EPBC Act referral

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Title of proposal	2022/9153 - Cocos West Island Seawater Desalination Plant

Section 1

Summary of your proposed action

1.1 Project industry type Water Management and Use

1.2 Provide a detailed description of the proposed action, including all proposed activities

Water Corporation is proposing an action to construct a seawater desalination plant (SDP) to replace the existing West Island public drinking water source. Feedwater for the SDP will be sourced from a water production borefield and effluent (brine) produced by the desalination process will be discharged into nearshore marine waters. Product water (drinking water) from the SDP will be conveyed to the West Island settlement via a new pipeline. Collectively, the borefield, the desalination plant and the conveyance are referred to as the SDP (the proposed action) and include:

- five beach bores capable of producing 200 kilolitres (kL)/day each
- seawater reverse osmosis (SWRO) system located within a new WTP, situated directly north of the existing WWTP. Production capacity of the SWRO system will be 200 kL/day
- brine disposal system including tank, pumping station and pressure main connecting to existing wastewater treatment plant (WWTP) ocean outfall,
- potable water pumping station and associated pipeline (DN100 PVC) to transfer water to the West Island settlement
- chlorination plant
- fluoridation plant.

The proposed SDP will utilise the existing WWTP ocean outfall, which is approximately 400 m in length and discharges at a depth of approximately 10 metres below sea level (mbsl). The outfall pipe lies across a gently down-sloping seabed that is predominantly reef habitat composed of coral bomboras and reef-rubble, with some areas of bare sand habitat proximate to the shoreline. The end of the outfall pipe is positioned within metres of the reef edge, beyond which the seabed slopes steeply downwards to over 1000 mbsl.

Discharge of treated wastewater currently occurs for approximately two hours per day. The wastewater from the existing WWTP will be discharged at different times to the brine from the proposed SDP, hence no co-mingling of waste discharges is anticipated to occur. A combination of gravity-fed and pumped discharge will occur, dependent on brine tank levels.

The location of the proposed action on West Island, incorporating all the SDP key infrastructure elements relative to the existing WWTP ocean outfall, is depicted in (Att 1, Figure A).

The activities during the construction phase of the proposed action that may have a direct or indirect impact on the environment are:

- vegetation clearing at the proposed SDP and borefield sites, noting that vegetation at the borefield that is between Sydney Highway and an existing (cleared) access track that is approximately parallel to the highway will be retained; the boundary of the borefield will abut the eastern edge of the existing track.
- construction of a water production borefield including headworks and infrastructure
- construction of buildings to house the SDP
- installation of pipeline between borefield and SDP, and SDP and settlement, using open excavation to a maximum depth of 1 m
- generation of construction noise (restricted to daytime hours)
- alteration of the setting, angle and orientation of the terminal end of the existing ocean outfall pipe.

The activities during the operational phase of the proposed action that may have a direct or indirect impact on the environment are:

- generation of noise during the operation of the bore pumps and SDP
- artificial lighting at the SDP site
- discharge of SDP effluent (brine) to nearshore marine waters.

1.3 What is the extent and location of your proposed action?

See Appendix B

1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for off-shore actions, shortest distance to mainland)

The proposed action is ~2 km north-west of the Cocos (West) Island settlement and ~2130 km north-west of nearest point on mainland Western Australia.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

The proposed SDP and the associated borefield will be located on the eastern side of Sydney Highway, on flat terrain with white beach sands supporting planted Cocos nucifera (coconut trees).

The pipeline connecting the borefield, the SDP and the settlement will be located in flat terrain within existing road reserves, which are comprised of white beach sands that support introduced grass and weed species.

Discharge of brine from the proposed SDP will be to nearshore marine waters, via the existing WWTP ocean outfall. The terminal end of the existing outfall is ~400 m offshore of the west coast of Cocos (West) Island, on the seabed shelf and in water depth of ~10 m. The seabed at the existing discharge location is gently down-sloping reef habitat beyond which the seabeds drops off sharply to abyssal depth.

1.6 What is the size of the proposed action area development footprint (or work area) including disturbance footprint and avoidance footprint (if relevant)?

The development area footprint (DAF; Att 1, Figure B) is 1.47 ha and includes:

- an area (0.8731 ha) directly north of the existing West Island Wastewater Treatment Plant (WWTP) where the proposed SDP infrastructure is to be located
- an area (0.2500 ha) further north where the five proposed bores will be located
- an area (0.3464 ha) that will be disturbed to install the water pipeline
- an area (0.0001 ha) around the existing WWTP ocean outfall pipe that will be disturbed to facilitate altering the setting, angle and orientation of the terminal end of the pipe.

The pipeline route has been included in the DAF but will be installed within existing road reserves that are bare sand or colonised by introduced turfing grass species and will not involve the permanent remove of any native flora or vegetation and will not impact on any MNES. The spatial extent of the pipeline route has been included in the DAF as its construction is associated with the proposed action.

1.7 Proposed action location

Other - The proposed action will be located on Part Lot 100 (Plan 18500) Sydney Hwy, Cocos (West) Island.

1.8 Primary jurisdiction Cocos Keeling Island

1.9 Has the person proposing to take the action received any Australian Government grant funding to undertake this project?

☐ Yes ☑ No

1.10 Is the proposed action subject to local government planning approval?

☐ Yes ☑ No

1.11 Provide an estimated start and estimated end date for the proposed action

Start Date 06/03/2023
End Date 30/06/2023

1.12 Provide details of the context, planning framework and state and/or local Government requirements

Most Western Australian (WA) laws have been applied to the Commonwealth as Applied Law for the Indian Ocean Territories, which includes the Cocos (Keeling) Islands. Once a WA law has been applied, it becomes a Commonwealth legislation known as Commonwealth Applied Law. For example, WA's EP Act 1986 is known as the Environmental Protection Act 1986 (WA)(CI)(CKI) when applied to Christmas Island (CI) and the Cocos (Keeling) Islands (CKI).

At a local government are level, the Shire of Cocos (Keeling) Islands is required to operate as if it were a Western Australian local government subject to WA legislation in respect of all operations.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

A development application is not required to be submitted to the Shire to establish the proposed SDP infrastructure; by virtue of Section 137 of the Water Services Act 2012, Water Corporation is a Section 6 body under the Planning and Development Act 2005. This means it is exempt from the requirement to obtain development approvals under Local Planning Schemes.

With respect to environmental approvals, WA laws apply under Section 8A of the Cocos (Keeling) Islands Act 1955 (Cth) and are administered by the WA Department of Water and Environmental Regulation (DWER). In relation to the proposed action:

- water production bores and the buildings required to house the SDP are considered structures and as such clearing of vegetation for their construction is exempt under Item 1, Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004
- a 26D licence to construct the water production bores and a 5C licence to abstract water are not required as the borefield is not in a proclaimed area under the Rights in Water and Irrigation Act 1914 (WA).

1.13 Describe any public consultation that has been, is being or will be undertaken, including with Indigenous stakeholders

The public consultation process commenced with notice of the proposed SDP published on the Commonwealth's Department of Infrastructure, Transport, Regional Development and Communications webpage in February 2022. Fact Sheets (Att 3, pages 1-2) and FAQ (Att 3, pages 3-4) for the proposed SDP have been published on the Department's website and will also be translated into Cocos Malay.

The Department referred the proposed SDP to the Parliamentary Standing Committee on Public Works (PWC) on 17 February 2022 for Parliamentary approval. The PWC Report and Statement of evidence has been published and public comment is open until 17 March 2022.

Key local stakeholders and residents on Cocos (Keeling) Island will be informed through articles in the local community newsletter, "The Atoll". The first public notice (Att 3, page 5) was published in "The Atoll" edition dated 25 February 2022 and includes reference to the PWC process and public comment opportunity. Additional notices and public information on the proposed SDP will be published in "The Atoll" as required throughout the project.

A community workshop will be held in mid-2022 to provide further information to the community on the proposed SDP.

Water Corporation has been working closely with the officers and Council of the Shire of Cocos (Keeling) Islands, who are strongly supportive of the proposed SDP.

The Cocos (Keeling) Islands were uninhabited prior to settlement in 1826 and as such there is not considered to be any indigenous stakeholders.

1.14 Describe any environmental impact assessments that have been or will be carried out under Commonwealth, State or Territory legislation including relevant impacts of the project

Water Corporation has undertaken the following technical studies and biological surveys to assist in assessing potential impacts to West Island's environment from to the proposed SDP:

- Dispersion Modelling and Environmental Impact Assessment (included as Att 4-Dispersion Modelling and EIA Report_v2)
- Flora and Fauna Survey (included as Att 2-Flora and Fauna Survey Report_v2)
- Cocos (Keeling) Islands Outfall Monitoring 2020 Supplementary Report (included as Att 5-Cocos West Island Outfall Monitoring 2020 Report).

The WA Department of Water and Environmental Regulation (DWER) have advised that Regulation 5, Item 1 exemption (Clearing to construct a building) is applicable and a clearing permit under the Environmental Protection Act 1986 (WA)(CKI) is not required.

DWER have advised that licences to construct a well and to abstract water under the Rights in Irrigation and Water Act 1914 are not required as the borefield is not within a proclaimed area under the Act.

1.15 Is this action part of a staged development (or a component of a larger project)?

☐ Yes ☑ No

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

1.16 Is the proposed action related to other actions or proposals in the region?

☐ Yes ☑ No

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 2

Matters of national environmental significance

2.1 Is the proposed action likely to have any direct or indirect impact on the values of any World Heritage properties?

☐ Yes ☑ No

2.2 Is the proposed action likely to have any direct or indirect impact on the values of any National Heritage places?

☐ Yes ☑ No

2.3 Is the proposed action likely to have any direct or indirect impact on the ecological character of a Ramsar wetland?

☐ Yes ☑ No

2.4 Is the proposed action likely to have any direct or indirect impact on the members of any listed species or any threatened ecological community, or their habitat?

☑ Yes ☐ No

Species or threatened ecological community

Hypotaenidia philippensis andrewsi (buff-banded rail (Cocos (Keeling) Islands)

This subspecies of the buff-banded rail is thought to be restricted to the North Keeling Island of the Cocos (Keeling) Islands and persisted on the South Island and West Island of the main atoll until the 1980s (Department of Agriculture, Water and the Environment [DAWE] 2021a).

The buff-banded rail (Cocos (Keeling) Islands) occupies wetlands that are permanent and ephemeral, saline and fresh, terrestrial, estuarine and littoral. In coastal areas, they can occur on reef flats, sand banks and beaches. They also inhabit dense vegetation, such as mangroves, overgrown grasses, rushes and reeds, and non-wetland vegetation, such as pastures, crops and forests. They use all habitats equally on the North Keeling Island. On the West Island, they have previously been recorded using an airstrip for feeding and sheltering in thickets of Scaevola taccada.

This species is a listed Threatened (Endangered) species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the buff-banded rail (Cocos (Keeling) Islands) have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

This species presence has declined on the West Island since the 1980s and was considered eradicated by 2000 (Woinarski et al. 2015). An individual was anecdotally observed on West Island in 2014, believed to have been from the stock reintroduced to Horsburgh Island, located approximately 9 km to the north-northeast.

There is up to 1.47 ha of potential habitat available for the buff-banded rail (Cocos (Keeling) Islands), if present, within the terrestrial DAF. The fauna habitat recorded within the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4). Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations. In areas dominated by coconut trees, Scaevola taccada was absent in the mid-storey but was present in disturbed areas such as adjacent to access tracks and cleared areas (Att 2, Section 3.2).

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (Department of the Environment and Energy [DoEE] 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat available proximate to the terrestrial DAF on West Island and more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the buff-banded rail (Cocos (Keeling) Islands), if present, due to the direct loss of 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Species or threatened ecological community

Choeroichthys sculptus (sculptured pipefish)

Sculptured pipefish are widely distributed in the tropical Indo-Pacific region, including the South China Sea, southern Japan, Samoa and the Northern Mariana Islands (Atlas of Living Australia [ALA] 2021a). In Australia, they have been recorded in northern Western Australia and the Great Barrier Reef.

Sculptured pipefish are found in inshore waters and inhabit coral reef flats, seagrass beds and mangroves.

This species is a listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and direct impacts due to benthic habitat disturbance during modification of the existing ocean outfall.

No biologically important areas for the sculptured pipefish have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites looked at the reef flat ecosystem. Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Sections 2.3.2 and 2.4).

Sculptured pipefish have been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). The habitats that the two NatureMap records from 1989 were observed in were rock pools and an outer reef flat opposite the southern end of runway (Department of Biodiversity, Conservation and Attractions [DBCA] 2021). The sculptured pipefish could potentially utilise the benthic habitats and waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Sculptured pipefish may occur proximate to the existing WWTP ocean outfall pipe. Given that water quality impacts will be avoided and direct impacts from the proposed amendments minimised, coupled with considerable abundance of potential coral reef habitats, the risk of a significant impact occurring to the sculptured pipefish (if present) is considered low.

Species or threatened ecological community

Cosmocampus banneri (roughridge pipefish)

Roughridge pipefish are found in the Red Sea and Western Indian Ocean to Fiji, the Marshall Islands, and the Ryukyu Islands (ALA 2021b).

They have been recorded off Western Australia's north-west coastline and are found in coral reefs at depths of 2-30 m.

This species is a listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and direct impacts due to benthic habitat disturbance during modification of the existing ocean outfall.

No biologically important areas for the roughridge pipefish have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites (<10 m deep) looked at the reef flat ecosystem, while the deep survey sites (>10 m deep) looked at the reef front ecosystem. Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Sections 2.3.2 and 2.4).

The roughridge pipefish has not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). Roughridge pipefish could potentially utilise the benthic habitats and waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Roughridge pipefish may occur proximate to the existing WWTP ocean outfall pipe. Given that water quality impacts will be avoided and direct impacts from the proposed amendments minimised, coupled with considerable abundance of potential coral reef habitats, the risk of a significant impact occurring to the roughridge pipefish (if present) is considered low.

Species or threatened ecological community

Doryrhamphus excisus (bluestripe pipefish)

Of three subspecies of bluestripe pipefish, one is endemic to the Red Sea, one is endemic to Mexico and last is a widespread Indo-Pacific species (DAWE 2021b).

The bluestripe pipefish occupies various reef habitats, from coastal to outer reefs. They prefer access to small crevices or caves to shelter in when threatened.

This species is a listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and direct impacts due to benthic habitat disturbance during modification of the existing ocean outfall.

No biologically important areas for the bluestripe pipefish have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites looked at the reef flat ecosystem. Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Sections 2.3.2 and 2.4).

Bluestripe pipefish have been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). The habitats that the two NatureMap records from 1989 were observed in were rock pools and an outer reef flat opposite the southern end of runway (DBCA 2021). The bluestripe pipefish's Indo-Pacific subspecies could potentially utilise the benthic habitats and

waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Bluestripe pipefish may occur proximate to the existing WWTP ocean outfall pipe. Given that water quality impacts will be avoided and direct impacts from the proposed amendments minimised, coupled with considerable abundance of potential coral reef habitats, the risk of a significant impact occurring to the bluestripe pipefish (if present) is considered low.

Species or threatened ecological community

Hippocampus trimaculatus (flat-faced seahorse)

Flat-faced seahorses are endemic to Western Australia, distributed from Dirk Hartog Island to Broome (Bray 2020). Flat-faced seahorses inhabit rubble and macroalgal reefs and tidepools in shallow bays from intertidal depths of up to approximately 20 m.

This species is a listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and direct impacts due to benthic habitat disturbance during modification of the existing ocean outfall.

No biologically important areas for the flat-faced seahorse have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites (<10 m deep) looked at the reef flat ecosystem, while the deep survey sites (>10 m deep) looked at the reef front ecosystem. Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Sections 2.3.2 and 2.4).

The flat-faced seahorse has not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). Flat-faced seahorses could potentially utilise the benthic habitats and waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Flat-faced seahorses may occur proximate to the existing WWTP ocean outfall pipe. Given that water quality impacts will be avoided and direct impacts from the proposed amendments minimised, coupled with considerable abundance of potential coral reef habitats, the risk of a significant impact occurring to the flat-faced seahorse (if present) is considered low.

Species or threatened ecological community

Micrognathus brevirostris (thorntail pipefish)

Thorntail pipefish are known to occur from the Christmas and Cocos (Keeling) Islands, the Timor Sea and the North-West Cape of Western Australia, and from the Great Barrier Reef, Cape York to Southport, Queensland, in Australian waters (Bray and Thompson n.d.). Outside of Australia, they also occur in the tropical western Pacific.

Thorntail pipefish inhabit inner and seaward reefs and sheltered coastal reef lagoons, usually within crevices, small caves and gutters. They are typically found below 10 m depths but have been recorded at 20 m depths.

This species is a listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and direct impacts due to benthic habitat disturbance during modification of the existing ocean outfall.

No biologically important areas for the thorntail pipefish have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites (<10 m deep) looked at the reef flat ecosystem, while the deep survey sites (>10 m deep) looked at the reef front ecosystem. Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Sections 2.3.2 and 2.4).

Thorntail pipefish have been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). The habitats that the two NatureMap records from 1989 were observed in were rock pools and an outer reef flat opposite the southern end of runway (DBCA 2021). Thorntail pipefish could potentially utilise the benthic habitats and waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Thorntail pipefish may occur proximate to the existing WWTP ocean outfall pipe. Given that water quality impacts will be avoided and direct impacts from the proposed amendments minimised, coupled with considerable abundance of potential coral reef habitats, the risk of a significant impact occurring to the thorntail pipefish (if present) is considered low.

Species or threatened ecological community

Phoxocampus belcheri (black rock pipefish)

Black rock pipefish are widely distributed throughout the tropical Indo-West Pacific, from the Red Sea and east and South Africa, Madagascar and the Seychelles, south to Western Australia and New Caledonia, north to China, Taiwan and southern Japan, and east to Tonga and Fiji (Bray n.d.). In Australian waters, they are known to occur around the Monte Bello Islands, Western Australia.

Black rock pipefish occur in up to 25 m depths in tidepools and shallow intertidal reefs, usually in coral rubble.

This species is a listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and direct impacts due to benthic habitat disturbance during modification of the existing ocean outfall.

No biologically important areas for the black rock pipefish have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites (<10 m deep) looked at the reef flat ecosystem, while the deep

survey sites (>10 m deep) looked at the reef front ecosystem. Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Sections 2.3.2 and 2.4).

The black rock pipefish has not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). Black rock pipefish could potentially utilise the benthic habitats and waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Black rock pipefish may occur proximate to the existing WWTP ocean outfall pipe. Given that water quality impacts will be avoided and direct impacts from the proposed amendments minimised, coupled with considerable abundance of potential coral reef habitats, the risk of a significant impact occurring to the black rock pipefish (if present) is considered low.

Species or threatened ecological community

Sphyrna lewini (scalloped hammerhead)

Scalloped hammerheads have a circum-global distribution in tropical and sub-tropical waters (DAWE 2022). The scalloped hammerheads found in Australia are likely to be a shared stock with Indonesia.

In Australia, scalloped hammerheads have been recorded from New South Wales (approximately Wollongong), to the north of Australia, and south to Western Australia (approximately Geographe Bay). Scalloped hammerheads rarely move into or across deep oceanic waters and are frequently found within shallow coastal shelf waters.

Breeding occurs in shallow intertidal habitats. Scalloped hammerhead pups occupy shallow inshore habitats for their first few years of life, before migrating to deeper waters. Adults spend most of their time offshore in midwater (IUCN Red List 2022).

This species is a listed Threatened (Conservation Dependent) species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the scalloped hammerhead have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Scalloped hammerheads have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Salinity has been reported to influence distribution and local abundance of sharks but most likely has a greater influence on nearshore coastal shark species than pelagic species (Schlaff et al. 2014).

Scalloped hammerheads are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Given elevated salinity levels are only anticipated for 16 m down current of the

modified ocean outfall (i.e. minor area of impact), coupled with the shallow near shore environment (i.e. 10 mbsl) where the ocean outfall is located, it is not anticipated that the brine discharge would indirectly alter the distribution or abundance of this species nor its prey availability. Similarly, impacts on habitat utilisation will have a very low-no risk of adversely impacting this species.

Species or threatened ecological community

Charadrius leschenaultia (greater sand plover)

The greater sand plover breeds in the N hemisphere including central Asia, NW China, SE Kazakhstan west to the Aral Sea, south to Afghanistan, west into Turkey and south though Syria to Jordan (DAWE 2021e).

They migrate south for the boreal winter. Their non-breeding distribution includes Australian coastal areas, particularly in the north and islands in the SW Pacific Ocean. They have been recorded on outlying islands in the Indian Ocean (e.g. Cocos (Keeling) Islands), Pacific Ocean and off New Zealand.

In the Australasian region, greater sand plovers are found in coastal littoral and estuarine habitats. They occur on sandy estuarine lagoons and protected sandy, muddy or shelly beaches with large intertidal mudflats or sandbanks. They can also be found in rock platforms, inshore reefs and rocky islands or sandy cays on coral reefs.

This species is a listed Threatened (Vulnerable), listed Migratory and listed Marine species.

Impact

The proposed action will not impact this species.

No biologically important areas for the Christmas Island white-tailed tropicbird have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).
Greater sand plover has not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). No suitable coastal littoral or estuarine habitats were identified within the terrestrial DAF (Att 2, Sections 3.2 and 3.4).

Given the greater sand plover's preference for coastal littoral and estuarine habitats, it is not considered likely that this species would occur within the terrestrial DAF.

Species or threatened ecological community

Balaenoptera borealis (sei whale)

Sei whales migrate between polar, temperate and tropical waters, and tend to be more offshore than other large whale species (DAWE 2021j). Sei whales migrate north-south between Australian waters, feeding areas in the Antarctic and Subantarctic and breeding areas in tropical and subtropical waters. Sightings of sei whales have been infrequently recorded in Australian waters, such that the extent of occurrence and area of occupancy cannot be calculated.

Australian waters may be used for opportunistic feeding. Long-range movements of sei whales appear to be associated with food availability. Winter (April to August) in the southern hemisphere is their main breeding season, which also takes place from November to March in the northern hemisphere.

This species is a listed Threatened (Vulnerable) and listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP.

No biologically important areas for the sei whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately

40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Sei whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Avoidance of hypersaline waters by whales has been reported along the Western Australian migration route (Meynecke et al. 2021) and sei whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Given that elevated salinity levels are only anticipated for 16 m downcurrent of the modified ocean outfall (i.e. minor area of impact), coupled with the shallow nearshore environment where the ocean outfall is located (i.e. ~10 mbsl), it is not anticipated that the brine discharge would alter the behaviour of this species. Localised changes to marine water quality during brine discharge will have a very low-no risk of adversely impacting this species.

Species or threatened ecological community

Balaenoptera musculus (blue whale)

There are two subspecies which occur in Australian waters, the Antarctic blue whale or 'true' blue whale (B. musculus intermedia) and the pygmy blue whale (B. musculus brevicauda) (DAWE 2021l). Blue whales move between Australian waters, feeding areas in the Antarctic and Subantarctic and breeding areas in the tropics (Indonesian waters and possibly south-west Pacific waters).

The Antarctic blue whale can reside in the Antarctic year-round, with some migrating to lower latitudes during the Australian summer for feeding, breeding and calving. The pygmy blue whale is more widespread, moving between Australia and the warmer waters of Indonesia. The Banda and Molucca Seas are a likely calving area whilst the Perth Canyon/Naturaliste Plateau region of Western Australia is a common feeding area.

This species is a listed Threatened (Endangered) and listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP.

No biologically important areas for the blue whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Blue whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Avoidance of hypersaline waters by whales has been reported along the Western Australian migration route (Meynecke et al. 2021) and blue whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Given that elevated salinity levels are only anticipated for 16 m downcurrent of the modified ocean outfall (i.e. minor area of impact), coupled with the shallow nearshore environment where the ocean outfall is located, it is not anticipated that the brine discharge would alter the behaviour of this species. Localised changes to marine water quality during brine discharge will have a very low-no risk of adversely impacting this species.

Species or threatened ecological community

Balaenoptera physalus (fin whale)

Fin whales have well defined migratory patterns, moving between polar, temperate and tropical waters, and rarely occur in inshore waters (DAWE 2021m). Fin whales migrate north-south, moving between Australian waters, feeding areas in the Antarctic and Subantarctic and breeding areas in the tropics (Indonesia, the northern Indian Ocean and south-west South Pacific Ocean waters).

Fin whales are distributed between 20-75° S latitudes. They can be found in areas of complex and steep bathymetry where prey congregates when in the Southern Ocean or Subantarctic. The Australian Antarctic waters are important feeding grounds for fin whales, and potentially also the Bonney Upwelling area. There are no known breeding or calving areas for fin whales in Australian waters.

This species is a listed Threatened (Vulnerable) and listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP.

No biologically important areas for the fin whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Fin whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Avoidance of hypersaline waters by whales has been reported along the Western Australian migration route (Meynecke et al. 2021) and fin whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Given that elevated salinity levels are only anticipated for 16 m downcurrent of the modified ocean outfall (i.e. minor area of impact), coupled with the shallow nearshore environment where the ocean outfall is located (i.e. ~10 mbsl), it is not anticipated that the brine discharge would alter the behaviour of this species. Localised changes to marine water quality during brine discharge will have a very low-no risk of adversely impacting this species.

Species or threatened ecological community

Caretta caretta (loggerhead turtle)

Loggerhead turtles occur in tropical, subtropical and temperate waters (DAWE 2021q). Nesting occurs mainly on subtropical beaches, with major aggregations in Oman, eastern USA, southern Japan, Greece, Turkey, southern Queensland and Western Australia. In Australia, loggerhead turtles are typically found in rocky and coral reef waters, seagrass beds and muddy bays throughout eastern, northern and western Australia.

Loggerhead turtles forage in a variety of tidal and sub-tidal habitats and show commitment to their foraging and breeding areas. Loggerhead turtles breed from November to March with a peak in late December/early January. They nest on open, sandy beaches, from which the hatchlings enter the open ocean.

This species is a listed Threatened (Endangered), listed Migratory and listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the loggerhead turtle have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E). Critical nesting and inter-nesting areas are not known to occur on the Cocos (Keeling) Islands (DoEE 2017).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats:

- The shallow monitoring sites were characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9).
- The deep monitoring sites were characterised by a hard coral cover of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8).

Loggerhead turtles have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially very infrequently utilise the benthic habitats and waters surrounding the ocean outfall. Loggerhead turtles were not reported by a long-term study of sea turtles in the Cocos (Keeling) Islands (Whiting et al. 2014).

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe and indirect impacts due to avoidance of the area by turtles may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are considered to be well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Based on the modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Loggerhead turtles are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present).

Identified impacts to benthic habitat, marine water quality and habitat utilisation will have a low risk of adversely impacting this species.

Species or threatened ecological community

Chelonia mydas (green turtle)

Green turtles occur in tropical and subtropical waters around the world, usually between the 20°C isotherms (DAWE 2021r). They nest, migrate and forage across tropical northern Australia. For the first 5-10 years, they drift on ocean currents before settling in shallow benthic foraging habitats such as tropical coral and rocky reef habitat or inshore seagrass beds.

Eggs are buried in aerated sand by females and males return to their foraging grounds. Females lay an average of 5 clutches of eggs per season and remain close to the nesting beach during each inter-nesting period. The Cocos (Keeling) Islands is an important nesting area (North Keeling Island) and inter-nesting area (20 km radius) for green turtles (DoEE 2017). A large proportion of the population remain as residents and forage around the southern atoll. Nesting occurs from October to April.

This species is a listed Threatened (Vulnerable), listed Migratory and listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP, from temporary avoidance behaviour during modification of the existing ocean outfall and from noise and light impacts during operation of the proposed SDP and borefield.

No biologically important areas for the green turtle have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E). Nesting is known to occur on the North Keeling Island, with its inter-nesting area over 15 km north of the existing WWTP ocean outfall (DoEE 2017).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats:

- The shallow monitoring sites were characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9).
- The deep monitoring sites were characterised by a hard coral cover of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8).

Green turtles have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but have been observed resting and feeding on seagrass on the fringing reef along the western side of West Island (Whiting et al. 2014). Its north-western shoreline has several areas (e.g. Quarantine Beach and North Beach) that support irregularly low-density green turtle nesting. Green turtle could potentially infrequently utilise the benthic habitats and waters surrounding the ocean outfall or nest on the shoreline.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor

direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe and indirect impacts due to avoidance of the area by turtles may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are considered to be well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Based on the modelling results, there is not likely to be a significant impact on surrounding water quality from of the proposed brine discharge. Green turtles are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present).

Pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any nesting turtles) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting turtles or hatchlings). Further, the proposed SDP location is approx. 100 m inland of the beach and is separated by a continuous stand of coconut trees (Att 1, Figure B).

Identified impacts to benthic habitat, marine water quality, habitat utilisation and potential terrestrial nesting habitat will have a low risk of adversely impacting this species.

Species or threatened ecological community

Dermochelys coriacea (leatherback turtle)

Leatherback turtles are found globally in tropical, subtropical and temperate waters (DAWE 2021s). They occupy a wide latitudinal distribution, from Alaska in the north to the Cape of Good Hope in the south. They are pelagic feeders and have been recorded foraging all around Australia in its continental shelf waters.

Australia has no known major nesting areas for the leatherback turtle, with isolated nesting recorded in southern Queensland and the Northern Territory. Leatherback turtles venture close to shore during the nesting season and nest on sandy beaches. Hatchlings enter the open ocean, presumably dispersed by the ocean currents. Juveniles occupy a range of ocean and coastal habitats.

This species is a listed Threatened (Endangered), listed Migratory and listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the leatherback turtle have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E). Critical nesting and inter-nesting areas are not known to occur on the Cocos (Keeling) Islands (DoEE 2017).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats:

- The shallow monitoring sites were characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9).
- The deep monitoring sites were characterised by a hard coral cover of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8).

Leatherback turtles have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially very infrequently utilise the benthic habitats and waters surrounding the ocean outfall. Leatherback turtles were not reported by a long-term study of sea turtles in the Cocos (Keeling) Islands (Whiting et al. 2014).

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe and indirect impacts due to avoidance of the area by turtles may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are considered to be well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling

National Park.

Based on the modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Leatherback turtles are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present).

Identified impacts to benthic habitat, marine water quality and habitat utilisation will have a low risk of adversely impacting this species.

Species or threatened ecological community

Eretmochelys imbricata (hawksbill turtle)

Hawksbill turtles are found in tropical, subtropical and temperate waters of all oceans (DAWE 2021t). Nesting usually occurs at tropical beaches. High numbers of nesting females are found in Mexico, Seychelles, Indonesia and in two Australian regions. The largest nesting aggregate is found in Australia, with subpopulations found in the northern Great Barrier Reef, Torres Strait and Arnhem Land and in the North West Shelf of Western Australia.

For the first 5-10 years, hawksbill turtles drift on ocean currents before settling to forage in tropical tidal and subtidal coral and rocky reef habitats. They infrequently forage in seagrass habitats of coastal waters and in the deeper habitats of trawl fisheries. The Cocos (Keeling) Islands are a known foraging area for hawksbill turtles (DoEE 2017).

This species is a listed Threatened (Vulnerable), listed Migratory and listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the hawksbill turtle have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E). Critical nesting and inter-nesting areas are not known to occur on the Cocos (Keeling) Islands (DoEE 2017).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats:

- The shallow monitoring sites were characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9).
- The deep monitoring sites were characterised by a hard coral cover of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8).

Hawksbill turtles have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but have been regularly sighted in the lagoon on the eastern side of West Island (Whiting et al. 2014) and could potentially infrequently utilise the benthic habitats and waters surrounding the ocean outfall.

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe and indirect impacts due to avoidance of the area by turtles may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are considered to be well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Based on the modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Hawksbill turtles are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present).

Identified impacts to benthic habitat, marine water quality and habitat utilisation will have a low risk of adversely impacting this species.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Species or threatened ecological community

Lepidochelys olivacea (olive ridley turtle)

Olive ridley turtles have migratory circuits in tropical and some subtropical areas, and nest throughout tropical waters of nearly 60 countries worldwide (DAWE 2021u).

Nesting involves the laying of eggs on sandy beaches, with hatchlings being dispersed on ocean currents. Small juveniles and adults inhabit coastal areas of northern Australia, with some recorded over the soft bottomed habits of northern Australia's continental shelf waters. Olive ridley turtles forage in shallow benthic habitats off northern Western Australia to south-east Queensland.

This species is a listed Threatened (Endangered), listed Migratory and listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the olive ridley turtle have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E). Critical nesting and inter-nesting areas are not known to occur on the Cocos (Keeling) Islands (DoEE 2017).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats:

- The shallow monitoring sites were characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9).
- The deep monitoring sites were characterised by a hard coral cover of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8).

Olive ridley turtles have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially very infrequently utilise the benthic habitats and waters surrounding the ocean outfall. Olive ridley turtles are known in the region from being stranded in discarded nets and washed ashore at Cocos (Keeling) Islands (Whiting et al. 2014).

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe and indirect impacts due to avoidance of the area by turtles may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are considered to be well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Based on the modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Olive ridley turtles are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present).

Identified impacts to benthic habitat, marine water quality and habitat utilisation will have a low risk of adversely impacting this species.

Species or threatened ecological community

Natator depressus (flatback turtle)

The distribution of flatback turtles is restricted. They are found in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya (DAWE 2021v). It is one of two sea turtle species without a global distribution.

Nesting occurs on Australia's sandy beaches only, in eastern Queensland, Torres Strait and Gulf of Carpentaria, Northern Territory and Western Australia.

Unlike other sea turtles, the flatback turtle hatchlings do not have a wide oceanic dispersal phase. Adults occupy soft bottom habitat within northern Australia's continental shelf, extending into Papua New Guinea and Irian Jaya, and forage in shallow inshore waters at latitudes north of 25° S.

This species is a listed Threatened (Vulnerable), listed Migratory and listed Marine species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the flatback turtle have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E). Critical nesting and inter-nesting areas are not known to occur on the Cocos (Keeling) Islands (DoEE 2017).

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats:

- The shallow monitoring sites were characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9).
- The deep monitoring sites were characterised by a hard coral cover of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8).

Flatback turtles have not been recorded within 10 km of the proposed SDP by NatureMap (Att 1, Appendix C) but could potentially very infrequently utilise the benthic habitats and waters surrounding the ocean outfall. Flatback turtles were not reported by a long-term study of sea turtles in the Cocos (Keeling) Islands (Whiting et al. 2014).

Indirect impacts (i.e. marine water quality changes) to the nearshore benthic reef environment will be avoided through implementation of the proposed modifications to alter the setting, angle and orientation of the terminal end of the existing ocean outfall pipe. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe and indirect impacts due to avoidance of the area by turtles may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are considered to be well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Based on the modelling results, there is not likely to be a significant impact on surrounding water from the proposed brine discharge. Flatback turtles are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present).

Identified impacts to benthic habitat, marine water quality and habitat utilisation will have a low risk of adversely impacting this species.

Species or threatened ecological community

Carcharodon carcharias (great white shark)

Great white sharks are widely distributed in all seas and are more frequently found in coastal temperate and subtropical regions, such as north-western Atlantic, the Mediterranean Sea, off South Africa, South Australia, New Zealand and the north-eastern Pacific (DAWE 2021w). They have also been observed in tropical regions.

In Australia, great white shark movements are mostly recorded between the coast and the 100 m depth contour, in all coastal areas except the Northern Territory. They typically inhabit close inshore habitats (i.e. shallow coastal bays, rocky reefs) to the outer continental shelf and slope areas. They also can travel across ocean basins and are commonly found in areas of high prey density (i.e. pinniped colonies).

Great white sharks move up Australia's east and west coasts in autumn-winter and return during summer.

This species is a listed Threatened (Vulnerable) and listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the great white shark have been identified proximate to the Cocos (Keeling) Islands (Att

1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Great white sharks have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Great white sharks are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Impacts to marine water quality and habitat utilisation will have a very low-no risk of adversely impacting this species.

2.4.2 Do you consider this impact to be significant?

☐ Yes ☑ No

2.5 Is the proposed action likely to have any direct or indirect impact on the members of any listed migratory species or their habitat?

☑ Yes ☐ No

Migratory species

Anous stolidus (common noddy)

The common noddy is widely distributed throughout tropical and subtropical seas and land (DAWE 2021c). Within Australian waters, they are known to occur in the ocean off the Queensland coast, the north-west and central Western Australian coast, and on the Norfolk, Lord Howe, Christmas and Cocos (Keeling) Islands.

They are found on or around islands during their breeding season, on rocky islets and stacks with steep cliffs, shoals, coral cays or sand. They can nest on the ground, in grass, bare rock, sand near grassy areas, or among coral rubble, or in the forks of tall trees, fallen branches, stumps or cliff edges.

Outside of the breeding season, they mostly or totally desert the islands used for seasonal breeding and occur throughout the open ocean.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the common noddy have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4). The common noddy has been observed to nest at the tops of coconut trees (Cocos nucifera) (DAWE 2021c). Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

The common noddy has been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but the species were not recorded during a survey of the terrestrial DAF (Att 2, Section 3.5). There is up to 1.47 ha of potential habitat available for the common noddy within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees and introduced grasslands) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the common noddy (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Ardenna pacifica (wedge-tailed shearwater)

The wedge-tailed shearwater is distributed across the Indian and Pacific Oceans (DAWE 2021d). This includes islands off Western Australia, Cocos (Keeling) Islands, the Seychelles and Malagasy region in the Indian Ocean, and in Bonin Islands to Montague Island, Vanuatu, Fiji, Samoa, New Caledonia, Pitcairn Island and the Revilla Gigedo Islands in the Pacific Ocean.

They are pelagic in tropical and subtropical waters, and most abundantly found in surface-temperatures greater than 21°C and salinity is greater than 34.6%.

Wedge-tailed shearwaters breed in large flocks in areas of high food concentration, mainly on vegetated islands, atolls and cays. They usually burrow in flat or flattish areas with dense grassy and tussocky vegetation or burrow beneath tree or shrub cover.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the wedge-tailed shearwater have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the wedge-tailed shearwater. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Wedge-tailed shearwaters have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) and the species were not recorded during a survey of the terrestrial DAF (Att 2, Section 3.5). There is up to 1.47 ha of potential habitat available for the wedge-tailed shearwater within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees and introduced grasslands) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the wedge-tailed shearwater (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Cuculus optatus (oriental cuckoo)

The oriental cuckoo is widely distributed across northern China, Korea and Japan to the northern Eurasia east (New Zealand Birds Online 2013). Their non-breeding range is also wide ranging, including Malaysia, Indonesia, New Guinea, the Philippines and western Micronesia. They also migrate to northern and eastern Australia and occasionally to New Zealand.

Oriental cuckoos occupy open forest habitats and farmland with scattered trees, using the nests of other birds (Eurasian warblers).

This species is a listed Migratory species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the oriental cuckoo have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the oriental cuckoo. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Oriental cuckoos have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but potential nesting habitat for this species was identified within the terrestrial DAF (Att 2, Table 3, page 5). There is up to 1.47 ha of potential habitat available for the oriental cuckoo within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees) available proximate to the DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the oriental cuckoo (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low

Migratory species

Fregata ariel (lesser frigatebird))

The lesser frigatebird has major breeding populations in the tropical waters of the Indian and Pacific Oceans (excluding the east Pacific), and one in the South Atlantic (BirdLife International 2021). Immature and non-breeding birds are widely dispersed in these tropical waters during the non-breeding season and are sedentary.

Lesser frigatebirds breed on tropical and subtropical islands which are small and remote, nesting on the bare ground, in mangroves or bushes.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the lesser frigatebird have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the lesser frigatebird. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Lesser frigatebirds have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but potential nesting habitat for this species was identified within the terrestrial DAF (Att 2, Table 3, page 5). There is up to 1.47 ha of potential habitat available for the lesser frigatebird within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the lesser frigatebird (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Migratory species

Fregata minor (great frigatebird)

The great frigatebird has major breeding populations in the tropical waters of the Indian and Pacific Oceans and one in the South Atlantic (BirdLife International 2021). Immature and non-breeding birds are widely dispersed in these tropical waters during the non-breeding season (excluding the east and central Atlantic) and are predominantly sedentary.

Great frigatebirds breed on tropical and subtropical islands which are small and remote, nesting on the bare ground, in mangroves or bushes.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the great frigatebird have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the great frigatebird. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Great frigatebirds have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but potential nesting habitat for this species was identified within the terrestrial DAF (Att 2, Table 3, page 5). There is up to 1.47 ha of potential habitat available for the great frigatebird within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the great frigatebird (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Hirundo rustica (barn swallow)

The barn swallow breeds in the temperate and subtropical regions of Europe, north Africa, Asia and North America (DAWE 2021f). They migrate south for the boreal winter. They are found in northern Australia, on the Cocos (Keeling) and Christmas Islands, and infrequently along the coastline from the Pilbara region in Western Australia to Frasers Island in Queensland.

When breeding in the northern hemisphere, they occupy open habitats with access to water or low moist vegetation, near the edges of wetlands and human settlements. They also prefer areas with artificial structures to use for nesting.

When in Australia, they have been recorded in open country habitats in coastal lowlands, often close to water and settlements. They have also been sighted in or over freshwater wetlands, paperbark woodlands, shrub thickets and grassland.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the barn swallow have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the barn swallow. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Barn swallows have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but potential foraging habitat for this species was identified within the terrestrial DAF (Att 2, Table 3, page 5). There is up to 1.47 ha of potential habitat available for the barn swallow within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees and introduced grasslands) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the barn swallow (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Motacilla cinerea (grey wagtail)

The grey wagtail is a very widespread species, with 20% of the global range in Europe (BirdLife International 2021). It is found across much of northern Africa, Europe and Asia, ranging from western Europe to the Far East.

The grey wagtail is found around fast-flowing mountain streams, often in forested areas, as well as lowland watercourses such as canals and rivers. Outside of the breeding season it is found in a greater variety of habitats, including farmlands, forested tracks, plantations and even town centres.

Grey wagtail populations from islands and southern locations are resident, while other populations are partially or fully migratory.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the grey wagtail have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the grey wagtail. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Grey wagtails have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but potential foraging habitat for this species was identified within the terrestrial DAF (Att 2, Table 3, page 5). There is up to 1.47 ha of potential habitat available for the grey wagtail within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees and introduced grasslands) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the grey wagtail (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Migratory species

Motacilla flava (yellow wagtail)

The yellow wagtail is a very widespread species, distributed across Europe, east through Siberia to west Asia and north-western China and south through the Arabian Peninsula to Egypt (BirdLife International 2021). The majority of yellow wagtails migrate south, with European populations wintering in sub-Saharan Africa, and central and eastern populations wintering in South Asia and Africa.

The yellow wagtail occupies wet habitats with low vegetation, including marshes, sewage farms, bogs, and damp meadows to grassy tundras and forest clearings.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the yellow wagtail have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the yellow wagtail. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

Yellow wagtails have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but potential foraging habitat for this species was identified within the terrestrial DAF (Att 2, Table 3, page 5). There is up to 1.47 ha of potential habitat available for the grey wagtail within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees and introduced grasslands) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the yellow wagtail (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Phaethon lepturus (white-tailed tropicbird)

The white-tailed tropicbird is distributed across the tropical oceans, including the western and central Pacific, southern Indian Ocean and southern Atlantic Ocean (BirdLife International 2021). Breeding colonies are also found in the Caribbean.

White-tailed tropicbirds are found in pelagic and coastal habitats in tropical and subtropical waters. They nest on small remote islands, in rocky crevices or sheltered scrapes on the ground preferably where it is easy to take flight and is inaccessible.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the white-tailed tropicbird have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the white-tailed tropicbird. Coconut trees are common and widespread over West Island, with the

island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

White-tailed tropicbirds have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). There is up to 1.47 ha of potential habitat available for the white-tailed tropicbird within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the white-tailed tropicbird (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Sula dactylatra (masked booby)

The masked booby is found in the tropical and subtropical waters of the Indian, Pacific and Atlantic Oceans, between 30°N and 30°S latitudes (DAWE 2021g). They are often located near deep water and forage widely from their breeding islands, however, are not migratory. Within Australia, they are known to occur from the Dampier Archipelago in Western Australia, across the northern and eastern coastline to Brisbane.

The masked booby is a pelagic and marine bird that breed on oceanic islands, atolls and cays. They nest on open flat ground, from the high tide mark to central areas, on surfaces of sand, guano, coral fragments or lava, or among low cover grass, herbs or shrubs.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the masked booby have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the masked booby. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

The masked booby has not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C). There is up to 1.47 ha of potential habitat available for the masked booby within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the masked booby (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Sula sula (red-footed booby)

The red-footed booby is found in the tropical oceans of Indian, Pacific and Atlantic Oceans between 30°N and 30°S latitudes (DAWE 2021i). Within Australia, they have been recorded on the Great Barrier Reef and Coral Sea islands, north of Cape York and east to Innisfail.

They are pelagic, tropical and aerial, inhabiting waters of greater than 22°C surface temperature. Their distribution may be influenced by access to important prey and vegetated islands for breeding. They forage in deep water, up to 150 km from breeding islands. They typically nest on low altitude beaches or ridges of cays or atolls, or on slopes and terraces of mountainous islands up to 70 m above sea level. Dense vegetation may be used to support nests.

This species is a listed Migratory and listed Marine species.

Impact

There is potential direct impact to this species due to the clearing of vegetation and indirect impact from noise/light during operation of the proposed SDP and borefield.

No biologically important areas for the red-footed booby have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The fauna habitat recorded at the terrestrial DAF is primarily comprised of coconut trees (Att 2, Section 3.4) and may provide potential habitat for the red-footed booby. Coconut trees are common and widespread over West Island, with the island being almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations.

The red-footed booby has been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but the species was not recorded during a survey of the terrestrial DAF (Att 2, Section 3.5). There is up to 1.47 ha of potential habitat available for the red-footed booby within the terrestrial DAF.

The pumps used at the borefield will be submersible (and hence will present a low terrestrial noise risk to any foraging/nesting birds) and any light sources required to be installed for SDP operation would be compliant with the Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable (and hence will present a low light risk to any nesting birds).

Given the substantial extent of potential habitat (coconut trees) available proximate to the terrestrial DAF on West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park, the risk of significant impact occurring to the red-footed booby (if present) as a result of the direct loss of up to 1.47 ha of potential habitat during SDP construction and indirect disturbance from noise/light during SDP operation is considered low.

Migratory species

Balaenoptera edeni (Bryde's whale)

Bryde's whales are found year-round in warm temperate and tropical waters exceeding 16.3°C, typically around 20° C, between 40° N and 40° S latitudes (DAWE 2021k). Two distinct forms have been found off South Africa and Japan; a coastal form restricted to within 32 km of the coastline, and an offshore form occurring more than 80 km from the coastline which migrates to the equator for winter. Similar forms of the Bryde's whale may be found in Australian waters.

The coastal form appears to be limited to the 200 m depth isobar, while the offshore form is found in 500 m to 1000 m depths.

The offshore form may migrate to warm tropical waters in winter, possibly to allow breeding and calving. Bryde's whale general movements are considered to be influenced by prey movements.

This species is a listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP.

No biologically important areas for the Bryde's whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the

modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Bryde's whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Avoidance of hypersaline waters by whales has been reported along the Western Australian migration route (Meynecke et al. 2021) and Bryde's whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Impacts to marine water quality will have a very low-no risk of adversely impacting this species.

Migratory species

Megaptera novaeangliae (humpback whale)

Global distributions of humpback whales are severely fragmented with two distinct subpopulations found in Australia: the west coast population and the east coast population (DAWE 2021n).

Humpback whales migrate annually between tropical feeding areas along Australia's west and east coast (15–20° S) and feeding areas in the Antarctic (south of 56° S), primarily between 70° E and 130° E (west coast) and 130° E and 170° W (east coast). Habitat occupied around Australia is typically in coastal waters, less than 200 m deep and within 20 km. During southern migration, some humpback whales appear to split off from the coastal migratory route and head offshore from the coast between Exmouth and Shark Bay.

This species is a listed Migratory species and was removed from the EPBC Act list of threatened species on 26 Feb 2022.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP.

No biologically important areas for the humpback whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Humpback whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Avoidance of hypersaline waters by whales has been reported along the Western Australian migration route (Meynecke et al. 2021) and humpback whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Given that elevated salinity levels are only anticipated for 16 m downcurrent of the modified ocean outfall (i.e. minor area of impact), coupled with the shallow nearshore environment where the ocean outfall is located (i.e. ~10 mbsl), it is not anticipated that the brine discharge would alter the behaviour of this species. Localised changes to marine water quality during brine discharge will have a very low-no risk of adversely impacting this species.

Migratory species

Orcinus orca (killer whale)

Killer whales are found in any marine region, throughout all oceans and adjoining seas and in polar to tropical waters (DAWE 2021o). Killer whales' preferred habitat includes oceanic, pelagic and neritic regions. They are commonly found in cold and deep waters but have been observed along the continental slope and shelf and near prey populations (i.e. seal colonies).

Of the three 'ecotypes' of killer whales, Type A occurs mainly offshore, Type B occurs in inshore waters, pack ice and the Antarctic Peninsula Area, and Type C occurs in inshore waters of East Antarctica. Killer whales are known to make seasonal movements, possibly along migratory routes. Type A likely migrates to Antarctica for feeding in summer and moving to lower

latitudes in the winter. Less is known about the movements of Type B or Type C. Mating occurs year-round. No calving areas are known in Australian waters.

This species is a listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP and from temporary avoidance behaviour during modification of the existing ocean outfall.

No biologically important areas for the killer whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Killer whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely to be a significant impact on surrounding water quality from the proposed brine discharge. Killer whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Impacts to marine water quality or habitat utilisation will have a very low-no risk of adversely impacting this species.

Migratory species

Physeter macrocephalus (sperm whale)

Sperm whales are found in all oceans and adjoining seas and in polar to tropical waters (DAWE 2021p). Sperm whales are typically found in deep waters offshore (600 m or more) but they can also occur at depths exceeding 200 m close to coastlines (i.e. volcanic and oceanic islands).

Sperm whales are often found where seabeds steeply rise from great depths, likely associated with concentrations of major food in upwelling areas, and around Australia’s subantarctic islands, such as Macquarie and Heard Island.

Female and young male sperm whales appear to be restricted to warmer waters, north of 45° S, while adult male sperm whales migrate north to Antarctica in winter. When in Australian waters, sperm whales move westwards along the continental shelf off Albany, and when in open ocean, movement is generally northwards in winter and southwards in summer.

This species is a listed Migratory species.

Impact

There is potential for indirect impacts to this species from localised changes to marine water quality (salinity) where brine will be discharged during operation of the proposed SDP.

No biologically important areas for the sperm whale have been identified proximate to the Cocos (Keeling) Islands (Att 1, Figure E).

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22).

Sperm whales have not been recorded within 10 km of the proposed SDP by NatureMap (Att 4, Appendix C) but could potentially pass through deeper waters proximate to West Island. Based on the dispersion modelling results, there is not likely

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

to be a significant impact on surrounding water quality from the proposed brine discharge. Sperm whales are highly mobile in the marine environment so are unlikely to be remain in the vicinity of the ocean outfall for extended periods (if present). Impacts to marine water quality will have a very low-no risk of adversely impacting this species.

2.5.2 Do you consider this impact to be significant?

☐ Yes ☑ No

2.6 Is the proposed action to be undertaken in a marine environment (outside Commonwealth marine areas)?

☐ Yes ☑ No

2.7 Is the proposed action likely to be taken on or near Commonwealth land?

☐ Yes ☑ No

2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park?

☐ Yes ☑ No

2.9 Is the proposed action likely to have any direct or indirect impact on a water resource from coal seam gas or large coal mining development?

☐ Yes ☑ No

2.10 Is the proposed action a nuclear action?

☐ Yes ☑ No

2.11 Is the proposed action to be taken by a Commonwealth agency?

☐ Yes ☑ No

2.12 Is the proposed action to be undertaken in a Commonwealth Heritage place overseas?

☐ Yes ☑ No

2.13 Is the proposed action likely to have any direct or indirect impact on any part of the environment in the Commonwealth marine area?

☑ Yes ☐ No

2.13.1 Describe the nature and extent of the likely impact on the whole of the environment

The proposed SDP will utilise the existing WWTP ocean outfall which extends approximately 400 m from the west coast of West Island and truncates as an open pipe positioned at a depth of approximately 10 mbsl. The outfall pipe is proposed to be modified to allow for brine discharge past the reef into deeper water, thereby avoiding settling impacts in the nearshore environments, and across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22). The dilution rate should then slow because the density differential between the brine and seawater would be lost, and the plume would cease to plunge (Att 4, Section 3.4, page 22). Based on the modelling results and the outcomes of the species level impact assessments there is not likely to be a significant impact on any marine fauna species or to the surrounding water quality from the proposed brine discharge.

The West Island benthic habitat survey (Att 5) assessed the cover of benthic life forms in shallow and deep habitats close and distant to the ocean outfall. The shallow survey sites (<10 m deep) identified that the nearshore reef flat environment is characterised by a hard coral cover of approximately 40% and a total algal cover of approximately 70% (Att 5, Section 2.3.2, page 9). The deep survey sites (>10 m deep) identified that the reef front environment is characterised by a hard coral cover

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

of approximately 23%, a soft coral cover of approximately 19% and abiotic substrate of approximately 58% (mostly rock) (Att 5, Section 2.3.1, page 8). Coral colonies on the shallow reef platform were in a healthy condition with a similar hard coral cover at all sites, indicating that no impacts to coral from the ocean outfall were evident (Att 5, Section 2.3.2, page 9). The Cocos (Keeling) Island coral reef environments are known support diverse fish (approximately 533 species) and mollusc (approximately 610 species) assemblages, with starfish and sea cumbers also widespread (CSIRO 2009).

Indirect impacts (i.e. marine water quality changes) to the nearshore reef flat environment will be avoided through that implementation of the proposed modifications. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago, including the Pulu Keeling National Park. Given that indirect impacts to the nearshore reef flat environment have been avoided and direct impacts to the reef front environment from the proposed amendments minimised, coupled with considerable abundance coral reef communities and available habitat for associated marine species assemblages, the risk of a significant impact occurring to the either the coral reef communities or any associated marine species is considered low.

2.13.2 Do you consider this impact to be significant?

☐ Yes ☑ No

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 3

Description of the project area

3.1 Describe the flora and fauna relevant to the project area

A flora and fauna survey (Att 2) was undertaken for the terrestrial DAF (Att 1, Figure D).

FLORA

The low habitat diversity of the Cocos (Keeling) Islands has led to a flora assemblage characterised by very low endemicity with indigenous taxa of pan-tropical or Indo-Pacific distribution dominating (Director of National Parks 2015).

A total of 12 flora species were recorded within the terrestrial DAF, five introduced (weed) species and seven native species (Att 2, Section 3.3). The dominant families recorded were the Arecaceae (three species) and Rubiaceae (three species) families (Att 2, Section 3.3, Table 2). The pipeline will be installed within existing road reserves, which are comprised of introduced grass species.

The species recorded are common and widespread over West Island. No Threated flora species listed under the EPBC Act or State Biodiversity Conservation Act 2016 (BC Act) or DBCA-listed Priority flora species were directly recorded within the terrestrial DAF or the introduced grasslands (Att 2, Section 3.3).

TERRESTRIAL FAUNA

No mammals exist on the Cocos (Keeling) Islands but land crabs are conspicuous on the forest floor, seabirds are prolific on North Keeling, and there are a host of small invertebrates present. The Pulu Keeling National Park provides key breeding habitat for red-footed booby, lesser frigatebird, great frigatebird, Cocos buff-banded rail and white-tailed tropicbirds. Very few birds remain on West Island dues to previous hunting and predation (Director of National Parks 2015).

Three fauna species were observed within the terrestrial DAF, the green jungle fowl (Gallus varius), white-breasted waterhen (Amauronis phoenicurus) and land crab (Cardisoma carnifex) (Att 2, Section 3.5). The terrestrial DAF may provide potential nesting habitat for EPBC Act listed species including lesser frigatebird, great frigatebird, and oriental cuckoo, and potential foraging habitat for barn swallow, yellow wagtail and grey wagtail (Att 2, Section 3.4, Table 3).

No Threated fauna species listed under the EPBC Act or State BC Act or DBCA-listed Priority fauna species were directly recorded within the terrestrial DAF or the introduced grasslands (Att 2, Section 4).

MARINE FAUNA

The Cocos (Keeling) Islands, and specifically North Keeling, supports high density resident Green and Hawksbill turtles and low to moderate density nesting Green turtles (Whiting et al. 2014). Green turtles have been observed resting and feeding on seagrass on the fringing reef along the western side of West Island (Whiting et al. 2014). Its north-western shoreline has several areas (e.g. Quarantine Beach and North Beach) that support irregularly low-density green turtle nesting. Hawksbill turtles are regularly sighted in the lagoon on the eastern side of West Island (Whiting et al. 2014).

About 550 species of fish have been recorded in the seas of the Cocos (Keeling) Islands. Compared with other oceanic atolls, the islands' fish fauna appears impoverished. Reasons for this may include the small physical size of the islands, the relative isolation and lack of surrounding island 'stepping stones', and limited surveys of fish. Most fish found around the Cocos (Keeling) Islands have distributions that cover large areas of the Indo-Pacific region (Director of National Parks 2015).

Ninety-nine species of reef corals are recorded from the Cocos (Keeling) Islands. Of these, all but 12 are also known from Western Australia. Nine species are not recorded elsewhere in the eastern Indian Ocean and two (one being taxonomically doubtful) may be endemic (Director of National Parks 2015).

3.2 Describe the hydrology relevant to the project area (including water flows)

OCEANOGRAPHY

Cocos (Keeling) Islands are situated in the path of the South Equatorial Current that carries the Indo-Pacific Through Flow waters into the Indian Ocean. The South Equatorial Current originates in the western Pacific and has a generally westward flow, which is dispersed by New Guinea and north-eastern Australia. Part of this flow becomes the East Australian Current and part flows around the northern side of New Guinea and between the eastern islands of Indonesia and the Timor Sea to become the Indo-Pacific Through Flow (CSIRO 2009).

TERRESTRIAL HYDROLOGY

West Island comprises highly porous beach sand. All rainfall infiltrates very rapidly to the shallow groundwater, which is in direct connection with seawater. The infiltrated rainfall forms a thin brackish lens over the saline groundwater.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

3.3 Describe the soil and vegetation characteristics relevant to the project area

SOIL

The terrestrial DAF is underlain by calcareous white beach sand derived from coral breakdown over limestone (CSIRO 2009; Att 2, Section 3.1).

VEGETATION

West Island has been almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations. Some regrowth of shrubs has occurred over the years as the plantations were removed or destroyed by cyclonic activity.

The vegetation within the terrestrial DAF was assessed to be Closed Cocos forest, comprised of Cocos nucifera with scattered Morinda citrifolia, Terminalia catappa and Guettarda speciosa mid forest over Cocos nucifera shrubland with scattered *Turnera ulmifolia. Scattered *Turnera ulmifolia, *Tridax procumbens and *Cyanthillium cinereum were present along the disturbed edges (Att 2, Section 3.2, Table 1). Patches of Scaevola taccada were observed in areas of previous disturbance (i.e. adjacent to access tracks) (Att 2, Section 3.2, page 3).

The pipe connecting the proposed SDP to the West Island settlement will be installed within existing road reserves, which are comprised of introduced grass species, and will not involve the permanent removal of any native flora or vegetation.

No Threated ecological communities listed under the EPBC Act or State BC Act or DBCA-listed Priority ecological communities were recorded within the terrestrial DAF.

3.4 Describe any outstanding natural features and/or any other important or unique values relevant to the project area

Neither the terrestrial DAF for the proposed SDP nor the spatial area where pipe connecting to the West Island settlement have any outstanding natural features or any other important or unique values.

3.5 Describe the status of native vegetation relevant to the project area

West Island has been almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations. Coconut trees (Cocos nucifera) are now common and widespread over West Island. Some regrowth of shrubs has occurred over the years as the plantations were removed or destroyed by cyclonic activity. The resulting low habitat diversity of the Cocos (Keeling) Islands has led to a flora assemblage characterised by very low endemicity with indigenous taxa of pan-tropical or Indo-Pacific distribution dominating (Director of National Parks 2015).

A survey of the vegetation within the terrestrial DAF recorded 12 species; five introduced (weed) species and seven native species (Att 2, Section 3.3). The dominant families recorded were the Rubiaceae (three species) and the Asteraceae (two species) families (Att 2, Section 3.3, Table 2). The species recorded are common and widespread over West Island. No Threated flora species listed under the EPBC Act or State Biodiversity Conservation Act 2016 (BC Act) or DBCA-listed Priority flora species were directly recorded within the terrestrial DAF or the introduced grasslands (Att 2, Section 3.3).

Overall, the vegetation condition within the terrestrial DAF was rated as Good and the vegetation structure was intact and minimal disturbances were observed, with weed species mostly limited to the edge/boundary of the vegetation (Att 5, Section 3.2, page 3).

3.6 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area

The topography of the terrestrial DAF is flat and lies just above sea level. The existing WWTP ocean outfall discharges at a depth of approximately 10 mbsl. The end of the outfall pipe is positioned within metres of the reef edge, beyond which the seabed slopes steeply downwards to over 1000 mbsl (Att 1, Figure C).

3.7 Describe the current condition of the environment relevant to the project area

The condition of the vegetation within the terrestrial DAF was assessed to be in Good condition (Att 2, Section 3.2, page 3). Vegetation structure was intact and minimal disturbances were observed, with weed species mostly limited to the edge/boundary of the vegetation (Att 2, Section 3.2, page 3).

Five introduced flora taxa (which accounted for 50% of the total flora taxa) were recorded within the terrestrial DAF (Att 2, Section 3.3, Table 2):

- Cyanthillium cinereum
- Tridax procumbens
- Euphorbia prostrata
- Turnera ulmifolia
- Oldenlandia corymbosa

No species listed under the State Biosecurity and Management Act 2007 were identified (Att 2, Section 3.3).

3.8 Describe any Commonwealth Heritage places or other places recognised as having heritage values relevant to the project

A search of the Heritage Council's Inherit database identified that the entire extent of West Island is broadly mapped as the West Island Housing Precinct (Place 18509). Lot 100, which contains the terrestrial DAF, is not included in the listing nor does the DAF contain existing built infrastructure.

The pipeline connecting the proposed SDP to the West Island settlement will be installed within existing road reserves and will not impact any areas or built infrastructure of heritage significance.

3.9 Describe any Indigenous heritage values relevant to the project area

A search of the Department of Planning Lands and Heritage's Aboriginal Heritage Inquiry System undertaken in November 2021 did not identify any registered or other heritage site on West Island. The Cocos (Keeling) Islands were uninhabited prior to settlement in 1826, as such there is not considered to be any aboriginal heritage considerations.

3.10 Describe the tenure of the action area (e.g. freehold, leasehold) relevant to the project area

The terrestrial DAF and pipeline alignment are comprised of land held in the Cocos (Keeling) Islands Lands Trust for the community. The lands trust is administered by the Shire of the Cocos (Keeling) Island. The existing WWTP ocean outfall is in Commonwealth marine waters.

3.11 Describe any existing or any proposed uses relevant to the project area

The terrestrial DAF is currently vegetated and is situated to the north of the existing WWTP. The pipeline connecting the proposed SDP to the West Island settlement will be installed within existing road reserves.

The proposed SDP will utilise the existing WWTP ocean outfall to discharge brine to the marine environment.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 4

Measures to avoid or reduce impacts

4.1 Describe the measures you will undertake to avoid or reduce impact from your proposed action

Water Corporation is proactively proposing to implement key mitigation measures to avoid and minimise any potential impacts to Matters of National Environmental Significance (MNES) during construction and operation of proposed SDP, including:

- minimising native vegetation clearing to the 1.47 ha terrestrial DAF extent. The pipeline will be installed within existing road reserves, which are comprised of introduced grass species, and will not involve the permanent removal of any native flora or vegetation
- clearly demarcating the terrestrial construction works area on-site prior to the commencement of vegetation removal works to prevent accidental disturbance to retained vegetation outside of the works area
- extent of authorised disturbance will be clearly defined and demarcated on appropriate plans, as well as on-site, and all site personnel responsible for vegetation removal to be fully briefed on the removal task during toolbox meetings
- clearing works to be undertaken at a slow pace away from the coast in an easterly direction to allow fauna to disperse into adjacent vegetated areas
- restricting machinery access to within the approved disturbance area
- if native fauna is encountered during clearing/construction works it should, initially, be allowed to make its own way from the works area. However, if this is not possible or practicable, an appropriately qualified wildlife handler will be contacted to relocate it
- trenching required for pipeline installation will be kept open for only as long as necessary. Trenches will be inspected for fauna immediately prior to filling
- inspection of the terrestrial DAF and pipeline trenches at the start of each morning to check for injured fauna or for fauna that may have become entrapped in fences and trenches/pits will be undertaken. If any fauna is found to be trapped, an appropriately qualified wildlife handler will be contacted to rescue the animal and provide treatment (if required)
- clearing and construction works will be limited to daytime hours to avoid disturbing any nocturnal fauna behaviours
- altering the setting, angle and orientation of the existing WWTP ocean outfall pipe, as follows, to avoid any potential impacts to any MNES inhabiting the nearshore coral reef environments:
  - outfall pipe to be extended so that the end of the pipe is past the coral reef shelf (i.e. discharging into deeper water past the coral reef)
  - raise the outfall pipe end to be at 60 degrees to the horizontal (i.e. elevating the discharge to mitigate settling effects)
  - realign the end of the outfall pipe to discharge perpendicular to the prevailing drift current and coral reef shelf (i.e. discharging across the prevailing current to assist with dilution)
- the existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Direct impacts to reef environments from the extension of the WWTP ocean outfall pipe to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches.
- submersible pumps for the bore field to be the quietest reasonably available to reduce potential noise impacts to be as low a reasonably practicable.
- terrestrial light sources to be compliant with Commonwealth's Light Pollution Guidelines (DoEE 2020) practice lighting design principles as far as practicable. Proposed measures to minimise light impacts are:
  - no lighting to be installed at borefield
  - light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill
  - use the lowest intensity lighting appropriate for the task
  - use non-reflective, dark-coloured building surfaces where possible
  - use lights with reduced or filtered blue, violet and ultra-violet wavelengths.

4.2 For matters protected by the EPBC Act that may be affected by the proposed action, describe the proposed environmental outcomes to be achieved

It is not anticipated that the construction and operation of proposed SDP will result in significant adverse impacts to the receiving terrestrial or marine environments.

The proposed terrestrial environmental outcomes achieved are:

- avoidance of direct disturbance to beach and nearshore environments which may be potentially used by shorebirds and marine turtles through using the existing WWTP ocean outfall
- avoidance of native flora and vegetation through siting pipeline infrastructure within existing cleared road reserves
- minimising the extent of native vegetation / fauna habitat clearing through implementing environmentally focused construction management measures
- minimising risk of injury or death of native fauna species during vegetation clearing and construction through implementing environmentally focused construction management measures
- minimising the noise risks through selecting the quietest reasonably available submersible pumps for the bore field
- minimising light impacts of the proposed SDP to shorebirds and marine turtles through the implementation of the

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Commonwealth's Light Pollution Guidelines (DoEE 2020) as far as practicable.

The proposed marine environmental outcomes achieved are:

- avoidance of indirect impacts to the nearshore coral reef environments through the altering the setting, angle and orientation of the existing WWTP ocean outfall pipe
- minimising direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe from altering the setting, angle and orientation of the existing WWTP ocean outfall pipe to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches
- dispersion and mixing of discharged brine in the marine environment to be with a horizontal distance of around 16 m from the end of the outfall pipe through altering its setting, angle and orientation.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 5

Conclusion on the likelihood of significant impacts

5.1 You indicated the below ticked items to be of significant impact and therefore you consider the action to be a controlled action

- ☐ World Heritage properties
- ☐ National Heritage places
- ☐ Wetlands of international importance (declared Ramsar wetlands)
- ☐ Listed threatened species or any threatened ecological community
- ☐ Listed migratory species
- ☐ Marine environment outside Commonwealth marine areas
- ☐ Protection of the environment from actions involving Commonwealth land
- ☐ Great Barrier Reef Marine Park
- ☐ A water resource, in relation to coal seam gas development and large coal mining development
- ☐ Protection of the environment from nuclear actions
- ☐ Protection of the environment from Commonwealth actions
- ☐ Commonwealth Heritage places overseas
- ☐ Commonwealth marine areas

5.2 If no significant matters are identified, provide the key reasons why you think the proposed action is not likely to have a significant impact on a matter protected under the EPBC Act and therefore not a controlled action

TERRESTRIAL / MIGRATORY SPECIES

West Island has been almost completely denuded of its native vegetation by extensive historical clearing for coconut plantations and its native fauna over hunted and predated by introduced ferals. The scale of the terrestrial clearing and construction works for proposed SDP is considered minor. The permanent loss of 1.47 ha of Closed Cocos forest vegetation represents an impact to approximately 0.08% of the main atoll's land area.

No MNES were recorded within the terrestrial DAF (Att 2, Sections 3 and 4) but the terrestrial DAF and the indicative pipeline alignment may be infrequently visited by EPBC Act listed shorebirds. These species inhabit a broad variety of coastal and nearshore environments, which are widespread and common on West Island and more generally across the Cocos (Keeling) archipelago including the Pulu Keeling National Park.

Water Corporation is proactively proposing to implement key mitigation measures to avoid and minimise potential impacts to MNES. Given the above, it is considered unlikely that the implementation of the minor works program for proposed SDP will result in a significant impact occurring to any MNES (i.e. threatened species, migratory species). This assertion is underpinned by the outcomes of the Dispersion Modelling and Environmental Impact Assessment (Att 4).

MARINE / MIGRATORY SPECIES

The existing WWTP ocean outfall pipe is currently orientated parallel with the shoreline and ocean floor drop-off, with end of the outfall pipe situated in a hollow among coral bomboras and reef-rubble. The outfall pipe is angled towards a relatively large bommie that is colonised by soft and hard coral. Initial dispersion modelling indicated that maintaining the existing setting, angle and orientation of the outfall pipe would achieve low dilution due to the slow proposed discharge rate (approximately 0.05 m/s), and lead to the brine plume spreading out down current over the seabed with the heavier (more salty water) settling into crevices among the reef rubble.

Altering the setting, angle and orientation of the existing WWTP ocean outfall pipe will allow brine to be discharged across the current at increased distance to the seabed which will result in the brine plume descending while bending to the current and a substantially increased dilution rate with vertical distance (Att 4, Section 3.4, pages 20-21). With the discharge occurring past the coral reef into deeper water, thereby avoiding settling impacts in the nearshore environments, the brine plume should continue to sink down slope with ocean floor drop-off while continuing to dilute by entraining ambient water. Calculations for the dilution and excess salinity with distance for the modified configuration indicates more rapid initial dilution and that the plume would continue to dilute to achieve approximately 40 dilutions and salinity differential of <1 ppt within a horizontal distance of around 16 m (Att 4, Section 3.4, page 22). The dilution rate should then slow because the density differential between the brine and seawater would be lost, and the plume would cease to plunge (Att 4, Section 3.4, page 22).

Indirect impacts (i.e. marine water quality changes) to the nearshore reef environment will be avoided through implementation of the proposed above modifications. The existing WWTP ocean outfall configuration is positioned within a few metres of the reef edge. Minor direct impacts to reef environments immediate to the existing WWTP ocean outfall pipe may be realised as part of the proposed modifications but these are anticipated to be temporary, associated with siting the pipeline extension and will be minimised to be as low as reasonably practicable through applying environmentally sensitive design and field siting approaches. The nearshore coral reef environments are well represented adjacent to West Island, more broadly within the Cocos (Keeling) Island archipelago including the Pulu Keeling National Park.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Given the above, it is considered unlikely that the discharge of brine from the proposed SDP to the receiving marine environment or the extension of the existing WWTP ocean outfall pipe will result in a significant impact occurring to any MNES (i.e. threatened species, migratory species, marine species). This assertion is underpinned by the outcomes of the Dispersion Modelling and Environmental Impact Assessment (Att 4).

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 6

Environmental record of the person proposing to take the action

6.1 Does the person taking the action have a satisfactory record of responsible environmental management? Explain in further detail

Yes, Water Corporation (the proponent for the proposed action) has a satisfactory record of responsible environmental management. This is reflected in the range of evidence for excellence in environment performance, including the Australian Water Association (AWA) WA Infrastructure Project Innovation Awards for the regional Vasse Diversion Drain upgrade (2021) and the metro Wharf Street Basin Next Generation Community Park project (2021), AWA WA Water Sensitive Urban Design Award (2017) for the White Gum Valley waterwise development, climate adaptation award from the Banksia Environmental Foundation (2013), Earth awards (2011) for the Walkington Avenue Community Verge Garden project (Margaret River), Prime Minister's Award (2004) for environmental excellence in Public Sector Management, WA Premiers Award (2004), 2003 Australian Greenhouse Office Gold Award, and United Nations Association of Australia World Environment Day Award 2004 for excellence in Marine and Coastal Management.

6.2 Provide details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against either (a) the person proposing to take the action or, (b) if a permit has been applied for in relation to the action – the person making the application

Water Corporation has had no actions bought against it in relation to its environmental performance under Commonwealth legislation but has received two modified penalty notices from WA State authorities. Note that under the applicable WA legislation modified penalty notices do not represent an admission for the purposes of criminal or civil proceedings.

6.3 If it is a corporation undertaking the action will the action be taken in accordance with the corporation's environmental policy and framework?

☑ Yes ☐ No

6.3.1 If the person taking the action is a corporation, provide details of the corporation's environmental policy and planning framework

Water Corporation maintains an Environmental Management System certified to ISO14001:2015. The system includes processes and standards to ensure that Water Corporation complies with its environmental obligations, prevents pollution and improves our environmental performance. The core document in our management system is the Environment Policy (Att 6) which outlines how the Corporation aims to achieve this by:

1. Managing risks – We are all responsible for identifying and addressing environmental risks and potential incidents.
2. Taking personal responsibility – We are all responsible for protecting the environment and understanding and meeting our environmental obligations.
3. Improving performance – Our environmental objectives include reducing native vegetation clearing, reducing greenhouse gas emissions, reducing water use and increasing recycling of wastewater. We set targets to continually reduce our environmental impact and improve our environmental performance. We regularly review our performance against these targets.
4. Maintaining an effective system – Our Environmental Management System provides the framework for setting and reviewing our environmental objectives and targets and continually improving our environmental performance.

6.4 Has the person taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

☑ Yes ☐ No

6.4.1 EPBC Act No and/or Name of Proposal

2021/8936 Collie Allanson 6ML Storage and Pipeline
2021/8915 Lennox Weir Removal
2020/8794 Onslow Seawater Desalination Plant Maine Geophysical Investigation
2020/8680 Broome Borefield Bushfire Mitigation Program
2019/8572 Yule Brook Main Drain Flood Mitigation Works
2019/8547 Goldfields Water Supply Scheme Project
2019/8454 Perth Desalination Plant 2
2019/8453 Alkimos Seawater Desalination
2019/8432 Residential Development Lot 522 in Plan 070706, Ditchingham Pl
2018/8239 Pipeline Extension, Hazelmere and Helena Valley
2018/8224 Alkimos Seawater desalination Plan, Offshore Investigations
2018/8215 Quinns Main sewer extension, Clarkson – Neerabup, WA
2017/8059 Greenbushes to Kirup Link, WA
2017/7935 Goldfields water supply scheme – remove sections from existing main conduit.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

2017/7932 Vasse Diversion Drain Upgrade
2016/7786 Groundwater replenishment scheme (GWRS) Stage 2
2015/7421 Ellenbrook reliable water storage project
2014/7329 Onslow water supply infrastructure upgrade project, Onslow
2014/7277 Stirling to Harris dam pipeline construction, Harris River State Forest
2013/6833 Home Island (CKI Group) Desalination Plant and Associated Infrastructure
2013/6720 Mount Barker to Albany Water Supply Pipeline
2012/6632 Millstream to Greenbushes Link Mains
2012/6379 Millstream 20GL Pipeline, Bungaroo, Borefield Integration
2012/6329 Samson Brook Dam Remedial Works
2012/6315 Mundaring outlet works upgrade – Stage 1
2012/6248 Sepia Depression Ocean outlet landline duplication
2011/6096 Fire control access track
2011/6077 Dwellingup water supply new source and supply pipeline
2010/5614 Millstream dam expansion
2010/5345 Perth hills district office and depot relocation
2009/5193 Mundaring water treatment plant and Mundaring C pump station project
2009/4970 Wastewater treatment plant, East Rockingham
2008/4545 Wastewater treatment plant, Broome
2008/4173 Southern seawater desalinisation project
2007/3532 Wungong transfer mains project
2007/3259 Development of new Alkimos wastewater treatment plant
2006/2507 Bulgarene Borefield
2005/2073 Yarragadee water supply development
2005/1971 Perth seawater desalinisation project: Thomsons Lake to Kogolup pipeline

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 7

Information sources

Reference source

Atlas of Living Australia. 2021a. Choeroichthys sculptus (Günther, 1870), Accessed 15 October 2021. https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:eff15072-2948-4e9c-b84d-8a34c9ede9e4

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

Atlas of Living Australia. 2021b. Cosmocampus banneri (Herald & Randall, 1972). Accessed 15 October 2021 https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:1ef522c8-04a4-42a0-96bf-c6bd58e15e6e

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

BirdLife International. 2021. IUCN Red List for birds. Accessed on 2 November 202 1http://www.birdlife.org

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

Bray. D.J. 2020. Flatface Seahorse, Hippocampus planifrons Peters 1877. Accessed 1 November 2021 https://fishesofaustralia.net.au/home/species/1537#moreinfo

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

Bray, D.J., n.d. Black Rock Pipefish, Phoxocampus belcheri (Kaup 1856). Accessed 1 November 2021 https://fishesofaustralia.net.au/home/species/3125#moreinfo

Reliability

Non-government organisation website

Uncertainties

Nil

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Reference source

Bray, D.J. and V. Thompson, n.d. Thorntail Pipefish, Micrognathus pygmaeus (Fritzsche 1981). Accessed 1 November 2021 https://fishesofaustralia.net.au/home/species/3114#moreinfo

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

CSIRO. 2009. Conservation values in Commonwealth waters of the Christmas and Cocos (Keeling) Island remote Australian territories. Cleveland, Queensland

Reliability

Prepared by CSIRO

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment, 2021a, Hypotaenidia philippensis andrewsi in Species Profile and Threats Database, Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=88994

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021b. Doryrhamphus excisus in Species Profile and Threats Database. Accessed 1 November 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66211

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021c. Anous stolidus in Species Profile and Threats Database. Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=825

Reliability

Prepared by Commonwealth Government agency

Uncertainties

NIl

Reference source

Department of Agriculture, Water and the Environment. 2021d. Ardenna pacifica in Species Profile and Threats Database. Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/spratpublic/publicspecies.pl?taxon_id=84292

Reliability

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment, 2021e, Charadrius leschenaultii in Species Profile and Threats Database, Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/ sprat/public/publicspecies.pl?taxon_id=877

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021f. Hirundo rustica in Species Profile and Threats Database. Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=662

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021g. Sula dactylatra in Species Profile and Threats Database. Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1021

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021i. Sula sula in Species Profile and Threats Database. Accessed 2 November 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1023

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021j. Balaenoptera borealis in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=34

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Reference source

Department of Agriculture, Water and the Environment. 2021k. Balaenoptera edeni in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=35

Reliability

Prepared by Commonwealth Government agency

Uncertainties

NIl

Reference source

Department of Agriculture, Water and the Environment. 2021l. Balaenoptera musculus in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=36

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021m. Balaenoptera physalus in Species Profile and Threats Database, Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=37

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021n. Megaptera novaeangliae in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov./cgi-bin/sprat/public/publicspecies.pl?taxon_id=38

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021o. Orcinus orca in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=46

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021p. Physeter macrocephalus in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?showprofile=Y&taxon_id=59

Reliability

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021q. Caretta caretta in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1763

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment, 2021r, Chelonia mydas in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1765

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021s. Dermochelys coriacea in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1768

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021t. Eretmochelys imbricata in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1766

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021u. Lepidochelys olivacea in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1767

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Reference source

Department of Agriculture, Water and the Environment. 2021v. Natator depressus in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59257

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment. 2021w. Carcharodon carcharias in Species Profile and Threats Database. Accessed 14 October 2021 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64470

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Agriculture, Water and the Environment, 2022, Sphyrna lewini in Species Profile and Threats Database, Accessed 9 March 2022 https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85267

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of Biodiversity, Conservation and Attractions. 2021. NatureMap, Accessed 13 October 2021 https://naturemap.dbca.wa.gov.au/

Reliability

State Government agency database

Uncertainties

Nil

Reference source

Director of National Parks, 2015, Pulu Keeling National Park, Management Plan 2015-2025, Canberra, Australian Capital Territory

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of the Environment and Energy. 2017. Recovery Plan for Marine Turtles in Australia. Accessed 14 October 2021 http://www.environment.gov.au/system/files/resources/46eedcfc-204b-43de-99c5-4d6f6e72704f/files/recovery-plan-marine-turtles-2017.pdf

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

Department of the Environment and Energy. 2020. National Light Pollution Guidelines for Wildlife, Including marine turtles, seabirds and migratory shorebirds. Canberra, Australian Capital Territory

Reliability

Prepared by Commonwealth Government agency

Uncertainties

Nil

Reference source

ICUN Red List, 2022, Scalloped Hammerhead, Accessed 9 March 2022 https://www.iucnredlist.org/species/39385/2918526#habitat-ecology

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

Meynecke, J., de Bie, J., Barraqueta, J., Seyboth, E., Dey, S., Lee, S., Samanta, S., Vichi, M., Findlay, K., Roychoudhury, A. and B. Mackey. 2021. The Role of Environmental Drivers in Humpback Whale Distribution, Movement and Behaviour: A Review. Frontiers in Marine Science 8:720774. doi: 10.3389/fmars.2021.720774

Reliability

Peer reviewed paper published in scientific journal

Uncertainties

Nil

Reference source

New Zealand Birds Online. 2013. Oriental cuckoo Cuculus optatus Gould, 1845. Accessed 2 November 2021 https://www.nzbirdsonline.org.nz/species/oriental-cuckoo

Reliability

Non-government organisation website

Uncertainties

Nil

Reference source

Schlaff, A. Simpfendorfer, C. and M. Heupel. 2014. Influence of Environmental Factors on Shark and Ray Movement, Behaviour and Habitat Use: A Review. Reviews in Fish Biology and Fisheries. 24:1089–1103. doi: 10.1007/s11160-014-9364-8

Reliability

Peer reviewed paper published in scientific journal

Uncertainties

Nil

Reference source

Whiting, S. D., Macrae, I., Thorn, R., Murray, W., and A. U. Whiting, 2014, Sea turtles of the Cocos (Keeling) Islands, Indian Ocean. Raffles Bulletin of Zoology. Supplement 30: 168–183

Reliability

Peer reviewed paper published in scientific journal

Uncertainties

Nil

Reference source

Woinarski, John, MacRae, I., Flores, T., Detto, Tanya, Reid, Julian, Pink, Caitlyn, Flakus, S., Misso, M., Hamilton, Neil, Palmer, Russell, Morris, Keith, Znidersic, L. and Hill, Brydie, 2015, Conservation status and reintroduction of the Cocos Buff-banded Rail (Gallirallus philippensis andrewsi). Emu. 116. NULL. 10.1071/MU15052.

Reliability

Peer reviewed paper published in scientific journal

Uncertainties

Nil

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 8

Proposed alternatives

Do you have any feasible alternatives to taking the proposed action?

☑ Yes ☐ No

8.0 Provide a description of the feasible alternative

An alternative to replacing the shallow freshwater lens, as the West Island public drinking water source, through the construction of the SDP would be to continue its current use. Given that the shallow freshwater lens that sits below an active airplane runway and that extensive upgrades to the runway are planned, drinking water contamination from the future runway land use was considered by the Corporation to present an unreasonably high level of risk to the supply of safe potable water to the local community.

An alternative to altering the setting, angle and orientation of the existing WWTP ocean outfall pipe would be leave the outfall pipe in its current location. The outfall pipe is currently orientated parallel with the shoreline and ocean floor drop-off, with end of the outfall pipe situated in a hollow among coral rubble. The outfall pipe is angled towards a relatively large bommie that is colonised by soft and hard coral. Not altering the angle and orientation of the ocean outfall pipe would result is higher salinity water flowing up against the bommie and settling into voids within the rubble field. This outcome presents a risk to the receiving nearshore coral reef environments proximate to the end of the outfall pipe, when compared to altering its setting, angle and orientation.

For these reasons, constructing the SDP to facilitate the long term supply of safe drinking water to the local community and altering the setting, angle and orientation of the existing WWTP ocean outfall pipe to address potential impacts to the nearshore coral reef environments present as beneficial outcomes when compared to the ‘do nothing’ alternatives.

8.1 Select the relevant alternatives related to your proposed action

☐ Timeframes
☐ Locations
☐ Activities

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

8.25 Do you have another alternative?

☐ Yes ☑ No

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 9

Person proposing the action

9.1.1 Is the person proposing the action an organisation or business?

☑ Yes ☐ No

Organisation

Organisation name (as registered for ABN/ACN)	WATER CORPORATION
Business name	
ABN	28003434917
ACN	
Business address	629 Newcastle St, Leederville, 6007, WA, Australia
Postal address	
Main Phone number	(08) 9420 2420
Fax	
Primary email address	environment@watercorporation.com.au
Secondary email address	

9.1.2 I qualify for exemption from fees under Regulation 5.23(1)(ii) of the EPBC Regulations because I am:

☐ Small business
☑ Not applicable

9.1.2.2 I would like to apply for a waiver of full or partial fees under Regulation 5.21A of the EPBC Regulations

☐ Yes ☑ No

9.1.3 Contact (for an organisation - the contact details of the person authorised to sign on behalf of the organisation)

First name	Megan
Last name	Lally
Job title	Manager - Operations Group Regional Projects (North West Region)
Phone	(08) 9420 3568
Mobile	
Fax	
Email	megan.lally@watercorporation.com.au
Primary address	629 Newcastle St, Leederville, 6007, WA, Australia
Address	

Declaration: Person proposing the action (To be signed by the person at 9.1.3)

I, Megan Lally **, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf or for the benefit of any other person or entity.**

Signature: ..... Date: 8/2/22

I, _____, the person proposing the action, consent to the designation of _____ as the proponent for the purposes of the action described in this EPBC Act Referral.

Signature:.....Date: .....

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Proposed designated proponent

9.2.1 Is the proposed designated proponent an organisation or business?

☑ Yes ☐ No

Organisation

Organisation name (as registered for ABN/ACN)	WATER CORPORATION
Business name	
ABN	28003434917
ACN	
Business address	629 Newcastle St, Leederville, 6007, WA, Australia
Postal address	
Main Phone number	(08) 9420 2420
Fax	
Primary email address	environment@watercorporation.com.au
Secondary email address	

9.2.2 Contact (for an organisation - the contact details of the person authorised to sign on behalf of the organisation)

First name	Megan
Last name	Lally
Job title	Manager - Operations Group Regional Projects (North West Region)
Phone	(08) 9420 3568
Mobile	
Fax	
Email	megan.lally@watercorporation.com.au
Primary address	629 Newcastle St, Leederville, 6007, WA, Australia
Address	

Declaration: Proposed Designated Proponent

I, Megan Lally **, the proposed designated proponent, consent to the designation of myself as the proponent for the purposes of the action described in this EPBC Act Referral.**

Signature: ..... **Date:** 8/2/22

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Referring party (person preparing the information)

9.3.1 Is the referring party an organisation or a business?

☑ Yes ☐ No

Organisation

Organisation name (as registered for ABN/ACN)	WATER CORPORATION
Business name	
ABN	28003434917
ACN	
Business address	629 Newcastle St, Leederville, 6007, WA, Australia
Postal address	
Main Phone number	(08) 9420 2420
Fax	
Primary email address	environment@watercorporation.com.au
Secondary email address	

9.3.2 Contact (for an organisation - the contact details of the person authorised to sign on behalf of the organisation)

First name	Julia
Last name	Phillips
Job title	Environmental Specialist - Marine
Phone	(08) 9420 3504
Mobile	
Fax	
Email	julia.phillips@watercorporation.com.au
Primary address	629 Newcastle St, Leederville, 6007, WA, Australia
Address	

Declaration: Referring party (person preparing the information)

I, Julia Phillips **, declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence.**

Signature: ..... **Date:** .....09/02/2022.....

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Appendix A

Attachment

Document Type	File Name
action_area_images	*FigA_Site location_211021.pdf
action_area_images	*FigB_DAF and associated infrastructure mapbook_211021.pdf
action_area_images	*FigC_Bathymetry_211021.pdf
action_area_images	*FigD_Flora and fauna survey areas_220117.pdf
action_area_images	*FigE_BIA and Commonwealth waters_211021.pdf
action_area_images	Att 1-Figures A to E_v2.pdf
public_consultation_reports	Att 3-Public Consultation.pdf
supporting_tech_reports	Att 1_Dispersion Modelling and Environmental Impact *Assessment_2022.pdf
supporting_tech_reports	*Att 2_Cocos West Island Ocean Monitoring Survey Baseline_2020.pdf
supporting_tech_reports	Att 4-Dispersion Modelling and EIA Report_v2.pdf
supporting_tech_reports	Att 2-Flora and Fauna Survey Report_v2.pdf
supporting_tech_reports	Att 5-Cocos West Island Outfall Monitoring 2020 Report.pdf
corp_env_policy_docs	Att 6-WaterCorp Environment Policy.pdf

Appendix B

* NOT PUBLISHED - SUPERSEDED

Coordinates

Area 1
-12.168046091,96.821922922996
-12.168095023,96.822379500996
-12.168544218,96.822329764996
-12.168495277,96.821873186996
-12.168046091,96.821922922996
Area 2
-12.161763104,96.821492064996
-12.161737276,96.821845243996
-12.163779503,96.821979311996
-12.163805331,96.821626129997
-12.161763104,96.821492064996
Area 3
-12.165895517958,96.817104629456
-12.165904554634,96.817104555672
-12.165904482042,96.817095370536
-12.165895445366,96.817095444321
-12.165895517958,96.817104629456
Area 4
-12.168215051122,96.821904214968
-12.168219558873,96.821903715849
-12.168224066624,96.821903216729
-12.168223385826,96.821875186047
-12.169069768366,96.82178363684
-12.17028218822,96.821646156142
-12.170282289492,96.82164614348
-12.170282427728,96.821646122366
-12.170509257019,96.821607820787
-12.173076173217,96.82120414837
-12.173297008151,96.821202347537
-12.173297574165,96.821202306704
-12.173298137317,96.821202192284
-12.173596189761,96.82112082294
-12.173924307664,96.821063495984
-12.176276321428,96.820655434868
-12.177685222946,96.820419115591
-12.177935925344,96.820374537994

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

-12.178051234141,96.820355882628
-12.17816734254,96.820344390632
-12.178283923253,96.820340088039
-12.178400545826,96.820342990744
-12.178516779652,96.820353088039
-12.178632331444,96.820370362965
-12.178632458626,96.820370380108
-12.178632630846,96.820370397404
-12.178767369832,96.820381285519
-12.178767589528,96.82038129781
-12.178902690213,96.820385505753
-12.17890288756,96.820385507459
-12.17903805227,96.820383024941
-12.1790382721,96.820383015457
-12.179173135029,96.820373848957
-12.179173354144,96.820373828606
-12.179307618179,96.820357999547
-12.179307699891,96.820357989145
-12.179307836059,96.820357968378
-12.179441182829,96.820335514285
-12.179441398959,96.820335472371
-12.179573411686,96.820306468577
-12.17967422636,96.820289159617
-12.179775922336,96.820278961943
-12.179878067988,96.820275915113
-12.179980177254,96.820280033632
-12.180081764243,96.820291297911
-12.180182345551,96.820309654355
-12.180281442558,96.820335015625
-12.180378583706,96.820367261044
-12.180473306744,96.82040623718
-12.180565160927,96.82045175857
-12.180653701909,96.820503604357
-12.181367740315,96.820995195185
-12.181665384887,96.821677851733
-12.182158406966,96.823575036375
-12.182229634273,96.824272885353
-12.182229697115,96.824273308164
-12.182229722988,96.824273431415
-12.182440381646,96.825213555705
-12.182440595313,96.825214249909
-12.182440914117,96.82521490112
-12.182441330062,96.825215493005
-12.182966396096,96.825849239998
-12.182966785593,96.825849654579
-12.182967097278,96.825849921888
-12.183436257536,96.826216762673
-12.183436721973,96.82621708127
-12.18343722163,96.82621733899
-12.183437748825,96.826217531869
-12.183616875558,96.826270570322
-12.183910116401,96.826461845569

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

-12.183994193763,96.826569930813
-12.183994722107,96.826570502115
-12.183995338349,96.826570973743
-12.18399602453,96.82657133195
-12.183996760651,96.826571566298
-12.183997525259,96.826571669957
-12.183998296071,96.826571639906
-12.183999050622,96.82657147702
-12.183999766922,96.826571186046
-12.184000424095,96.826570775466
-12.184064097132,96.826522906493
-12.184253706719,96.826569453944
-12.184254237077,96.826569550548
-12.184254453184,96.826569571177
-12.184792756741,96.826607723289
-12.184793500676,96.826607713602
-12.184794232962,96.826607579955
-12.184794933746,96.826607325971
-12.18479558403,96.826606958536
-12.184796166183,96.826606487612
-12.184796664422,96.826605925966
-12.184797065239,96.826605288826
-12.184797357768,96.826604593464
-12.184797534077,96.826603858734
-12.184797589388,96.826603104554
-12.184797012206,96.826529861386
-12.184976851109,96.826569604041
-12.185126055647,96.826622835673
-12.186277299944,96.827299013588
-12.186307356829,96.827388283311
-12.186307619453,96.827388908116
-12.18630796988,96.827389486703
-12.186308400441,96.827390006409
-12.186308901715,96.827390455863
-12.186309462732,96.82739082523
-12.186621477422,96.827564390943
-12.186939671621,96.827786362958
-12.187872408119,96.828592870306
-12.187872709206,96.82859310911
-12.187872816417,96.828593184613
-12.188233245304,96.828839266336
-12.188879883577,96.829378176568
-12.188416925729,96.830136165223
-12.188269836084,96.830149331235
-12.188270628779,96.830158482105
-12.188419969126,96.830145114637
-12.188420656633,96.830144998245
-12.188421318352,96.83014477576
-12.188421938539,96.830144452475
-12.188422502438,96.830144036083
-12.188422996632,96.830143536489
-12.188423409362,96.830142965582

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

-12.188889650904,96.829379600624
-12.188889981521,96.829378948136
-12.188890205677,96.829378250447
-12.188890317647,96.829377525371
-12.188890314571,96.829376791423
-12.18889019653,96.829376067343
-12.188889966536,96.82937537162
-12.188889630463,96.829374722018
-12.188889196892,96.829374135125
-12.188888676893,96.829373625925
-12.188238808309,96.828832023557
-12.188238570075,96.828831838109
-12.188238462864,96.828831762606
-12.187878068054,96.828585704161
-12.186945348807,96.827779211761
-12.18694504772,96.827778972958
-12.186944977914,96.827778923271
-12.186626403125,96.827556685768
-12.186626015527,96.827556443617
-12.186315339162,96.827383622388
-12.186285301736,96.82729441046
-12.186285048718,96.827293804621
-12.186284713113,96.827293241761
-12.186284301812,96.82729273344
-12.186283823261,96.827292290094
-12.186283287285,96.827291920827
-12.18513021115,96.826614667026
-12.185129837242,96.826614470435
-12.185129446959,96.826614310069
-12.184979580361,96.82656084224
-12.184979172572,96.826560718348
-12.184979043871,96.826560687896
-12.18479340848,96.82651966428
-12.184792679284,96.82651956543
-12.184791943973,96.826519588168
-12.184791222036,96.826519731892
-12.184790532612,96.826519992791
-12.184789893972,96.82652036395
-12.184789323046,96.826520835531
-12.184788834968,96.826521395034
-12.184788442673,96.826522027628
-12.184788156562,96.826522716546
-12.184787984217,96.826523443526
-12.184787930207,96.826524189299
-12.184788513549,96.826598214115
-12.184255459827,96.826560434102
-12.184064167534,96.826513473569
-12.184063519107,96.826513364374
-12.184062861955,96.826513351959
-12.184062209983,96.826513436584
-12.184061576987,96.826513616459
-12.184060976359,96.826513887779

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

-12.184060420809,96.826514244803
-12.183998568855,96.8265607447
-12.183916736678,96.826455545748
-12.183916226154,96.82645499077
-12.183915632607,96.826454528939
-12.183621206504,96.82626248058
-12.183620637441,96.826262165511
-12.183620029893,96.826261936425
-12.183441093057,96.826208954206
-12.182972994006,96.825842943204
-12.182448949547,96.825210429254
-12.18223859488,96.824271661648
-12.182167359531,96.823573733925
-12.182167296688,96.823573311114
-12.182167233811,96.823573034892
-12.181674030275,96.821675152034
-12.181673947631,96.821674870751
-12.181673792595,96.82167446406
-12.181375477458,96.820990269572
-12.181375182585,96.820989703502
-12.181374813106,96.820989184635
-12.181374376207,96.820988723063
-12.181373880384,96.820988327762
-12.180658633615,96.82049590504
-12.180658355196,96.820495728011
-12.180569536714,96.820443719733
-12.180569426192,96.820443657095
-12.180569261421,96.820443571145
-12.1804771269,96.820397910828
-12.180476842185,96.820397781885
-12.180381830054,96.820358686798
-12.180381764184,96.820358660303
-12.180381537271,96.820358578115
-12.18028409965,96.820326234286
-12.180283800192,96.820326146379
-12.180184393401,96.820300705845
-12.180184096036,96.820300640998
-12.180083207756,96.820282228534
-12.180082919403,96.82028218566
-12.179981002219,96.820270884679
-12.17998069138,96.820270861205
-12.17987827048,96.82026673012
-12.179878055041,96.820266726657
-12.179877958789,96.820266728485
-12.179775501391,96.820269784618
-12.17977519033,96.820269804829
-12.179673183981,96.820280033628
-12.179673025281,96.820280052427
-12.179672875031,96.820280075589
-12.179571805129,96.820297428373
-12.179571603081,96.820297467893
-12.179439597336,96.820326470157

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

-12.179306467702,96.820348887691
-12.179172422297,96.82036469098
-12.179037778972,96.820373842559
-12.178902856997,96.820376320738
-12.178767976302,96.820372119651
-12.178633497284,96.820361252549
-12.178517958745,96.820343979607
-12.178517831563,96.820343962465
-12.178517686015,96.820343947405
-12.178401178496,96.820333826338
-12.178400904345,96.820333811033
-12.178284007164,96.820330901497
-12.178283860278,96.820330900269
-12.178283732605,96.820330903145
-12.178166877384,96.820335215874
-12.17816660343,96.82033523447
-12.178050221634,96.820346753529
-12.178050057248,96.820346772895
-12.178049949297,96.820346789004
-12.177934470643,96.820365471853
-12.177934402289,96.820365483459
-12.177683708663,96.820410059613
-12.17627482551,96.820646375783
-12.173922781998,96.821054442104
-12.173594453517,96.821111805861
-12.173594053537,96.821111894882
-12.173296357872,96.821193166834
-12.173075771482,96.821194965648
-12.173075205468,96.82119500648
-12.173075116867,96.821195019502
-12.170507825662,96.821598751122
-12.170281066071,96.821637040795
-12.169068789252,96.821774505345
-12.168218287773,96.821866500073
-12.168217554102,96.821866642537
-12.168216853546,96.821866905906
-12.168216205247,96.821867282985
-12.168215626922,96.821867763469
-12.168215134375,96.821868334228
-12.168214741064,96.821868979665
-12.168214457737,96.821869682144
-12.168214292138,96.821870422466
-12.168214248791,96.821871180404
-12.168215051122,96.821904214968
Area 5
-12.168138147864,96.82191273005
-12.168142642542,96.821912232378
-12.16814713722,96.821911734707
-12.168144389502,96.821873803021
-12.168144279912,96.821873081143
-12.168144059117,96.821872386053
-12.168143732701,96.821871735333

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

-12.16814330892,96.82187114544
-12.168142798493,96.821870631295
-12.16814221433,96.821870205902
-12.168141571206,96.821869880021
-12.168140885387,96.821869661894
-12.16814017422,96.821869557038
-12.168139455693,96.821869568105
-12.167754778511,96.821906728532
-12.167754018839,96.821906869286
-12.167753293839,96.82190713946
-12.167752624685,96.821907531164
-12.167640633744,96.821986763003
-12.166889556487,96.822065649311
-12.16668073123,96.822055226437
-12.165819304571,96.82195896838
-12.165819212929,96.821958959099
-12.164652706495,96.821853018249
-12.164651943328,96.821853014709
-12.164651190461,96.821853141767
-12.16465046937,96.821853395799
-12.164649800627,96.821853769557
-12.164649203308,96.821854252381
-12.1645676214,96.821932498052
-12.163788123389,96.821861434186
-12.163787453435,96.821870595369
-12.164568839652,96.821941831403
-12.164569603123,96.821941835182
-12.16457035632,96.821941708255
-12.164571077742,96.821941454246
-12.16457174679,96.821941080408
-12.164572344364,96.821940597412
-12.164653926944,96.8218623511
-12.165818362801,96.821968103943
-12.166679879438,96.822064372084
-12.166680151596,96.822064394062
-12.166889456987,96.822074840907
-12.166889714817,96.822074846287
-12.166890143035,96.822074822109
-12.167642722483,96.821995778051
-12.167643469078,96.821995634347
-12.167644181425,96.82199536551
-12.167644839379,96.821994979144
-12.167756814061,96.82191575881
-12.16813571583,96.821879156311
-12.168138147864,96.82191273005