West Gate Tunnel Project

Report of Jonathan Medd

1 Introduction

My firm Golder Associates Pty Ltd prepared the technical report titled West Gate Tunnel Project, Technical Report C – Impact Assessment – Groundwater 1521107-6003-R-Rev0 (Technical Report) which is included as Technical Report C to the Environment Effects Statement (EES) for the West Gate Tunnel Project (Project)

The role that I had in preparing the Technical Report was lead author of the Technical Report. Other significant contributors to the Technical Report and their expertise is set out as follows:

- Irena Krusic (Principal Hydrogeologist – Golder Associates), who provided input in to the conceptual hydrogeological model as well as review of the numerical groundwater model.
- Scott Fidler (Principal Geotechnical Engineer – Golder Associates), who provided technical review of the Technical Report.
- Trevor O'Shannessy (Principal Geotechnical Engineer – Golder Associates), who provided the geological setting that was used to develop the hydrogeological conceptual model for the Technical Report.
- Timothy Anderson (Senior Hydrogoelogist – GHD), who provided peer review of the Technical Report.
- Claire Miller (Senior Hydrogeologist), who prepared the report titled, West Gate Tunnel Project, Appendix A – Groundwater Factual Report 1521107-6003-AppA-Rev0.
- Kevin Hayley (Senior Groundwater Numerical Modeller), who prepared the numerical groundwater model to assist in evaluating the potential impacts associated with groundwater inflows and drawdown during construction of operation of the tunnel component of the project.

I adopt the Technical Report, in combination with this document, as my written expert evidence for the purposes of the West Gate Tunnel Project Inquiry and Advisory Committee's review of the EES, draft planning scheme amendment and works approval application.

2 Qualifications and experience

Appendix A contains a statement setting out my qualifications and experience, and the other matters raised by Planning Panels Victoria 'Guide to Expert Evidence'.

A copy of my curriculum vitae is provided in Appendix B.

3 Further work since preparation of the Technical Report

Since the Technical Report was finalised, I have undertaken further work in relation to assisting Project Co in the development of a Groundwater Management Plan (GMP). This involved reviewing draft versions of the GMP provided by Project Co with respect to compliance with the intent the Environmental Performance Requirements (EPRs) and the key GMP elements that are described in Section 2.5 of the Technical Report.

This further work has not caused me to materially change my opinions as expressed in the Technical Report.

4 Written Submissions

4.1 Submissions Received

I have read the public submissions to the EES that are relevant to the Technical Report and my area of expertise. These include the following submissions:

29, 158, 184, 278, 326, 368, 434 and 442.

4.2 Summary of Issues Raised

The submissions have raised the following issues in relation to the following matters that are relevant to my area of expertise:

- Adequacy of characterisation of groundwater contamination (submission numbers 184 and 368)
- Treatment and management of drainage and waste water during construction (submission numbers 368 and 434)
- Management of poly- and per- fluoroalkyl substances (PFAS) during construction (submission number 368)
- Interception and mobilisation of existing contaminated groundwater plumes during construction and the migration of contaminated groundwater along the permanent tunnel structures (submission number 368)
- Drawdown of groundwater during construction which could lead to acidification of soils, which could alter the quality of land and groundwater and so affect their use (submission number 368)
- Groundwater management and disposal during operation (submission numbers 368 and 429)
- Impacts on groundwater dependent waterways and ecosystems (submission numbers 29, 158, 368 and 442)
- General comments not specifically related to groundwater impacts (submission numbers 278 and 326)

4.3 Response to Issues Raised

Set out below are my comments and response to the issues raised by the written submissions relevant to the area of my expertise.

Adequacy of characterisation of groundwater contamination

Submission numbers: 184, 368

Submission 184 suggested that the evaluation objective for groundwater did not require sufficient assessment of the impact of the Project and that the Project should be assessed to avoid the adverse effects on groundwater quality. I am of the opinion that the Technical Report provides sufficient assessment of the potential impacts of the Project on groundwater quality. The Technical Report builds on the evaluation objective and examines a broad range of potential environmental impacts associated with the project's interaction with groundwater during both the construction and operational phases. The impacts were similar to those considered for the Metro Tunnel project and East West Link.

The key concern for submission 368 relates to the extension of the tunnel approximately one kilometre further to the west than originally anticipated during the design and implementation of the main site investigation works for the EES. This means that there is less data in relation to the potential for groundwater contamination or the hydraulic properties of the relevant aquifers further to the west. This was addressed in Section 7.2.6.1 of the Technical Report by identifying sources of groundwater contamination from the site history report (Appendix A of Technical Report B *Contaminated soil and*

spoil management). Hydraulic properties of the Newer Volcanic aquifer in this section of the tunnel alignment were inferred based on data for this aquifer unit collected elsewhere along the alignment in combination with my team's experience gained from groundwater studies in this aquifer unit in the general vicinity of Melbourne CBD and to the west of Melbourne.

The information presented in the Technical Report is sufficient to inform the EES of the potential impacts and mitigation measures to address the identified impacts.

EPRs have been developed that govern the construction and operation of the West Gate Tunnel Project. EPR GWP5 (Groundwater monitoring) outlines the requirements for implementation of monitoring program during the pre-construction (design), construction and post-construction (operational) phases of the project to enable the assessment and management of the impacts of the project. In addition, a GMP is being prepared by Project Co for both the construction and operational phases of the project. The GMP is proposed to be part of the broader Construction Environment Management Plan (CEMP) and Operation Environment Management Plan (OEMP) for the project and its key elements are described in Section 2.5 of the Technical Report. The GMP requires the establishment of a hydrogeogical conceptual model, baseline conditions and a monitoring network to assist in detecting changes to groundwater during the project as well as designing mitigation measures.

Submission 368 indicated its support for the EPR GWP5 and has requested that the monitoring program include:

- *"monitoring (consistent with EPA Victoria Publication 669 (2000): Groundwater Sampling Guidelines) prior to construction to include data from winter and summer seasons;*
- *the installation of groundwater wells;*
- *sampling and/or measurements to be undertaken in accordance with the relevant guidelines including, EPA Publication 669 Groundwater Sampling Guidelines, EPA Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines, and where relevant the National Environment Protection (Assessment of Site Contamination) Measure (NEPM);*
- *data on transmissivity/ hydraulic conductivity to be obtained from groundwater wells both within, up gradient and downgradient of the construction area;*
- *groundwater flow directions;*
- *groundwater level data;*
- *groundwater quality data and consideration of SEPP (GOV) indicators and objectives; and*
- *surface elevations to be surveyed*."

EPR GWP5 requires that the sampling be carried out in accordance with EPA Publication 669. The reference to EPA Publication 668 may be a useful amendment to the EPR as it provides a description of the principles that need to be addressed in designing an investigation plan and taking appropriate hydrogeological measurements. The reference to the NEPM is not required as the relevant guidelines established by the EPA are intended to guide investigations consistent with the NEPM within the context of the Victorian statutory framework.

Additional investigations to obtain further data on groundwater conditions in accordance with EPR GWP5 can be undertaken by Project Co as part of detailed design. These investigations include drilling additional investigation bores, installation of monitoring wells, conduct of single well and packer tests in select bores and conduct of pumping tests. These works will be included in the GMP. As the GMP is proposed to be part of the CEMP and OEMP it would be subject to review and approval by the Independent Reviewer Environmental Auditor (IREA) in accordance with the Environmental Management Framework (EMF).

In relation to EPR GWP4 (Predictive groundwater model), submission 368 also recommended that *"further site-specific data be collected on the groundwater quality, levels, and flow to better inform the*

risk assessment and development of mitigation measures". This recommendation is addressed by EPR GWP5 and my response above. EPR GWP4 requires that a groundwater model be developed and maintained throughout the construction period to assess potential impacts and develop potential contingency measures.

Treatment and management of drainage and waste water during construction.

Submission numbers 368 and 434

Submission 434 states that the treatment and management of waste water during construction is not well defined, specifically in relation to water pumped from the tunnel works as well as water treatment and reuse schemes. Submission 368 identified the "*need to characterise the groundwater and decide on the appropriate treatment options before reuse, disposal or discharge"*. Submission 368 also indicated that if there is to be reinjection of extracted groundwater, this should be undertaken in accordance with Clause 20 of the *State Environment Protection Policy (Groundwaters of Victoria)* (SEPP GoV) and that EPA and Southern Rural Water approval may be required.

The approach to treatment and management of groundwater (including consideration of PFAS contamination) from dewatering excavations during construction will be defined during the detailed design phase by Project Co. Preliminary information indicates that Project Co proposes to dispose of the groundwater to sewer assuming that appropriate approvals for such disposal are provided by the relevant authorities. Other options include some reuse in construction, disposal to surface water or reinjection to groundwater, although I understand that the latter two options have not been proposed at this time. The overall project design has also taken a number of steps to reduce the amount of waste groundwater that would require such disposal in accordance with the principles of the waste hierarchy as follows:

- Reducing groundwater inflows through the use of
    - a secant pile wall at the northern portal
    - perimeter grout curtains at each of the southern portals
    - jacked cross passage construction methods
    - injection grouting prior to cross passage and egress out and under passage construction, as required based on the permeability of surrounding materials
    - operation of the EPB TBM in closed or semi-closed mode for the driven tunnel excavation
- Reuse and recycling of groundwater as part of the TBM operation and general construction works.

The EPA has provided information to WDA on how to best approach the assessment, treatment and management of waste groundwater. The disposal of intercepted groundwater to sewer is normal practice for construction projects such as this. Disposal to sewer requires the approval of the relevant authority, in this case City West Water. Section 7.5.4 of the Technical Report highlighted the potential for salt loads to affect the capacity of the relevant authorities to accept this water.

Overall, groundwater management and disposal during construction will be addressed in the CEMP for the project which is to be reviewed and approved by the IREA. A specific GMP which is proposed to be part of the CEMP is currently being prepared by Project Co in line with the elements indicated in Section 2.5 of the Technical Report. In this regard, submission 368 has stated that *"the groundwater management aspects of the CEMP must be developed and implemented to the satisfaction of the EPA"* and has indicated a number of requirements that are similar to those already outlined for the GMP in Section 2.5 of the Technical Report. In addition submission 368 has recommended that *"…it be consulted during the development of the Construction Environment Management Plan (CEMP) regarding groundwater management"*. Engagement with this stakeholder has been occurring during preparation of the EES and would continue to occur to ensure the content of the CEMP is developed to meet the relevant standards, guidelines, statutory requirements and best practice as per the requirements of EPR EMP2 (Environment management plans). My expertise does not cover the specific wording for approvals required by government authorities, which should be addressed by others.

Management of poly- and per- fluoroalkyl substance (PFAS)

Submission number 368

PFAS have been measured in groundwater samples at a number of locations across the project study area and in particular in the vicinity of the tunnel portals. Submission 368 indicates that there are emerging concerns about the health and ecological effects of PFAS in the environment and there are limited options for the treatment or disposal of PFAS contaminated wastes in Victoria, including groundwater. The EPA has indicated that PFAS impacted liquids need to be treated to capture and remove the PFAS prior to discharge to sewer (http://www.epa.vic.gov.au/your-environment/land-and-groundwater/pfas-in-victoria/managing-pfas-impacted-wastes-in-victoria).

Submission 368 has recommended that *"a new EPR be developed to address the management of, treatment and disposal of PFAS-contaminated groundwater … in consultation with EPA"*. Treatments for PFAS contaminated water are being developed and include technologies such as filtering through activated carbon or the use of proprietary filter media and adsorbents. However, the PFAS concentrated wastes from this process, i.e. the filter medium, may require storage until a method of disposal or treatment is developed for this waste. EPR GWP6 (Interception of groundwater) requires Project Co to include the methods for management of groundwater interception during construction in the CEMP. This is to include identification, treatment, disposal and handling of contaminated groundwater. The inclusion of an additional EPR for PFAS contaminated groundwater would therefore not be required.

Interception and mobilisation of existing contaminated groundwater plumes during construction and the migration of contaminated groundwater along the permanent tunnel structures.

Submission number 368

In relation to interception and mobilisation of existing contaminated groundwater plumes during construction, submission 368 has recommended that EPR GWP7 (Impacts on groundwater users) *"include assessment to ensure that contaminated groundwater is not mobilised and does not impact on sensitive receptors and beneficial uses of groundwater"*. The intent of GWP7 was to minimise the impact on existing groundwater users from the perspective of availability of groundwater, for example where groundwater drawdown during construction impacts on the ability to obtain sufficient water from the bore. The addition of these words to GWP7 is not considered consistent with its intent. The protection of groundwater quality and related beneficial uses are addressed by other EPRs. For example, EPR GWP1 (Groundwater management measures) already requires that Project Co implement a CEMP for management, monitoring, reuse and disposal of groundwater inflows during construction that complies with SEPP GoV as well as other directly relevant legislation. EPR GWP3 (Tunnel drainage and construction methods) requires Project Co adopt construction methods to minimise changes to groundwater levels to manage, mitigate and minimise mobilisation of contaminated groundwater. If changes to groundwater levels are kept to a minimum, the potential for mobilisation of contaminated groundwater to the extent that it causes an adverse impact to sensitive receptors and beneficial uses of groundwater is also minimised. Project Co has included a number of measures to achieve this which are outlined in Section 2.4 of the Technical Report. EPR GWP5 (Groundwater monitoring) outlines the requirements for a monitoring program to confirm that these management measures are achieving the outcomes required by GWP1 and GWP3.

Submission 368 also states *"…requires notification of the identification of contamination, Project compliance, and effectiveness regarding groundwater management and contingency measures."* I note that the EMF (Figure 8-1) shows that Approval Authorities would receive audit reports on compliance relevant to their approval. The requirements for notification of the identification of contamination is unclear and requires further clarification with this stakeholder. If it is in regards to monitoring and management of existing groundwater conditions, it would seem more beneficial to have a process of notification of a change in the groundwater condition that would impact on the beneficial uses of groundwater. The GMP is required to have triggers and timelines for action and hence it would seem reasonable that this request be clarified through the development of such notification processes in the GMP to meet the needs of this stakeholder.

With respect to migration of contaminated groundwater along the permanent tunnel structures, the space between the tunnel lining and the rock or soil will be progressively backfilled with pressurised grout as the tunnel boring machine (TBM) advances. I am not an expert in the operation of TBMs and associated pressurised grouting systems and hence cannot comment on the consistency of the grouting between the tunnel lining and the annulus of the hole excavated by the TBM. However, the tunnel is to be constructed as an undrained structure which would limit the potential for movement of groundwater along the tunnel due to drainage.

Drawdown of groundwater during construction which could lead to acidification of soils, which could alter the quality of land and groundwater and so affect their use

Submission number 368

Management of impacts in relation to the potential for acidification of soils as a result of groundwater drawdown have been addressed by EPR GWP3 (Tunnel drainage and construction methods) through the principle of adopting construction methods that minimise changes to groundwater levels. Project Co has included a number of measures to achieve this which are outlined in Section 2.4 of the Technical Report. These measures include provision for groundwater recharge systems using injection wells to control groundwater levels.

Concerns about groundwater management and disposal during operation

Submission numbers 368

Concerns about groundwater management and disposal during operation raised by submission 368 principally relate to the potential for mobilisation of existing groundwater contamination as a result of changes to groundwater levels due to long term operation of the tunnel. In this regard, Section 7.6.3.2 of the Technical Report indicates that for the southern section of the tunnel, the long term groundwater levels are not likely to be significantly altered. This is due to the requirements for the construction of an undrained tunnel structure which results in low limits for the seepage of groundwater into the tunnel. This seepage is estimated to be in the order of 31 m^3/day. Section 7.6.3.2 of the Technical Report also identified that the groundwater levels will rise in response to sealing a section of the current brick-lined North Yarra Main (NYM) sewer which could locally alter the flow direction of groundwater and hence the distribution of existing groundwater contamination. EPR GWP3 (Tunnel drainage and construction methods) specifically includes a requirement for Project Co to develop and implement a plan to mitigate and manage potential future displacement of contaminated groundwater in this area. I anticipate that this plan would be included in the GMP as part of the OEMP which would be subject to review and approval by the IREA or the Environmental Auditor depending on the time since construction completion.

Concerns about impacts on groundwater dependent waterways and ecosystems

Submission numbers 29, 158, 368 and 442

Concerns were raised in relation to changes in groundwater quality or level as a result of the construction and operation of the tunnels that might be detrimental to surface water systems such as Stony Creek, Yarra River or Maribyrnong River as well as to local parks and gardens. Specific concern was raised by submissions 158 and 442 in relation to changes in groundwater levels impacting on park assets and ecology, in particular Yarraville Gardens which is located to the west of the northern portal. Submission 368 relates to the protection of groundwater quality in relation to protecting groundwater dependent waterways and ecosystems which has been addressed above in relation to concerns about mobilisation of existing contamination during construction and operation of the tunnel. The principles of minimising changes to groundwater levels during construction and operation as required by EPR GWP3 (Tunnel drainage design and construction methods) also serve to protect these assets. In particular, Project Co's design includes the construction of a secant pile wall around the perimeter of the northern portal during construction to limit groundwater inflow. A contingency for a groundwater recharge system via injection wells has also been included. Both design elements serve to limit drawdown in groundwater levels and hence potential for impact on Yarraville Gardens to the west.

Submission 158 also sought baseline environmental studies in Yarraville Gardens to assess *"depth to groundwater"* and *"any existing groundwater contamination or contaminants above natural background levels or relevant health and investigation levels having regard to existing groundwater impacts from nearby industry"*. The depth to groundwater at Yarraville Gardens was assessed using five groundwater monitoring wells as part of the site investigation for the EES and was found to already be affected by drawdown associated with seepage of groundwater in the NYM sewer. The depth to groundwater is approximately 8 to 10 metres below the surface on the eastern side of the gardens. Groundwater quality data has also been collected for these wells. Project Co's design and management measures for construction of the northern portal, in particular the inclusion of a groundwater recharge system as a contingency, are intended to limit the extent of change in groundwater levels and hence limit the impact on the gardens. This also minimises the potential for mobilisation of existing groundwater contamination as outlined in the sections above. During operation, the groundwater levels are indicated to rise as a result of sealing a section of the current brick-lined NYM sewer. EPR GWP5 (Groundwater monitoring) includes the requirements for a monitoring program that can be used to assess and manage the impact of construction on the beneficial uses of surface water as well as on groundwater dependent ecosystems, in particular Stony Creek and Yarraville Gardens. This monitoring program would be included in the GMP which would be subject to review and approval by the IREA.

General comments not specifically related to groundwater impacts.

Submission numbers 278 and 326

Submission 278 raised the concern that acquisition of stratum below their property would remove future access to groundwater. There is not indicated to be a registered groundwater bore currently on this property (see Section 7.2.8.2 of the Technical Report). It is presumed that this concern relates to future value of the property due to restrictions on the ability to access groundwater. I do not have the expertise to comment on this as it relates to a land acquisition matter.

Submission 326 noted that they do not have any expertise to consider groundwater and indicated support for the expertise of Hobsons Bay City Council (HBCC) on this matter. I am not aware that HBCC has raised any specific concerns related to groundwater management and disposal during construction.

5 Response to the Preliminary Matters and Further Information Request issued by the West Gate Tunnel Project Inquiry and Advisory Committee

I understand that these requests are being addressed by others.

Declaration

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 Inquiry and Advisory Committee.

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Signed

Date: [2nd August 2017]

Appendix A Matters Raised by PPV Guide to Expert Evidence

(a) the name and address of the expert;

Jonathan Medd
Building 7, Botanicca Corporate Park,
570-588 Swan Street
Richmond, Victoria 3121

(b) the expert's qualifications and experience;

Jonathan holds a Bachelor of Science (Hons) and a Master of Environmental Science and Hydrogeology. He has over 24 years' experience in the field of environmental management and impact assessment, specifically in the areas of land contamination, groundwater contamination and groundwater flow management. Jonathan is also appointed as an Environmental Auditor of Contaminated Land and Industrial facilities under the *Environment Protection Act 1970*.

(c) a statement identifying the expert's area of expertise to make the report;

Jonathan was the lead for the Secondary Risk Assessment for Melbourne's oldest Hazardous Waste Landfill at Tullamarine, in Victoria. This was a project of State significance and involved considerable public review and consultation. More recently he has also taken lead roles providing construction, groundwater management and impacts assessment advice for Contractors over a range of infrastructure projects in Victoria including East West link. He has also provided specialist advice in relation to the Metro Tunnel project. Further information is provided in the attached CV.

(d) a statement identifying all other significant contributors to the report and where necessary outlining their expertise;

Irena Krusic (Principal Hydrogeologist), provided input in to the conceptual hydrogeological model as well as review of the numerical groundwater model. Irena has been the lead hydrogeologist and numerical modeller for the Melbourne City Link tunnel, Metro Tunnel, Main Sewer Replacement project and East West Link tunnel. Irena has over 30 years' experience in hydrogeology and has a Bachelor Degree in Geology with Major Specialisation in Hydrogeology from the University of Belgrade, Yugoslavia.

Scott Fidler (Principal Geotechnical Engineer and Hydrogeologist), provided technical review of the Technical Report. Scott has over 25 years' experience focussed on public infrastructure development, and infrastructure development for the resource sector. Scott has provided a leading role in geotechnical or hydrogeological aspects of Inner City Bypass, Gateway Upgrade and Clem7 and the Airport Link project in Queensland as well as Westconnex in Sydney and the Metro Tunnel project.

Trevor O'Shannessy (Principal Geotechnical Engineer), provided the geological setting that was used to develop the hydrogeological conceptual model for the Technical Report. Trevor has over 15 years' experience in geotechnical engineering, geological modelling and ground movement impacts for infrastructure projects including East West Link and Melbourne Main Sewer. Trevor has a B Eng. (Hons) at the Royal Melbourne Institute of Technology and is a Certified Practising Engineer.

Claire Miller (Senior Hydrogeologist), who prepared the Groundwater Factual Report. Claire has over 9 years of experience involving detailed soil and groundwater investigations. She has a BSc in Geology from Cardiff University, UK and a MSc in Hydrogeology from the University of Leeds, UK.

Kevin Hayley (Senior Groundwater Numerical Modeller), who prepared the numerical groundwater model. Kevin has 11 years' experience in the construction and calibration of numerical models of groundwater flow and contaminant transport as well as geophysical methods for environmental monitoring. Kevin has a PhD in the area of geophysics and hydrogeology from the University of Calgary.

Timothy Anderson (Senior Hydrogeologist – GHD), who provided peer review of the Technical Report.

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

The scoping requirements for the EES specify the evaluation objectives and provide the context for the technical studies informing the EES. The relevant evaluation objectives for groundwater are:

"Hydrology and water quality – To avoid or minimise adverse effects on surface water and groundwater quality and hydrology in particular resulting from the disturbance of contaminated or acid-forming 'materials, and to maintain functions and values of floodplain environments."

"Waste management – To manage excavated spoil and other waste streams generated by the project in accordance with the waste hierarchy and relevant best practice principles."

The requirements relevant to groundwater are described in the table below:

Aspect	**Scoping requirements**	Refer
Key issues	Potential for contaminated run-off or other water, including groundwater, to be discharged into surface waters or groundwater environments.	Sections 7.5, 7.6 and 8.4
	Potential for disturbance of anthropogenic contaminated soil or groundwater or naturally occurring acid sulphate soils.	Also Technical report E Surface Water
	Management of a range of waste streams from the project.	Sections 7.5, 7.6 and 8.4
Priorities for characterising the existing environment	Identify existing groundwater conditions (including declared Groundwater Quality Restricted Use Zones) and characteristics within the general area that might be affected by project works	Also Technical report E Surface water and Technical report B Contaminated soil and spoil management
	Identify known and potentially contaminated sites and ground conditions indicative of acid sulphate soils.	Sections 7.5.4, 7.6.5 and 8.4.3
	Characterise other key waste streams from the project.	Also Technical report E Surface water and Technical report B Contaminated soil and spoil management
Design and mitigation measures	Describe measures to protect surface water quality, especially during the construction phase, in the light of relevant SEPP objectives and other relevant standards and guidelines.	Sections 6.2, 7.2 and 8.2
	Describe measures to protect groundwater and aquifers, including with respect to the potential effects of constructing and operating the road tunnel.	Also Technical report E Surface water
	Describe and evaluate proposed design,	Sections 7.2 and 8.2

Aspect	Scoping requirements	Refer
	management or site protection measures that could avoid or mitigate potential adverse effects of the excavated spoil or other waste streams generated by the project on land or water values, especially with regard to the project construction activities.	
Assessment of likely effects	Assess residual effects on short-term or longer-term changes to groundwater conditions, with particular regard to ground subsidence, tunnel drainage, groundwater quality, relevant SEPP standards and beneficial uses.	Also Technical report E Surface water and Technical report B Contaminated soil and spoil management
	Assess residual effects on surface and groundwater users or environmental values from contaminated soil, acid sulphate soils or contaminated groundwater.	Sections 7.5.4, 7.6.5 and 8.4.3
	Analyse residual effects on land and water values from project waste streams.	Also Technical report E Surface water and Technical report B Contaminated soil and spoil management
Approach to manage performance	Describe principles for programs for monitoring any flooding events during construction, surface water and groundwater quality and groundwater levels.	Sections 6.4, 7.7 and 8.4
	Describe contingency measure principles if unexpected adverse effects are identified.	Also Technical report E Surface water
	Describe principles to be adopted for monitoring management of spoil and other waste streams.	Sections 6.4, 7.5, 7.6 and 8.4

I was engaged by Clayton Utz (6 July 2017) as the expert witness – contaminated soil and spoil management to carry out the following work:

- Review the public submissions and identify those relevant to my area of expertise.
- Review the Technical report and identify whether there are any changes to the conclusions of the report arising out of the issues raised by the public submissions or as a consequence of the any other relevant matter.
- Prepare an expert report that:
    - responds to the public submissions relevant to my area of expertise;
    - addresses my previous Technical Report and any changes to the conclusions reached; and
    - other matters that I consider relevant to my area of expertise.

(f) the identity of the person who carried out any tests or experiments upon which the expert relied in making this report and the qualifications of that person;

ALS Limited and Eurofins performed the environmental testing of groundwater samples. ALS and Eurofins are accredited by the National Association of Testing Authorities (NATA) for the analyses undertaken for this assessment.

(g) a statement setting out the key assumptions made in preparing the report;

- All submissions relevant to my area of expertise have been allocated to me by WDA and I have not reviewed any other submissions other than those allocated to me.
- The Technical Report relies on Project Co's tendered design and information gathered within the study area.
- This impact assessment of the West Gate Tunnel Project relies on site investigation data gathered for this project. Due to evolution of the design over time, the data is less detailed in the area of the westbound portal and tunnel that extends approximately one kilometre to the west of the eastbound southern portal. The following outlines how this has been addressed in this EES:
    - An assessment of the potential groundwater contamination impacts for the design was possible by identifying potential sources of contamination contained in the site history report (Appendix A of Technical Report B Contaminated soil and spoil management). Some of the historical investigations provide data relevant to understanding potential groundwater contamination.
    - Hydraulic properties of the Newer Volcanic aquifer unit in this section of the alignment has been inferred based on data for this aquifer unit collected elsewhere along the alignment in combination with our experience.

  It is also expected that Project Co will conduct additional investigations as required to address information gaps in this area of the project in a manner that is specific to its design. This would also be the case for other areas of the project where the level of information gathered and deemed sufficient for the EES needs to be supplemented for the design, construction and operational phases.
- This assessment is intended to characterise potential groundwater impacts associated with construction of the West Gate Tunnel Project and waste likely to be generated from construction works. As part of this, site-specific investigations have been carried out to gain a broad understanding of the groundwater quality and potential for contamination in the study area.
- Investigation locations for the purpose of assessing groundwater contamination were generally sited based on concurrent geotechnical and groundwater investigations. Some groundwater well locations were chosen specifically to assess groundwater quality between the tunnels and properties with known or potentially contaminated groundwater. In some cases, investigation of specific areas were not possible due to access restrictions posed by existing roads, below ground infrastructure and third party property access limitations. Investigations supplemented the information available from existing investigation reports relating to groundwater contamination.
- Interpretation of sub-surface conditions and the nature and extent of contamination is based on field observations and chemical analytical data from widely spaced sampling locations. Site investigations identify sub-surface conditions only at those points where sub-surface tests were conducted or samples were taken. It is possible that contamination exists in areas that were not investigated, sampled or analysed.
- This assessment is based on conditions that existed at the time the assessment was completed. Its findings and conclusions may be affected by the passage of time, by man-made events such as construction on, or adjacent to, the project boundary and by new releases of hazardous substances.

Appendix B CV

Education

Master of Science Environmental Science & Hydrogeology, University of Melbourne, 1995

BSc (Honours) , University of Melbourne, 1989

Certifications

Statutory Environmental Auditor - Contaminated Land and Industrial Facilities

Affiliations

Member, Environment Institute of Australia and New Zealand

Member of Australian Land and Groundwater Association

Member of National Ground Water Association

Relevant Experience

Statutory Environmental Auditor - Contaminated Land and Industrial Facilities

Environmental Risk Assessment

Groundwater Assessment and Remediation

Environmental Management

Contaminated Land

Golder Associates Pty Ltd – Melbourne

Employment History

Golder Associates Pty Ltd – Melbourne, Australia

Principal Hydrogeologist (1997 to Present)

Jonathan is responsible for leading the Water Remediation technical capabilities for Golder Australia and is a leader within Golder's Site Investigation Remediation Technology Network (SIRTN). SIRTN is a global internal community which shares best practice knowledge amongst more than 700 professionals to help provide the best solutions to our clients.

Jonathan has over 25 years of experience in research and environmental consultancy specialising in groundwater quality assessment, hydrogeological investigations groundwater remediation and due diligence. His expertise covers project in the mining, landfill, civil / infrastructure and manufacturing areas.

Jonathan has provided specialist hydrogeological and groundwater related advice across the country for large scale projects such as Melbourne Metro Rail project, Westgate Tunnel Project, East West link Project, Tullamarine Hazardous Waste Landfill, Lennard Shelf mine rehabilitation, Thevenard Island rehabilitation. He possesses a unique set of skills that enable him to evaluate hydrogeological issues from different perspectives and to collaborate with others to enhance the overall understanding of regional and local hydrogeology and related groundwater impacts.

Jonathan specialises in combining multiple disciplines to develop risk management solutions for complex land, hydrogeological and groundwater impact problems.

Ernst & Young – Melbourne, Australia

Senior Project Manager (1999 to 1999)

Environmental Business Risk Management. Responsible for providing business risk management advice including the integration of risk based environmental management advice into company business plans.

Hyder Consulting Pty Ltd – Melbourne, Australia

Environmental Consultant (1995 to 1997)

Environmental Management, Land Rehabilitation and Assessment. Development of preliminary Environmental Management Plans in accordance with ISO14001 standards.

University of Melbourne – Melbourne, Australia

Guest Lecturer (1993 to 1995)

Guest Lecturer at the University of Melbourne. Postgraduate lectures on the application of biotechnology to remediation of contaminated soils and groundwater.

OTEK Australia Pty Ltd – Melbourne, Australia

Environmental Scientist/Hydrogeologist (1994 to 1994)

Hydrogeological investigations, fate transport modelling and site assessment / remediation.

PROJECT EXPERIENCE – HYDROGEOLOGY & GROUNDWATER

East West Link
Melbourne, Victoria

Technical Director responsible for leading hydrogeological input in the Momentum Infrastructure tender for the East West Link Tunnel. Activities included interpretation of the site investigation data, development of a 3D geological model for the tunnel alignment, development of a hydrogeological conceptual model and numerical modelling to analyse potential impacts and provision of design input advice. Tasks also included providing advice on maximum design groundwater levels and estimation of tunnel inflows during construction. The works were summarised in a final design report for the submission which also presented an assessment of potential hydrogeological risks.

Westgate Tunnel Project
Melbourne, Victoria

Technical Director responsible for the hydrogeological and groundwater contamination related investigations and impact assessment for the West Gate Tunnel project. This is a major infrastructure project, providing an alternative road link from the west into the Melbourne Central Business District. The project involves a 2.5 kilometre long tunnel through the complex geology and hydrogeology in the west of Melbourne. The investigation phase of the project included installation of 117 monitoring wells, in situ hydrogeological testing in numerous bore holes and two pumping tests. The local and regional hydrogeology was interpreted from the investigation and regional data to enable numerical flow modelling and an overall assessment of potential, groundwater related impact from the project construction and operation.

Tullamarine Landfill Groundwater Risk Assessment
Tullamarine, Victoria

Project Manager and lead risk assessor responsible for the comprehensive assessment of the groundwater conditions and human and ecological risks that may be associated with the impacts to groundwater from the former Tullamarine Hazardous Waste Landfill. The risk assessment considered both short and long term risks to the environment. The assessment was supported by a 3 year program of planned hydrogeological, hydrological and ecological studies. The implementation of this program required the development of a detailed Groundwater Quality Management Plan. The risk assessment methods included vapour risk migration modelling, recreational exposure modelling, direct ecological impact assessment using a "multiple lines of evidence" approach as well as the development of a numerical groundwater model to support long term risk predictions.

The project also required continual liaison with the Tullamarine Landfill Community Consultative Committee.

Melbourne Metro Rail Project, Victoria

Provision of specialist advice in relation to groundwater contamination investigation and management across the project. This included the design of groundwater contamination investigation programs and evaluation of data contribution to the EES. Jonathan also provided specialist advice and concept designs relating to the management of specific groundwater contamination issues to minimise the potential for future impacts to beneficial uses of groundwater and land.

Yallourn Ash Landfill
Yallourn, Victoria

EPA appointed environmental Auditor for the Yallourn Ash landfill. The landfill is situated in the former Yallourn North Open Cut mine on the edge of the Yallourn Monocline. This complex hydrgeoleological setting has considerable implications on the hydrogeological features that influence the movement of groundwater from the Ash Landfill and assessment of potential impacts on receiving water bodies such as the LaTrobe River. Jonathan has been working on this project for over six years and during this time has provide considerable input into the hydrogeological understanding of the site in relation to the regional mine setting. This is because of his strong ability to combine the regional hydrogeological setting with other more local groundwater and contamination data to improve the overall understanding of groundwater flow and related impacts. This has challenged more traditional hydrogeological interpretations that have been assumed in the past.

Loy Yang Ash Pond
Traralgon, Victoria

Jonathan was the lead hydrogeologist responsible for the independent review of the hydrogeology relating to the seepage leached ash waste water from the Loy Yang Ash ponds. His role was to challenge the interpretation and quality of work being carried out be the incumbent consultant. His work resulted in a improved understanding of the nature and extent of the seepage from the ash pond and the factors influence its movement in the groundwater. This enabled the client to have confidence that the risk posed to the environment by the seepage was very low.

Lennard Shelf Mine
Pillara, Western Asutralia

Project Director responsible for the environmental investigation and assessment of risk or the closed Lennard Shelf Mine. The mine includes a 600 metre deep underground zinc mine. A key challenge in this project is the efficient assessment of the hydrogeological conditions to help understand the potential impact associated with mine void drainage on the surrounding users and agribusiness in the regional setting. The initial stages of the project has involved review of a large amount of mine exploration and operational data to develop and hydrogeological conceptual model for the site. This model has enabled a considerable change in the understanding of the potential risk associated with the mine and its impacts on groundwater quality. The conceptual model has enabled us to demonstrate how the limestone aquifer setting of the mine is disconnected from the regional aquifer system that supplies groundwater for local agribusiness and drinking water.

Kwinana Alumina Refinery
Kwinana, Western Australia

Technical lead involved in the review of a number of hydrogeological and related investigation reports and site data to develop a hydrogeological conceptual model for the site. The site hydrogeology involves integrating the understanding of the relationship between three main aquifer systems in a marine setting with a saline instruction. The work is building toward an improved understanding of the relationship between impacted groundwater at the refinery and the nearby marine ecosystem in order to assess legislative compliance and improve operation efficiency.

PROJECT EXPERIENCE – CONTAMINATED LAND & GROUNDWATER

Mobil Altona Refinery
Altona, Victoria

Project Director responsible for the assessment and remediation of ExxonMobil's Altona Refinery in response to a Notice from the EPA that ultimately required a Clean Up Plan to be prepared for the site. The approach required the development of a strategic plan and road map to guide the client and Auditor through the 3 year work program, culminating in a CUP that was acceptable to all stakeholders. Investigation tasks included preparation of a detailed site history, hydrogeological assessment, air quality assessment, conceptual site model, risk assessment report and risk management plan. Remediation works included operation of an existing treatment system for a plume of free phase steam cracked naphtha and further pilot trial works to assess potential alternate remediation approaches to optimise treatment.

Pipeline Petrol Release Site, Melbourne
Melbourne, Australia

Project Director responsible for the clean up of a release of petrol into a fractured rock aquifer. The projects include site investigation of air and groundwater quality as well as the design and installation of a range of remediation systems. To date, over 600,000 litres of petrol has been successfully recovered. Tasks included the investigation, design, construction and operation of a groundwater treatment system in a residential area which includes extraction followed by reinjection of treated groundwater. The system has successfully captured the hydrocarbon impacts and is gradually reducing the extent of the impacted groundwater area.

Thevenard Island Rehabilitation Project
Western Australia

Technical Director responsible for the investigation and design of a soil and groundwater remediation approach for Chevron's oil and gas production facility on Thevenard island. Works have included working with Chevron to conduct a DSI, Remediation Options assessment and detailed remediation cost analysis. This work has led to development of the remediation strategy for the site, input into the design plant nursery trials to evaluate contaminant toxicity and conduct of a range of soil remediation trial in preparation for presentation of the approach to the Auditor and regulator.

Paint Manufacturing Facility
Sunshine, Victoria

Project Director responsible for helping the client respond to a Notice from the EPA that required a Clean Up Plan to be prepared for the site. Activities included a hydrogeological assessment, development of a conceptual site model, risk assessment for soil, soil vapour and groundwater leading towards development of a Clean Up Plan and associated costing for implementation. Specialist toxicological advice was also provided. The works were conducted in a very short time frame and were well regarded by the Auditor.

Defence Site Maribyrnong - Former Explosive Manufacturing Facility
Melbourne

Technical Director responsible for input into the strategy for assessment, remediation and closure of issues relating to soil vapour and groundwater impacts at a former defence explosives manufacturing facility. The objective of the project is capitalise the value of the land for Defence by remediating the site in an effective manner and achieve a Statutory 53X audit. This project is progressing towards a remediation specification. Innovative soil vapour investigation techniques were used to identify the potential sources and extent of a carbon tetrachloride groundwater plume. A remediation pilot trial is currently under way for this plume. Works have also included the development of a detailed hydrogeological conceptual model for the site.

Former Explosive Manufacturing Facility
Melbourne, Victoria

Technical Director responsible for leading the strategy for assessment, remediation and closure of issues relating to soil vapour and groundwater impacts at a former explosives manufacturing facility which is currently under a Statutory 53X audit. An Audit has successfully been achieved for one portion of the site. Groundwater impacts form several different and extensive plumes exist at the site. Contaminants include tetrachloroethene, trichloroethene, BTEX, nitrobenzene, chloronitrobenzene, perchlorate, nitrate and ammonia. A number of carefully designed investigation programs and field scale pilot trials were conducted in collaboration with the client leading to a full scale in situ chemical reduction treatment for the trichlororethene plume. This treatment is proving to be very successful. We are also providing strategic advice to optimise sale of the site. Works have also included the development of a detailed hydrogeological conceptual model for the site.

Ford Geelong - Groundwater Interception Trench
Geelong, Victoria

Project Director responsible for the investigation, design, construction and operation of a groundwater interception trench to mitigate potential impacts to an adjacent creek. This involved the successful attainment of CUTEP determination from EPA without a Statutory 53X Audit. The system continues to operate successfully.

Ford Geelong - Groundwater Biosparge System

Project Director responsible for the investigation, design, construction and operation of a groundwater biosparge system at Ford's manufacturing facility. The system was so successful that is has progressively been expanded to treat a wider area of the plume. A Clean Up Plan was also developed for the site in response to a Notice from EPA.

Former Fitzroy Gasworks Plume Containment System Design
Victoria

Technical director responsible for the preliminary design of a groundwater capture and migration control system. The design included developing a conceptual hydrogeological model, numerical modelling and sensitivity analysis to form a preliminary design to mitigate the potential movement of impacted groundwater from the former Fitzroy Gasworks during the proposed construction of the East West Link tunnel.

Former Chlorinated Organic Manufacturing Site
Melbourne

Project Director responsible for the assessment and remediation of a former chlorinated organic manufacturing facility in response to a Notice from the EPA that ultimately required a Clean Up Plan to be prepared for the site. This is understood to be one of the first Clean Up Plans prepared in Victoria. A number of carefully design investigation programs and bench scale remediation options assessments were conducted for a complex mixture of organics. The works have resulted in a non stator agreement with the Auditor EPA on the practicability of remediation of groundwater. We prepared the soil remediation works and are currently in the design and tendering process. In our role on this project we have also provided considerable strategic advice that has resulted in the successful sale of the site.

Rail Maintenance Yard
Victoria

Responsible for the investigation of arsenic impact of soil and groundwater at an operational rail maintenance yard. Activities included developing a remediation solution for the arsenic impacted waste that integrates with the proposed redevelopment of the site for ongoing use as a rail yard. Providing ongoing advice to a community forum and responsible for negotiating the remediation design with the EPA.

Expert Witness Representative
New South Wales

Responsible for the management of a team providing expert witness advice to Planning NSW on the use of a direct fired thermal oxidiser to remediate hydrocarbon and chlorinated organic impacted soils. Responsible for delivering the team's findings at the Commission of Enquiry.

Fertiliser Manufacturer Victoria	Responsible for the design of a biopile network to remediate fuel oil impacted soils at an operational fertiliser manufacturer. Assisted in the tendering and management of the contractor responsible for conducting the works. Remediation of the contaminated soils was achieved with 12 to 16 weeks.
Former Gasworks Victoria	Responsible for the design of a biopile network and management of the contractor to remediate dichlorobenzene contaminated clays at former gasworks. Assisted in the management of the contractor responsible for conducting the works.
Former Quarry Victoria	Responsible design, procurement and installation of a pilot trial vacuum enhanced leachate recovery system for a former quarry that was filled with petroleum tank bottom sludge's. This trial is part of a larger rehabilitation design for the former quarry.
Council Depot Victoria	Project Director responsible design, procurement and installation of an automated groundwater treatment and control system as well as bioremediation of soil impacts leading to cost effective development of the site for high density residential land use and a public park. In an effort to reduce long term costs to the client the groundwater remediation system is being progressively moved to biosparging.
Council Depot Victoria	Responsible for assessment of soil and groundwater contamination for an operational council depot. Tasks also included air emission studies and health risk assessment. This project is currently in Pilot Trial stages for groundwater treatment.
Former Printed Circuit Board and Electronics Manufacturer Victoria	Involved the detailed investigation of a site impacted with chlorinated solvents in fractured volcanic rock and provision of ongoing management and risk assessment advice.
Former Capacitor Manufacturing Facility Victoria	Involved the detailed investigation of a site impacted with Polychlorinated biphenyls and other chlorinated solvents. Soil remedial strategies include the potential use of thermal treatment system to desorb chlorinated organics and condense them into a concentrated liquid for subsequent dechlorination. Groundwater impact of free product containing chlorinated solvents and PCBs has also occurred and remedial strategies included a combination of source excavation & dissolved phase extraction due to times frames required. Remediation of soil is currently under way.
Former Gasworks Redevelopment Victoria	Project Manager responsible for investigation, remediation design and clean up supervision of a former gas works site that is subject to Statutory Environmental Audit. This site is being redeveloped as a school facility.
Business Park Docklands, Victoria	Project Manager responsible for co-ordination of a site investigation involving 260 bore locations and approximately 20 groundwater well installations within 10 days. The investigation information was being collected to facilitate the divestment of the property.
Terminal Facility Altona, Victoria	Project Manager responsible for providing strategic environmental assessment and contamination advice to an International Terminals Operator for storage of bulk flammable chemicals. Involves ongoing investigation, monitoring and advice

Cyanide Contamination Study South Australia	Part of a multi-disciplinary team investigation soil, vapour and groundwater contamination from suspected historic disposal of cyanide. Responsible for establishing protocols for measuring potential cyanide gas flux emissions from soils at the site.
Canal Rehabilitation Project Sydney, New South Wales	Part of a multi-disciplinary team involved in identifying strategic options for reduction of contaminant input loads and future development of the canal. Provision of technical advice of contaminated land, water and waste water inputs and groundwater discharge and contamination potential.
Major Oil Company Australia	Provision of environmental advice concerning contamination of land and groundwater. Liability advice, contractual agreement interpretation. Key client contact and responsible for development of site management and work plans, specific investigation and QA/QC procedures to satisfy contractual obligations. Client liaison, provision of technical advice. Manager of a review of 43 site case histories to determine potential worst case environmental liability and risk ranking.
Development of Former Gasworks Contaminated Site Melbourne, Victoria	Part of a multi-disciplinary team involved in identifying, purchase negotiation, planning and developing options for future development of a contaminated property. Responsible for provision of environmental advice and determining potential costs associated with each development strategy.
Gasworks Remediation Melbourne, Victoria	Responsible for the development of guidelines for validation, assessment, QA/QC, auditing, and remediation activities for the West Melbourne Gasworks Clean-Up Project.
Depot Remediation and Biotreatment Pile Tasmania	Project management, design and implementation of the first biotreatment cell on public land in Tasmania. Included planning of site remediation activities, coordination of sub-contractors and suppliers, management of site operations, negotiation with Department of Environment and Land Management and local Councils. Final validation results indicate that this remediation strategy has been successful.
Dichlorobenzene Bioremediation Project Melbourne, Victoria	Responsible for the technical design and overview of the bioremediation of 3,000 cubic metres of dichlorobenzene contaminated soil. The project was successful with over 99.9% destruction of the contaminant.

PROJECT EXPERIENCE – ENVIRONMENTAL AUDITING

Huntsman Chemical Company of Australia Pty Ltd, 454 -460 Sommerville Road, Brooklyn Melbourne, Australia	Statutory Environmental Audit under Section 53V of the EP Act (1970). Audit of risk of possible harm to land and groundwater associated with activities at the site. The site has operated as a chemical manufacturing plant since its construction in 1941. Over its history, the site has been used to manufacture a wide range of chemicals and chemical products including pharmaceuticals, plastics, resins, phenols, styrene and styrene derivatives such as polystyrene and expanded polystyrene. The Audit included an operational review of current and historic activities at the site to identify possible sources of contamination.
Energy Australia - 53V Landfill Audit Yallourn, Victoria	Works included: 1. Verification of a Landfill Monitoring Program as per the requirement of Appendix 5 Section 5.4 of the Environment Protection Authority (EPA) publication 1323.2 Landfill Licensing Guidelines. 2. Conduct of a 53V Statutory Environmental Audit for the ash landfill, hazardous waste landfills as well as the asbestos containing material and synthetic mineral fibre landfill.
OneSteel Martin Bright, Cliffords Road, Somerton Melbourne, Australia	Environmental Audit under Section 53V of the EP Act (1970). Audit of risk of possible harm to land, groundwater and surface associated with Chrome Plating activities at the site. Included an operational audit of chromium handling of current and historic electroplating facilities. This project includes ongoing independent review of the groundwater remediation process.
Residential Development, 32 – 34 Nepean Highway, Seaford Seaford, Victoria	Environmental Audit under Section 53X of the EP Act (1970) for a 41 unit residential development on a former Service Station Facility. Currently underway.
Kindergarten Facility. 3-7 Fulton Road, Armadale Melbourne, Australia	Environmental Audit under Section 53V of the EP Act (1970). Audit of risk of possible harm to land at the site. Assessment of remediation of soils at a Kindergarten facility and provision of an Audit with respect to the suitability of the final condition of soils at the site for ongoing use as a play area for the facility. Included attendance at community and council stakeholder meetings.
Residence, 41 Charles Street, Prahran Melbourne, Australia	Environmental Audit under Section 53X of the EP Act (1970). Issue of a Statement of Environmental Audit for a residential extension.
Warehouse, 32-34 Kerr Street, Fitzroy Melbourne, Australia	Environmental Audit under Section 53X of the EP Act (1970). Issue of a Statement of Environmental Audit for redevelopment of a warehouse in a set of residential apartments.
Landfill 53V Audit Keilor, Victoria	Statutory 53V Environmental Audit of a former landfill on the edge of a creek.
Statutory Environment Auditing Support Melbourne, Victoria	Assisted in the preparation of approximately 100 Statutory Environmental Audit reports on behalf of EPA appointed Auditors of Contaminated Land. Major audits completed and currently undertaken include the former West Melbourne Gasworks Site, Maygar Army Barracks, South Melbourne Gasworks, HMAS Lonsdale Stages 1 and 2, Albion Explosives and many major inner city residential development projects

Car Manufacturer Melbourne, Australia	The audit was part of the car manufacturer's Environment Improvement Plan and the scope was developed in consultation with EPA. The audit included: 1. A Waste Management Practices Environmental Compliance Audit to assess the current solid and liquid waste management practices against EPA legislation and GM Holden's EPA Site Waste Discharge License. 2. A Waste Generation Audit to establish a profile of the current general wastes, Prescribed Industrial Wastes (PIW), and recyclable materials generated on-site and to assess management practices in order to identify opportunities for higher levels of waste management with to the waste hierarchy.
Aluminium Wine Cap Fabricator, Brooklyn, Victoria Australia	Due Diligence. Aluminium Wine Cap Fabricator. Operational audit of compliance for a medium sized manufacturing business. The business fabricates and prints screw caps for wine bottles and beer bottle tops. The project involved identifying their compliance with respect to relevant environmental legislation. Their manufacturing plants in Victoria and Queensland were reviewed for compliance. The review resulted in the need to discuss the findings with the EPA in order to establish a process upon which to go forward with respect to licencing.
Environmental Oil, Laverton Melbourne, Australia	Support Auditor for an Environmental Audit of a Waste Oil Recycling facility in order to address the requirements of the Environmental Protection Authority, Victoria. This project uses risk management methodologies to prioritise identified issues and associated improvement plans.
Compliance Management Review Melbourne, Victoria	Lead Auditor responsible for review of a gas utility company's compliance to Victorian Environmental and Dangerous Goods Legislation. The organisation's degree of compliance was evaluated using risk assessment methodologies in order to provide a prioritised list of Risk Management Improvement Plans.
Due Diligence Review Melbourne, Victoria	Lead Auditor responsible for an Environmental Due Diligence review of a major domestic Australian airline. Project required identification of high risk issues on behalf of the client as part of a prospective partial purchase of the airline.
Due Diligence Review Melbourne, Victoria	Lead Auditor part responsible for an Environmental Due Diligence review of 14 commercial and industrial properties for GE Capital.
Due Diligence Review South Australia	Lead Auditor responsible for an Environmental Due Diligence review of an automotive parts production and assembly plant for Cummins Engine Company. Lead Auditor responsible for an Environmental Due Diligence review of an automotive parts production and assembly plant for Cummins Engine Company.

PROJECT EXPERIENCE – ENVIRONMENTAL PERMITTING AND RISK MANAGEMENT

Works Approval Application, Soil Treatment Facility South Australia	Works Approval Application for the thermal treatment of hydrocarbon impacted soil. Tasks included detailed assessment of air emissions.
Works Approval Application, Soil Treatment Facility Victoria	Draft Works Approval Application for a contaminated soil treatment facility. The works approval was specifically designed to facilitate use of multiple soil treatment techniques and hence set clear performance requirements with respect to emission to the environment to both meet and exceed environmental regulatory requirements.
Landfill Site, Sunbury Victoria	Project Director responsible for preparation of a business case and feasibility study for a multi-soil treatment technology facility in Sunbury. Tasks included reviewing EPA information and interviews to establish the potential market opportunity. Involved working with the proponent to attain HazWaste funding.
Works Approval Application, Landfill Victoria	Prepared a Works Approval Application for an extension to an existing landfill facility in Victoria t that currently receives Prescribed Industrial Waste.
Corporate Environmental Risk Management Framework Victoria	Consultant responsible for helping VicTrack Access develop a Corporate Environmental Policy and Environmental Plan of Action. Project is workshop based to ensure that the issues are captured and that ownership remains with VicTrack. This project is ongoing.
Whole of Business Risk Management Review Regional Victoria	Part of a multidisciplinary team involved in developing a Whole of Business Risk Management framework for a regional water authority.
Corporate Environmental Risk Management Framework Melbourne, Victoria	Consultant responsible for initiating the development of a Corporate Environmental Management Framework for one of Australia's largest private Dairy Co-operatives. This project utilised risk assessment and risk management procedures as well as organisational awareness training and risk identification workshops to develop the framework. The project is still underway.
Risk Assessment of Landfill Rehabilitation & Development Kuala Lumpur, Malaysia	Responsible for the preparation of a semi-quantitative environmental risk evaluation of a proposed landfill rehabilitation and commercial / residential development. The document was submitted to the Malaysian Department of Environment for review.
Hazard Reduction Study Tasmania	Party of a team responsible for site auditing, hazard identification and preparation of environmental management plan to reduce potential hazards for an Iron Ore mine, slurry transfer pipeline, pelletising plant and ship loading facility. The study used risk assessment techniques to evaluate and prioritise hazards and will form part of the mine's permit condition requirements.
Geothermal Pipeline, Environmental Risks Assessment Ngawha, New Zealand	Lead Auditor responsible for inspection and evaluation of the environmental risks associated with the installation of a geothermal pipeline associated with a Geothermal Power Generation Plant.

Due Diligence New South Wales	Included preliminary due diligence auditing of approximately 90 Rail Estate properties, marketing and strengthening of market opportunities, liaison with NSW EPA, development of assessment strategy for a Brick Pit owned by Sydney Water and project initiation of our successful bid.
DNAPL Remediation - Strategic Options Paper Melbourne, Australia	Responsible for compilation of a strategic options paper for the risk management and control of a major DNAPL spill and groundwater plume in Australia. The paper will be provided to the local and regulatory Authorities as well as the public for review as part of the decision making process for developing a detailed contaminated groundwater management plan.
Environmental Management Plan Melbourne, Victoria	Development of a preliminary Environmental Management Plan for the CityLink Project in accord with ISO14000 standards. Identification of Statutory requirements, State and National Guidelines/Standards, Best Practice Environmental Management. Development of monitoring and reporting structures. The plan has been successfully implemented as part of the CityLink Project.
Construction Environmental Management Plan Melbourne, Victoria	Development and implementation of an Environmental Management Plan for a major bayside residential development project in Melbourne. The content of the management plan was in line with the principles of the ISO14000 standards.
Design & Construction Environmental Management Plan Melbourne, Victoria	Development and implementation of an Environmental Management Plan for the design and construction of a major commercial and residential development project on the Yarra River, in Melbourne. The content of the management plan was in line with the principles of the ISO14000 standards.
Landfill Works and Planning Approval Melbourne, Victoria	Responsible for establishment and Project Management of a multi-disciplinary team of specialist consultants involved in preparation of the necessary documentation for a EPA Works Approval and License as well as to obtain Local Government Planning Approval. Tasks involved preparation of an Environmental Impacts Assessment as well as a detailed Environment Management Plan and implementation structure for construction and operation of the facility in accord with ISO14000 standards. Issues included noise, waste water discharge negotiation, groundwater, flora and fauna, traffic movement, flora and fauna and air pollution. The application has been successful.
Best Practice Contaminated Land Management Australia	Preparation and provision of technical advice on best practice management of contaminated land portfolios in Government Agencies.

PROJECT EXPERIENCE – ENVIRONMENTAL RISK ASSESSMENT

Risk Assessment Manual Australia	Responsible for development of Golder Associates' Risk Assessment Manual for both human health and ecological risk evaluation.
Wetland Development Melbourne, Victoria	Development of a preliminary risk assessment for exposure to Dioxins as a part of a wetland development project.
Risk Assessment Advice, Various Properties Melbourne, Victoria	Provision of risk assessment advice on exposure to polycyclic aromatic hydrocarbons (PAH) to GHD as part of their assessment of various PAH contaminated properties.
Air Dispersion Risk Assessment, Former Quarry Melbourne. Victoria	Development of a two dimensional risk assessment and air dispersion model to evaluate the human health risks associated with emission of vapours from the quarry on nearby users.
Former Gasworks Melbourne, Victoria	Responsible for various risk assessments including groundwater fate and transport, aesthetic risk, groundwater extraction and use. This site is being developed and a Primary School.
Council Depot Melbourne, Victoria	Responsible for the preparation of a human health risk assessment for emission of vapours from contaminated groundwater into nearby residences. This was combined with air quality testing to verify results as well as considerable community and stakeholder consultation.
Human Health & Ecological Risk Assessment Melbourne, Victoria	Responsible for the preparation of an ecological and human health risk assessment for conservation park in Victoria, Australia. The site was a former riffle range and is currently inhabited by a range of significant indigenous species and migratory birds. The assessment is currently underway.
Explosives Factory Melbourne, Victoria	Responsible for development of quantitative risk based clean up criteria for the site including chemicals used in the manufacture of explosives. This involved the development of a new risk model for deriving these criteria. The model has some significant differences to those commonly used in current consulting practice.
Explosives Factory Melbourne, Victoria	Development of quantitative risk models for groundwater extraction and use for recreational purposes. Involved the development and application of site specific models.
Groundwater Due Diligence Study Gippsland, Victoria	Responsible for the site audit and preparation of due diligence review of groundwater contamination at a major Victorian Power Station. The document was part of the due diligence information provided to prospective purchasers of the facility.
ICI Australia Limited Melbourne, Victoria	Assisted in development of a preliminary hydrological model concerning discharge of contaminated run-off water into and ephemeral creek. Preparation of a submission to EPA concerning application for a Waste Discharge License.
Groundwater Modelling Melbourne, Victoria	Project management and initiation of a fate transport modelling survey for a contaminated groundwater plume for BP. Interaction with hydrogeological experts to determine data input requirements and necessary field information. Development of proposal and negotiation with client for project approval.