

Residual Environmental Risk Analysis

Chapter 9 reported on the environmental risk assessment undertaken to identify key issues for the Project and the associated risks for individual environmental aspects. Potential impacts were subsequently considered and assessed in Chapters 10-17. This included identification of suitable mitigation measures to avoid or reduce impacts. This chapter considers the anticipated effectiveness of these measures through assessing the level of residual environmental risk for the various environmental aspects.

As described in Chapter 9, a risk assessment was conducted to identify and/or confirm the key environmental issues of interest for the project and to assign a related level of risk to individual aspects reflecting the anticipated magnitude of impact. One reason for such an exercise is to identify where best to assign resources to reduce impacts to acceptable levels.

The same methodology used to determine 'raw' or unmitigated risks (refer Section 9.2) was employed to determine 'residual' risk. Residual risk refers to the anticipated remaining risk once all practicable management and mitigation measures have been put in place.

It should be noted that some mitigation measures would take time to reach full effectiveness. For example the habitat corridor would take a number of years for vegetation to reach full maturity. There could also be external factors which could influence achievement of the full effect of mitigation. Continuing with the habitat corridor example, a bushfire could destroy or damage vegetation and prolong the time for it to reach maturity.

The residual risk scores are shown in Table 18.1. This table is similar to Table 9.3 which presented the raw risk scores. Table 18.1 omits the likelihood and consequence ranks for the raw risk scores but includes them for the residual risk (denoted by 'L' and 'C' respectively) together with the assigned residual risk score. A column is also added providing summary

details on mitigation and management measures for each environmental issue where relevant. Risk levels in bold blue text represent where there is expected to be a reduced level of risk following implementation of impact mitigation and management measures.

For some aspects there would be no practicable impact mitigation measures available. For example, the dam would permanently interrupt the movement of sediment down the Williams River from above the dam. The fluvial geomorphology investigation noted that generally there is little that can be done to prevent the scour process downstream of dams short of ongoing augmentation of the sediment supply. It also noted that bed material augmentation downstream of dams is an expensive and logistically difficult procedure, and would only be warranted if it could be demonstrated that there would be no significant negative impacts and the gravel-dependent ecological, economic and social assets of the river were of sufficient value.

The analysis also shows that, notwithstanding the implementation of mitigation measures and management strategies, the level of residual environmental risk would be expected to remain as 'major' in relation to aspects associated with the changed hydrological regime, ie discharge magnitude and frequency, water quality, fluvial geomorphology and aquatic ecology.

TABLE 18.1 RESIDUAL ENVIRONMENTAL RISKS

ENVIRONMENTAL ASPECT	ENVIRONMENTAL ISSUE	POTENTIAL IMPACT	INITIAL RISK LEVEL	MANAGEMENT/MITIGATION	L	C	RESIDUAL RISK
Air quality	Dust generation from construction activities	Reduced air quality at nearby residences	Moderate	Implementation of mitigation measures listed in Section 16.2.8	Possible	Minor	Minor
Aquatic ecology	Changes in hydrology upstream of dam through inundation	Loss of existing habitat	Moderate	No practicable measures available	Almost certain	Moderate	Moderate
	Reduction in frequency and volume of flows downstream of dam	Loss of existing habitat	Major	Implementation of release strategy described in Chapter 10	Almost certain	Major	Major
	Possible differences in storage water quality and downstream water quality	Detrimental effects on aquatic fauna from differences in water quality	Moderate	Provision of multi-level offtake to allow abstraction of water of suitable quality Implementation of mitigation and management strategy described in Chapter 4 of Working Paper F	Possible	Moderate	Moderate
Climate change and GHG emissions	GHG emissions from construction activities	GHG releases to atmosphere	Moderate		Possible	Minor	Minor
	Inundation of 2,100 ha of vegetation	GHG emissions from decaying vegetation	Major	Establishment of habitat corridors (including supplementary planting as required) on eastern and southern sides of the storage Other revegetation activities on HWC-owned land	Possible	Moderate	Moderate
Environmental flows and river management	Reduction in flows through creation of barrier	Changes in downstream water quality, flow regime, aquatic habitat, and channel morphology		Implementation of release strategy described in Chapter 10	Likely	Major	Moderate

ENVIRONMENTAL ASPECT	ENVIRONMENTAL ISSUE	POTENTIAL IMPACT	INITIAL RISK LEVEL	MANAGEMENT/MITIGATION	L	C	RESIDUAL RISK
Fluvial geomorphology	Disruption of sediment supply to Williams River downstream of dam	Erosion of channel and banks, particularly immediately downstream of dam	Major	No practicable measures available Conservation of Munni House	Almost certain	Major	Major
Contemporary heritage	Presence of items of local and State heritage significance	Damage to items from construction activities or from inundation	Major	Implementation of management measures listed in Section 13.9	Possible	Moderate	Moderate
Aboriginal heritage	Presence of Aboriginal heritage items	Damage to items from construction activities or from inundation	Major	Implementation of management measures as listed in Section 14.6	Possible	Moderate	Moderate
Landscape and visual amenity	Introduction of new built elements into the landscape	Reduced visual amenity at residences near dam and spillway	Major	Selection of suitable materials for construction where practicable Screening plantings to soften views for nearby residences	Possible	Minor	Minor
	Introduction of major water body into the landscape	Change to rural character but not necessarily a negative impact	Moderate	No practicable mitigation measures, however, establishment of buffer zone would serve to 'soften' the regularity of the storage shoreline	Almost certain	Moderate	Moderate
Noise and vibration	Noise and vibration generation from construction activities	Increased noise and vibration at nearby residences	Moderate	Implementation of mitigation measures listed in Section 16.1.3	Possible	Minor	Minor

ENVIRONMENTAL ASPECT	ENVIRONMENTAL ISSUE	POTENTIAL IMPACT	INITIAL RISK LEVEL	MANAGEMENT/MITIGATION	L	C	RESIDUAL RISK
Roads and infrastructure	Use of public roads by construction vehicles	Damage to road pavements	Moderate	HWC contribution to Dungog Shire Council for road maintenance Implement road safety improvements Restrict construction vehicles to specific routes to limit extent of further damage to road pavements	Possible	Moderate	Moderate
		Loss of existing access to properties	Minor	Provision of alternate access to equal or better than existing standard	Rare	Minor	Minor
	Property access	Severance of existing routes	Minor	Construction of new section of Salisbury Road Provision of alternate access to Quart Pot Creek locality Provision of temporary bypass around dam construction site	Rare	Minor	Minor
		Loss of rural firefighting capability	Minor	Relocation of RFS station outside of inundation area	Rare	Minor	Minor
	RFS station lies within inundation area Telecommunication and electricity services traverse inundation area	Inundation of services	Minor	Relocation of affected services in consultation with relevant service provider	Unlikely	Minor	Minor
		Disruption to local residents	Minor				

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Roads and infrastructure	Change in land use (agricultural to water supply)	Loss of agricultural land and associated economic activities	Major	No practicable offset for reduction in available agricultural land, however, the Project would provide opportunities for the development of tourism-related commercial activities as described in Working Paper N Provision of operational releases downstream to preserve existing irrigation and third party use rights	Possible	Major	Moderate
	Inundation of Munni/Quart Pot Cemetery	Area occupied by cemetery would be underwater for majority of time	Major	Establishment of new cemetery outside of inundation area Relocation of grave sites and burials in existing cemetery	Rare	Moderate	Minor
Socioeconomic	Presence of construction work force	Potential demand on local services	Moderate	No specific measures considered necessary	Possible	Minor	Minor
	Inundation of terrestrial ecosystems	Loss of habitat	Major	Establishment of habitat corridors (including supplementary planting as required) on eastern and southern sides of the storage Implementation of measures listed in Section 11.5	Possible	Moderate	Moderate
		Impact on threatened species and endangered ecological communities	Moderate	Establishment of habitat corridors (including supplementary planting as required) on eastern and southern sides of the storage Implementation of measures listed in Section 11.5	Possible	Moderate	Moderate

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Water quality and hydrology	Pollutants entering water during construction	Change in water quality during construction	Moderate	Implementation of measures listed in Chapter 10	Possible	Moderate	Moderate
	Permanent change in downstream hydrological regime	Changes in downstream water quality, flow regime, aquatic habitat, and channel morphology	Major	Implementation of release strategy described in Chapter 10	Almost certain	Major	Major
	Stratification of storage	Alteration of downstream water quality and consequent impacts on aquatic fauna	Moderate	Provision of multi-level offtake to allow abstraction of water of suitable quality There are unlikely to be other practicable measures in view of the large storage volume	Possible	Moderate	Moderate