

19. Cumulative impacts

The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts. Cumulative impact assessment requires an analysis of the incremental effects on an area from one or more activities as they accumulate over time. The purpose of this chapter is to provide information on the overall impacts of the Water for Bowen Project, with consideration of the interrelationship of these impacts.

Cumulative impacts specific to the Project may relate to:

- multiple forms of impact at one location (e.g. the nearest sensitive receiver will probably be impacted by noise, dust, air quality, traffic, land acquisition etc.)
- an environmental value being impacted at several locations or by a number of forms of impact e.g. water quality may be effected by construction activities at a number of locations, by habitat change (creation of the channel) and by operational activities
- the potentially counter-active effects of negative and positive impacts.

Cumulative impacts also include those of the Project acting in combination with other known activities in the region/catchment including:

- other water resource development projects
- other known developments or types of development that may impact upon the same environmental values as the Project.

19.1 Methodology

The methodology used to identify and assess the direct and indirect impacts of the Project on each of the identified environmental elements is set out in each chapter of the EIS and in the corresponding technical reports. Each chapter applied mitigation strategies to the identified impacts and in cases where the impact could not be satisfactorily mitigated, a residual impact was reported. This chapter examines the potential key cumulative impacts associated with the Project based on the identified residual impacts for each environmental element. It should be noted that while impacts were assessed in the various chapters as being successfully mitigated from a legislative or compliance viewpoint, they are still incorporated here if, when assessed in an additive manner, the cumulative impact may require further mitigation.

The methodology adopted for this cumulative impact assessment has been based on consideration of:

- ranked key direct and indirect residual impacts associated with the Project, as predicted in each of the chapters
- appropriate spatial boundaries
- appropriate temporal boundaries, considering short term and long term impacts
- the key interactions of Project impacts on environmental elements.

Cumulative impacts also include those of the Project acting in combination with other known activities in the region. The method applied in this assessment distinguishes between those activities that are interrelated with the Water for Bowen Project and those that are separate.

Where appropriate, management and mitigation measures are presented for the key cumulative impacts where they are required beyond the measures nominated in the individual chapters.

Table 19.1 outlines the spatial boundaries considered in the cumulative impact assessment, Table 19.2 the temporal boundaries and Table 19.3 outlines how the cumulative impact is scored based on these boundaries. Cumulative impacts might range from a major beneficial impact to a major adverse impact. In some cases the assessment of significance has required adjustment where the intensity of the residual impact is considered high and where this is not adequately reflected in the cumulative impact calculation.

Table 19.1 Spatial boundaries

Spatial boundaries	Definition
Local	The Project area (being the footprint and very nearby)
Regional	Within approximately 20 km of the Project area and encompassing the State Suburbs of Home Hill, Gumlu, Guthalungra and Bowen
State	Queensland

Table 19.2 Temporal boundaries

Temporal boundary	Definition
Short term	Occurring immediately during the undertaking of an activity, or immediately following the activity and continuing for up to two years after the cessation of the activity i.e. during the construction period or shortly after
Long term	Occurring for longer than two years after the activity has ceased

Table 19.3 Cumulative impact calculation

Cumulative impact (beneficial or adverse)	Definition
Major	Long term at State level
Moderate	Long term at Regional level, or Short term at State level
Minor	Long term at Local level, or Short term at Regional level
Insignificant	Short term at Local level

Key cumulative impacts identified are based on information available at the time of assessment, with the assessment providing a review of the major interactions of residual impacts identified in the chapters. Some inherent uncertainty exists in cumulative impact assessment given the additive or synergistic nature of cumulative impacts that may potentially be experienced over the life of the Project. There has been no attempt to weight impacts across EIS disciplines, that is, there is no difference in impact rankings between physical, natural or social environments.

19.2 Overall impacts

The residual impacts within each environmental element associated with the Water for Bowen Project itself are summarised in Table 19.4 and the secondary impacts related to eventual use of the water by customers is in Table 19.5. Table 19.5 concentrates on the secondary impacts associated with agricultural production, because the secondary impacts associated with industrial and urban uses will be subject to separate approval processes.

Table 19.4 Key cumulative impacts of the water transport infrastructure

Environmental element	Residual impact	Spatial boundary	Temporal boundary	Significance
Land use	Changes to land tenure within the infrastructure corridor	Local	Long-term	(-ve) minor
	Loss of good quality agricultural land within the infrastructure corridor	Local	Long-term	(-ve) minor
	Restrictions on existing land use within the pipeline easement and land severance	Local	Long-term	(-ve) minor
	Restrictions on the movement of livestock across the channel alignment	Local	Long-term	(-ve) minor
	Increased land use security for livestock grazing and horticultural customers	Local	Long-term	(+ve) moderate*
Geology and soils	Aggravated wind and water erosion resulting from disturbance to sodic and dispersible soils	Local	Short-term	(-ve) insignificant
Visual amenity	Activities associated with pipeline construction visible in Gumlu, Guthalungra, from Bruce Highway and local roads	Local	Short-term	(-ve) insignificant
Terrestrial ecology	Vegetation and habitat clearing	Regional	Long-term	(-ve) moderate
	Invasion and establishment of weeds as a result of earth-works and vehicle movement	Local	Long-term	(-ve) minor
	Habitat fragmentation and barrier to wildlife movement across the infrastructure corridor	Regional	Long-term	(-ve) moderate
	Spread and introduction of exotic fauna	Local	Long-term	(-ve) minor
	Fauna mortality resulting from drowning in the open channel during operation	Local	Long-term	(-ve) minor
Aquatic ecology	Physical habitat disturbance and runoff/sedimentation	Local	Short-term	(-ve) minor
	Application of biocides to control aquatic plant infestations	Local	Short-term	(-ve) insignificant
	Overflows and risk of pest species transfer	Local	Long-term	(-ve) minor
Surface water	Catchment diversion and flooding	Local	Long-term	(-ve) minor
	Overflow and drainage control	Local	Long-term	(-ve) minor

Environmental element	Residual impact	Spatial boundary	Temporal boundary	Significance
Groundwater	Channel and overflow seepage	Local	Long-term	(-ve) minor
Water quality	Erosion and sediment runoff, spillage	Local	Short-term	(-ve) minor
GHG emissions	Increased GHG emissions	State	Long-term	(-ve) minor*
Waste management	Waste generated during construction phase	Regional	Short-term	(-ve) minor
Transportation	Disturbance to traffic flows on local roads during construction phase	Local	Short-term	(-ve) insignificant
Indigenous cultural heritage	Loss of local indigenous cultural heritage items and context during construction	Local	Long-term	(-ve) minor
Socio-economic	Disturbance to the social fabric of local communities resulting from establishment of construction camps for workforce accommodation	Regional	Short-term	(-ve) minor
	Increased employment creation during construction	State	Short-term	(+ve) moderate
	Increased economic activity	Regional	Long-term	(+ve) moderate

* Corrected assessment of significance based on consideration of the intensity of the residual impact

The above indicates that construction phase impacts tend to be short-term and local other than the economic and employment impacts related to the capital expenditure. Location is a key consideration in the determination of cumulative impacts i.e. local receptors are likely to incur a greater range of impacts because they happen to be close to the Project compared with Regional and State receptors. Interactions are further developed in Table 19.6.

Construction phase impacts can also largely be successfully mitigated via standard methodologies, with the caveat that they must be implemented diligently. This applies particularly to areas such as dealings with landowners over purchase or severance issues (particularly if they are the same landowners who will be impacted by noise, dust or traffic issues), sediment and erosion control, traffic and sensitive clearing of vegetation to ensure minimum impact on fauna.

Operations phase impacts tend to be long-term but are generally of minor significance. Some are continuations of construction phase impacts but may result from a different impact mechanism. For example accidental death of fauna in the construction phase mainly relates to road strike or physical injury during clearing whereas in the operations phase it may result from drowning in the open channel. Individually, each impact mechanism can be mitigated successfully. Similarly sediment and erosion control remains an issue, albeit at significantly reduced scale, in the operations phase. In this case it mainly relates to cross drainage culvert tail outs.

Table 19.5 addresses potential impacts in the benefited areas. It can be seen that several forms of impact are equivalent to those of the construction or operation phase of the infrastructure so clearly represent cumulative impacts. These include land clearing, sediment and erosion control and the impact of the former on waterways. Quite distinctly separate impacts relate to the application of additional water to the land but the final potential impact also relates to potential impacts on local waterways or the coastal and nearshore environment. The most significant beneficial impacts are the social and economic benefits related to water supply security and increased productivity.

Impacts in the benefited areas tend to start at a local scale (the security and productivity benefits to individual users of the water) but are expected to accrue over the long-term to provide benefits at regional or state scales.

Table 19.5 Secondary impacts related to irrigation development

Environmental element	Potential consequential impact	Spatial boundary	Temporal boundary	Significance
Land use	Expansion of horticultural land use	Local	Long-term	(+ve) minor
Geology and soils	Erosion resulting from land clearing and working for crops	Local	Long-term	(-ve) minor
Terrestrial ecology	Additional vegetation and habitat clearing	Regional	Long-term	(-ve) moderate
	Invasion and establishment of weeds as a result of land disturbance and vehicle movement	Local	Long-term	(-ve) minor
Aquatic ecology	Increased permanence and reactivity to rainfall	Regional	Long-term	(+ve) minor*
	Discharge of higher pollutant loads to downstream waterways	Regional	Long-term	(-ve) minor
Surface water	Increased permanence and reactivity to rainfall	Regional	Long-term	(+ve) minor*
Hydrogeology	Raised groundwater levels as a result of; additional groundwater infiltration from applied water or rainfall; source substitution	Regional	Long-term	(+ve) minor*
Water quality	Discharge of higher pollutant loads to downstream waterways	Regional	Long-term	(-ve) minor
Coastal and marine resources	Increase in pollutant loads discharging to the Barrier Reef Lagoon	Regional	Long-term	(-ve) minor*
Socio-economic	Appreciation in land value for properties located within benefit areas	Local	Long-term	(+ve) minor
	Increased employment creation in agriculture, industry and their service providers	Regional	Long-term	(+ve) moderate
	Increased economic activity	Regional	Long-term	(+ve) moderate
	Support for NET and other planning initiatives	State	Long-term	(+ve) major
Health and safety	Increase in the incidence of mosquito borne disease	Local	Long-term	(-ve) minor

* Corrected assessment of significance based on consideration of the intensity of the residual impact

19.3 Interrelationship of impacts

The interaction of residual impacts for the environmental and social elements produce cumulative impacts that are summarised in Table 19.6.

Table 19.6 Summary of key interactions of residual impacts

	Land use	Topography	Geology and soils	Land contamination	Visual amenity	Terrestrial ecology	Aquatic ecology	Coastal and marine	Hydrology	Hydrogeology	Water quality	Air quality	GHG emissions	Waste management	Noise	Vibration	Transportation	Indigenous CH	Non-indigenous CH	Social	Economics	Health and safety
Land use					✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓
Topography																						
Geology and soils										✓	✓	✓										
Land contamination																						
Visual amenity	✓					✓														✓		
Terrestrial ecology	✓				✓		✓	✓			✓											
Aquatic ecology	✓					✓			✓		✓											
Coastal and marine	✓					✓			✓		✓											
Hydrology	✓						✓	✓			✓											
Hydrogeology	✓	✓									✓									✓	✓	
Water quality	✓	✓				✓	✓	✓	✓	✓										✓	✓	✓
Air quality	✓	✓																		✓		✓
GHG emissions	✓												✓									
Waste management																				✓		✓
Noise																	✓			✓		✓
Vibration																	✓			✓		✓
Transportation															✓	✓				✓		✓

	Land use	Topography	Geology and soils	Land contamination	Visual amenity	Terrestrial ecology	Aquatic ecology	Coastal and marine	Hydrology	Hydrogeology	Water quality	Air quality	GHG emissions	Waste management	Noise	Vibration	Transportation	Indigenous CH	Non-indigenous CH	Social	Economics	Health and safety
Indigenous CH	✓																			✓		
Non-indigenous CH	✓																			✓		
Social	✓				✓				✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓
Economics	✓								✓	✓										✓		
Health and safety	✓										✓	✓		✓	✓	✓	✓			✓		

Based on the interactions presented in Table 19.6, and recognising cause and effect relationships between Project elements and impacts, the key cumulative impact areas (positive and negative) of most significance (referring to Tables 19.4 and 19.5) relate to:

- land use
- social and economic benefits
- water quality
- health and safety.

These cumulative impacts arise both directly from Project development and secondarily as a consequence of enhanced water availability.

19.3.1 Land use change

Land clearing is a major source of potential impact across Project phases and components with indirect impacts related to erosion, terrestrial ecology, water quality and eventually aquatic and coastal environmental impacts. The tenure aspects of land use change are a short term issue applying to directly affected landowners. The longer term issues relate to property severance that may not be fully mitigated for sections of the open channel, fragmentation of habitat (which is again mainly related to the channel but also potentially to benefited areas) and to clearing within the benefited areas which enables expansion of horticultural activities.

It is land use change which drives the additional application of water to land via irrigation in the benefited areas hence is linked to the potential runoff and water quality issues in those areas. It is also the driver of the major long term strategic planning benefits related to support for the Northern Economic Triangle Infrastructure Plan.

The Project therefore recognises these aspects of land use change as a core area of required mitigation and the respective chapters have devoted considerable attention to this issue. In the majority of cases the individually recognised impacts could be successfully mitigated to minor or insignificant levels but in recognition of the cumulative impacts, SunWater developed a broad approach to mitigation which is discussed in Section 19.5.

19.3.2 Social and economic benefits

The amenity of properties in close proximity to the infrastructure corridor will be adversely affected by impacts related to visual amenity, air quality, noise and traffic; though these are expected to be temporary impacts and of minor significance. Several properties along the open channel are also affected by land tenure and severance issues, leading to significant cumulative impacts that need resolution through careful planning (channel crossings, fencing etc) or compensation through water supply security or financial means.

A major justification for the Project is the long term water supply security offered to irrigation, livestock, industry and urban sectors via a surface water supply. As noted above, while these are initially felt at the local scale, they accrue via links to strategic planning initiatives to regional and state level positive social and economic benefits.

19.3.3 Water quality

As noted, land clearing and its relationship to erosion and runoff, is the major source of construction phase impacts on water quality and this aspect also occurs during the development of benefited areas. Once developed, runoff from new irrigation areas will not only carry sediment but potentially nutrient (from fertilisers) and agricultural chemical residues. Potential hydrology or hydrogeology issues in the operations phase may also impact on water quality, though Chapters 8 and 9 assessed the risk in these areas as low. This is an aspect that is best addressed through the implementation of Land and Water Management Plans.

The potential positive impacts on water quality relate to the application of a low conductivity surface water supply to the irrigated areas and reduced emphasis on groundwater extraction, thereby reducing the risk of saltwater intrusion into the aquifers.

19.3.4 Health and Safety

The health and safety aspects that were highlighted in Table 19.6 relate almost exclusively to the construction phase (other than the risk of drowning in the open channel) and relate to focussed on the sensitive receptors near the construction works (with respect to air, noise, traffic), regional traffic associated with material delivery and worker transport (and associated potential emergency access restrictions), general construction workplace OH&S issues and with the construction camps, particularly with respect to issues such as mosquito borne disease control. This is an example of a cumulative impact that is based on a number of relatively minor individual issues but is highlighted as an area requiring attention.

19.4 Other regional developments or initiatives

The Water for Bowen Project is only one of a number of developments and planning initiatives proposed or currently being undertaken in the region that may impact upon some of the same environmental values. Further, the impacts of the Project and other current developments are additional to the impacts resulting from historic developments but these have been taken into account through state and local government planning processes such as the Regional Ecosystem classification scheme under the VM Act or the desired environmental outcomes and zoning provisions of local government planning schemes.

19.4.1 Major development projects

Existing major infrastructure in the region includes the Port of Abbot Point, the Bruce Highway, Brisbane/Townsville/Cairns rail link, Collinsville Power Station, and coal mines at Collinsville and Newlands. Other historic developments include the urban area of Bowen, its associated fishing and tourism fleets and the regional agricultural development.

Notwithstanding the impacts of the current economic crisis, the region centred on Bowen is undergoing a significant economic expansion as is evident by the multitude of major infrastructure and projects currently proposed or under construction. The growth of the Bowen Basin coal industry, with over 20 operational mines and significant reserves to support future activities, is driving the development of regional infrastructure and inducing further private sector investment. Mining is expected to remain a leading component of the

region's economy in at least the next 20 years (DLGPSR 2006). Section 1.3.3 discusses the relationships of the Project to other regional developments and strategic plans.

While none of these projects are directly related to the Water for Bowen Project the provision of a reliable water supply is essential to securing future regional development. Major projects currently proposed or under construction in the region include:

- Queensland Rail Northern Missing Link — a 69 km track from North Goonyella to Newlands will improve the ability to export coal from the mines of the North Bowen Basin through the Port of Abbot Point. It is estimated this project will cost approximately \$965m and is due to commence construction in 2011
- Strathmore to Bowen 132 kV transmission line project — the \$50–\$70m Powerlink project will increase the capability of the Queensland Rail network servicing coal mines in the region
- Abbot Point Coal Terminal, Stage 3 — The Ports Corporation of Queensland has committed to an additional \$770m expansion which will include the construction of additional onshore handling facilities and an additional offshore berth and ship loader to increase coal throughput to 50 Mt per annum. Construction has recently commenced. Stage 4, reaching 110 Mt per annum is currently under assessment
- Abbot Point Multi Cargo Facility development. This proposal is currently in the assessment phase but is likely to be associated with the proposed industrial development within the recently declared State Development Area at Abbot Point
- the Abbot Point SDA is a component of the Queensland Government's Northern Economic Triangle (NET). NET is a commitment to foster sustainable economic, social and community growth through the emergence of Mount Isa, Townsville and Bowen as a triangle of mineral processing and industrial development
- the supply of water from the Project to Abbot Point is being examined in association with the SDA, as described in Chapter 2 Project Need, Section 2.2.2.2. The SDA will provide for the establishment of large scale industrial development within the Bowen sub-region. The Development Scheme for the Abbott Point SDA has been prepared to manage land use in the SDA and is the land use control instrument to guide future industrial development and essential infrastructure and services
- two new large scale aquaculture projects are already operating within the Bowen region, with the potential for development of two further facilities
- Bowen Marina — this \$600m committed development will transform the existing boat harbour into a facility that will include a residential village, a tavern, a retail precinct, offices, floating berths and a specialised marine industrial precinct
- Bowen Foreshore Development — the Bowen Shire Council will spend an estimated \$20 million to develop the foreshore into a modern, multifunctional participation space
- Whitsunday Shores — The Aspen Group has committed to develop a \$32m residential estate, comprised of 669 lots, a country club, a retail precinct, a retirement village and an 18 hole golf course.

Each of the other developments, being in the same geographic region, has the potential to impact on the same environmental values and has or will undergo its own impact assessment and approvals process. They each have different impacts, some directly related to the marine environment, some not specifically in the Water for Bowen study area and some potentially many years in the future but all may impact on the social fabric of the region or particular aspects of the physical and biological environment.

Development of the SDA is likely to result in a variety of cumulative impacts, including land use, terrestrial and aquatic ecology, hydrology, hydrogeology, coastal and marine resources, air quality, waste, noise, vibration, transport, cultural heritage, social, economic, health and safety. For example, the SDA area includes significant wetland communities, 'of concern' regional ecosystems, and patches of a nationally significant vegetation community (semi-evergreen vine thicket).

The impacts of full development of the SDA are likely to be of far greater significance to the local area, region and state than those arising from the Water for Bowen Project alone. The Coordinator-General will assess and determine all applications for land use development within the SDA.

Neither SunWater nor its consultants can completely identify or quantify the various impacts associated with these developments because it does not have the intimate knowledge of the projects that would be required to do so. There is undoubtedly a need for strategic coordination across projects to ensure that incremental impacts on particular environmental values, which would not be discernable within single EIS's, are identified and ameliorated. This role is best served by State and Federal governments and is available via the current legislation. The Planning Scheme for the SDA is an example of strategic planning for long term development within a particular region but there is a need for this to be extended to a broader area. This is currently being undertaken by DIP through collaborative groups such as the Bowen Abbot Point Community Consultation group, on which SunWater participates.

19.4.2 Policy and planning initiatives

A number of regional, state and commonwealth policies and planning initiatives are applicable to the design and implementation of the Water for Bowen Project as they provide a framework for future development. Table 19.7 identifies the principal policies and planning initiatives of relevance to the Project, including the geographic location and environmental values they are intended to control. Relevant references within the EIS to these policies and plans or to the related values are noted.

Table 19.7 Policy and planning initiatives of relevance to the Project

Name	Geographic location	Shared environmental values	EIS Reference
National Strategy for Ecologically Sustainable Development 1992	National	Sectoral issues: agriculture, urban planning. Intersectoral issues: biological diversity, nature conservation, land use planning, coastal zone management, water resource management, employment	Section 1.6
National Strategy on Conservation of Australia's Biological Diversity 1996	National	Biological diversity, natural resource management (including agriculture and pastoralism, water)	Section 1.6

Name	Geographic location	Shared environmental values	EIS Reference
Reef Water Quality Protection Plan 2003	Great Barrier Reef catchment area	Water quality	Section 1.6, Chapters 9 & 10
National Water Initiative 2004	National	Socio-economic development, water resources	Section 1.6, Chapter 8
Bowen Water Management Policy 2007	Bowen Groundwater Management Area	Surface and groundwater, socio-economic development	Section 2.2.4.4; Hydrogeology, Section 8.2
State Coastal Management Plan – Queensland's Coastal Policy 2002	Queensland coastal zone	Coastal use and development, water quality, cultural heritage, nature conservation	Section 1.6; Chapter 7, 10, 15
Whitsunday Hinterland and Mackay Regional Plan 2006	Whitsunday Hinterland and Mackay Region	Environment and natural resources, economic development, social infrastructure, settlement pattern	Section 6.1
Bowen Shire Planning Scheme 2006	Bowen Shire	Land and water management, social and economic development, biodiversity, water quality, terrestrial ecology	Section 6.1.1.2
Burdekin Shire IPA Planning Scheme 2008	Burdekin Shire	Land and water management, social and economic development, biodiversity, water quality, terrestrial ecology	Section 6.1.1.2
Water Resource (Burdekin Basin) Plan 2007	Burdekin river basin	Social and economic development, hydrology, nature conservation	Section 1.6; Section 8.1.1.3
Burdekin Dry tropics Natural Resource Management Plan (2005 – 2010)	Burdekin river basin	Land, soils and agriculture; biodiversity; surface water and groundwater; coastal, marine	Chapter 7 Nature conservation; Section 9.1
Burdekin Water Quality Improvement Plan – draft 2009	Burdekin river basin	Water quality (freshwater, estuarine, marine)	Chapter 7 Nature conservation, Section 7.2.3.3; Chapter 9 Water quality, Section 9.1
Environmental Protection (Water) Policy 1997	Queensland	Water quality, social and economic development	Chapter 9 Water quality, Section 9.1

The common goal of these various policies and plans is to provide a strategic framework to guide future development, and enhance or protect environmental values through the efficient use of resources and best environmental management.

SunWater will aim to design and implement the Project in a manner that is compatible with these policies and plans.

19.5 Management and mitigation measures

SunWater will design and implement the Project in a manner that is compatible with the regional, state and commonwealth legislation, policies and plans identified in Section 19.5 and 1.6.

In general the consequential impacts of regional development arising from the Project are beyond the direct control of SunWater but assessments are undertaken here on the assumption that the various measures available through local or state government will be implemented in accordance with relevant legislation and land use controls.

With respect to the key cumulative impact areas identified in Section 19.3 SunWater has committed to undertake a range of initiatives to ensure the negative impacts are minimised and the beneficial impacts are maximised. These are described in the respective chapters and included within the draft EMP. They include a number of broader scale commitments as a result of the recognition of cumulative impacts. The major commitments are summarised below and while some reiterate commitments made in the chapters, others are additional.

19.5.1 Land and Water Management Plans (LWMP's)

Sediment and erosion control and either runoff or accessions to waterways through groundwater, are recognised as a key area of environmental management. As described in Chapter 6 Land, Section 6.1.2.3, all agricultural customers who purchase water from the Project for irrigation will be required to develop and operate under a LWMP. This is both a requirement by law and by SunWater as part of the contractual arrangements between the water supplier and the water user. In this way SunWater is committing to take some direct responsibility for development of the plans, while acknowledging that legal responsibility rests with DERM and the water user. The LWMP must demonstrate that the irrigation and land management practices of the property owner are sustainable and do not lead to unacceptable environmental impact either on or off farm.

The LWMPs are expected to contain provisions to mitigate the cumulative impacts associated with the Water for Bowen Project including:

- protection of remnant vegetation and habitat areas
- a soils assessment for acid sulphate soils and salinity risk
- control of pollutant loads discharging to the downstream aquatic environment via best practice irrigation, optimal chemical usage and runoff control.

SunWater views the development, implementation and auditing of the LWMPs as an essential mitigation strategy to ensure their customers operate sustainable enterprises within the study area. From a cumulative perspective it is important that a holistic view is taken with respect to environmental management. As such, SunWater will, through liaison with applicable agencies and the recognised regional NRM group, develop the LWMP template within a larger regional framework. The offsets required for the Project under the VM Act, or as otherwise required, will be coordinated with this framework and with the LWMP's. As an example, if SunWater is required to offset an area of a particular RE then any such areas that are within the potential benefited areas will be identified and SunWater will work with the landowner (a potential customer) to develop their LWMP such that it protects this area while still allowing suitable development of the property.

19.5.2 Water quality

Water quality is largely managed by the land management commitments made in the respective chapters of this EIS and as elaborated upon above.

Beyond this, DERM is encouraged to continue the monitoring and management of the Bowen Groundwater Management Area. The outcomes of this EIS are encouraging with respect to the ability to achieve long term sustainable management of the groundwater system through balanced use with surface water supplies. Use of surface water delivered via the Project in the SDA is seen as the preferred solution for that area, further minimising risks to the groundwater aquifers. Given the regional source substitution and despite the EIS concluding that impacts to hydrology and hydrogeology are likely to be minor, SunWater commits to cooperate with DERM and regional management groups with respect to the monitoring of the levels and quality of groundwater in the benefited areas. While SunWater is not directly responsible for groundwater management, it will commit to active participation in regional management forums and to take actions as appropriate to its areas of responsibility should the need arise. This is a precautionary approach which will ensure that early detection and intervention will occur should any unforeseen problems arise.

19.5.3 Social issues, health and safety

The cumulative impact assessment recognised that in a formal sense the negative components of these issues can be adequately addressed through standard mitigation measures, the cumulative impact emphasises the need for an open and responsive consultation program by SunWater and the construction contractor/s. This includes with responsible agencies, directly impacted landowners, potential customers and the broader community. The community response to the Project to date has been very positive and the aim should be that this continues to be the case throughout implementation. Processes for ongoing consultation are outlined in the EMP.

19.6 Conclusion

This chapter has summarised the residual impacts recognised in the respective EIS chapters and identified a number of key cumulative impacts across the construction and operations phases of the Project and associated with the end use of the water. It is concluded that emphasis on previously identified mitigation strategies and involvement by SunWater in regional assessment and planning activities are appropriate actions to ameliorate the identified cumulative impacts.