / Summary from report(s) interrogated Chapter-17-Groundwater and Chapter-21-Cumulative-Impacts	Not addressed/Potential Gaps
Page 671 of Appendix K (Fig 1.1 Appendix D within Appendix K)	The numerical model (Ground Water Model) boundary does not cover the entire project Domain and excludes the northern third of the project area.	It is understood that the groundwater model was based upon a previous groundwater model used as part of the Level Crossing Removal Authority (LXRA) Project. Using this model (or variation thereof) would also allow quantification of cumulative impacts associated with the LXRA Project. Furthermore, it is acknowledged that 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 Outer Suburban Arterial Roads (OSAR) Project. Despite the intentions of the above, the risk assessment undertaken as part of the EES identified the presence of landfills (a potential contamination source) in this northern region of the project area. The risk consequence for the Construction effects on beneficial users (including groundwater dependent ecosystems) was rated as “minor consequence” (Table 6-3). This is defined as “Temporary minor change to groundwater quality and groundwater levels affecting existing users (registered bore owners, GDEs and surface water)” with likelihood of contamination from landfills as “Unlikely” (defined by “has not happened in Metropolitan Melbourne”). With reference to the above risk qualification, it should be noted that at least 2 landfills in recent history within Metropolitan Melbourne are known to warrant remedial efforts after landfill gas and/or leachate was discovered in the surrounding environment which may have been exacerbated as a result of civil construction efforts. These are; 1. Stevenson’s Road Landfill at Cranbourne and its potential impact on the Brookland Greens estate; and 2. 20 ha site at Huntingdale Estate in South Oakleigh (quarry turned in to a landfill) Therefore, knowing such issues have occurred, at minimum the risk should have been initially rated “medium” (defined by a possible likelihood and moderate consequence). As such with the pre-existing model indicating a general north- south flow direction, it would have been warranted to include this northern third of the project area to address the risk above and ensure appropriate management actions are developed to lower its risk profile.

Report Reference	Statement / Summary from report(s) interrogated **Chapter-17-Groundwater and Chapter-21-Cumulative-Impacts**	Not addressed/Potential Gaps
Page 683 of Appendix K (Section 3 Appendix D within Appendix K)	The Groundwater Model was classified as a Class 2 model.	Under the strictest definition of Using Table 2-1 from Barnett et al., 2012, the model meets more Class 1 criteria than Class 2. In order to satisfy that condition, numerous quantifiable indicators are required to define the confidence-level classification. From a review of Appendix K it appears the following characteristics and indicators were not achieved and therefore the groundwater model should be re-classified as a Class 1 model: • Model boundary does not cover the area to be modelled. • Use of metered groundwater extraction data. • Use of Streamflow data and baseflow estimates. • Model Calibration statistics not spatially presented and or fall outside the range of that of a "calibrated model". • Seasonal fluctuations not adequately replicated/undertaken in all parts of the area. • No model validation presented/undertaken. • Model stresses and sensitivity analysis not presented or fall outside the range of Class 2 criteria. • Temporal discretisation in the predictive model not presented/undertaken. 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*".
EES Chapter 17 Section 17.6.4	Section States *"flow rates measured in each aquifer were similar:* *Quaternary Aquifer – 0.05–0.80 metres per day (0.2 metres per day average)* *Upper Tertiary Aquifer – 0.13–0.70 metres per day (0.3 metres per day average)".*	There is confusion regarding this statement. I believe this is inferred as Hydraulic Conductivity. Flux or velocity would be magnitude times smaller. Need to be confirmed as implications are large. For example; Figure 17-7 (Groundwater levels Brighton Group aquifer) - Groundwater levels near the Edithvale Wetlands are higher than in the Quaternary aquifer. Conceptually this doesn't make sense. Upon review, the flow rates presented are actually hydraulic conductivity (K) values. To obtain flow rates, you use the hydraulic gradient (i) and K to calculate a Darcy Flux (q) = K.i and then use the porosity η to obtain a Pore Space Velocity (v) – q/η (or flow rate). This will result in flow rates much slower than 0.2 m/day. More likely around 0.001 m/day.

Report Reference	Statement / Summary from report(s) interrogated **Chapter-17-Groundwater and Chapter-21-Cumulative-Impacts**	Not addressed/Potential Gaps
Page 98 of Appendix K (Table 7.1)	The average recharge values from Table 7.1 (Appendix K) is 1.57 mm/d	This equates to an annual recharge of 573.6 mm. This is roughly equal to 70% of annual rainfall. Whilst Net ET is taken into consideration, if recharge in this instance refers to "deep draining" i.e. rainfall making it past the unsaturated zone, this would be conceptually and physically incorrect and certainly mitigate changes in wetland water levels.
Appendix K (general statement)	Vertical hydraulic gradients	Evidence suggests that there is direct response to rainfall in the Quaternary aquifer and where the Brighton Group aquifer is unconfined (refer to page 61 of appendix K; Figure 5.11 and 5.13). Considering the road alignment, location of landfills in the northern project area, direction of groundwater flow (north to south) and likely proposed number of piles required, the EES does not account for this upwards vertical hydraulic gradient. If piling has the potential to form preferential pathways between 2 aquifers (or areas of poorer water quality to shallow systems), consideration should have been made in either the groundwater model or the risk assessment to address this as this has the potential to change the risk ranking from Low to Medium.
Page 66 of Appendix K (Section 5.8.1)	The 95% protection of fresh water ecosystem criteria was adopted	Under the SEPP (waters), the 99% ecosystem protection values should have been adopted as the model domain includes aquatic reserves/wetlands with a high conservation value. This would mainly impact criteria levels attributed to dissolved metals, TPH/ BTEX compounds and pesticides. The criteria would be more conservative using the 99% ecosystem protection values.
Page 66 of Appendix K (Section 5.10)	Groundwater Flow Direction	It is stated that groundwater flow in the Brighton Group aquifer is towards the coast. Therefore, conceptually impacts could result in mounding on the eastern side of the embankment and drawdown on the western side. As shown on Figure 4.2 (Page 701 of Appendix K), impacts are seen directly underneath the road which does not conceptually make sense.
Appendix K (general statement)	Source receptor pathway methodology adopted	There are no cross-sections showing groundwater/surface water interaction in the vicinity of each sensitive wetland to support the groundwater chemistry data. Furthermore, these cross-sections would be required to verify these processes.

Report Reference	Statement / Summary from report(s) interrogated **Chapter-17-Groundwater and Chapter-21-Cumulative-Impacts**	Not addressed/Potential Gaps
Page 682 of Appendix K (Figure 2.2)	Only one conceptual N-S and one conceptual E-W cross-section provided across the entire project area	The cross-sections do not provide enough detail, including areas of vertical gradients etc. The cross-sections also show that all surface water features are connected to the Quaternary aquifer not the Brighton Group aquifer (see E-W cross-section). In addition, whilst Boron is found in seawater, its also found in other groundwater and surface water impacted by some industrial facilities/landfills (which as discussed earlier have not been included within the EES). As these wetlands also contain ammonia, when looking at the flow directions, there is a groundwater mound between the coast and the wetlands thus, conceptually it is not possible for seawater intrusion to occur. If the model used this as a source, or constant flux boundary, this is conceptually wrong.
Page 674 of Appendix K (Figure 1.2)	Establishment of a groundwater baseline not achieved	Whilst there are 36 groundwater wells installed in the project area, there are no wells to the north of Lower Dandenong Road to verify groundwater contamination due to landfills and other industry. In addition, it does not appear that dataloggers were installed in any of the Wetlands or surface water systems. These are required to verify the water balance modelling, and to confirm groundwater/surface water processes. Along with this it also appears that the Woodland Industrial Wetland and Braeside Park Wetland were only sampled once (February 2018 only). As a result, this does not meet the requirements of baseline sampling frequency, therefore a baseline has not been defined.
Appendix K (general statement)	Dewatering considerations along with the Implementation of a Water Management and Monitoring Plan to monitor potential risks of groundwater	The project design (EES) does not include dewatering scenarios. Given the shallow nature of the water table, some groundwater management may be required. In addition, there is no discussion on how groundwater will be managed if encountered. Furthermore, whilst a WMMP has not been developed, in Appendix K (Section 4.3.2.1) it states that the monitoring network will be used for 2 years post construction but in Chapter 17 and 18 it states that it should be for 5 years. Five years seems more reasonable

As discussed in **Table 4-1** and **Table 4-2,** several risk factors and/or omissions in understanding hydrogeological behavior and its potential impact on environmental receptors are presented. To overcome these, **Table 4-3** outlines recommendations or EPR for additional work.

Table 4-3 Recommendations and Potential Environmental Performance Requirements (EPR)

Risk / Uncertainty	Suggested EPR/Additional Work
Establishment of a groundwater baseline not achieved	As some bores have only been monitored once, anomalous data has the potential to skew the existing dataset. Therefore, all bores should be sampled at least 3 times (preferably at regular intervals over a 12-month period). In addition, pressure transducers should be placed in nested well sets located near Edithvale Wetlands to better understand surface water/groundwater interactions. This data can also improve model reliability and aid in improving its model classification. Finally, when presenting the data, a QA/QC summary should also be provided to ensure outliers are identified and appropriate procedures have been followed. This seems to be missing in the EES.
The groundwater model does not address all risks identified in the project area.	Use the risk assessment framework to re-evaluate risks, inclusive of landfills (present in the northern area). Under a range of scenarios designed to stress the system, re-run the updated model that includes the northern area. Use the results to confirm the risk status or develop mitigation strategies where risks are still apparent.
Groundwater quality and adoption of protection levels	The 95% protection of fresh water ecosystem criteria was adopted, however as the project area includes aquatic reserves/wetlands with a high conservation value (e.g. RAMSAR listed Wetland), the 99% ecosystem protection values should have been adopted. Therefore, a recommendation is to monitor water quality results against these levels. If levels exceed the criteria, the establishment of a background dataset (discussed above) is crucial, as under the SEPP, background takes priority over exceedences against protection values. e.g. if the system naturally has a low pH, the SEPP will not request the proponent to increase pH to the levels listed
Improve understanding vertical hydraulic gradients	Uncertainty exists in the behaviour or understanding of vertical hydraulic gradients (i.e. movement of groundwater between aquifers vertically). Considering the road alignment, location of landfills in the northern project area, direction of groundwater flow (north to south) and likely proposed number of piles required, the EES does not account for this upwards vertical hydraulic gradient. If piling has the potential to form preferential pathways between 2 aquifers (or areas of poorer water quality to shallow systems), consideration should have been made in either the groundwater model or the risk assessment to address this as this has the potential to change the risk ranking from Low to Medium. To address this, groundwater pressure transducer results should be corrected to a fresh water equivalent and flux calculations assessed. This information can be used in the model, or as inputs to a dilution attenuation analytical model or risk assessment.

5 Declaration by the Expert

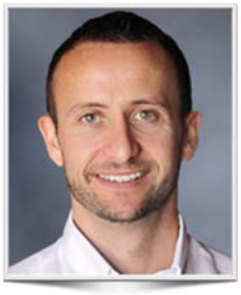
With respect to my instructions, I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the PPV.

Sincerely,

Chris Smitt,
Principal Hydrogeologist | Director
EHS Support Pty Ltd

Appendix A CV

PROFESSIONAL PROFILE



CHRIS SMITT, B.SC (HONS) HYD & GEO

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Search Chris Smitt

Chris is a principal hydrogeologist with over 18 years' experience in both private and public sector within Australia, North America and the Middle East. After graduating with a degree in Physics and Earth Science, Chris majored in Hydrogeology & Geophysics during his honours year (2000) from the Flinders University of South Australia.

Chris then began his career as a hydrogeologist with CSIRO Land & Water where he developed a large-scale 3D numerical model capable of predicting surface water & groundwater interactions in complex basaltic aquifers across Southern Australia.

In 2006, Chris has worked as a hydrogeologist in private industry and has been responsible for project delivery of numerous large scale, technically and logistically complex projects including; CSG and Shale gas resource development projects in Australia and North America (e.g. Great Artesian Basin Drilling Program); Coal mine rehabilitation (e.g. rehabilitation of the Anglesea Coal Mine); Managed Aquifer Recharge Projects (e.g. Canberra Integrated Water Management Program); Sustainable Groundwater Development projects (e.g. Aspire Zone Development, Doha, Qatar); and Catchment and groundwater impacts assessments (e.g. Development of an Victorian Index of Groundwater Condition and numerous development and review of State groundwater management plans).

Chris has worked extensively with upstream Oil and Gas development projects focusing on CSG and Shale gas resource development projects in Australia and North America. Throughout these projects, Chris has worked with peers and senior management within client organizations to deliver numerous large scale, technically and logistically complex Aquifer Injection Projects (such as in the Roma MAR Scheme, Australia), Irrigation assessments and Hydraulic Fracking Risk assessments.

EDUCATION

Bachelor of Science (Honours, Hydrogeology and Geophysics), Flinders University, Adelaide

PROFESSIONAL AFFILIATIONS

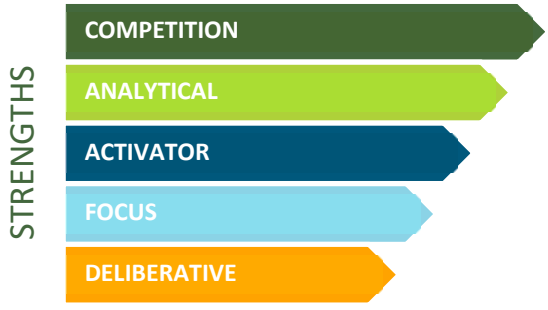
- International Association of Hydrogeologists
- National Groundwater Association
- Australian Institute of Geoscientists
- Australian Water Association

CERTIFICATION & TRAINING

- Certificate of Advanced GIS Analysis & Modelling, Adelaide University, 2002
- Certificate of competency for German language studies, Adelaide University, 2003
- Advanced Resuscitation and Senior Occupational First Aid

EXPERTISE

- Deep bore installation supervision
- Inter-aquifer communication and petroleum activities
- Coal seam/shale gas water management
- Managed aquifer recharge (MAR)
- Analytical and numerical groundwater modelling
- Groundwater investigation in complex fractured rock and sedimentary basins



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KEY EXPERIENCE

Coal Seam Gas Experience

Tier 1-3 Groundwater and Soil Gas Risk Assessments | South West Queensland

Technical Hydrogeologist and PM 2

The project involved management and coordination for a major Oil and Gas Company to undertake a soil gas investigation and risk assessment works in the relevant parts of the regulator-imposed "Excavation Caution Zone (ECZ)" close to Chinchilla (QLD).

The over-arching strategic objectives were to undertake a phased approach to:

- Undertake a risk assessment and develop control measures to mitigate identified risks; and
- To demonstrate that CSG development in the relevant overlapping parts of the ECZ can be conducted safely with acceptable and mitigated risk to employees, the community and the environment.

More specific project objectives include:

- Assess and characterise shallow geology and delineate the likelihood of potential UCG combustion gases in the shallow soil/weathered rock profile being present within the study area;
- Assess human health and environmental risk exposure pathways and risks associated with the identified likely combustion gases within the ECZ/Orana gas field overlap area;
- Assess the potential for contaminants associated with the UCG site to be mobilised due to CSG development operations.

Roma Managed Aquifer Recharge Scheme, Santos

Senior Project Manager and Technical Lead

Senior project manager and technical lead for the Roma Managed Aquifer Recharge Scheme valued at $18M over 2 years. The project initially involved drilling design, supervision and pump testing deep (>250m) groundwater observation bores and injection wells used to trial water injection into the Great Artesian Basin (South-East Queensland). Results from the trial (which included hydrochemical analysis and numerical modelling) lead to the development of detailed design requirements for the installation of large scale MAR scheme consisting of up to 8 injection wells and 12 observation bores targeting deep (up to 600m) beneficial use aquifers capable of receiving up to 20-30ML/d of treated CSG water.

Multiple Irrigation and Groundwater Assessments, Origin Energy South West Queensland

Technical Lead and Project Manager

Origin wished to expand the areas of irrigation using treated coal seam Gas water at several locations, however it is understood that over-irrigation (irrigation rates that exceed the internal drainage capacity of deeper soils after evapotranspiration losses) could potentially lead to seepage and discharge of saline irrigation water to surfacewater systems.

As a result, for each area, Chris undertook a study that involved a hydrogeological investigation and development of a numerical groundwater model to assess the potential for seepage and associated impacts of irrigation.

Santos GLNG Well and Bore Integrity Risk Assessment, Santos

Project Manager and Technical Lead

Santos GLNG has expended considerable effort in the management and maintenance of the aquifers and the prevention of aquifer interconnectivity. However, to date all of this work has not been integrated into a single plan or report. This project provided a systematic review of the well installation processes, the management and assessments completed by Santos GLNG to date, and an assessment of the potential risks posed by existing and proposed wells. Through this process, Santos GLNG demonstrated that aquifer interconnectivity arising from well or bore failure has been adequately considered in the development program, and the methodologies used for drilling, completion and abandonment of CSG wells are sufficient for management of long term risks.

Well Integrity Risk Assessment, Confidential Client

Project Manager and Technical Lead

Chris undertook a risk assessment for a proponent which evaluated common mechanism of failure for historic conventional oil and gas wells, CSG wells, and private landholder water bores. The likelihood and consequence of failure was also addressed, and the methodology used is adaptable to future development areas.

The risk assessment demonstrated that historical conventional oils and gas wells posed the highest risk relative to CSG production wells for gas migration to surface and inter-aquifer interaction. Private landholder water bores were also considered in terms of gas and fluid migration. While the majority of these bores were constructed in a relatively unregulated industry (during the early 20th century), they pose a low risk of cross aquifer flow being low. These bores are generally located above potential coal seam or conventional gas targets resulting in low risk of gas migration.

By using this desktop approach, the proponent can satisfy community, State and Federal environmental concerns, as well as recognizing significant cost or cash flow reduction (multi millions) as management actions including risk-based monitoring, inspection and plug and abandonment decisions could be implemented and prioritized based on the relative magnitude of risk.

Armour Energy, Identifying Sources of Sustainable Water for 2014/15 Shale Gas Drilling Program

Project Manager and Technical Lead

Chris undertook the following tasks:

1. Reviewed existing environmental values;
2. Reviewed surface water characteristics;
3. Assesses groundwater characteristics within the project area with a view to completing a baseline assessment; and
4. Summarise the system's capability to take water from either the surface or the groundwater system.

The results found across the eastern half of ATP 1087, water is likely to be available from both surface water (Nicholson River) and groundwater options.

Across the western half of ATP 1087 no perennial surface water systems exist with only intermittent and ephemeral river systems being available for potential water extraction. Water in this region should focus on groundwater within the Walford Dolomite which known to contain water bearing lenses.

Bibblewindi Study, Santos

Technical Lead

The study involved an assessment of the potential impacts of brine seepage and development of remedial alternatives for groundwater. A detailed hydrogeologic conceptual model was developed using hydrogeologic and geochemical analyses to assess the magnitude of impacts and leakage and the fate and transport in groundwater. Using information on groundwater and soil/bedrock chemistry the maximum lateral extent of impacts was determined and a groundwater extraction system designed and installed.

Tintsfield Study, Santos

Technical Lead

Hydrogeologic and geochemical assessment of coal seam water storage ponds. The study involved a detailed assessment of hydrogeologic data and groundwater geochemistry to assess the potential for pond leakage and impacts in the perimeter groundwater monitoring network. The study demonstrated that the pond was not significantly impacting groundwater and a long-term monitoring program, better focused on groundwater geochemistry, was developed to assess the potential for leakage.

Development of an EMP for an Underground Coal Gasification Pilot Trial, Confidential Client

Hydraulics Technical Lead

This project involved completion of a risk assessment and development of an EMP for an Underground Coal Gasification Pilot Trial in South East QLD. An underground gas storage risk assessment was conducted to determine the adequacy of geological strata for the trial. The project also involved understanding contaminants of concern and undertaking a toxicology risk assessment. A fate and transport model was also undertaken as well as risk-based rehabilitation and remediation plan.

Gunnedah Managed Aquifer Recharge Scheme, Santos

Project Manager and Technical Hydrogeologist

Project manager and technical hydrogeologist to assess the viability and risks of a proposed managed aquifer recharge scheme in the Gunnedah-Oxley basin, NSW. The project involved assessing the hydrogeological properties of the region, developing a numerical model to estimate impacts, and undertaking a risk assessment and priority matrix to define priority areas for MAR.

Narrabri Managed Aquifer Recharge Scheme | Santos

Project Director

Project director of a proposed MAR scheme where treated CSG water would be discharged in to the base of a deep alluvial creek system in the Narrabri region, NSW. The project involved geophysical transect to determine the storage capacity of the system as well as laboratory analysis of core samples to determine geochemical compatibilities and surface water / groundwater interactions. Liaison with the NSW Office of Water was also a key consideration of the project with all approved outputs being used to assist in the procurement and detailed design of surface infrastructure to trial a MAR.

Scotia Managed Aquifer Recharge Scheme, Santos

Senior Project Manager and Technical Lead

Senior project manager and technical lead for the Scotia Managed Aquifer Recharge Scheme. The project involved an assessment of the groundwater conditions underneath the site, including, coring 500m of aquifer material with XRD/XRF analysis, design and supervision of large diameter, deep injection wells, pumping tests, geochemical compatibility modeling, and detailed design criteria for the procurement of surface infrastructure. The project was undertaken in accordance with the National Water Quality Management Strategy guidelines for Managed Aquifer Recharge (MAR), published in July 2009.

Surat Basin Flow and Solute Transport Numerical Model, Santos

Project Manager

Project manager for the development of a flow and solute transport numerical model. The model was designed to simulate cumulative impacts of a proposed MAR scheme in the Roma CSG field and its potential impact on surrounding landholders and town water supply bores. The model was also used to inform injection pressure calculations and pipe diameter sizing for the EPCM contractor to factor in to the engineering detail design.

Arrow Energy MAR Feasibility Options Analysis, Arrow Energy

Project Manager

The aim of this project was to review up to 50 Managed Aquifer Recharge (MAR) schemes from around the world, its objectives and results (if a trial has occurred) and then to ask the question, ‘’in hindsight, what would the proponent have done differently (from permitting, to design to operation)’. The results were then used to guide Arrow Energy’s decision-making process regarding their water management strategy involving MAR.

Hydrogeological Assessments and Audits

Anglesea Coal Mine Rehabilitation | Anglesea Victoria

Project Manager and Lead Hydrogeologist

The long-term objective is the development of a pit lake with a self-sustaining circum-neutral stratified water body and discharges from the pit lake which can potentially improve downstream beneficial users in the Lower Anglesea River.

However, within the mine catchment, the geological profile consisting of the Eastern View Formation (EVF) is dominated by a coal lithological unit containing a pyritic siltstone, a form of iron sulfide. As a result, the catchment naturally generates acid when its shallow coal seams (which contain high a sulfur content) come in and out of contact with water and oxygen.

Due to the elevated dissolved metals and acidity within the surface water, active and passive treatment methods have been developed to be incorporated in the Mine Closure Plan to increase alkalinity and reduce dissolved metal concentrations. These methods are summarized in a surface water and groundwater management and monitoring plan and are a critical component of water quality management during the early stages of pit lake development to ensure the long-term objectives are achieved.

The hydrogeological technical studies that formed the basis behind the Mine Closure Activities were:

- Sub Catchment Scale Geochemical Modelling
- Numerical Groundwater Modelling
- Water Quality Baseline sampling and Analysis
- Pit and Spoil pH Balance Assessment
- Risk assessment in accordance with AS/NZ ISO 31000:2009; and
- Management of civil design engineers tasked with works on waterways, surface water diversion structures and dam analysis

Rehabilitation of the Point Henry Refinery | Geelong, Victoria

Technical Hydrogeologist

Chris was tasked with peer reviewing 3rd party hydrogeological reports as well as developing regional and site hydrogeological models. This lead to the development of a groundwater monitoring network in which Chris assisted in supervising the installation of over 200 groundwater and soil gas monitoring bores.

Securing Sustainable Groundwater for Aspire Zone | Aspire Zone Doha, Qatar

Project Manager

The Leisure Land precinct adjacent to Aspire Zone in Doha, Qatar was irrigated with potable water supplied by Khara-Maa. Due to high costs and the possibility of Khara-Maa tightening supply, Aspire Zone wished to replace or augment this supply with a suitable supply of groundwater. As such, a hydrogeological study was undertaken to characterise the quality and quantity of groundwater that can be extracted and to design an extraction regime. Chris project managed a series of hydrogeological investigations on the proposed site. This included a desktop analysis of the characteristics and history of the aquifer and surrounding area. Drilling, completion and sampling of 13 boreholes. Pumping tests and analysis to determine optimum well yield and aquifer parameters; Development of a numerical model of the physical resource and to test various well-field configurations that may be used in the development of the groundwater resource.

LGL Ballarat Groundwater Monitoring System | Lihir Gold Limited

Assistant Auditor

Assistant auditor to conduct an audit of the groundwater monitoring system at LGL Ballarat as part of EPA Works Approval No WA63536. The works approval is to allow LGL Ballarat Pty Ltd to store recycled brine within the Terrible Gully Tailings Storage Facility (TSF) at the Woolshed Gully Site in Ballarat. The audit objectives were to the assess the adequacy of the groundwater monitoring program, and to provide recommendations for any additional measures required

Canberra Managed Aquifer Recharge Scheme, Federal Treasury

Project Manager and Technical Hydrogeologist

Project manager and technical hydrogeologist to assist the ACT Government to reduce the demand on the mains water supply, by 12% by 2013 and 25% by 2023. This was partly achieved by stormwater harvesting, storage and recovery as a means to help the ACT Government achieve these targets.

In order to identify suitable areas for this type of MAR scheme to occur, the project involved exploratory geophysics, groundwater bore design and installation, geochemical modelling and other hydraulic information to assist in the procurement and detailed design of surface infrastructure to trial a MAR scheme in the northern suburbs of Canberra. The project found one of the highest yielding parts of the Canberra Formation investigated to date (>50 l/s) which allowed the ACT Government to store and recover more water than anticipated.

Western Metropolitan Melbourne MAR Feasibility, Melbourne Water

Project Manager

Project manager for a regional review on the feasibility for a 1-2GL/year type MAR schemes across western metropolitan Melbourne for irrigation and third pipe in new suburb developments. The initial phase was to complete a desktop assessment of the groundwater conditions at a number of strategic distribution locations in the region, including the presence, quality and depth of groundwater (both in the shallow and deeper aquifers and movement between these aquifers) and to assess the suitability of these aquifers for the storage and extraction of captured water. The desktop assessment was undertaken in accordance with the National Water Quality Management Strategy guidelines for Managed Aquifer Recharge (MAR), published in July 2009. The final phase of the project focused on the most promising locations, based on the outcomes of the Entry Level and Stage 1 Risk Assessment, and collecting site specific data and conceptualising the potential MAR scheme with the groundwater conditions to develop an understanding of the key data gaps and work required to progress a MAR scheme in the area.

to ensure the risk to the beneficial uses is minimised and maintained at an acceptable level.

Development of an Victorian Index of Groundwater Condition | Dept of Sustainability and Environment

Project Manager

Project manager and lead hydrogeologist for developing the Victorian Index of Groundwater Condition (IGC). An online user friendly tool which identified which aquifers within Victoria were under stress from either human or environmental factors. The project involved a trial in six aquifers assessing their beneficial use and “naturalness” for groundwater quality, quantity, environmental support and physical characteristics.

Determining Victoria Groundwater Age for Management Options | Dept of Sustainability and Environment

Project Manager

In Southern Australia, groundwater became a significant freshwater resource since the onset of the drought in the (mid 1990’s to late 2000’s), with the rates of bore installation and extraction of water from aquifers increasing during this time. Whilst the drought has led to many declining groundwater levels across the State of Victoria, it has also facilitated studies involving isotope hydrogeochemistry to better understand surface water / groundwater interactions, groundwater flow paths and age of the resource. Chris was the project manager and lead hydrogeologist to conduct a desktop literature review and collect additional field data involving carbon-14 (14C), tritium (3H), chloride-36, (36Cl) and chlorofluorocarbons (CFCs) dating to determine the ages of the groundwater in “key areas” of Victoria. The results helped set sustainable future allocation limits for groundwater extraction.

Yarra Valley Water Hydrogeological and Geophysical Assessment | Coca-Cola Amitil

Project Manager

Project manager of a desktop study followed by on-site investigations in the Yarra Valley region of Victoria to identify a new groundwater source which will supplement existing bottled spring water supplies and assist in making amendments to the existing groundwater extraction license on the site. The hydrogeological assessment involved geophysics, baseflow impact calculations into the Don River and surrounding rivers as well as analysis of isotope geochemistry.

Residential Development Impact Assessment, New Gisborne | Colanz Pty

Project Engineer

Project engineer involving a desktop assessment, site visit and field investigations to provide Colanz Pty Ltd with technical advice upon the impact of a residential development on the racecourse reserve Marshlands. The project involved drilling, instillation and sampling of 6 licensed groundwater investigation bores. A short-term pumping test and analysis was also performed.

Impacts of the Donald Wastewater Treatment Plant | Grampians Wimmera Mallee Water

Project Manager

The Donald Wastewater Treatment Plant (WWTP) is situated near the Donald township and the Richardson River and came under question by the Donald Neighbourhood Environment Improvement Plan (NEIP) that operations at the WWTP are having a negative effect on water quality in the Richardson River via leaching of nutrients and contaminants to the watertable, with contaminated groundwater discharging to the river as baseflow. Chris project managed and undertook an investigation whether the WWTP and its operations are resulting in adverse impacts on the river. The project involved the collation of data and site history. A review of the monitoring program, including the sampling methodology to determine reliability of the monitoring results was undertaken and soil infiltration potential was calculated. The assessment concluded that there has been no evidence of treated wastewater impacting the Richardson River via baseflow, however, localised contamination could be identified in other areas of the landscape. Suggested improvements to the current monitoring programs and remedial actions which may mitigate any identified or potential environmental impacts to the River in the future were made.

Lake Corangamite Groundwater Modelling | Corangamite CMA

Project Manager

Lake Corangamite is a terminal lake within the Corangamite River Basin in south western Victoria. In the past, water has been diverted away from the lake to the Barwon River via the Woady Yaloak diversion scheme. This resulted in relatively low water levels and increased salinity which in part has been exacerbated by drought conditions over the past decade. Chris project managed and developed a steady-state numerical groundwater model (Modflow) for the target region, encompassing Lakes Corangamite, Weering, Gnarpurt, Beeac, Colac, Murdeduke and Cundare Pool. The model was calibrated to best represent the naturally occurring conditions associated with the major lakes and rivers in the area. A number of scenarios trialing the effects of drought, extraction, land-use and lake level were then run. Scenario modelling highlighted the changes to groundwater systems, under a number of different environmental conditions. For drought and extraction scenarios recharge was altered to show the effect on groundwater flow conditions by removing/adding water to the system. The effect of lake level modelling found that changing lake levels altered capture zones and flow paths, as well as changing groundwater divides between lake systems.

Critical Review of the Warrion WSPA Groundwater Management Plan | SRW

Project Manager

In 2002 the Consultative Committee developed the Warrion Water Supply Protection Area (WSPA) (Groundwater) Management Plan to be submitted to the Minister. The plan acknowledged that the PAV was estimated with a low level of confidence and adopted a PAV of 16,500 ML/yr which is greater than the recommended level set out in 2001. On behalf of the Department of Sustainability and Environment, Chris developed a decisions paper detailing recommendations as to any consequent changes to the plan or the plan prescriptions. The paper provided an assessment of the key technical issues related to the development of the Warrion WSPA groundwater management plan. In particular the assessment focused on technical studies related to Groundwater Dependent Ecosystems; Surface water and groundwater connectivity; Acid Sulfate Soil potential; and Groundwater level trends.

Determine a New Method for Assessing the Status of Dryland Salinity Across Victoria | Dept of Sustainability and Environment

Project Manager

The 2000 National Land and Water Resources Audit estimated that 670,000 ha of land was at high risk from shallow water tables (equivalent of high dryland salinity risk) in Victoria. The Audit then predicted that by the year 2050, the risk of dryland salinity in Victoria would increase by over 450%. However, by 2008 only 256,194 ha of mapped dryland salinity existed (this equates to a 76% reduction of the Audit's prediction for 2008. With this new evidence, Chris project managed a review that assessed the extent and nature of the current dryland salinity risk, identifying and discuss the major factors influencing this and describe the likely future outlook to the year 2015 and 2050 for two areas in Victoria these being the Corangamite Catchment Management Area (CCMA) and the North Central Catchment Management Area (NCCMA). The outcomes of the review provided recommendations to DSE on future policy directions for dryland salinity management across the areas and eventually across the State. These were then later adopted in the 2008 Biodeversity white paper.

Development of a Groundwater and Irrigation Drainage Monitoring, Evaluation and Reporting (MER) Plan | Mallee Catchment Management Authority

Project Manager

Project manager who was responsible the development of a groundwater and irrigation drainage Monitoring, Evaluation and Reporting (MER) plan to help identify which parts of the landscape are sufficiently being monitored and those where threats related to groundwater and irrigation drainage are deficient. The project was a large Microsoft Access and GIS database which was accepted by the Mallee CMA in 2006.

Determining Water and Salt Balances for the Murray-Darling Basin End-of-Valley Target Sites | Murray Darling Basin Authority

Project Engineer

The project involved collation of all available flow and electrical conductivity (EC) data for the 32 Murray-Darling Basin End-of-Valley target stations for the benchmark period (1975-2000). Various statistical methodologies were then used to explore the raw data with the use of flow, EC, and saltload exceedance curves. Estimation of historical stream salinity trends for the benchmark period using the GENSTAT statistical software, and Estimation of historical catchment salt balances for the last 15 years of the benchmark period (1985-2000) was then undertaken. The results were used as a basis for policy development for environmental flow and water allocation issues throughout the Murray-Darling Basin.

Defining Groundwater Flow Systems (GFSs) on the Victorian Volcanic Plains to Accurately Assess the Risks of Salinity and Impacts of Changed Land Use | Corangamite Catchment Management Authority

Project Engineer

The project involved the development a 3D geological and hydrological numerical model using GMS MODFLOW and ARC Hydro to produce images of the lithology and groundwater chemistry under the Victorian Volcanic Plains (VVP) of western Victoria. The model was then calibrated using water level and chemistry data. The model improved our understanding of the hydrological processes across the VVP and helped delineate where local, intermediate and regional GFS dominate the salinity processes. The model also helped establish the cause(s) of rising salinity trends in the VVP as described in the Corangamite Regional Salinity Action Plan and enabled new targets to be established on saline land to measure the risk to the ecology from either increasing or decreasing salinity as described in the Corangamite Regional Salinity Action Plan.

EXPERT WITNESS STATEMENTS

1. Peninsula Hot Springs and Southern Rural Water and St Andrews Beach Country Club Golf Course - VCAT Proceeding No. P2730/2015
2. 320 Mooleric Road, Ombersley (Colal Otway Shire Council and MCG Quarries Pty Ltd) – VCAT Proceeding No. P281/2015
3. Max Castle vs Southern Rural Water - VCAT proceeding no p1348/2007
4. O'Keefe and Brimin Sands Groundwater License Application – Expert report VCAT appeal P205/2008

Publications and Presentations

Smitt, C., Goulding, N., and Silverman, T., (2014). Surat Basin Well Integrity Risk Assessment. In Proceedings of the American Society of Civil Engineers (ASCE) Shale Engineering Energy Conference, Pittsburgh, Pennsylvania, July 21-24.

Smitt, C., Vanderzalm, J., Dillon, P., Ife., D and Davidge, S., (2012). Aquifer Recharge to Assist in the Management of Produced CSG Water. in Proceedings of 2012 Annual APPEA Conference, Adelaide.

Smitt, C., Vanderzalm, J., Dillon, P., Ife., D and Davidge, S., (2011). Aquifer Recharge to Assist in the Management of Produced Coal Seam Gas Water. in Proceedings of 2011 National Groundwater Association Spring Meeting, Baltimore, Maryland.

Dahlhaus, P., Cox, J., Simmons, C., Smitt, C., (2007). Beyond hydrogeologic evidence: challenging current salinity models in the Corangamite region, Australia. Hydrogeology Journal HJ-2007-0621

Smitt, C. M., Cox, J. W., Herczeg, A., Wilford, J., Henschke, C., Liddicoat, C., and Walker, G., (2006). The origins, mobilisation and management of salt in the Eastern Mt Lofty Ranges of South Australia. Australian Journal of Earth Sciences.

Smitt, C., Herczeg, A., Davies, P., and Cox, J (2005). Identifying sources of salt and its mobilisation processes in the Eastern Mt Lofty Ranges, South Australia. in Proceedings of “Where Waters Meet” NZHS-IAH-NZSSS Auckland Conference, New Zealand, 28th November to 2nd December

Smitt, C., Gilfedder, M., Dawes, W., Petheram, C., Stauffacher, M., and Walker, G., (2001). Modelling the Effectiveness of Recharge Reduction for Salinity Management: Sensitivity to Catchment Characteristics, in Proceedings of Murray-Darling Basin Groundwater Workshop, September, Victor Harbor

Appendix B Instructions

Russell Kennedy Lawyers

Our Ref: AJS 302500-00677

Contact
Andrew Sherman
Tel +61 3 9609 1502
Fax +61 3 9609 6702
asherman@rk.com.au

Chloe Hall
Tel +61 3 9609 1685
chall@rk.com.au

14 January 2019

BY EMAIL chris.smitt@ehs-support.com

PRIVATE AND CONFIDENTIAL

Mr Chris Smitt
Principal Hydrogeologist
EHS Support
Level 17
31 Queen Street
MELBOURNE VIC 3000

Dear Chris

Mordialloc Bypass (Freeway) – Environmental Effects Statement

1. We act for the City of Kingston (**Council**).

Scope of retainer

2. We are instructed to retain your services on behalf of our client to provide an expert opinion in relation to the Mordialloc Bypass (Freeway) Project Environmental Effects Statement (**EES**) and to appear to give expert evidence at the EES Inquiry and Advisory Committee (**IAC**) hearing.

3. The project is a new section of freeway to connect the Dingley Bypass to the Mornington Peninsula Freeway. Because of the proximity of the project to the Ramsar Edithvale-Seaford Wetlands (**Wetlands**), in September 2017 the Minister for Planning requested under the *Environmental Effects Act 1978* that an EES be prepared by the Major Road Projects Authority to assess the potential environmental effects of the project.

4. Additionally, the Commonwealth Minister for the Environment and Energy determined that the project required approval under the *Environment Protection and Biodiversity Conservation Act 1999* due to the potential cumulative impact on the Wetlands, listed threatened species and migratory species. The EES also assesses and considers impact on Matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999*.

5. The Council will retain you via this office. You should liaise with this office to obtain instructions and for the purpose of providing all advice.

6. We will provide you separately a brief of documents.

7. Please prepare a fee proposal addressing this retainer.

8. As an expert witness you will also need to:

   8.1 consider the documents provided to you by us;

   8.2 undertake or procure such enquiries and investigations as you consider necessary for the formulation of your opinions;

   8.3 if necessary, meet with any such other persons or organisations as may be appropriate to obtain supplementary information to assist you in formulating an opinion;

   8.4 provide your opinions in writing in the form of a report; and

   8.5 give evidence as to your opinions orally at the IAC hearing.

Timing

9. We request your preliminary report by **13 February 2019**.

10. A public hearing is listed to commence on **25 February 2019** with your attendance (and presentation) likely later that week or early the next. **Please** let us know **before 30 January 2019** of any days where you cannot be available (from 25 February to 8 March 2019) before the schedule for the Panel is set.

Expert witness statement

11. You are to prepare a report in writing detailing your opinions in respect of:

   11.1 a peer review of the EES and the EES Attachments and Appendices relevant to your areas of expertise;

   11.2 in particular, the potential impact on groundwater levels. We draw your attention specifically to chapters 17 and 21 of the EES and the relevant Attachments and Appendices;

   11.3 matters relevant to your experience raised in Council's submissions;

   11.4 responding to any (relevant) other submissions;

   11.5 recommendations for improvement and/or changes to the Project, including to Environmental Performance Requirements; and

   11.6 any other matters you believe relevant to the proceeding within your area of expertise.

12. Your report should take the form of a narrative. Further, your report should be expressed in a manner that is unemotional and non-partisan and that reflects the objectivity and independence you have brought to the completion of your tasks pursuant to your retainer as expert. However, in your report you should address the points specifically raised in this letter and answer the questions put to you.

13. Your report will be filed with the IAC and consequently will be accessible to the public.

14. If, after reviewing this letter and the documents you have been provided, you come to the view that it is appropriate for you to address matters in addition to those set out in the list above, please let us know. If appropriate, we will provide you with a supplementary letter of instructions inviting to answer some or all of the questions you propose.

Duties as an expert witness

15. The preparation of your expert witness statement and the giving of expert evidence to the IAC Hearing must comply with the guide published by Planning Panel Victoria relating to expert evidence. A copy is **enclosed**.

Your conduct

16. You should assume that all documents and correspondence passing between this firm and you, may be, or become, discoverable and therefore be seen by the other parties in any proceeding arising out of the subject-matter of your retainer. Such documents include this letter, the documents provided to you as part of your retainer, email and other communications and any drafts of your report.

17. Please do not discuss this matter or any of the enclosed material with any person, including officers of the Council without the prior consent of this office. All communications should in the first instance be through this office. This includes seeking further documents or information in order to prepare your report; this should be done through this firm rather than from any other person directly.

18. Should it become necessary for you to retain the services of another person in order to assist you in the preparation of any aspect of your report, please let us know. Should that be necessary, you are (of course) at liberty to discuss the matter and the documents provided to you with that person provided that you do so on a strictly confidential basis.

19. You may need to visit the site and the surrounding area. Please arrange permission to do so through this office.

Conclusion

20. Please contact our office in order to confirm receipt of this letter.

Yours faithfully
RUSSELL KENNEDY

Andrew Sherman
Principal

Enclosure(s)

Appendix C Request for Clarification

January 31, 2019

Andrew Sherman
Principal
Russell Kennedy Pty Ltd
Level 12, 469 La Trobe Street
Melbourne, VIC 3000

Subject: Mordialloc Bypass EES

Dear Andrew:

I have noted several concerns after initially reviewing the following documents relating to the *Mordialloc Bypass (Freeway) Environment Effects Statement (EES);*

1 Chapter-17-Groundwater; and
2 Chapter-21-Cumulative-Impacts.

Of the concerns listed below, the review of these documents does not make it immediately clear or provide justification on the issue. Whilst I appreciate that there may be numerous external studies related to this EES which may address these concerns, if you could please forward these queries to the relevant company and/or person(s) to seek the required clarification, that would be appreciated.

1. The Numerical model boundary does not cover the entire project Domain. In fact, it 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?
2. The 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 were **not achieved** and therefore should be considered as a Class 1 model?
    a. Model boundary does not cover the area to be modelled.
    b. Use of metered groundwater extraction data.
    c. Use of Streamflow data and baseflow estimates.
    d. Model Calibration statistics not spatially presented and or fall outside the range of that of a "calibrated model".
    e. Transient calibration data not presented/undertaken?
    f. Seasonal fluctuations not adequately replicated/undertaken in all parts of the area.
    g. No model validation presented/undertaken?
    h. Model stresses and sensitivity analysis not presented/undertaken?
    i. Temporal discretisation in the predictive model not presented/undertaken?

    The implications of a Class 1 (lower confidence model) vs 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*".
    Considering the project area consists of RAMSAR listed wetlands, a Class 2 model at the minimum would be required.

3. Groundwater flow rates of 0.2 m/day are discussed. This is very high. Please confirm if this value represents the Hydraulic Conductivity as opposed to a flux or velocity.
4. 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 is conceptually and physically incorrect. Please clarify.
5. Considering the road alignment, direction of groundwater flow and likely proposed number of piles required, please justify why upwards vertical hydraulic gradients were not considered more. This has the potential to increase the rate of movement of groundwater/affect quality.
6. Please confirm why only one conceptual N-S and one conceptual E-W cross-section provided across the entire project area. Furthermore, considering the importance of the wetlands why are there no cross-sections showing groundwater/surface water interaction in the vicinity of these sensitive wetland.
7. Please confirm your conceptual (and numerical model) provide a flux from the coast to the wetlands. This is despite groundwater levels indicating a divide exists between the coast and the wetlands.
8. The 95% protection of fresh water ecosystem criteria was adopted however as the model domain includes aquatic reserves/wetlands with a high conservation value, shouldn't the 99% ecosystem protection values be more applicable?
9. Segment A2 was adopted, however Segment B or Segment C is 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 is likely influenced from the Dingley Drain
10. 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.

Should you have any questions or require additional information, please feel free to contact Chris Smitt 03 9646 8615.

Sincerely,

Chris Smitt
Director / Principal Hydrogeologist
EHS Support Pty Ltd
17/31 Queen St,
Melbourne, VIC, 3207