14.0 Surface Water

14.1 Introduction

This chapter describes the catchments, surface water bodies and associated environmental values (EVs) in and around the Study Area. Potential impacts on these EVs are identified and mitigation measures are provided to minimise and manage these potential impacts through the design, construction and operational phases of the Project.

14.2 Scope of assessment

This chapter presents an assessment of potential impacts to surface water arising from the Project and sets out proposed mitigation measures. The potential impacts to surface water EVs were assessed with reference to matters relevant to surface water, including:

- construction of waterway barrier works
- taking, using or interfering with flow of water
- flooding hazards
- impacts on surface water quality (primarily through sedimentation)
- proximity to a watercourse
- changes to existing drainage patterns
- additional demand on existing water networks.

The impacts and mitigation measures for identified relevant matters above are discussed further in this chapter. Given the location and proposed infrastructure for the Project, the following matters are not considered relevant to surface waters for the Project:

- proximity to fisheries habitat
- removal, destruction or damage of marine plants
- risk of storm surge
- impacts to declared wild river areas
- development in tidal areas, watercourse bed and banks, lakes or springs.

An assessment methodology is presented in Section 14.4.

14.3 Legislation and policy

A number of legislative instruments and strategies are relevant to the management of water quality, catchment health and riparian zones in Queensland. The following are applicable to the construction and operation of the Project:

- *Environment Protection Act 1994*
  - Environmental Protection Policy (EPP) (Water)
- *Water Act 2000*
  - Water Regulation 2002 (QLD)
  - Water Resource (Condamine and Balonne) Plan 2004 (current as at 19 December 2014)[1]
  - Condamine and Balonne Resource Operations Plan 2008 (amended July 2015, Revision 5)

[1] The moratorium notice for the area of the *Water Resource (Condamine and Balonne) Plan 2004*, which had effect from 12 December 2008, ceased to have effect from 12 December 2014.

- Water Resource (Burnett Basin) Plan 2014 (current as at 1 July 2015)
- Burnett Basin Resource Operations Plan 2003 (amended November 2014, Revision 12)

- *Sustainable Planning Act 2009* (SP Act)
- *Fisheries Act 1994.*

In addition, the following guidelines and plans may be applicable to the Project:

- Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC Guidelines) (ANZECC/ARMCANZ, October 2000)
- Queensland Water Quality Guidelines 2009 (DEHP, 2013)
- Best Practice Erosion and Sediment Control (IECA, 2008)
- Surat Basin Regional Planning Framework (DLGP, 2011a)
- Wide Bay Burnett Regional Plan (DLGP, 2011b).

Environmental Protection Act 1994

The EP Act aims to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

Environmental Protection (Water) Policy 2009

The EPP (Water) is an instrument of the EP Act. Amongst other functions, the EPP (Water) governs the discharge of wastewater to land, surface water, and groundwater, aims to protect EVs and sets water quality objectives to provide guidance to protect EVs.

Water Act 2000 and Water Regulation 2002

The *Water Act 2000* (Water Act) governs all surface water and groundwater in Queensland. The state is divided into 23 catchments that are individually managed. The Study Area covers an area which falls within the Burnett Basin in the east and the Condamine and Balonne Basin to the west (refer to Figure 14.1, Volume 2).

A Water Resources Plan (WRP) has been developed for individual catchments to outline the objectives for achieving a balance between the allocation and sustainable use of water to meet human needs and meeting the needs of the environment. A Resource Operations Plan (ROP) has also been developed for each catchment which details management practices to meet the objectives specified in the WRP.

Under the Water Act, there are a number of options for accessing surface water in these catchments. The legislative means of access to this water are:

- water allocations
- water licences
- water permits.

Under the Water Act, it is possible for a water allocation holder to trade its water. It is also possible under the Water Act to obtain temporary water permits to take water for an activity, (including, for example, the construction of a road) that has a foreseeable conclusion date. Consideration must be given to the impacts on existing water entitlements and natural ecosystems.

The Water Regulation 2002 (Water Regulation) supports the application of the provisions of the Water Act relating to the identification of watercourses and establishing the location of outer banks of watercourses.

Water Resource (Condamine and Balonne) Plan 2004

The Water Resource (Condamine and Balonne) Plan 2004 (WRP Condamine and Balonne) was originally enacted in 2004 under the Water Act. The latest reprint of the WRP Condamine and Balonne was released in December 2014, and its main objectives are:

a. to define the availability of water in the plan area

b. to provide a framework for sustainably managing water and the taking of water

c. to identify priorities and mechanisms for dealing with future water requirements

d. to provide a framework for establishing water allocations

e. to provide a framework for reversing, where practicable, degradation in natural ecosystems

f. to regulate the taking of overland flow water.

Downfall, Jingi Jingi, Mount, Jandowae and Jimbour Creeks and their tributaries are regulated under the WRP Condamine and Balonne.

Condamine and Balonne Resource Operations Plan 2008

The purpose of the Condamine and Balonne Resource Operations Plan 2008 (Condamine and Balonne ROP) is to implement the WRP Condamine and Balonne. The latest version of the Condamine and Balonne ROP is dated July 2015 (Revision 5).

Water Resource (Burnett Basin) Plan 2014

The Water Resource (Burnett Basin) Plan 2014 (WRP Burnett) commenced on 22 August 2014 and replaced the repealed WRP from 2000. The latest reprint the WRP was released in July 2015, and its main objectives are:

a. to define the availability of water in the plan area

b. to provide a framework for sustainably managing water and the taking of water

c. to identify priorities and mechanisms for dealing with future water requirements

d. to provide a framework for establishing water allocations

e. to provide a framework for reversing, where practicable, degradation in natural ecosystems

f. to regulate the taking of overland flow water

g. to regulate the taking of groundwater

h. to provide interim rules for the taking or sharing of water.

Ironpot and Boughyard Creeks and tributaries are regulated under the WRP Burnett.

Burnett Basin Resource Operations Plan 2003

The purpose of the Burnett Basin Resource Operations Plan 2003 (Burnett ROP) is to provide a strategic framework for the allocation and management of water within the Burnett Basin to meet defined outcomes. The Burnett ROP is the primary tool for implementing the WRP Burnett. It defines the rules that will guide the day-to-day management of stream flows and water infrastructure to achieve the objectives of the WRP Burnett. The latest version of the Burnett ROP is dated November 2014 (Revision 12).

Sustainable Planning Act 2009

The SP Act seeks to achieve ecological sustainability by:

a. managing the process by which development takes place, including ensuring the process is accountable, effective and efficient and delivers sustainable outcomes

b. managing the effects of development on the environment, including managing the use of premises

c. continuing the coordination and integration of planning at the local, regional and State levels.

Construction of roads or tracks with associated crossing infrastructure may constitute waterway barrier works and will require an Operational Works Permit under the SP Act.

Fisheries Act 1994

The Fisheries Act regulates development:

- for aquaculture
- for waterway barrier works
- for the removal, destruction or damage of marine plants
- in a declared Fish Habitat Area.

Free movement of fish along waterways and onto floodplains is an essential requirement for many species of fish in Queensland. The potential for some works to provide barriers to fish movement has been recognised under the Fisheries Act which provides for some control over the building of the waterway barrier. The intent of the Fisheries Act is to maintain access for fish stocks to move along waterways while allowing for the construction of barriers across and within waterways. Dams, weirs, culverts, causeways, tidal/flood gates, levee banks, silt curtains, litter booms and riffle structures are some examples of works that could trigger a waterway barrier works application.

A fisheries development approval is not required where the works comply with a self-assessable code, such as placing a temporary waterway barrier during construction to provide a dry work environment.

The Project Site crosses a number of waterways that are identified under the Fisheries Act as providing fish passage. The creeks within the Project area are identified as High (red), Moderate (amber), and Low (green). There are no Major (purple) creeks within the vicinity of the proposed works.

14.4 Methodology

The surface water assessment involved the following:

1. Review of relevant legislation and policy and applicability to the Project.
2. Assessment of EVs which may be affected by the Project. There are no defined EVs or water quality objectives for the Condamine-Balonne Basin under the Condamine and Balonne WRP 2004. Therefore draft EVs and associated descriptions have been reviewed from the Condamine catchment by the Condamine Alliance (2012). Draft EVs for the Burnett Catchment were reviewed based on the information published by the Burnett Mary Regional Group (undated).
3. Review of publicly available information relating to surface water quality and flooding within the Study Area, including:
    a. Department of Natural Resources and Mines (DNRM) Interactive FloodCheck Maps (DNRM 2016), including the Interim Floodplain Assessment Overlay and Basin/Sub Basin flood modelling developed during the Queensland Flood Mapping Program
    b. South Burnett Regional Council and the Western Downs Regional Council websites
    c. Bureau of Meteorology (BoM) website for Flood Warning System for the Condamine-Balonne and Burnett catchments (BoM, 2016a, 2016b and 2016c).
4. Discussions with DRNM (Bundaberg and Toowoomba Offices) with regard to construction and operational water supply options.

14.5 Description of environmental values

The Study Area is located within two catchments; the Burnett River catchment in the north-east and the Condamine River catchment in the south-west (refer to Figure 14.1, Volume 2).

The Burnett River catchment includes an area of over 33,000 km^2, starting south near the Bunya Mountains, and extending north to Burnett Heads and forms part of the larger Burnett Basin. The Condamine River catchment, bounded to the south by the Herries Ranges south-west of Warwick, and to the east by the Great Dividing Range, includes a catchment area of over 13,000 km^2. The Condamine River becomes the Balonne River near Glenmorgan and forms part of the wider Condamine and Balonne Basin. The Condamine and Balonne Basin covers approximately 13% of the Murray-Darling River System, which traverses four states within Australia.

Waterways in the Study Area include Ironpot and Boughyard Creeks in the Burnett River catchment (refer to Figure 14.2, Volume 2). These creeks flow to the Boyne River which discharges to the Burnett River. Mount, Jandowae, Downfall, Jingi Jingi, and Jimbour Creeks and their multiple tributaries intersect the Study Area within the Condamine River catchment. Climatic variability within the Study Area cause the above mentioned creeks to be ephemeral in nature, flowing only in times of sufficient rainfall. High flows generally occur during the summer wet season. Given that the Project Site is located in the headwaters of the surface water environment, flows are expected to last for only short periods during and immediately following rainfall events. Due to the ephemeral nature of the tributaries in the Study Area, water quality is likely to be highly variable.

14.5.1 Catchment condition

14.5.1.1 Condamine and Balonne Catchment

The State of the Rivers Report for the Upper Condamine River (DPI, 1994) described the Upper Condamine catchment as in moderate to degraded overall condition. The specific condition of each of the attributes according to DPI (1994) is described below:

- Reach Environs – Very poor to moderate condition, largely attributable to grazing and cropping land uses. Roads, bridges, culverts and water extraction activities are also likely causes
- Bank Stability – Mostly stable to very stable (11% of those surveyed were unstable to very unstable). Almost all banks surveyed showed some signs of erosion. Factors attributable to bank instability include presence of stock, clearing of riparian vegetation, runoff and excessive flow to streams
- Bed and Bar Stability – Only half of the streams surveyed had stable beds. Erosion and aggradation were present at most sites surveyed, and are largely attributable to agricultural practices
- Channel Diversity and Habitat Types – Most of the stream lengths surveyed had poor to very poor channel diversity, as two channel habitat types (pools and riffles) were predominant throughout the catchment. The diversity of aquatic flora and fauna throughout the catchment is expected to be low as a result of poor channel diversity
- Riparian Vegetation – Most of the stream lengths within the catchment had very poor riparian vegetation condition. Weed species formed over one-third of the species composition within the riparian zone. The riparian zone was generally less than 21 m and was similar to the upper bank width
- Aquatic Vegetation – Mostly poor to very poor condition in the areas surveyed, attributable to the dry period leading up to the survey in 1994
- Aquatic Habitat – Over half (61%) of the sites surveyed had poor to very poor aquatic habitat, reflecting poor in-stream cover and habitat diversity. Passage for aquatic organisms was generally very restricted
- Scenic and Recreation Values – 90% of the sites surveyed were classified as undeveloped rural.

14.5.1.2 Burnett Catchment

The State of the Rivers Report for the Burnett River (DNR, 1999) described the Burnett catchment as in good to poor overall condition, with the most common stream condition being moderate. The specific condition of each of the attributes according to the former Department of Natural Resources (1999) is described below.

- Reach Environs – Moderate to poor condition for the Lower Burnett sub-catchment. This is attributed to extensive clearing of vegetation adjacent to streams, in addition to the ability of stock to access riparian zones
- Bank Stability – Mostly stable to very stable. Over two-thirds of banks surveyed showed some signs of erosion. Factors attributable to bank instability include presence of stock, clearing of riparian vegetation and runoff
- Bed and Bar Stability – Half of the streams surveyed had stable beds. Erosion and aggradation were present at some sites surveyed, which is largely attributable to agricultural practices. Bars were recorded in the stream bed of over one-third of all sites surveyed
- Channel Diversity and Habitat Types – Most of the stream lengths surveyed had poor to very poor channel diversity, as three channel habitat types (pools, runs and riffles) were predominant throughout the catchment. The diversity of aquatic flora and fauna throughout the catchment is expected to be low as a result of poor channel diversity
- Riparian Vegetation – Most of the stream lengths within the catchment had very poor riparian vegetation condition. Weed species were recorded at over 80% of the survey sites. The riparian zone was generally less than 19 m
- Aquatic Vegetation – Mostly poor to very poor condition in the areas surveyed. Whilst abundance of aquatic vegetation was low, diversity was generally good, with native vegetation dominating most streams surveyed.

- Aquatic Habitat – Over three-quarters of the sites surveyed had very poor to moderate aquatic habitat, reflecting poor in-stream cover and habitat diversity. The northern sub-catchments demonstrated relatively good aquatic habitat. Passage for aquatic organisms was generally restricted
- Scenic and Recreation Values – 65% of the sites surveyed were classified as undeveloped rural, with 21% of the sites classified as semi-natural areas.

14.5.2 Flooding and drainage

Figure 14.3 shows the indicative flood hazard for the Project Site. The mapped flood hazard comprises data obtained from DNRM and consists of:

- The Queensland Reconstruction Authority (QRA) 2014 Interim Floodplain Assessment Overlay (IFAO), which shows the likely extent of riverine floodplains; and
- The DNRM Basin Flood Mapping overlay which complements the IFAO and provides detail for identifying potential flood hazard at a catchment level.

Interim Floodplain Assessment Overlay

The QRA, with the support of DNRM, has undertaken a State-wide mapping exercise to establish interim mapping of floodplains at a sub-basin level. This mapping exercise resulted in the development of the IFAO (QRA, 2014). The mapping is not based on a particular flood event/magnitude, nor does it represent the Probable Maximum Flood (PMF) which is commonly derived through detailed flood studies to identify the ultimate extent of the floodplain. The mapping also does not include or specify a flood level or flood flow velocity. Instead, the mapping is generally based on various landform datasets that represent or indicate previous inundation. It is a spatial extent based on these datasets to determine an area of interest for potential flooding impacts.

To support the floodplain maps, a Model Code has been prepared to support the assessment of development on land wholly or partially within the area shown on the maps. Councils may decide on the types of development to which the Model Code applies. The purpose of the Code is to manage the presence of structures in the floodplain so that risks to life and property during future flood events are minimised and to ensure that future development does not increase the potential for flood damage on site or any other property (QRA 2014).

Figure 14.3 shows that the mapped extent of the IFAO for the Burnett and Condamine-Balonne sub-basins does not fall within the Study Area. The Model Code is therefore unlikely to apply to any new development at the Project Site.

Basin Flood Mapping

The Basin Flood Mapping provides catchment level understanding of flood behaviour during major flood events and complements the initial flood hazard assessment by providing an additional level of accuracy. Results are not appropriate for design of flood mitigation options, but do communicate flood risk to the community. The methodology is generally considered conservative.

Figure 14.3 shows that the Basin Flood Mapping overlay indicates the potential for inundation resulting from the 100 year Average Recurrence Interval (ARI) event. It is noted however that the Project Site is located in catchment headwaters at the top of the Great Dividing Range; widespread inundation of the Project Site is therefore not expected, even in extreme rainfall events. It is also noted that while localised runoff will follow gully contours down the range during rainfall events these flows are likely to be subject to rapid recession upon cessation of the rainfall event.

Additional Flood Studies

The DNRM Flood Information Report Database for the Project Site location indicates that a flood study has been undertaken for Beardmore Dam, 300 km west south-west of the Project. The study was undertaken during the dam design and does not appear to be publicly available on the internet.

BoM operates a flood warning system for the Condamine and Balonne and Burnett Basins based on rainfall and river height observations. The BoM Flood Warning Centre issues flood warnings, which include the river height predictions and river height bulletins for the catchments during flood events. The flood warning system is useful to assess riverine flooding in middle to lower reaches of the catchments. As the Project Site is in catchment headwaters and not considered at risk of riverine flooding, the BoM flood warning system provides limited use to assess the Project Site flood risk.

A review of cyclone risk for the Project site indicates that the average annual number of cyclones is approximately less than 0.1 (Bureau of Meteorology, 1969/70 to 2005/06 data).

In summary, a review of relevant existing information is sufficient to provide a high level understanding of the flood risk within the Study Area. The review indicates that the Study Area is not subject to riverine (floodplain) flooding but is likely to be subject to overland flow during significant rainfall events, as runoff is conveyed along the numerous headwater drainage lines that traverse the site. This runoff is likely to be subject to rapid recession upon cessation of the rainfall event.

14.5.3 Water supply options

Construction water supply

Water will need to be sourced for a number of demands during construction. Assuming a construction programme of two to two and a half years, the Project's construction water supply requirements have been preliminarily estimated to be 250 ML. Supply will be to the following key demands:

- Bulk earthworks and material conditioning
- Vegetation and topsoil stripping
- Dust suppression
- Concrete batching.

This volume is subject to ongoing refinement as the Project progresses through to detailed design and construction planning.

Discussions were held with DNRM in Bundaberg and Toowoomba with regard to gaining access to water from surface water streams within the Burnett River and Condamine River catchments respectively. DNRM (Bundaberg and Toowoomba Offices) advised in 2016 that under the current climate conditions groundwater was the preferred water supply resource for construction. Further detail regarding groundwater use is presented in Chapter 15 Groundwater.

AGL will also consider whether water supply can be obtained from stock dams through negotiation with the landholder. It is noted that stock dams may not provide a sustainable supply of water for the construction period as water availability in stock dams is dependent on factors such as catchment area, consistent rainfall, farm use requirements and groundwater recharge. Construction of new dams will require relevant planning and environmental approvals.

Based on the available information it is considered that using groundwater (under a Water Permit) would be the most appropriate option for the construction period (further discussed in Chapter 15 Groundwater). Construction water supply options will be determined during the detailed design of the Project and confirmed prior to construction.

Given the simplistic nature of the Projects water management requirements, the current level of design progression and that supply volume is subject to ongoing refinement, a construction water balance has not been prepared.

Operational water supply

Long term operational water requirements will be subject to the availability of water and the successful application for a Water License. There will be a limited amount of water required during operation, which can be adequately supplied through rain water tanks, on-site dam/s or water-truck deliveries to the site. Operational water supply options will be determined during the detailed design of the Project and confirmed prior to construction. Given the limited requirement for operational water supply and the current level of design progression, an operational site water balance is not considered appropriate as the potential demands would likely be significantly within any model margin of error.

Any construction and/or operation of on-site dam/s would be subject to relevant approvals under the SP Act and the Water Act which regulate the taking, using or interference of overland flows and watercourses. It should be noted that the Moratorium Notice restricting new works which involve taking of or interfering with overland flow in the Condamine and Balonne catchment (which had effect from 12 December 2008) ceased to have effect from 12 December 2014.

14.5.4 Published Environmental Values

EVs are the qualities that make water suitable for supporting aquatic ecosystems and human uses. EVs are being progressively determined for areas of Queensland by the DEHP. As EVs are defined for Queensland waters, they are added to Schedule 1 of the EPP (Water). The suite of EVs that can be chosen for protection, along with definitions, are provided in Table 14.1.

EVs for sub-catchments relevant to the Study Area are presented in Table 14.2. Associated descriptions for sub-catchments in the Condamine catchment are presented in Table 14.3.

Table 14.1 Suite of surface water EVs that can be chosen for protection

EV	Definition
Aquatic ecosystem	A community of organisms living within or adjacent to water, including riparian or foreshore area. (EPP Water, Schedule 2). The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species (such as turtles, platypus, seagrass and dugongs) and their habitat, food and drinking water. Waterways include perennial and intermittent surface waters, groundwater, tidal and non-tidal waters, lakes, storages, reservoirs, dams, wetlands, swamps, marshes, lagoons, canals, natural and artificial channels and the bed and banks of waterways.
Irrigation	Suitability of water supply for irrigation, for example, irrigation of crops, pastures, parks, gardens and recreational areas.
Farm water supply/use	Suitability of domestic farm water supply, other than drinking water. For example, water used for laundry and produce preparation.
Stock watering	Suitability of water supply for production of healthy livestock.
Aquaculture	Health of aquaculture species and humans consuming aquatic foods (such as fish, molluscs and crustaceans) from commercial ventures.
Human consumption of aquatic foods	Health of humans consuming aquatic foods, such as fish, crustaceans and shellfish from natural waterways.
Primary Recreation	Health of humans during recreation which involves direct contact and a high probability of water being swallowed, for example, swimming, surfing, windsurfing, diving and water-skiing. Primary recreational use, of water, means full body contact with the water, including, for example, diving, swimming, surfing, water-skiing and windsurfing. (EPP (Water), clause 6).
Secondary recreation	Health of humans during recreation which involves indirect contact and a low probability of water being swallowed, for example, wading, boating, rowing and fishing. Secondary recreational use, of water, means contact other than full body contact with the water, including, for example, boating and fishing. (EPP (Water), clause 6).
Visual recreation	Amenity of waterways for recreation which does not involve any contact with water - for example, walking and picnicking adjacent to a waterway. Visual recreational use, of water, means viewing the water without contact with it. (EPP (Water), clause 6).
Drinking water supply	Suitability of raw drinking water supply. This assumes minimal treatment of water is required, for example, coarse screening and/or disinfection.
Industrial use	Suitability of water supply for industrial use, for example, food, beverage, paper, petroleum and power industries. Industries usually treat water supplies to meet their needs.

EV	Definition
Cultural and spiritual values	Indigenous and non-indigenous cultural heritage, for example: - Custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities - Symbols, landmarks and icons (such as waterways, turtles and frogs) - Lifestyles (such as agriculture and fishing). Cultural and spiritual values, of water, means its aesthetic, historical, scientific, social or other significance, to the present generation or past or future generations. (EPP (Water), clause 6).

Source: Adapted from EPP (Water). Dawson River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Dawson River Sub-basin except the Callide Creek Catchment (DEHP 2011).

Table 14.2 Published draft surface water EVs for the Study Area

EV	Condamine Balonne Catchment		Burnett Catchment
	Jandowae and Upper Charleys Creeks[A]	Jimbour Creek[A]	Boyne River above Boondooma Dam Storage[B]
Aquaculture	×	×	×
Aquatic ecosystems (incorporating Habitat value)	✓	✓	✓
Cultural and spiritual values	✓	✓	✓[C]
Drinking water (raw water supplies taken for drinking)	×	✓	✓
Farm supply (e.g. fruit washing, milking sheds, intensive livestock yards)	✓	✓	?
Human consumption (e.g. of wild or stocked fish)	✓	×	✓
Industrial use (e.g. power generation, manufacturing, road maintenance)	✓	×	×
Irrigation	✓	✓	✓
Primary recreation (fully immersed in water e.g. swimming)	×	×	✓
Secondary recreation (possibly splashed with water, e.g. sailing)	×	×	✓
Stock watering (e.g. grazing cattle)	✓	✓	✓
Visual appreciation (no contact with water, e.g. picnics)	×	✓	✓

[A] Condamine Alliance (2012)
[B] Burnett Mary Regional Group (undated)
[C] Indigenous and non-indigenous
× = EV not applicable
✓ = Applicable EV
? = Unknown

Table 14.3 EV description for Condamine sub-catchments

Sub-catchment	Values description
Jandowae & Upper Charlies Creeks	Contains sub-catchments with: - >20% irrigation by area and irrigation extraction licences (irrigation environmental value) - Intensive livestock extraction licence and associated cropping farm use (farm supply environmental value) - >75% grazing use and moderate-high density horses (stock watering environmental value) - 1-10 mining wells (industrial use environmental value) - Fishing (stocked) (human consumption environmental value) - Natural, mostly permanent freshwater wetland (aquatic ecosystem and cultural and spiritual environmental values)
Jimbour Creek	Contains sub-catchments with: - Associated cropping farm use (farm supply environmental value) - 50-75% grazing use and moderate-high density horses (stock watering environmental value) - Bunya Mountains National Park, Jimbour House and Natural, mostly permanent freshwater wetland (aquatic ecosystem, visual appreciation and cultural and spiritual environmental values) - Cattle Creek weir, 10-20% irrigation by area and irrigation extraction licences (irrigation environmental value)

Source: Adapted from the draft surface water EVs for the Condamine catchment (Condamine Alliance 2012)

14.6 Potential impacts

Site activities and water-related discharges with the potential to impact the identified surface water EVs (refer to Section 14.5) are presented in Table 14.4. It is anticipated there will be no controlled releases of water or wastewater to the environment by the Project.

Table 14.4 Potential surface water impacts arising from Project activities

Project phase	Project activity	Potential Impact/s	Relevant EVs
Construction	Earthworks associated with vegetation clearance	Reduced aquatic habitat quality due to loss of riparian vegetation Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground resulting in adverse impacts on receiving environment surface water quality.	Aquatic ecosystems Cultural and spiritual values Drinking water Human consumption Irrigation Primary recreation Secondary recreation Stock watering Visual appreciation
	Earthworks and excavation associated with construction of on-site infrastructure such as wind turbines, access roads and buildings	Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground resulting in adverse impacts on receiving environment surface water quality.	
	Trenching for underground electrical reticulation	Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground resulting in adverse impacts on receiving environment surface water quality.	
	Construction of waterway crossings	Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground resulting in adverse impacts on	

Project phase	Project activity	Potential Impact/s	Relevant EVs
		receiving environment surface water quality Changes in stream geomorphology and aquatic habitat quality resulting from stream bank erosion and scouring Restriction of flow resulting in upstream flooding Restriction of the passage of fish, both upstream and downstream, by increasing flow velocities at crossings (such as bed level crossings, culverts or bridges).	
	Use and storage of chemicals such as fuel	Chemical spills/leaks into surface water bodies resulting in adverse impacts on receiving environment surface water quality.	
Operation	Stormwater runoff from impervious surfaces such as wind turbine hardstand areas and foundations	Increased flow resulting in changes in stream geomorphology and aquatic habitat quality (stream bank erosion and scouring) Increased flow contributing to downstream flooding.	Aquatic ecosystems Cultural and spiritual values Human consumption Primary recreation Secondary recreation
	Presence of waterway crossings	Changes in stream geomorphology resulting from stream bank erosion and scouring Restriction of flow resulting in upstream flooding Restriction of the passage of fish, both upstream and downstream, by increasing flow velocities at crossings (such as bed level crossings, culverts or bridges) Discharge of water-borne sediments and associated contaminants from stream bank erosion and scouring resulting in adverse impacts on receiving environment surface water quality.	
Decommissioning	Earthworks associated with decommissioning of on-site infrastructure	Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground resulting in adverse impacts on receiving environment surface water quality.	Aquatic ecosystems Cultural and spiritual values Drinking water Human consumption Irrigation Primary recreation Secondary recreation Stock watering Visual appreciation
	Use and storage of chemicals such as fuel	Chemical spills/leaks into surface water bodies resulting in adverse impacts on receiving environment surface water quality.	

14.7 Mitigation measures

Mitigation measures associated with each of the potential surface water impacts identified in Section 14.6 are presented in Table 14.5.

Table 14.5 Potential surface water impacts and mitigation measures

Phase	Potential surface water impact	Discussion and proposed mitigation measures
Construction	Clearing of riparian vegetation leading to reduced aquatic habitat quality	The Project requires minimal vegetation clearing. The area of vegetation to be cleared will be determined during detailed design of the Project. Placement of infrastructure in vegetated areas will be avoided where possible. Where clearance of vegetation is required, clearance activities would be undertaken in accordance with the site-specific Erosion and Sediment Control Plan (ESCP), which will be prepared as part of an overarching CEMP prior to the commencement of construction.
	Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground (associated with earthworks, trenching and vegetation removal) resulting in adverse impacts on receiving environment surface water quality	Earthworks, trenching and vegetation removal will be undertaken in accordance with best practice erosion and sediment control, as per the ESCP and CEMP. It is expected that implementation and maintenance of standard erosion and sediment controls (such as those set out in 'Best Practice Erosion and Sediment Control' (International Erosion Control Association Australasia 2008)) will minimise the likelihood of material migrating off site.
	Changes in stream geomorphology and aquatic habitat quality resulting from stream bank erosion and scouring during construction of waterway crossings	Construction activities within and/or adjacent to waterways will be minimised as much as feasibly possible to minimise disturbance to those waterways. A riverine protection permit (as required under section 266 of the Water Act) will be obtained prior to any excavation or placement of fill within a watercourse unless the works can be undertaken in accordance with the Riverine protection permit exemption requirements (DNRM, 2013). The application will provide detail as to how the proposed works will comply with applicable guidelines. Best practice principles will be adopted when excavating or placing fill in a watercourse.
	Restriction of flow during construction of waterway crossings resulting in upstream flooding	
	Construction of waterway crossings restricting the passage of fish, both upstream and downstream, by increasing flow velocities at crossings (such as bed level crossings, culverts or bridges)	The Project will aim to design creek crossings in accordance with the DAF self-assessable codes, which exist for low-impact development activities such as temporary works, bed level crossings and culverts on red, amber and green creeks. Where the design provisions of the codes cannot be met, a development approval will be sought. In complying with the self-assessable codes, the impact to fish passage is expected to be minimal.
	Chemical spills/leaks into surface water bodies resulting in adverse impacts on receiving environment surface water quality	A Materials Handling Plan (MHP) will be included within the CEMP. The storage, disposal and use of all potentially hazardous materials will be in accordance with the relevant guidelines and Australian Standards as defined in the CEMP.

Phase	Potential surface water impact	Discussion and proposed mitigation measures
Operations	Stormwater runoff from impervious surfaces increasing flow and resulting in changes in stream geomorphology and aquatic habitat quality (stream bank erosion and scouring)	The proposed infrastructure will result in only a very small increase in the proportion of impervious area in the catchment and therefore there will be a very small increase in the runoff volume. It is not expected that this will significantly impact the peak flood and volume generated, or timing of the catchment especially considering the large size of the receiving environment catchments compared with the Study Area. Mitigation measures to control stormwater discharge from site are not considered necessary given the small volume discharged in the context of the receiving environment catchments. There will be no formal infrastructure on-site for directing stormwater discharges. Stormwater will be discharged diffusely across the site (predominantly via vegetated surfaces), which will assist in reducing any impacts to stream water quality and geomorphology.
	Stormwater runoff from impervious surfaces increasing flow and contributing to downstream flooding	
	Changes in stream geomorphology resulting from stream bank erosion and scouring as a result of the presence of waterway crossings	Stream crossings will be designed, constructed and maintained according to relevant industry practice, guidelines and standards, which require that any resultant afflux would not cause adverse impacts to neighbouring property owners or surface water (e.g. aquatic habitat, geomorphology and water quality). In addition, an operational management plan will be developed for the site which will detail methods for minimising sediment-laden runoff in accordance with relevant practice guidelines.
	Restriction of flow caused by waterway crossings resulting in upstream flooding	
	Discharge of water-borne sediments and associated contaminants from stream bank erosion and scouring resulting in adverse impacts on receiving environment surface water quality	
	Restriction of the passage of fish caused by waterway crossings, both upstream and downstream, by increasing flow velocities at crossings (such as bed level crossings, culverts or bridges)	The Project will aim to design creek crossings in accordance with the DAF self-assessable codes, which exist for low-impact development activities such as temporary works, bed level crossings and culverts on red, amber and green creeks. Where the design provisions of the codes cannot be met, a development approval will be sought. In complying with the self-assessable codes, the impact to fish passage is expected to be minimal.
Decommissioning	Discharge of sediments and associated contaminants (both air and water-borne) from exposed ground resulting in adverse impacts on receiving environment surface water quality	A site-specific ESCP will be prepared prior to the commencement of decommissioning works. Where clearance of vegetation is required, clearance activities would be undertaken in accordance with the ESCP and Decommissioning and Rehabilitation Plan (DRP). It is expected that implementation and maintenance of standard erosion and sediment controls would minimise the likelihood of material migrating off site.
	Chemical spills/leaks into surface water bodies resulting in adverse impacts on receiving environment surface water quality	A MHP will be included within the DRP. The storage, disposal and use of all potentially hazardous materials will be in accordance with the relevant guidelines and Australian Standards.

14.8 Residual impacts

With the mitigation measures identified in Table 14.5in place, the Project is not anticipated to cause significant impacts on the condition of either the Burnett or Condamine River catchments. Any potential impacts on water quality are likely to be minor in nature and localised in extent.

14.9 Cumulative impacts

The impacts on the surface water environment associated with the Project are considered to be minor, temporary and reversible. Implementation of the identified mitigation and control strategies are considered suitable to adequately protect the identified EVs in the Study Area. On a regional scale, the surface water impacts associated with the Project are considered to be negligible and are therefore unlikely to contribute to any cumulative impacts from other similar projects in the region.

14.10 Summary and conclusions

The Study Area falls within the catchments of the Burnett and Condamine Rivers. The overall condition of these catchments is considered moderate, with reach conditions varying from poor to very good.

The potential impacts of stormwater discharges from the Project on surface water quality and quantity arise from a range of activities associated with the construction, operation and decommissioning phases. This assessment considers that the impacts associated with the Project could be appropriately managed by implementing a range of mitigation measures during the various phases of the Project.

With respect to statutory permits relating to surface water, the construction of the Project will require a Riverine Protection Permit. With respect to statutory permits relating to Operational works under the SP Act, the construction of the Project will require an Operational Works Permit for the constructing or raising of a waterway barrier. All permits will be obtained prior to the construction and operational phases of the Project.

The construction contractor will be responsible for ensuring that erosion and sediment control procedures (in the form of an ESCP) and a MHP are contained within the CEMP.

The Project is not expected to have an adverse impact on the overall condition of the Burnett and Condamine catchments. Any impacts associated with the Project will be localised, temporary and reversible.

14.11 References

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ) 2000, ‘Australian guidelines for water quality monitoring and reporting’, Canberra

Bureau of Meteorology 2016a ‘Flood Warning System for the Condamine-Balonne River below Cotswold’, Bureau of Meteorology, Commonwealth of Australia, accessed 15 March 2016, http://www.bom.gov.au/qld/flood/brochures/condamine_balonne/condamine_balonne_downstream_of_cotswold.shtml

Bureau of Meteorology 2016b ‘Flood Warning System for the Condamine River Warwick to Cotswold’, Bureau of Meteorology, Commonwealth of Australia, accessed 15 March 2016, http://www.bom.gov.au/qld/flood/brochures/condamine_cotswold/condamine_cotswold.shtml

Bureau of Meteorology 2016c ‘Flood Warning System for the Burnett River’, Bureau of Meteorology, Commonwealth of Australia, accessed 15 March 2016, http://www.bom.gov.au/qld/flood/brochures/burnett/burnett.shtml

Burnett Mary Regional Group (undated). Burnett-Baffle Water Quality Improvement Plan.

Commonwealth of Australia 2013. Characterising the Relationship between Water Quality and Water Quantity. Prepared by Sinclair Knight Merz for the Department of Sustainability, Environment, Water, Population and Communities, August 2013.

Condamine Alliance (2012). Draft Surface Water Environmental Values for the Condamine Catchment, Queensland. March 2012.

Department of Environment and Heritage Protection (DEHP) 2009, ‘Queensland Water Quality Guidelines 2009’, Queensland Government.

Department of Environment and Heritage Protection 2011. *Environmental Protection (Water) Policy 2009. Dawson River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Dawson River Sub-basin except the Callide Creek Catchment.*

Department of Local Government and Planning (DLGP) (2011a) 'Surat Basin Regional Planning Framework', Queensland.

Department of Local Government and Planning (DLGP) (2011b) 'Wide Bay Burnett Regional Plan', Queensland.

Department of Natural Resources (DNR) (1999) 'The State of the Rivers Report for the Burnett River', Queensland.

Department of Natural Resources and Water (DNRW) (2008) 'Moratorium Notice, Water Resource (Condamine and Balonne) Plan 2004, Water Act 2000 (Section 26)', Queensland.

Department of Natural Resources and Water (DNRW) (2013) 'Riverine protection permit exemption requirements', Queensland.

Department of Natural Resources and Mines 2016 'Interactive FloodCheck Map', accessed 15 March 2016, http://flood.dnrm.esriaustraliaonline.com.au/floodcheck/

Department of Primary Industries (DPI) (1994) 'The State of the Rivers Report for the Upper Condamine River', Queensland.

International Erosion Control Association Australasia (IECA) 2008, 'Best Practice Erosion and Sediment Control'

Queensland Reconstruction Authority 2016. Planning for stronger, more resilient floodplains. Part 1 – Interim measures to support floodplain management in existing planning schemes. QRM, accessed 15 March 2016, http://qldreconstruction.org.au/u/lib/cms2/resilient-floodplains-part1-full.pdf

Standards Australia (2006) 'Australian Standard AS 1940:2004 The storage and handling of flammable and combustible liquids'.