KUR-World

Water Resources

Chapter 10.0

Environmental Impact Statement

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Abbreviations used in this chapter are as follows:

Term	Definition
Average Day (AD)	AD demand refers to the total annual demand, divided by 365.
Matters of National Environmental Significance (MNES)	Environmental and heritage matters protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Water Sensitive Urban Design (WSUD)	Planning and design of stormwater systems to integrate the urban water cycle and support healthy ecosystems.

10.0 WATER RESOURCES

10.1 Introduction

KUR-World will implement a best practice, integrated approach to total water cycle management, with the intention of:

- Minimising water consumption and wastewater generation through water efficient planning, design, construction and operation.
- Maximising opportunities for onsite harvesting, treatment and re-use of rainwater, stormwater, and site generated wastewater.
- Managing stormwater quality and quantity through the integration of best practice water sensitive urban design into the site master plan.
- Sustainably abstracting and utilising groundwater, mitigating impacts to the environment and other groundwater users.

This chapter describes the surface and ground water resources to be utilised or with the potential to be impacted by KUR-World. It addresses the equitable, sustainable and efficient use of water resources, corresponding to Sections 12.23 – 12.29 of the Terms of Reference.

It is noted that a significant proportion of the information required in the Water Resources sections of the Terms of Reference is addressed in the following chapters, which should be read in conjunction with this chapter:

- **Chapter 7.1 Water and Wastewater Infrastructure** – Describes the proposed strategy for the provision of water supply and wastewater services for KUR-World. This includes, a description of the detailed water balance analysis used to determine the site's potable and non-potable water demands, confirming the nature and extent of water resources to be utilised, and the development of the water supply and wastewater infrastructure proposed to be constructed both internal and external to the site. Chapter 7.1 corresponds to the Infrastructure Requirements sections of the Terms of Reference 10.13 – 10.17, 10.19 – 10.25 and 10.28 – 10.32, however also addresses the Water Resources sections 12.27 - 12.29.
- **Chapter 7.4 Stormwater** – Describes the proposed stormwater drainage strategy and infrastructure, including the quantity, quality and location of stormwater discharged to water courses. Chapter 7.4 corresponds to the Infrastructure Requirements sections of the Terms of Reference 10.26 – 10.27.
- **Chapter 9 Water Quality** – Describes the surface and groundwater hydrology and water quality across the site and assesses the potential impacts of any discharges on the quality and quantity of receiving waters. Chapter 9 corresponds to the Water Quality Sections of the Terms of Reference 11.24 – 11.31 and also addresses the Water Resources section 11.25.
- **Chapter 18 Hazards, Health and Safety** – Describes the natural hazards relevant to the project, including flooding hazard, corresponding to sections 12.16 – 12.17 of the Terms of Reference.

This chapter provides an assessment of the impacts, and mitigation measures to surface water and groundwater resources associated with the proposed development works, with cross-reference to the analysis and infrastructure descriptions provided in the above chapters. A description of the legislative and policy constraints surrounding the utilisation of surface water and ground water resources is also provided.

10.2 Surface water resources

10.2.1 Introduction

KUR-World has the potential to impact on surface water resources through the following activities:

- generating an increased demand on Mareeba Shire Council's (MSC) water supply network, contributing to increased water abstraction from the Barron River
- discharging stormwater and surplus treated effluent to the onsite water courses or alternative offsite water course
- the construction and operation of infrastructure and facilities with possible impacts to onsite watercourses and water quality

The legislation and policy constraints, impacts, mitigation measures and risks to surface water resources associated with these activities are described below.

10.2.2 Statutory Framework

10.2.2.1 Commonwealth

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Federal Register of Legislation, 2016) provides for the protection of nationally and internationally important flora, fauna, ecological communities and heritage places; known as Matters of National Environmental Significance (MNES). The EPBC Act is relevant to water resources to the extent that potential impacts on water resources may affect MNES. The KUR-World site contains species protected under the EPBC Act. The potential impacts associated with these species are described in Chapter 19 Matters of National Environmental Significance.

10.2.2.2 State

The *Water Act 2000* (Queensland Government, 2017 (b)) provides a framework for the sustainable management of all surface water and ground water resources in Queensland.

Subordinate legislation, the Water Plan (Queensland Government , 2016), along with the Barron Water Management Protocol (Department of Natural Resources and Mines, 2017 (a)), Mareeba-Dimbulah Water Supply Scheme (MDWSS) (Department of Natural Resources and Mines, 2017 (b)) and the MDWSS Operations Manual (Department of Natural Resources and Mines, 2017 (c)), provide the context for surface and ground water access within the Barron River Catchment and Barron Water Plan management area. This is the area in which KUR-World is located (Figure 10-1). The abstraction of any surface water from the Barron River or the various tributary water courses within the KUR-World site, would therefore be regulated under this legislation.

Excavation, placement of fill or destruction of vegetation in a watercourse requires a Riverine Protection Permit under the Water Act, unless the works comply with the Riverine Permit Exemption Requirements. The construction of pipeline and road crossings of watercourses will aim to avoid the excavation, placement of fill or destruction of vegetation or to comply with the exemption requirements.

The *Planning Act 2016* (Queensland Government, 2017 (a)) establishes how the state assesses operational works, including taking or interfering with water. The site contains several watercourses as defined under the Water Act, and an authorisation would be required to take or interfere with the flow of water in these watercourses. It is not proposed to take or interfere with the flow of water in watercourses at the site. Other legislation and policy relating to water quality is discussed in Chapter 9 Water Quality.

Figure 10-1: Barron Water Plan Area (Department of Natural Resources and Mines, 2017 (d))

10.2.3 Activities impacting on surface water resources

10.2.3.1 Increased Abstraction from Barron River

As outlined in Chapter 7.1 Water and Wastewater Infrastructure, MSC owns and operates the existing water supply system servicing the township of Kuranda. The MSC water supply network draws its water from the Barron River, under licence through the MDWSS, prior to treatment and distribution to consumers.

It is understood that MSC currently holds a permanent 460ML/year high priority allocation for the Kuranda water supply system, as well as a number of other temporary allocations. Kuranda's existing Average Day (AD) water demand (excluding any additional demand generated by KUR-World) is currently estimated at around 1.19ML/day (434ML/year) and this is projected to increase to around 1.88ML/day (686ML/year) under ultimate (2030) conditions. Based on these figures, it is anticipated that MSC's existing high priority water allocation will be exceeded at some point in the relatively near future, and that additional allocations will need to be acquired from the MDWSS water market to accommodate planned growth in the township.

In addition, it is estimated that KUR-World will generate a total AD water demand on the MSC water network of around 0.97ML/day (354ML/year). This increased demand will contribute to increased water abstraction from the Barron River, which will need to be accommodated through additional allocations acquired by MSC. Given the regulation of water abstraction from the Barron Water Management Plan area, any additional allocations will need to be acquired from existing licence holders, and so, the net impact on the Barron River Water Resource is expected to be negligible.

As an alternative to obtaining water from MSC, direct abstraction of water from the Barron River under a separate licence was also initially investigated as an option to supplement KUR-World's water demand. As described in Chapter 7.1 Water and Wastewater Infrastructure, this option was ruled out on the basis of numerous constraints and does not form part of the current preferred water supply strategy for the site. Should any changes to the proposed water supply strategy occur in the future, this option may need to be investigated further with consideration given to the purchase of an appropriate water allocation under the MDWSS, as well as the obtainment of other necessary approvals under the Water Act.

10.2.3.2 Discharge of Stormwater

Chapter 7.4 Stormwater Infrastructure provides details on the proposed stormwater infrastructure, management strategy, and discharge of stormwater from the site. The potential impacts, mitigation measures and risks to the water quality of surface water resources are described in Chapter 9 Water Quality.

The details are not repeated in this chapter, however at a high level it is noted that stormwater quantity and quality will be managed through the integration of best practice water sensitive urban design (WSUD) into the site master plan. WSUD features (such as rainwater tanks, swales, detention basins, bio-retention systems, ponds and lakes) will be used to detain and treat excess rainwater and stormwater, and enable harvesting for re-use onsite where feasible. The stormwater design for the site has been developed to achieve the target levels of stormwater quality improvement and stormwater quantity attenuation specified in Far North Queensland Regional Organisation of Councils (FNQROC) development manual (FNQROC, 2014).

10.2.3.3 Irrigation and/or Discharge of Surplus Treated Effluent

Chapter 7.1 Water and Wastewater Infrastructure provides details on the proposed treatment, re-use and discharge of treated effluent from the advanced wastewater treatment plant (WWTP). The potential impacts, mitigation measures and risks to the water quality of surface water resources are described in Chapter 9 Water Quality.

All wastewater will be treated to a high standard (Class A+ with low nutrient levels) by the WWTP and utilised extensively as part of the non-potable water supply strategy. During extended wet weather periods, a surplus supply of treated effluent will be generated. This will need to be disposed of by irrigation or discharge to an alternative location.

A detailed effluent irrigation feasibility study was completed as described in the NRA (2017) Report, *KUR-World Effluent Irrigation Feasibility Study* and summarised in Chapter 9 Water Quality. The conclusion from this study was that it would not be possible to irrigate all surplus effluent without generating at least some level of runoff (or storage overflow). The discharge of some surplus effluent to onsite or offsite water courses will therefore be required. Four alternative effluent disposal options, including to both onsite and offsite water courses have been considered. The confirmation of the preferred option will be undertaken on the basis of further investigations, in order to mitigate risks to surface and groundwater resources and associated ecosystems.

Regardless of which effluent disposal option is adopted, all onsite irrigation of treated effluent will be carefully managed under an irrigation management plan, incorporating as a minimum the management measures described in *KUR-World Effluent Irrigation Feasibility Study* (NRA, 2017):

- Only land identified as suitable for irrigation should be used for effluent disposal.
- Appropriate buffer zones/set-backs nominated in the report should be applied around creeks.
- Irrigable land with moderate slopes (12-20%) should be managed and land condition monitored to prevent run-off and accelerated erosion.
- No effluent irrigation should occur to native vegetation. Effluent from the Rainforest Education Centre should be pumped to the on-site WWTP for treatment.

10.2.3.4 Interference with Onsite Watercourses

The KUR-World site contains several watercourses defined under the *Water Act 2000* (Queensland Government, 2017 (b)), requiring an authorisation to take or interfere with the flow of water within the watercourses.

An extensive network of environmental areas have been designed into the KUR-World Masterplan (Arup, 2017), restricting construction and other activities, to protect these watercourses and other identified environmentally sensitive areas. All significant buildings and infrastructure have been located outside of these areas, however some minor works will be required including:

- road crossings (bridges or culverts)
- pipeline crossings (to be generally constructed via trenchless techniques such as horizontal directional drilling).

The detailed design of any such works will need to mitigate impacts on the defined water courses and may be subject to further approvals under the Water Act and Planning Act.

It is noted that no significant impoundment, extraction, diversion or interception of surface water or overland flow is proposed. In accordance with WSUD principles, some detention, treatment and potentially re-use of stormwater may potentially be undertaken, however the detailed design of any stormwater detention systems will be aimed at attenuating peak flows to match pre-development conditions and will therefore not reduce inflows to the onsite watercourses. A small stormwater sub-catchment also discharges to the existing farm dam, and this arrangement will be retained as part of the KUR-World development.

10.2.4 Potential Impacts

Table 10-1 below provides a summary of the potential impacts to surface water resources. The assessment cross-references to the other chapters of the EIS where further detail is provided.

Table 10-1: Summary of Potential Impacts to Surface Water Resources

Impact type	Chapter reference	Impact Description	Mitigation
Impoundment, extraction, discharge, injection, use or loss of surface water	Chapter 7.1 Water and waste water infrastructure Chapter 9 Water quality	There is no proposed impoundment, extraction or injection of surface water at the site. The use of surface water at the site will be limited to the utilisation of the existing farm dam to balance non-potable water supply and demand. Some detention, treatment and potentially re-use of stormwater may potentially be undertaken in accordance with WSUD principles. High quality recycled water produced by the wastewater treatment plant (WWTP) will be used as part of the site's non-potable water supply. In times of surplus supply, a number of discharge options are being further investigated including discharge to creeks, discharge to the dam, or discharge via a pipeline to an offsite location (either the existing Kuranda WWTP outfall or other acceptable location). There is a risk that the unmitigated discharge of treated effluent to creeks onsite could impact on the habitat of species recognised at the national level.	The detailed design of any stormwater detention systems will be aimed at attenuating peak flows to match pre-development conditions and will therefore not reduce inflows to onsite watercourses. Stringent WWTP effluent water quality criteria have been adopted on the basis of biological criteria for the protection of human health, and physical and chemical criteria (including nutrients) for the protection of freshwater ecosystems. The preferred option for discharge of surplus water from the WWTP will be confirmed in future design stages with consideration of ecological requirements (e.g. to avoid impacts to frog habitat or sensitive waterways) and in consultation with regulatory authorities. Should it be determined that the adopted effluent water quality criteria result in unacceptable environmental risks, additional treatment processes (such as reverse osmosis) will need be investigated, or alternative discharge outfall options considered as described in Chapter 7.1.

Impact type	Chapter reference	Impact Description	Mitigation
Diversion or interception of overland flow	Chapter 7.1 Water and wastewater infrastructure Chapter 7.4 Stormwater	The existing farm dam at the site intercepts surface flow within its small sub-catchment. This dam was subject to a separate approval process. The proposed development will increase the impervious fraction of the site, increasing the volume of stormwater generated by any rainfall event. Some detention, treatment and potentially re-use of stormwater will be undertaken in accordance with WSUD principles There is a risk that without mitigation, the proposed development could impact on the hydrology of the site and existing water courses.	WSUD features (such as rainwater tanks, swales, detention basins, bio-retention systems, ponds and lakes) will be used to detain excess rainwater and stormwater and enable harvesting for re-use onsite where feasible. The stormwater design for the site has been developed to achieve the target levels of stormwater quality improvement and stormwater quantity attenuation specified in the FNQROC manual (FNQROC, 2014).
Changes in flow regimes	Chapter 7.1 Water and waste water infrastructure Chapter 8 Flora and Fauna Chapter 9 Water Quality Chapter 18 Hazard and Risk (Flooding)	If effluent from the WWTP is discharged to waterways at the site (one of the options currently being considered), the additional flow to the waterways could temporarily alter the flow regime. However, discharge to waterways would only occur during the wet season (when excess supply is possible), therefore waterways at the site are likely to be already experiencing high flow volumes which would minimise the impact of the additional flow. The proposed development will increase the impervious fraction of the site, increasing the volume of stormwater generated by any rainfall event. Some detention, treatment and potentially re-use of stormwater will be	The discharge strategy for the WWTP will be confirmed as the design progresses, with consideration of avoiding or minimising impacts to flow regimes. The stormwater design for the site has been developed to achieve the target levels of stormwater quality improvement and stormwater quantity attenuation specified in the FNQROC manual (FNQROC, 2014). The stormwater design for the site incorporates stormwater detention basins and other measures to mitigate flood and water velocity impacts arising from the development. Detailed design will include further flood modelling to confirm the size and location of detention basins to achieve a ‘no-worsening’ outcome with respect to flood levels.

Impact type	Chapter reference	Impact Description	Mitigation
		undertaken in accordance with WSUD principles. Without mitigation, the increase in impervious surfaces at the site could result in afflux (a rise in water level) both within and adjacent to the site during flood events. This could have potential impacts on the hydrology, ecosystems and property on and adjacent to the site.	
Riparian vegetation and bank and channel morphology	Chapter 8 Flora and Fauna	Discharge of WWTP effluent in times of surplus supply could (without mitigation) cause changes to riparian vegetation or bank and channel morphology, for example if the discharge is not controlled and causes erosion or scouring. Flood modelling for the development indicates that without mitigation measures, there could be localised increases in flow velocities during flood events at the site. This has the potential to increase scouring in existing watercourses during flood events.	As described above the preferred WWTP effluent discharge arrangement will be confirmed as the design progresses, to avoid impacts to sensitive habitats and to ensure that the discharge point is appropriately designed to prevent scouring or erosion. The stormwater design for the site incorporates stormwater detention basins and other measures to mitigate flood and water velocity impacts arising from the development.
Water use and supply	Chapter 7.1 Water and wastewater infrastructure	The water use and supply for the site has been determined through a detailed water balance analysis. The water supply strategy for the development includes the use of potable water from the Kuranda water supply (with upgrades as required), the use of groundwater, and the use of recycled water from the WWTP. The increased demand on the MSC water network will contribute to increased water abstraction from the Barron River, which will need to be accommodated through additional	The sustainable yield from groundwater bores at the site has been determined through hydrogeological investigation which informed the rate of groundwater use proposed for the development. The design recognises that upgrades will be required to existing Kuranda water supply infrastructure in order to meet the water supply needs of the development without impacting Kuranda water supply.

Impact type	Chapter reference	Impact Description	Mitigation
		allocations acquired by MSC. Given the tight regulation of water abstraction from the Barron Water Management Plan area, any additional allocations would need to be acquired from existing licence holders, and so the net impact on the Barron River Water Resource is expected to be negligible.	
Surface Water Quality	Chapter 9 Water Quality Chapter 7.1 Water and wastewater infrastructure	Potential impacts to water quality are described in Chapter 9 Water Quality and may include: Pollution or sedimentation during construction	Best practice erosion and sediment controls and materials storage will be in place during the construction period to avoid impacts to water quality of waterways at the site.
		Stormwater runoff from the site during operation	WSUD features (such as rainwater tanks, swales, detention basins, bio-retention systems, ponds and lakes) will be used to detain excess rainwater and stormwater and enable harvesting for re-use onsite where feasible. The stormwater design for the site has been developed to achieve the target levels of stormwater quality improvement and stormwater quantity attenuation specified in FNQROC standards (FNQROC, 2014).
		Change in water quality arising from discharge from the WWTP or the farm dam during times of excess supply	Stringent WWTP effluent water quality criteria have been adopted on the basis of biological criteria for the protection of human health, and physical and chemical criteria (including nutrients) for the protection of freshwater ecosystems. The preferred option for discharge of surplus water from the WWTP will be confirmed in future design stages with consideration of ecological requirements (e.g. to avoid impacts to frog habitat or sensitive waterways) and in consultation with regulatory authorities. Should it be determined that the adopted effluent water quality criteria result in unacceptable environmental risks, additional treatment processes (such as reverse osmosis) will need be investigated, or

Impact type	Chapter reference	Impact Description	Mitigation
			alternative discharge outfall options considered as described in Chapter 7.1.
		Over irrigation of recycled water resulting in runoff into waterways	Modelling has been undertaken to confirm the maximum application rates for recycled water to prevent runoff and associated nutrient discharge to water courses. This is described further in Chapter 9 Water Quality. An Irrigation Management Plan will be developed to ensure that irrigation is managed in an environmentally conscious manner and protect the local environment.
		Failure of wastewater network infrastructure resulting in untreated wastewater discharged to waterways	Wastewater collection infrastructure will be well designed in accordance with FNQROC standards (FNQROC, 2014), and include provisions for emergency storage and backup power supply, to minimise the risk of emergency overflows. Preventative maintenance strategies shall be developed and implemented.
		Failure of wastewater treatment plant resulting in untreated wastewater discharged to waterways	The WWTP will be well designed in accordance with relevant standards, and include provisions for balancing inlet storage, duplication of critical components, and backup power. The preferred option for discharge of surplus water from the WWTP will be confirmed in future design stages with consideration of ecological requirements (e.g. to avoid impacts to frog habitat or sensitive waterways) and in consultation with regulatory authorities.

10.3 Groundwater resources

10.3.1 Introduction

KUR-World has the potential to impact on groundwater resources through the following activities:

- abstraction of groundwater for utilisation as part of the site's non-potable water supply system
- irrigation of recycled water as part of both routine irrigation practices, and to dispose of surplus treated effluent.

The legislation and policy constraints, impacts, mitigation measures and risks to groundwater resources associated with these activities are described below.

10.3.2 Statutory Framework

10.3.2.1 Commonwealth

The EPBC Act is relevant to groundwater resources to the extent that potential impacts on water resources may affect MNES. The KUR-World site contains species protected under the EPBC Act. The potential impacts associated with these species are described in Chapter 19 Matters of National Environmental Significance.

10.3.2.2 State

The *Water Act 2000* (Queensland Government, 2017 (b)) provides a framework for the sustainable management of all surface water and ground water resources in Queensland.

As the KUR-World site is not located within a groundwater management area, is not covered by a moratorium under the Water Plan (Barron) 2002, or within a declared groundwater area under the *Water Regulation 2016*, no licences or entitlements are required to abstract groundwater from the site. However, it should be noted that there is a provision in the Water Act (Queensland Government, 2017 (b)) that allows a water service provider to restrict access to sub-artesian water in certain circumstances, therefore access to groundwater may become subject to requirements in the future.

Water Regulation 2016 clause 98(1)(a) and Schedule 9 Part 1 indicate that works to take groundwater outside of the Atherton or Cairns Northern Beaches Groundwater Management Areas in the Barron water plan area is not assessable development. As such, no development approvals are required for the construction of the proposed groundwater infrastructure, however all bores and groundwater infrastructure will still need to comply with relevant standards including the Minimum Construction Requirements for Water Bores in Australia (Australian Government National Water Commission, 2012).

10.3.3 Activities impacting on groundwater resources

10.3.3.1 Abstraction of Groundwater For On-Site Use

As outlined in Chapter 7.1 Water and Wastewater Infrastructure, a detailed hydrogeological investigation was undertaken to provide an understanding of the regional and local hydrology at the site, and ultimately to confirm the maximum long-term sustainable groundwater yield to mitigate impacts on the environment and surrounding groundwater users. The hydrogeological investigation is detailed in the Rob Lait & Associates (2017) KUR-World Groundwater Report.
In summary, the report found:

- Groundwater abstraction was viable from five of the existing bores onsite.
- The combined maximum sustainable yield from the five bores, to mitigate impacts on the environment and surrounding groundwater users, is 0.54ML/day.

- If groundwater is utilised as a component of the water source for KUR-World, a rigid pumping and recovery schedule (14 hours pumping followed by 10 hours recovering for all tested bores) would need to be adopted.

On the basis of these recommendations, the water balance analysis has considered a maximum available groundwater supply of 0.54ML/day, based on abstraction from all five bores at a maximum of 14 hours per day, followed by 10 hours recovery.

10.3.3.2 Irrigation of Recycled Water

Section 7.1 Water and Wastewater Infrastructure provides details on the proposed treatment, re-use and discharge of treated effluent from the advanced WWTP. The potential impacts, mitigation measures and risks to the water quality of surface water resources are described in Chapter 9 Water Quality.

As outlined in Section 10.2.3.3 above, a detailed effluent irrigation feasibility study was completed which considered the potential impacts of effluent irrigation on surface and groundwater resources. The study is described in *KUR-World Effluent Irrigation Feasibility Study* (NRA, 2017), and as summarised in Chapter 9 Water Quality, no potential adverse groundwater impacts were identified under any of the effluent irrigation scenarios modelled for all stages of the project. Provided that irrigation occurs on land that is suitable for receiving irrigation, the land is used for agriculture or amenity planting, and effluent quality and quantity is similar to that modelled in the *KUR-World Effluent Irrigation Feasibility Study* (NRA, 2017), no adverse impacts to groundwater values are expected in the long term.

10.3.4 Potential Impacts

Table 10-2 below provides a summary of the potential impacts to groundwater water resources. The assessment cross-references to the other chapters of the EIS where further detail is provided.

Table 10-2: Summary of Potential Impacts to Groundwater Resources

Impact type	Chapter reference	Impact Description	Mitigation
Groundwater abstraction	Chapter 7.1 Water and wastewater infrastructure	Over abstraction of groundwater resulting in depletion of groundwater resources, associated impacts on other groundwater users and groundwater ecosystems.	A detailed hydrogeological investigation was undertaken to provide an understanding of the regional and local hydrology at the site, and ultimately to confirm the maximum long-term sustainable groundwater yield to mitigate impacts on the environment and surrounding groundwater users. The hydrogeological investigation is detailed in the Rob Lait & Associates (2017) KUR-World Groundwater Report. Groundwater abstraction will be limited to the estimated maximum sustainable yield of 0.54ML/day. A rigid pumping and recovery schedule (14 hours pumping followed by 10 hours recovering for all tested bores) will be adopted.
Groundwater quality	Chapter 9 Water Quality	Irrigation of recycled water resulting in leaching of nutrients, resulting in contamination of groundwater.	Modelling has been undertaken to confirm the maximum application rates for recycled water to prevent runoff and associated nutrient discharge to water courses. This is described further in Chapter 9 Water Quality. No potential adverse groundwater impacts were identified under any of the effluent irrigation scenarios modelled for all stages of the project. An Irrigation Management Plan will be developed to ensure that irrigation is managed in an environmentally conscious manner and protect the local environment, incorporating the following as a minimum: Incorporating as a minimum the management measures described in the KUR-World Effluent Irrigation Feasibility Study (NRA, 2017) Only land identified as suitable for irrigation should be used for effluent disposal. Appropriate buffer zones/set-backs nominated in the report should be applied around creeks. Irrigable land with moderate slopes (12-20%) should be managed and land condition monitored to prevent run-off and accelerated erosion.

Impact type	Chapter reference	Impact Description	Mitigation
			No effluent irrigation should occur to native vegetation. Effluent from the Rainforest Education Centre should be pumped to the on-site WWTP for treatment.

10.4 Conclusions

Potential impacts to surface and groundwater resources have been assessed in this chapter, with cross-reference to other chapters of the EIS which provide details of water and wastewater infrastructure, stormwater, water quality and flooding.

Potential water quality impacts will be further assessed and mitigated in future stages of design, and in consultation with regulatory agencies.

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