WATER FOR GOULBURN

Highlands Source Project

PART C

Environmental Impacts and Values

GHD CLIENTS | PEOPLE | PERFORMANCE

GOULBURN MULWAREE COUNCIL

8. Environmental risk analysis

The DGRs for this Environmental Assessment included the condition to undertake an environmental risk analysis. This chapter addresses that requirement. The rationale and details of the risk analyses undertaken are documented, as well as a description of how they were used to inform the overall Environmental Assessment.

8.1 Impacts, risks and risk analysis

The Project would have impacts on the surrounding environment. An impact can be considered as any change to the environment either wholly or partially resulting from activities associated with the Project. Different impacts may either be beneficial to the environment and local communities, or may give rise to changes that are considered as less desirable. The events or activities that would lead to impacts that do not provide a benefit would require some level of monitoring, mitigation and/or management. The extent of management or monitoring required would depend on the level of risk that may be associated with the impact.

Risk is generally measured as the result of a combined consideration of, in particular: (i) how likely is it that an impact would occur (*i.e.* the likelihood), and (ii) what would be the outcomes if it did occur (*i.e.* the consequence)? A risk analysis process (Figure 8.1) was a useful way to identify, assess and develop mitigation measures for the environmental impacts that may be associated with the Project.

For this Environmental Assessment, a risk analysis was the whole process of:

- Describing the current environment in the vicinity of the Project and the values it provides;
- Identifying and describing the potential impacts on the environment;
- Assessing the level of risk that may be associated with the impact, based on a consideration of the likelihood and consequences of the impact occurring (*i.e.* a "risk assessment");
- Developing impact mitigation measures (including the design of further investigations that were required to better inform the risk assessment), the extents of which have been informed by the assessed level of risk that may arise in association with it.

Figure 8.1 Risk analysis definition

8.2 How risk analysis was used for this Environmental Assessment

A risk analysis approach has been used for two purposes (Figure 8.2):

1. To prioritise and refine the scope of the investigations that were undertaken to inform this Environmental Assessment (by means of a *preliminary risk analysis*). The preliminary risk assessment was useful to identify the key information gaps and potential impacts & risks that required further investigation. More details are provided at Section 8.3; and
2. To prioritise the potential impacts that were identified and to consider an appropriate level of mitigation that may be required (by means of a series of *detailed risk analyses*). The detailed risk analyses were informed by the outcomes from a number of targeted investigations and studies that are documented throughout this report. Equally, the detailed risk analysis was iteratively used

to refine the scope of issues addressed by the targeted investigations, and to inform the development of appropriate mitigation measures. More details are provided at Section 8.4.

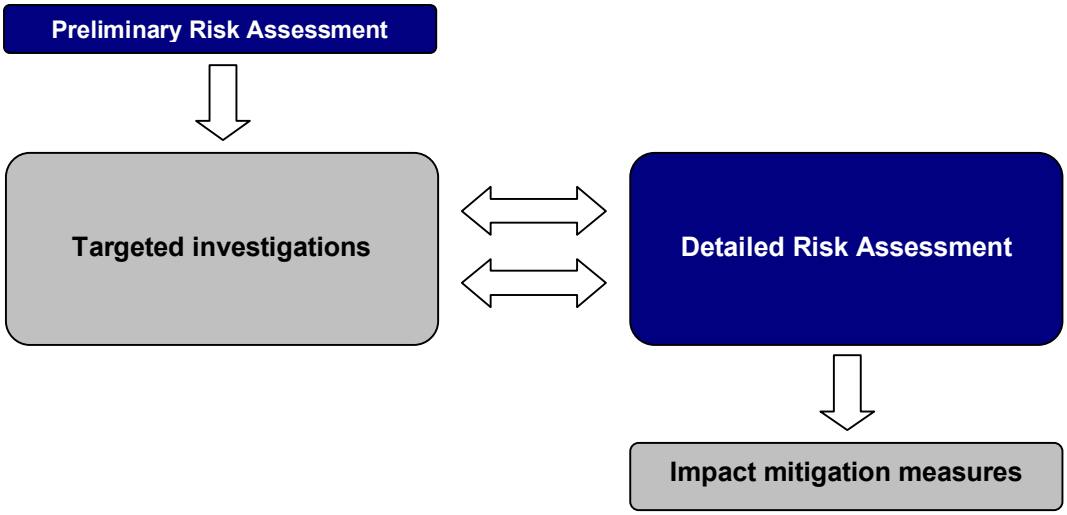

Figure 8.2 How risk analysis has been used for this Environmental Assessment

8.3 Preliminary risk assessment and outcomes

Based on the Project description (Chapter 6) the broad environmental elements that were identified that may be impacted by the Project include (in no particular order):

- Flora, fauna and aquatic ecology;
- Hydrology and surface water quality;
- Drinking water quality;
- Soils, geology and groundwater;
- Traffic and transport;
- Social and economic;
- Noise and vibration;
- Air quality;
- Landscape and visual amenity;
- Land use;
- Aboriginal and non-Indigenous heritage;
- Greenhouse gases; and
- Infrastructure.

A preliminary, desktop-level assessment was undertaken to assess very broadly the risks that may arise should the Project impact any of those environmental elements. The assessment was mainly based on the information presented within the Preliminary Environmental Assessment (PEA). The outcomes were used to inform the scope of further work and investigations that were undertaken as described in other

parts of this report (Chapters 9 - 27). Each impact was given a ranking between one and three for the likelihood of occurring if left unmanaged and a number between one and three for the perceived consequence of effects if left unmanaged, in accordance with the following definitions:

Likelihood of occurrence

1 Lower: Unlikely to occur

2 Medium: Potential to occur

3 Higher: Probable to occur

Consequence of unmanaged impacts

1 Lower: Insignificant to minor environmental change; localised implications; imperceptible or short term cumulative impacts; offsets readily available.

2 Medium: Moderate adverse environmental change; regional implications; modest or medium term cumulative impacts; offsets available.

3 Higher: Adverse environmental change; inter-regional implications; serious or long term cumulative impacts; offsets not readily available.

The matrix below (Table 8.1) was then used to place the described issue as either a Category A, B or C priority.

Table 8.1 Preliminary risk assessment: impact priority matrix

Likelihood of Occurrence	Consequence of Unmanaged Effects		
	3 Higher	2 Medium	1 Lower
1 Lower	Category B	Category C	Category C
2 Medium	Category A	Category B	Category C
3 Higher	Category A	Category A	Category B

The Category A issues were considered the highest priority areas and were the main focus of the Environmental Assessment. The higher priority issues generally required more detailed further assessments. In general, the following was applied when scoping the requirements for the Environmental Assessment:

- **Category A** issues – would require further specialist investigations and field work were the highest priority for the Environmental Assessment to enable identification of appropriate management and mitigation options. These issues are specifically addressed in the Statement of Commitments included as part of the Environmental Assessment.
- **Category B** issues – may be desirable to undertake further investigations as part of the Environmental Assessment to address some uncertainties, and these were addressed in the Statement of Commitments included as part of the Environmental Assessment.
- **Category C** issues – may not require further investigation where identifiable management/mitigation guidelines exist; only broad or desk-top level investigations were undertaken.

A summary of the issues and the prioritisation categories that were assigned to them is provided in Table 8.2, together with a listing of where the relevant detailed assessments may be found within this report.

Table 8.2 Preliminary risk analysis outcomes

Element that may be impacted	Project phase	Summary of potential impact (high-level description)	Preliminary Risk Category	Detailed assessment provided at …
Flora and fauna	Construction	Clearing of native vegetation, particularly Endangered Ecological Communities (EECs) and threatened species	A	Chapter 10 Appendix E
		Edge effects from construction and operation activities such as weed invasion		
		Indirect impact to fauna through habitat loss, altered run-off patterns, contamination of water courses, increased lighting, and increased predation by exotic species		
		Direct impact to fauna particularly frogs and reptiles through injury		
Hydrology and surface water quality	Construction	Potential blockage of flow paths affecting low flows through construction within creek lines and through erosion and sedimentation control structures	A	Chapter 14 & 15 Appendices H and I
		Deterioration in water quality of nearby waterways during construction, particularly from events such as storm events generating sediment-laden runoff		

Element that may be impacted	Project phase	Summary of potential impact (high-level description)	Preliminary Risk Category	Detailed assessment provided at …
Drinking water quality	Operation	Mixing of waters with different qualities may impact on the treatability of the raw water at Goulburn WTP and result in sub-optimal or poorer quality water being distributed to customers	B	Chapter 9 Appendix D
Soils, topography and groundwater	Construction	Groundwater aquifers in the region may be exposed or impacted by trenching activities	B	Chapter 13 Appendix G
		Ground excavations and earthworks involving the movement and exposure of spoil have the potential to increase the risk of erosion, runoff, and reduce local water quality through sediment laden runoff		
		Liberation of salts within the soils during construction activities, resulting in saline soils		
		Exposure of workers to contaminated soils		
Traffic and transport	Construction	Road haulage may place pressure on the local and regional road networks, potentially resulting in delays and delineation of alternative routes.	C	Chapter 22 Appendix O
Social and economic	Construction and Operation	Cumulative impacts if visual amenity, noise, vibration and air quality deteriorate.	A	Chapter 21 Appendix N
	Construction and Operation	Concerns amongst local residents regarding land acquisition and property values.		

Element that may be impacted	Project phase	Summary of potential impact (high-level description)	Preliminary Risk Category	Detailed assessment provided at …
Noise and vibration	Construction	Temporary noise and vibration impacts associated with construction of the pipeline and associated works	B	Chapter 18 Appendix L
	Operation	Additional localised noise and vibration impacts from the operation of the pump stations and other infrastructure		
Air quality	Construction	Dust emissions from exposed excavation, stockpile mounds, infrastructure construction, transport of fill, and construction machinery	B	Chapter 19 Appendix L
	Operation	Emissions associated with pumping		
Landscape and visual amenity	Construction	Temporary loss of visual amenity during construction due to introduction of plant and equipment and land disturbance	B	Chapter 17 Appendix K
	Operation	Permanent loss of visual amenity due to above ground structures.		
Land use	Construction and Operation	Construction of pipeline may impact in suitability or availability of land for current purposes	B	Section 16 Appendix J
Indigenous and Non-Indigenous heritage	Construction	Direct or indirect disturbance (including disturbance of amenity) to items listed on the NSW State Heritage Register, National Heritage List, *etc.*	A	Chapter 11 & 12 Appendix F
Greenhouse gases	Construction and Operation	Increase in national greenhouse gas emissions associated with construction materials (manufacture, delivery, etc.) and Project operation (power required for pumping, *etc.*)	C	Chapter 20 Appendix M
Infrastructure	Construction	Construction activities lead to damage of nearby infrastructure or amenities	B	Chapter 23 & 24 Appendix P
	Operation	Maintenance activities, or an event like a water pipeline leak, damages nearby infrastructure or amenities		

8.4 Detailed risk analysis

A detailed investigation and risk analysis was undertaken individually for each of the environmental issues listed above. This section provides the technique that was adopted to undertake a detailed risk analysis for each of the technical studies done as part of this Environmental Assessment. The risk analysis details and findings can be found within each of the technical reports in Appendices D to P and that are summarised in Chapters 9 – 26.

8.4.1 Impact identification

The first stage of the risk analysis was to identify and describe the potential environmental impacts, on which to conduct the risk assessment. A variety of inputs were relied upon to assist in identifying the impacts on existing environmental values (Figure 8.3).

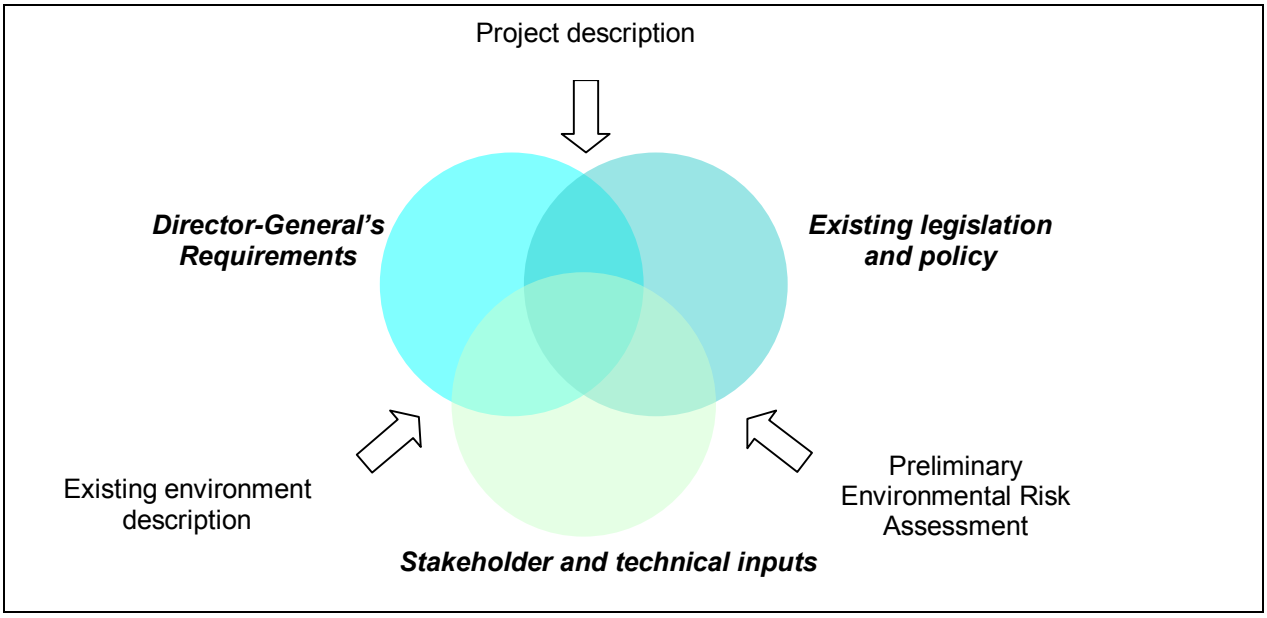

Figure 8.3 Inputs to the identification of impacts for detailed assessment

8.4.2 Risk assessment

The detailed risk assessment was conducted to:

1. Prioritise the identified impacts in terms of the potential relative risk each may pose to the environmental value and the consequences that may arise from any changes; and
2. Assist with identifying targeted actions and initiatives that would need to be adopted to monitor and manage the risks during the proposed Project operations.

A qualitative risk assessment approach was used, this time using more detailed likelihood/consequence descriptors and risk matrices. Table 8.4 - Table 8.3 provide examples of the risk assessment guidance tools that were adopted; however please note that they are examples only and the actual tools used are described in each technical study.

First, the relative risk for each identified impact was determined as a function of the likelihood of a certain impact event occurring as well as the consequences that may be associated with it. This was assessed on the basis of the Project description, the data and information collected during the detailed investigation, and the system understanding (*i.e.* how the current systems operate, the controls that already exist to manage some of the risks *etc.*) provided in this report. For the impacts with the higher relative risk scores, additional management and control activities have been identified for consideration, and the risks were reassessed assuming that these controls/actions would have been implemented. Hence, the residual risks associated with a treated impact were also assessed as part of the detailed risk assessment.

8.4.3 Outcomes

The detailed investigations, risk assessments, descriptions of controls and management actions that would be required, and a discussion on the residual risks that may exist in association with the Project, are provided in each of the technical investigation reports (Appendices D to P).

A summary of each of these is provided in Chapters 9 - 26. The additional management activities and controls that would be required to manage risks associated with the Project (in addition to those listed in the Project Description - Chapter 6) are summarised in Chapter 27.

Table 8.3 Detailed risk assessment: event consequence guidance table (example)

Environmental aspect or element that may be at risk	Consequence descriptors– guidance for allocating categories				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Flora and fauna species (including EPBC protected species)	Population change not detectable	Detectable change in population without impact on population viability	Detectable change in population and impact on population viability that is significant at a local level	Detectable change in population and impact on population viability that is significant at a regional level	Detectable change in population and impact on population viability that is significant at a State or Commonwealth level
Endangered Ecological Communities (EEC)	Insignificant loss of native vegetation	Loss of EEC significant at the local level Net gain achievable	Loss of EEC significant at the regional level Net gain achievable	Loss of EEC significant at the State level Net gain achievable	Loss of EEC significant at the State level Net gain not achievable
Waterways and floodplain function	Negligible change to waterway and flow regime	Changes to waterway or flow regime with minor implications	Changes to waterway or floodplain function with moderate implications	Waterway or floodplain function or river health significantly compromised	Extensive impact to waterway or floodplain function, river health irreversibly disturbed
Cultural heritage (Indigenous and non-Indigenous)	No impact to heritage sites	Disturbance or partial removal of a small number of heritage artefacts	Complete removal of one or more heritage artefacts confined to a small number of locations	Complete removal of many heritage artefacts across many locations. Disturbance of a heritage site of high scientific significance	Widespread removal of heritage artefacts across a region. Destruction of a heritage site of high scientific significance

Environmental aspect or element that may be at risk	Consequence descriptors– guidance for allocating categories				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Air quality, noise and water quality	Applicable air quality, noise and water quality standards met across the region	Isolated exceedance of air quality, noise or water quality standards that is short lived	Exceedance of applicable air quality, noise or water quality standards in a local area	Exceedance of applicable air quality, noise or water quality standards in a number of local areas	Widespread exceedance of applicable air quality, noise or water quality standards across the region
Groundwater	Negligible change to groundwater regime and availability	Changes to groundwater regime and availability but no significant implications	Changes to groundwater regime and availability with minor implications	Groundwater regime or availability significantly compromised	Widespread groundwater resource depletion and subsidence
Economic impacts on businesses	Loss of annual revenue less than $100,000	Loss of annual revenue less $1M but greater than $100,000	Loss of revenues less than $10M but greater than $1M	Loss of revenues less than $100M but greater than $10M	Loss of revenues less than $1B but greater than $100M
Land use planning impacts	Land use changes resulting in consistency with planning policies	Land use changes result in minor inconsistency with planning policies	Land use changes result in significant inconsistency with local planning policies	Land use changes result in significant inconsistency with state planning policies	Land use changes result in complete inconsistency with planning policies
Social	Changes to amenity, access, view shed, community facilities are not noticeable or displacement of a small number of residences	Changes to amenity, access, view shed, community facilities are noticeable or displacement of a number of residences within a local area	Changes to amenity, access, view shed, community facilities are noticeable and causing community concern or displacement of a number of residences effecting a small section of the region	Changes to amenity, access, view shed, community facilities are noticeable and causing major community concern or displacement of a number of residences effecting a large part of the region	Changes to amenity, access, view shed, community facilities are noticeable and causing major community concern perhaps resulting in negative media attention or displacement of a number of residences effecting the entire region
Project cost	Negligible increase in Project costs	Increase in Project costs by up to 5%	Increase in Project costs by up to 15%	Increase in Project costs by up to 50%	Increase in Project costs by more than 50%

Environmental aspect or element that may be at risk	Consequence descriptors– guidance for allocating categories				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Project delay	Delay in Project of < 1 week	Delay in Project of 1-4 weeks	Delay in Project of 1-3 months	Delay in Project of 3-6 months	Project cancelled or delayed indefinitely

Table 8.4 Detailed risk assessment: event likelihood guidance table (example)

Likelihood	Description
Almost Certain	The event is expected to occur in most circumstances
Likely	The event will probably occur in most circumstances
Possible	The event could occur
Unlikely	The event could occur but not expected
Rare	The event occurs only in exceptional circumstances

Table 8.5 Detailed risk assessment: relative risk matrix (example)

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Negligible	Low	Medium	High	High
Unlikely	Negligible	Low	Medium	Medium	High
Rare	Negligible	Negligible	Low	Medium	Medium