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Chapter 6 - Hydrology

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A	For Review	08 Oct 2022	Beth Salt	Senior Associate Scientist - Environment	Jess Miller	SEIS Coordinator
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Tables

Figures

6 Hydrology

6.1 Introduction

The NT EPA's objective for the Hydrological processes factor is:

> *Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.*

The NT EPA's objective for the Inland water environmental quality factor is:

> *Protect the quality of groundwater and surface water so that the environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.*

This chapter – Hydrology – combines the Hydrological Processes (Chapter 6) and Inland Water Environmental Quality (Chapter 7) from the Draft EIS into one consolidated chapter assessing water-related impacts across a full cycle. This chapter describes and assesses the significance of potential impacts to the hydrological regimes of surface water and groundwater associated with the Project. The potential impacts to hydrological regimes considered in this chapter were identified with reference to the Draft EIS TOR issued by the NT EPA, issues raised by stakeholders (refer to Appendix 3.1), and the professional judgement of the SEIS team (Appendix 1.5) based on their knowledge and understanding of the Project's components as described in Chapter 2 Project Refinements. Potential impacts were assessed using the EIA methods described in Chapter 3 Impact Assessment of the Draft EIS, and as summarised in Chapter 1 of this SEIS. This chapter presents the findings of the EIA process undertaken for the hydrological processes factor and the inland water environmental quality factor. The surface watercourses and groundwater aquifers present within, and surrounding the Project, as well as their WQ of these and the environmental values they maintain were identified and described in the Draft EIS.

Closely related environmental factors are covered elsewhere in this Draft EIS: Chapter 7 Aquatic Ecosystems considers impacts to those systems from changes to hydrological regimes and/or WQ; and Chapter 8 Marine Environmental Quality addresses impacts to WQ in the marine environment resulting from the Project's activities in the sea and on land.

6.2 Information Sources

Since the Draft EIS was lodged, the following reports have been prepared which deal with hydrology:

- Groundwater Assessment - Solar Precinct (Appendix 6.1)
- Environmental Design Criteria and Standards (Appendix 1.2)
- Constraints Planning and Field Development Procedure (Appendix 4.1)
- Land Based Electrode Technical Report (Appendix 12.1).

6.3 Project Amendments since Draft EIS

Project refinements presented in this SEIS (Chapter 2) which require additional footprint and have been assessed in this Chapter for their potential to impact hydrology include:

- Solar Precinct AI (located beyond previous footprint in the Draft EIS (see Figure 2-1). The estimated water demand for the Solar Precinct has also increased from 6,000 ML for construction to 8,040 ML over a period of four years, and from 10 ML per annum to 11.4 ML per annum for operations.
- OHTL Corridor (including the preferred routes at Katherine, Pine Creek, and Adelaide River). The preferred OHTL Corridor's additional footprint and potential impacts on surface water have been assessed in this chapter. The preferred route is unlikely to have any effect on groundwater. Changes to the OHTL Corridor are not material and the corridor has only been revised since the Draft EIS (see Figures in Appendix 2.2). More information regarding PFAS around Katherine has been sourced for this chapter (refer to Figure 6-2).
- The Powell Creek Electrode and DCS Electrode (including the HVDC Electrode Line Corridors and Access Tracks) (see Figure 2-11, Figure 2- 12).

6.4 Existing Environment and Values

6.4.1 Powell Creek AI

Further information is presented in the sections below to describe the environmental values associated with the Power Creek AI. The AI external to the Solar Precinct includes an additional 134 ha project footprint (see Figure 6-2), which occupies the space between the Solar Precinct and the Stuart Highway, along the Access Roads that will be built.

6.4.1.1 Climate and weather

Climate and weather conditions experienced in the region are described in Chapter 2 of the Draft EIS, along with details of how these have been taken into consideration to avoid and minimise impacts to hydrological regimes as part of the site selection and design process.

In semi-arid climates, indirect recharge mechanism to groundwater aquifers is generally considered the most significant process, though these are both poorly understood and quantified in the south of the Cambrian Limestone Aquifer (CLA). The infiltration of surface water from Lake Woods, particularly during the wet season, likely represents the major recharge mechanism to the Wiso Basin on Power Creel and Newcastle Waters Stations (Appendix 6.1).

6.4.1.2 Surface water

Lake Woods

No additional information is presented regarding the hydrology of Lake Woods and none of the proposed project refinements affect Lake Woods in a different manner to what was discussed in the Draft EIS. However, conclusions from Appendix N in the Draft EIS state that static flood levels derived from long-term simulations of water levels in Lake Woods showed only minor inundation of a small part of the site in extreme or rare events (0.1% AEP or a 1 in 1 000 event or greater). Climate change modelling showed potential increases in water levels with flood inundation from Lake Woods impacting parts of the site from rare to extreme events. However, these are unlikely to be as high as the levels extrapolated in the analysis due to outflows from Lake Woods that occur when flood levels go above the 'non flow' inversion level at Newcastle Waters (Appendix N from Draft EIS). Most importantly the predicted 1% AEP (standard 1 in 100 design event) by the year 2140 still has no impact on the site.

The AI occupies the space between the Solar Precinct and the Stuart Highway, along the Access Roads that will be built between the two locations. None of the AI is within the flood zone (based on mapping completed in Appendix N of the Draft EIS).

Watercourses

There are approximately three major flow paths (Billy Creek, Gleeson Creek, and Hunter Creek) that the sealed Main Access Road will cross and three major flow paths (Billy Creek, Gleeson Creek, and Hunter Creek) that the Gravel Access Road will cross.

6.4.1.3 Groundwater systems

The following information is derived from Appendix 6.1: Groundwater Assessment – Solar Precinct. Aquatic ecosystems rely on the surface expression of groundwater – this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands, and springs. Selective terrestrial ecosystems rely on the subsurface presence of groundwater and include vegetation ecosystems such as forests and riparian vegetation.

The western half of Project area, including the Solar Precinct, overlies the Wiso Basin which hosts a regional scale aquifer in the Montejinni Limestone with a reported bore yield range of 5-15 L/s. Groundwater resources hosted in the Montejinni Limestone aquifer have the potential to meet the construction water requirement of the Solar Precinct. Local data is limited, and site investigations will be required to confirm groundwater availability within the Montejinni Limestone prior to Groundwater Extraction Licence applications (refer to Figure 3 in Appendix 6.1: Aquifer Map).

Groundwater resources are limited in the east of the Project area where groundwater occurs in local scale aquifers within fractured and weathered Proterozoic basement rocks and fractured basalt of the Helen Springs Volcanics. It is unlikely that these aquifers can support the construction water requirement for the eastern part of the Project area. Demand at the eastern water consumption points should be met by piping water from the Montejinni Limestone in the vicinity of the Solar Precinct (refer to Figure 3 in Appendix 6.1: Aquifer Map).

Regional groundwater studies describe major recharge mechanisms to the CLA. These include direct recharge from the infiltration of rainfall to the water Table where the CLA outcrops or subcrops beneath porous surface cover and indirect recharge where aquifers underlie ephemeral drainage lines or surface water bodies/lakes. Lake Woods, particularly during the wet season, likely represents the major recharge mechanism to the Wiso Basin on Powell Creek and Newcastle Waters Stations.

Environmental receptors in the form of springs and permanent waterholes are mapped along several water courses in the east of the project area (see Figure 4 Groundwater Receptors in Appendix 6.1). These GDEs are associated with groundwater discharge from the fractured basement aquifers in the eastern side of the project area. In the western side of the project area, the depth to groundwater in the Montejinni Limestone aquifer ranges from 34 – 44 m below ground level (mBGL). No GDEs have been identified in the Montejinni Limestone and the aquifer is unlikely to support GDEs because the water Table depth exceeds 20 mBGL.

6.4.1.4 Water Control Districts and Water Allocation Plans (WAP)

The following information is derived from Appendix 6.1: Groundwater Assessment – Solar Precinct. A preliminary estimate of the groundwater storage in the Montejinni Limestone (beneath the Solar Precinct) assumes an average specific yield of 4%, which is consistent with the value adopted by DEPWS for licence assessments in the CLA aquifer and regional numerical models.

There is no licensed groundwater extraction in the vicinity of Solar Precinct. The nearest groundwater extraction licence taking water from the Wiso Basin is located 85 km north of the Solar Precinct at Newcastle Waters where Power and Water Corporation holds a licence of 100 ML/year for public water supply. Power and Water Corporation also holds a groundwater extraction licence for 300 ML/year in the Georgina Basin at Elliott, 50 km north-east of the Solar Precinct.

The project area is located in the Daly Roper Beetaloo Water Control District but outside of a WAP area. Under this scenario the regulator, DEPWS, assesses groundwater extraction applications on the basis of contingent allocation rules documented in the NT WAP Framework. The Arid Zone allocation rules apply to the project area, whereby groundwater extraction must not result in any deleterious change in groundwater discharges to dependent ecosystems and total extraction over a period of at least 100 years must not exceed 80% of the total aquifer storage at the start of extraction.

6.4.1.5 Beneficial uses

Domestic and stock watering represent the main beneficial uses of groundwater on Powell Creek and Helen Springs Stations. Most of the bores are used to supply water for cattle grazing on Powell Creek and Helens Springs Stations. A bore is also used for domestic water to supply to the Jangirulu Outstation at Gleeson Springs and two bores were drilled to supply water for the construction of the Alice Springs to Darwin railway line.

Groundwater quality data is available for the Montejinni Limestone (Wiso Basin), the Helen Springs Volcanics and the fractured basement aquifers. The Project plans to target groundwater resources in the Montejinni Limestone to meet the construction water requirement. Based on Total Dissolved Solids (TDS) and Electrical Conductivity (EC), the groundwater is suitable for a range of uses including potable use and livestock watering. Further information is provided in Appendix 6.1: Groundwater Assessment – Solar Precinct.

A high potential for aquatic GDEs is mapped along Powell Creek, north of the project area and a low potential along Hunter Creek and Burke Creek to the south. Billy Creek, Gleeson Creek and Bull Creek, located around the proposed Access Roads, are identified in the aquatic GDE layer but are unclassified. The presence of aquatic GDEs along the eastern extents of these drainage lines is consistent with the location of inferred springs identified during ecological surveys (detailed in Table 6-3 of the Draft EIS).

Terrestrial ecosystems rely on the subsurface presence of groundwater and include vegetation ecosystems such as forests and riparian vegetation. Subterranean ecosystems include cave aquifer ecosystems.

6.4.2 OHTL Corridor

6.4.2.1 Surface water

The OHTL preferred route at Katherine will pass south of the township and will involve crossing both Tindal Creek (approximately located at KP 454) and Katherine River (approximately located at KP 455.5) (refer to Figure 6-1). Katherine is known to be contaminated due to the use of substances containing PFAS at the RAAF Base Tindal, specifically AFFF used for firefighting. A PFAS Management Area has been declared for the Katherine (Figure 6-2).

Significant investigations have been undertaken by the Department of Defence since 2016, to determine the extent of contamination. Investigations undertaken to date include a Detailed Site Investigation, Human Health Risk Assessment, Ecological Risk Assessment and ongoing monitoring reports (see Department of Defence, 2022). Previous investigations and ongoing monitoring and reporting has been undertaken in accordance with relevant guidelines, including the:

- PFAS National EMP, as updated from time to time (HEPA, 2020) (PFAS, NEMP)
- National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013) (NEPM Guidelines)
- ANZG.

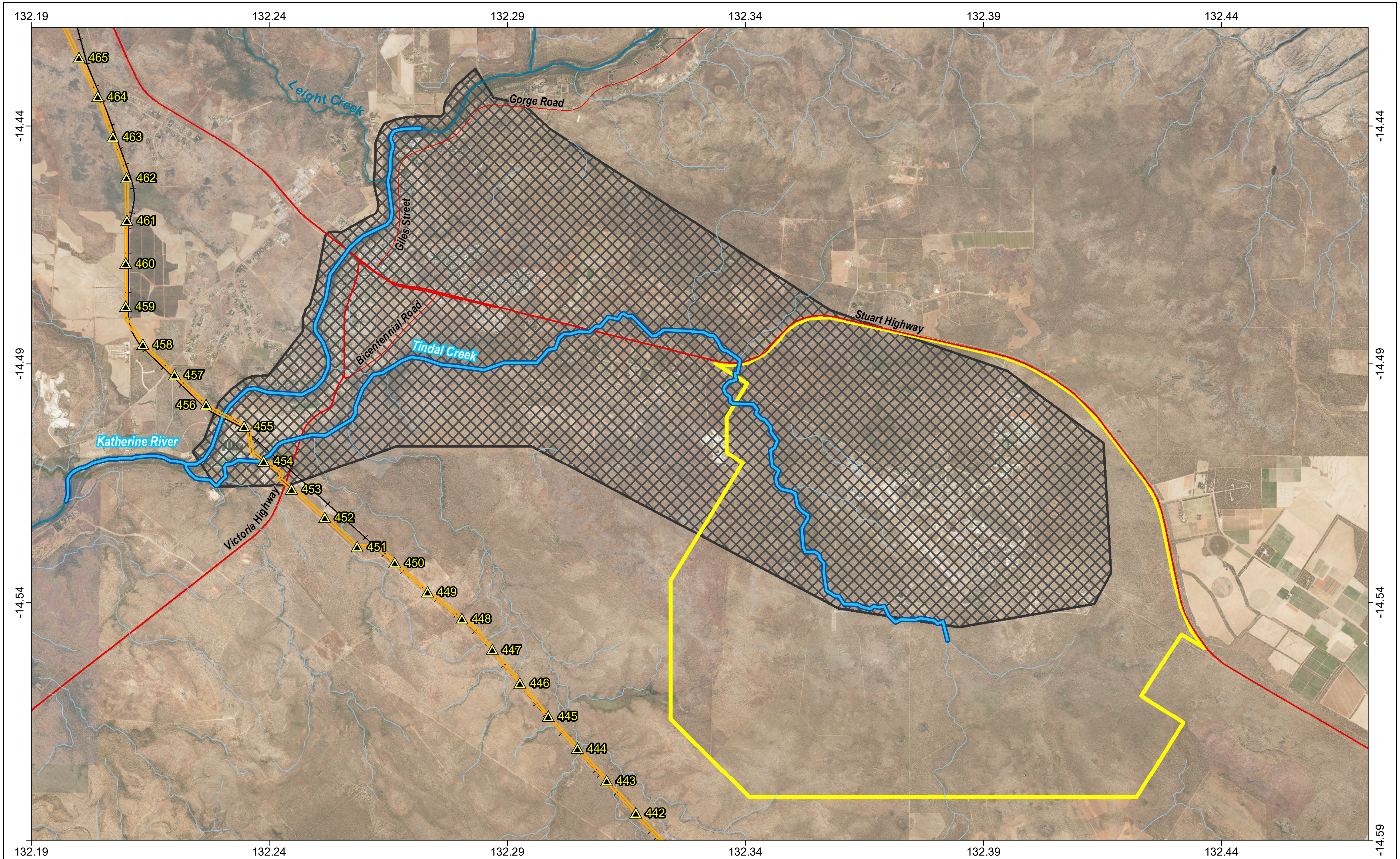
Groundwater and surface water monitoring is being undertaken by the Department of Defence to continue to monitor the level and extent of PFAS contamination within the Katherine region. A PFAS Management Area Plan has been developed by the Department of Defence for the RAAF Base Tindal which details the ongoing management and monitoring that will be undertaken within the Katherine PFAS Management Area to mitigate risks associated with the PFAS contamination. The PFAS Management Area Plan is consistent with the PFAS NEMP (see Department of Defence 2019).

The OHTL Corridor will not pass through the RAAF Base Tindal and so will not interact with the sources of contamination. However, the OHTL Corridor does intersect the western-most portion of the Katherine PFAS Management Area and will traverse the management area for approximately 3 km, from KP 453 to KP 456. This includes a distance of approximately 2 km south of the Katherine River and Figure 6-1).

The latest publicly available Interpretive Report for the PFAS Ongoing Monitoring Program – RAAF Base Tindal summarises the surface water and groundwater quality monitoring data collected until February 2020 (see AECOM, 2020). Surface waters in Tindal Creek and Katherine River are contaminated, with PFAS concentrations exceeding the PFAS NEMP drinking water guidelines, recreational water guidelines and/or freshwater guidelines for 99% species protection at several sites. Proximate to the OHTL watercourse crossing, PFAS concentrations at Katherine River exceed the guideline value for 99% species protection (ecological freshwater quality) and at both Katherine River and Tindal Creek exceed the guideline value for drinking water (human health).

Upstream and downstream of the OHTL watercourse crossing for both Katherine River and Tindal Creek, concentrations exceed the guideline value for drinking water and recreational water (human health) and 90% species protection (ecological freshwater quality).

Concentrations fluctuate seasonally in Katherine River depending on the proportion of flow that is groundwater fed (i.e., concentrations tend to increase in the dry season and are diluted in the wet season).



Legend

- Kilometre points
- AAPL Infrastructure
- Major Drainage
- Minor Drainage
- Streams
- Railways
- Principal road
- Secondary road
- RAAF Base Tindal
- PFAS Groundwater Management Area
- PFAS Surface Water Management Area

Source: Sun Cable, EcOz, NTG (NR Maps)

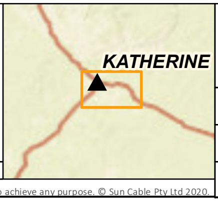


Figure 6-1: OHTL route within the Katherine PFAS Management Area

Project: Australia-Asia PowerLink	Reference: M-Files ID 198726	Revision: 0
Coordinate System: GDA2020	Date: 1/11/2022	
0 4 Kilometres	Scale: 1:110,335	A4

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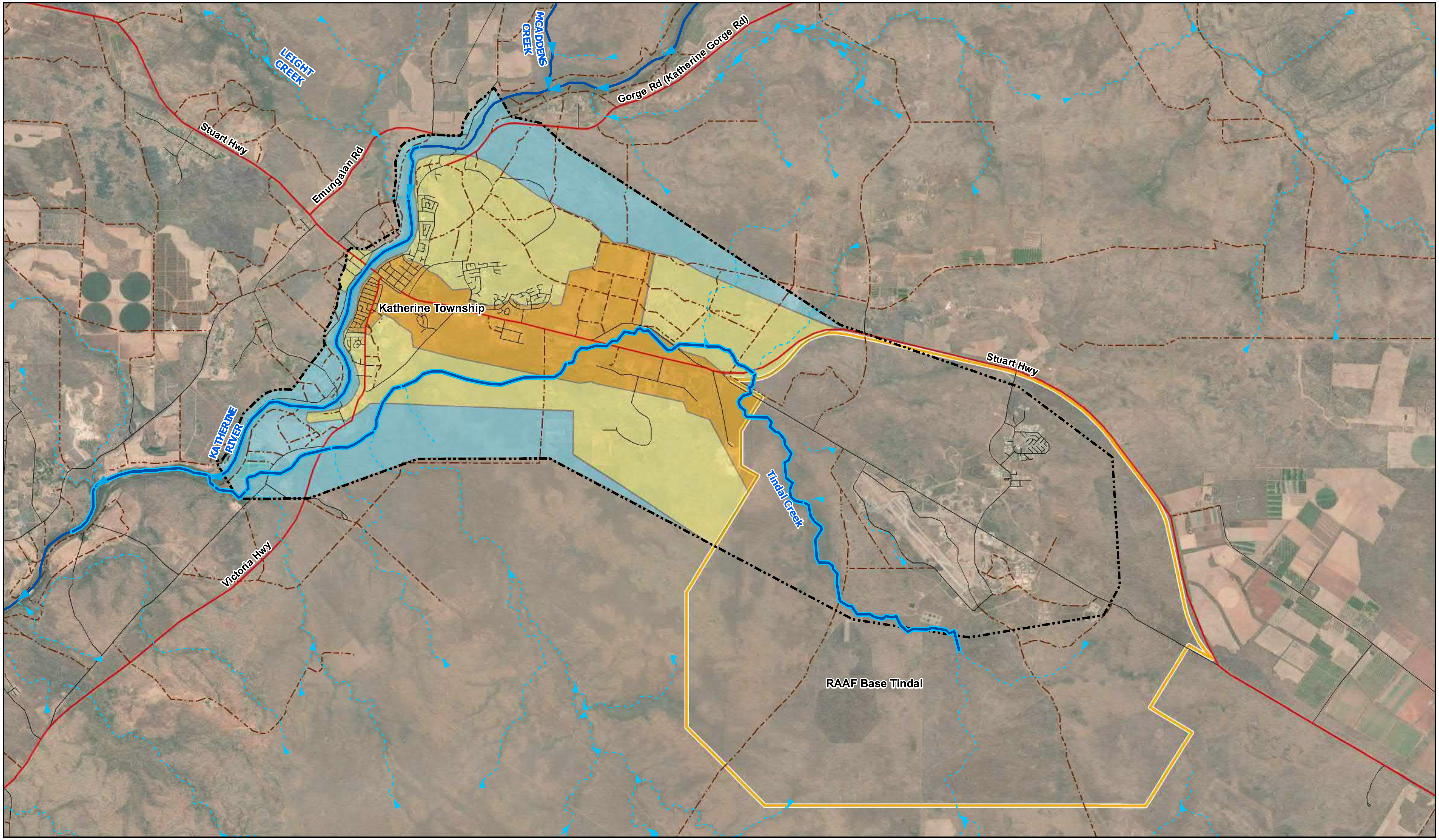
SUN CABLE



N

AECOM

DATUM GDA 1994, PROJECTION MGA ZONE 52

0 1 2 4

Kilometers

1:85,000 (when printed at A3)

Legend

- Surface Water Management Area
- Groundwater Management Area
- Highway
- Road
- Track
- Zone 1 Groundwater > Recreational Water Criteria
- Zone 2 Groundwater > Drinking Water Criteria
- Zone 5 Groundwater < Criteria
- Katherine River
- Drainage
- RAAF Base Tindal

Data sources:

Base Data: Imagery (c) 2017 ESRI

Department of Defence
RAAF BASE TINDAL
INTERPRETIVE REPORT 2020

Figure 6-2: Katherine PFAS Management Area

PROJECT ID	60612561
CREATED BY	AP
LAST MODIFIED	azrai.parishperandi107 Aug 2020
VERSION:	1

Figure **6-2**

A3 size

Filename: \\AUDWN1FP001\Projects\606x\60612561\900_CAD_GIS\920_GIS\60612561_Darwin_Def\02_MXDs\RAAF Tindal\2020\Interpretive_Report\10.6\RevB\60612561_A1_RAAFTindal_PFASMgmtArea_IntRpt_RevB_A3L.mxd

6.4.2.2 Groundwater

Groundwater within the PFAS Management Area is contaminated, with PFAS concentrations exceeding the PFAS NEMP guideline values for recreational or drinking water criteria (see AECOM 2020). The ongoing monitoring indicates the concentration of PFAS in groundwater is not changing significantly in nature or extent (i.e., concentrations are relatively stable).

Based on nearby sampling results, groundwater between KP 453-565 of the OHTL crossing is likely to have concentrations of PFAS that exceed the guideline value for 99% species protection (ecological freshwater quality). In the broader PFAS Management Area, concentrations exceed the guideline values for drinking water and recreational water (human health) and 90% species protection (ecological freshwater quality).

However, as stated in the Draft EIS, the construction and operation of the OHTL is unlikely to have impacts on groundwater quality (as discussed in Section 7.4 of the Draft EIS) and as such, groundwater quality in aquifers underlying the OHTL is not described in detail.

6.4.3 Powell Creek Electrode

The Powell Creek Electrode is located within the Wiso Basin and Lake Wood catchment. There are no groundwater receptors located within the footprint of the Powell Creek Electrode. There are also no surface hydrology present within the Electrode's footprint including the HVDC Electrode Line Corridor and Access Track.

6.4.4 DCS Electrode

The DCS Electrode is within the Leaders Creek and Fly Creek catchments: both drain north to the ocean. The HVDC Electrode Line Corridor crosses the second order Leaders Creek and the first order drainages of Fly Creek (see Figure 31 in Appendix 5.2). During flora and fauna field survey in July 2022, all creeks had flowing water, indicating the drainages may retain water throughout the dry season. There are no defined surface watercourses present within the DSC Electrode footprint.

The DSC Electrode and HVDC Electrode Line Corridor overlie the central portion of the Howard Groundwater System. The system covers an area of 1,462 km^2, and extends from south of the Arnhem Highway, west of the Howard River, east to the Adelaide River, and across all of Gunn Point peninsula in the north (DEPWS, n.d.). There are two main aquifers underlying Gunn Point (see Woltmann 2020):

- Upper (shallow) seasonal aquifer, hosted in lateritic rock, which is unconfined and recharges every wet season, discharging to springs, wetlands, and the coast over the dry season.
- Lower productive aquifer, mostly within the Koolpinyah Dolostone formation. Aquifer thickness, lithology and yields vary. The aquifer is confined in the north as the Wangarlu Formation increases in thickness; and is confined underlying the Darwin Converter Station and Cable Transition Facilities.

No groundwater extraction (other than what has already been assessed in the Draft EIS) is proposed for this project refinement.

6.5 Potential Impacts

The potential impacts to the hydrology and relevant environmental values, particularly around the project refinements and the additional knowledge gained from Appendix 6.1 has been assessed using the EIA methodology described in Chapter 3 of the Draft EIS, and as summarised in Chapter 1 of this SEIS.

The following impacts were identified and assessed as possibly occurring during construction and/or operations:

- Solar Precinct and AI:
  - Alteration to surface water flows in watercourses and wetlands caused by land development
  - Groundwater use from fractured Proterozoic basement exceeds the volume of water available
  - Changes to groundwater levels associated with extraction from the Montejinni Limestone aquifer
  - Changes to groundwater levels associated with recharge of the Montejinni Limestone aquifer
  - Installation of a water pipeline from the Solar Precinct to the footprint of AI
  - Contamination by release of fuels and hazardous substances within the AI area
  - Contamination from waste storage and disposal within the AI area.
- OHTL Corridor:
  - Changes to surface water flows from land clearing and development
  - Increased turbidity in watercourses caused by soil disturbance and erosion
  - Increased contamination outside of PFAS Management Area due to spread of contaminated soils or sediment
  - Increased contamination in Katherine River or Tindal Creek due to erosion of contaminated soils from OHTL
  - Increased contamination in OHTL footprints due to use of contaminated groundwater and surface water
  - Increased contamination in Katherine River or Tindal Creek due to runoff of contaminated groundwater or surface water used during construction.
- Electrodes (Powell Creek and DCS):
  - Alteration to surface water flows and flooding potential in watercourses and wetlands caused by land development
  - Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance.

6.5.1 Areas of Potential Impact (Direct and Indirect)

The area within which hydrological regimes may be directly impacted is limited to locations where the project footprint intersects surface water features and area where groundwater will be used as a water supply. At the Solar Precinct the direct disturbance footprint includes the flooding described above (Section 6.5).

As detailed in the Draft EIS, groundwater resources could be impacted in the vicinity of proposed groundwater extraction bores used during construction and operation of the Solar Precinct.

As stated in the Draft EIS, indirect impacts to surface water flows in watercourses outside of the direct disturbance footprint are unlikely to occur because the construction and operational activities do not involve any surface water extraction or activities that would alter discharges to watercourses.

Table 6-2 and Table 6-3 assess impacts resulting from the project refinements detailed in Chapter 2.

6.5.2 Construction

The potential impacts to hydrological regimes will be greatest during the construction phase, when catchment conditions are altered due to land clearing and development. During this period, project water demand from groundwater extraction will be greatest due to construction water requirements and the Temporary Construction Accommodation servicing a large construction workforce. The sections below discuss the addition potential impacts of construction activities at each project location to the hydrological regimes of surface water and groundwater.

Construction works within the PFAS Management Area will include:

- Clearing of the OHTL construction corridor, for a width of 22 m between OHTL structures.
- Access Track of 6 m width sited within the OHTL construction corridor.
- Installation of OHTL structures (steel poles or lattice towers), approximately every 200 m to 450 m. Note spans between structures will be adjusted as required to avoid works within watercourses and so the spans may vary in the PFAS Management Area. Cleared Construction Pads of 60 m x 100 m will be required for each structure.
- Stringing of conductors (i.e., powerlines).

6.5.2.1 Alteration to surface water flows within the Powell Creek AI

Impacts to the alteration of surface water flows (including flooding) due to the construction of the Powell Creek AI are unlikely as the footprints avoid watercourse and drainage areas.

6.5.2.2 Changes to groundwater from fractured Proterozoic basement

The eastern half of the Project area overlies local scale aquifers in the Helen Springs Volcanics and the Proterozoic Basement. These aquifers have limited groundwater supply potential and are unlikely to support the construction water requirement in the east of the project area. Demand at the eastern water consumption points should be met by piping water from the Montejinni Limestone in the vicinity of the Solar Precinct. Therefore, groundwater will not be extracted from this aquifer and therefore impacts are negligible.

6.5.2.3 Changes to groundwater from Montejinni Limestone aquifer

The Solar Precinct and the western half of the Project area overlie the Wiso Basin, a regional scale aquifer system with a predicted bore yield range of 5-15 L/s. Groundwater resources hosted in the Montejinni Limestone aquifer have the potential to meet the construction water requirement of the Solar Precinct. Local data is limited, and site investigations will be required to confirm groundwater availability within the Montejinni Limestone prior to the application of Water Extraction Licences.

The Solar Precinct Groundwater Assessment (Appendix 6.1) has conservatively assumed that construction could take up to 6 years. Analytical bore field modelling over this period estimates the drawdown impact on existing bores from the proposed Solar Precinct groundwater extraction will range from 0.27 to 0.84 m at the existing bores with drawdown concentrated around the production bore which has the highest extraction. This represents 0.5 – 14% of the available drawdown and suggests that Solar Precinct pumping will not have an appreciable impact on groundwater availability in the existing bores. Drawdown impacts on existing bores are subject to uncertainty from the assumed aquifer parameters and should be revised when site specific data has been collected. Drawdown impacts on environmental receptors are not expected as these occur in a separate aquifer system.

The spatial extent of the modelled drawdown towards the end of 2029 or year five of construction is predicted to be less than 1 m at the existing bores with drawdown concentrated around the production bore which has the highest extraction.

The water requirement for the construction of the Solar Precinct is spread across nine consumption points, each with an individual demand profile for a conservatively forecast six-year timeline in accordance with the precautionary principle. The cumulative demand across all consumption points peaks at 5,585 kL/day toward to end of the first year of construction. The total water requirement for the construction phase is estimated at 8,040 ML. The annual water requirement peaks in the second year of construction at 1,860 ML.

Existing data suggests that bore yields in the Montejinni Limestone should be adequate to meet the construction water requirement at:

- Aerodrome
- Batch plants
- Office/Laydown Area
- Permanent operational facility
- Solar Precinct converter station
- Construction truck fill point.

The potential bores located over the fractured Proterozoic basement aquifers have limited supply potential and are unlikely to meet the projected demand at:

- Access Road construction truck fill
- Temporary Construction Accommodation
- Borrow Pit truck fill point.

Therefore, water will be extracted from the Montejinni Limestone and pumped to meet the three demand areas.

The estimated water level decline from the Solar Precinct pumping represents between 0.5-14 % of the available drawdown in the existing bores. This suggests pumping for the Solar Precinct is unlikely to have a material effect on bore performance and groundwater availability in the existing production bores.

6.5.2.4 Installation of a water pipeline from the Solar Precinct to the AI

As the water supply required for the AI cannot be supplied by the suggested bores from the fractured Proterozoic basement, a pipeline to transport water from bores access water from the Montejinni Limestone at the Solar Precinct to the AI will be installed. This pipeline will follow the sealed and unsealed Access Road corridors, limiting their impact.

6.5.2.5 Contamination by release of fuels and hazardous substances within the AI area

Impacts from the contamination by release of fuels and hazardous substances within Powell Creek AI are unchanged from the assessment completed as part of the Draft EIS.

6.5.2.6 Contamination from waste storage and disposal within the AI area

Impacts from the waste storage and disposal with the Powell Creek AI are unchanged from the assessment completed as part of the Draft EIS.

6.5.2.7 Changes to surface water flows from land clearing and development

Impacts from the surface water flows from land clearing and development within the OHTL Corridor are unchanged from the assessment completed as part of the Draft EIS.

6.5.2.8 Increased turbidity in watercourses caused by soil disturbance and erosion

Impacts from increased turbidity in watercourses caused by soil disturbance and erosion within the OHTL Corridor are unchanged from the assessment completed as part of the Draft EIS.

6.5.2.9 Spread of PFAS contamination through soil, sediment, groundwater, surface water or erosion outside of PFAS Management Area

The Detailed Site Investigation undertaken by the Department of Defence has identified some areas of sediment that have PFAS levels greater than guidance values (Coffey, 2018). While the site contamination is existing, the Project has the potential to move this sediment to new, uncontaminated areas. The Constraints Planning and Field Development Procedure (Appendix 4.1) provides a process to identify higher risk areas (such as those containing PFAS) and require ESCPs and soil hygiene stations to prevent any contaminated soil and sediment from leaving site, either in eroded sediments or on the wheels of trucks. Monitoring and reporting against the plan will be undertaken in accordance with the CEMP (to be developed).

As stated above, groundwater and surface water will not be used on sites within the Katherine PFAS Management Area.

6.5.2.10 Alteration to surface water flows within the Powell Creek and DCS Electrode Sites

Although there are no surface watercourses, major or minor drainage present within the Powell Creek Electrode footprint nor the footprint of the DCS Electrode. At the footprint of the Powell Creek Electrode there are no watercourses, flats, lakes, existing or potential waterbodies, pondage areas, or major or minor drainage. At the footprint of the DCS HVDC Electrode Line Corridor, there are intermittent watercourses that flow during the wet season along the Access Road. However, at both electrode sites there are no lakes, existing or potential waterbodies, pondage areas, or major drainage.

Earthworks are likely to be undertaken and drainage mechanisms installed to protect the infrastructure and the surrounding environment from stormwater in accordance with Austroads standards.

6.5.2.11 Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance

Construction within the electrode footprints will expose land and soils, which may result in turbid runoff from the areas during rainfall events. There are no drainage depressions within either of the two 10 ha footprint. Stormwater drainage will be design and installed if necessary.

6.5.3 Operation

Once the AI and Electrodes are installed, during operations there is no predicted localised impacts to overland flows as incidental rainfall and runoff on the sites is captured in stormwater drainage systems. There are not predicted to be any ongoing impacts to surface water flows along the OHTL Corridor as these areas will have appropriate drainage systems installed at watercourse crossings and construction footprints will be reinstated, or where not reinstated, appropriate engineered drainage will ensure flows are unimpeded. During operations, the likelihood of impacts to WQ is further reduced.

Groundwater extraction will continue to occur at the Solar Precinct and will have an ongoing operational water requirement estimated at 11.4 ML/year, which is unlikely to alter groundwater levels. The ongoing demand meets several water requirements including at accommodation for operations personnel, road maintenance, vehicle washdown and fire protection.

Operational works within the PFAS Management Area will include:

- 6 m wide Access Road (retained from construction)
- 16 m x 16 m structure pad area around each OHTL structure (retained from construction)
- Reinstatement of the remaining area around construction pads
- Vegetation management within a 38 m wide corridor, to maintain electrical separation distances (tall trees may be pruned within this zone, as required – refer to Appendix 5.4: OHTL Vegetation Management Framework).

The impact of the above is detailed in Table 6-3.

6.6 Avoidance, Mitigation and Monitoring

Impact mitigation was undertaken in accordance with the environmental decision-making hierarchy consistent with Section 26 of the EP Act. The decision-making hierarchy sets the following priorities when addressing impacts which have been considered in developing Table 6-1.

1. Avoid – ensure that actions are designed to avoid adverse impacts on the environment.
2. Mitigate – identify management options to mitigate adverse impacts on the environment to the greatest extent practicable.
3. Offset – if appropriate, provide for environmental offsets for residual adverse impacts on the environment that cannot be avoided or mitigated. Residual impact.

Recommendations from Appendix 6.1 include:

- Complete a bore audit to ground truth the location of existing bores around the Solar Precinct and to collect baseline groundwater data (groundwater levels, quality data).
- Undertake an investigation drilling program to confirm the availability of groundwater in the Montejinni Limestone aquifer. This should include completing pumping tests on selected test production bores to allow for the collection of site-specific aquifer parameters and reduce uncertainty in the drawdown impact modelling.
- Develop a groundwater management plan to monitor impacts from the proposed solar precinct production bore on neighbouring bores and the broader aquifer system.

Table 6-1: Hydrology - Commitments

Impact	Avoidance	Mitigation	Monitoring	Reporting
Alteration to surface water flows in watercourses and wetlands caused by land development.	Powell and DCS Electrode locations selection process included avoidance of major watercourses. Consistent with Draft EIS measures.	Consistent with Draft EIS measures including Drainage, erosion, and sediment controls installed and maintained in accordance with ESCPs that align with the IECA 2008. Additional earthworks and re-grading across the Solar Precinct site to remove elements of the design blocking flow paths, potentially reducing flood depths and allowing freeboard requirements to be met.	Consistent with Draft EIS measures	Consistent with Draft EIS measures
Groundwater use from fractured Proterozoic basement exceeds the volume of water available.	Groundwater will not be extracted from this aquifer.	N/A	N/A	N/A
Changes to groundwater levels associated with extraction from the Montejinni Limestone aquifer. **Changes to groundwater levels associated with recharge of the**	Nil.	Informed by the implementation of the Groundwater Management Plan.	A bore audit to ground truth the location of existing bores around the Solar Precinct and to collect baseline groundwater data. An investigation drilling program to confirm the availability of groundwater in this aquifer. Develop a groundwater management plan to monitor impacts from the proposed Solar Precinct production	Internal reporting of the results of the bore audit, which will inform the investigation drilling program. Internal reporting of the investigation drilling program. Internal reporting of implementation of the Groundwater Management Plan.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Montejinni Limestone aquifer.			bore on neighbouring bores and the broader aquifer system.	External reporting in accordance with environmental approval conditions.
Installation of a water pipeline from the Solar Precinct to the AI.	Roadside drainage and culverts will be installed in accordance with Austroads standards.	The pipeline will be installed along the access road during the dry season when no flow is present. Drainage, erosion, and sediment controls will be installed and maintained in accordance with ESCP that align with the *Best Practice Erosion and Sediment Control (ESC) Guidelines* (IECA, 2008).	Routine visual inspections of the pipeline to ensure no leaks or damage to the infrastructure.	Internal records of ESCP inspection, as stipulated in ESCPs. Internal reporting on environmental performance. External reporting in accordance with environmental approval conditions.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Contamination by release of fuels and hazardous substances within the AI area.	During operations, solar power will be used as a power source, hence no requirement for bulk fuel storages. Dangerous Goods and Hazardous Substances will be stored and handled in accordance with regulated standards and codes of practice, and manufacturer's directions.	Hazardous substances and dangerous goods will adhere to AS/NZS 1940: The Storage and Handling of Flammable and Combustible Liquids. Adhere to Environmental Design Criteria and Standards (Appendix 2.1). Dangerous Goods and Hazardous Substances Registers will be maintained at all storage and handling locations. An Environmental Emergency and Spill Response Plan will be in place and equipment provided at all storage and handling locations. Construction and operations staff will be trained in spill response.	Routine visual inspections around storage locations and work areas.	Internal records of volumes used and stored in accordance with Workplace Health and Safety (WHS) Regulations. Internal inspection records and notes. Internal records of WQ monitoring. Incidents of off-site pollution or nuisance reported to the NT EPA within 24 hours.
Contamination from waste storage and disposal within the AI area.	Landfill will comply with the Guidelines for Siting, Design and Management of Solid Waste Disposal Sites in the NT (NT EPA 2003). No waste will be stored within 200 m of a watercourse.	Waste management will be in accordance with best practice guidelines (e.g. separation of waste, covering, bunded storage areas), and the requirements of the *Waste Management and Pollution Control Act 1998*. Adhere to Environmental Design Criteria and Standards (Appendix 2.1).	Routine visual inspections around landfill, waste storage locations and work areas.	Internal records of inspections. Incident reporting.

Impact	Avoidance	Mitigation	Monitoring	Reporting
		All listed waste will be disposal of at a licenced waste management facility.		
Changes to surface water flows from land clearing and development.	OHTL poles will not be placed in watercourses or drainage lines. Only minor drainage lines will be crossed by the OHTL access track. Major drainages will be approached from either side to avoid the need for constructing crossings. Roadside drainage and culverts will be designed and installed in accordance with accepted Austroads standards.	Watercourse crossings along access roads and OHTL installed during the dry season when no flow present. Drainage, erosion, and sediment controls installed and maintained in accordance with ESC Plans (ESCP) that align with the *Best Practice ESC Guidelines* (IECA, 2008). Reinstatement of OHTL construction corridor and Cable Transition Facilities footprints post-construction. Design criteria for engineered stormwater management systems installed at the Solar Precinct is to discharge water to similar locations and at similar volumes to pre-development conditions.	During construction, visual inspections of disturbed areas and ESCs as per ESCP (after significant rainfall events, at a minimum). Annual post wet season monitoring of revegetation success until disturbed areas are stabilised. Visual inspections of drainage structures, discharge points and site boundaries following rain events. Post-wet season inspections of all project locations and rectification of emerging erosion issues.	Internal records of ESCP inspections, as stipulated in ESCPs. Internal reporting on environmental performance. External reporting in accordance with environmental approval conditions.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Increased turbidity in watercourses caused by soil disturbance and erosion.	OHTL poles will not be placed in watercourses or drainage lines. Only minor drainage lines will be crossed by the OHTL access track. Major drainages will be approached from either side to avoid the need for constructing crossings. Stormwater drainage will be installed to capture and manage runoff. Stormwater capture within facilities will discharge to land, via ESCs. Roadside drainage and culverts will be designed and installed in accordance with accepted Austroads standards.	Watercourse crossings along access roads and OHTL installed during the dry season when no flow present. Drainage, erosion, and sediment controls installed and maintained in accordance with ESC Plans (ESCP) that align with the *Best Practice ESC Guidelines* (IECA, 2008). Develop and implement a Reinstatement Plan for post-construction reinstatement of works areas to stabilise soils and promote regrowth of native vegetation. Rectification of emerging erosion issues after each wet season.	During construction, visual inspections of disturbed areas and ESCs as per ESCP (after significant rainfall events, at a minimum). Annual post wet season monitoring of revegetation success until disturbed areas are stabilised. Visual inspections of drainage structures, discharge points and site boundaries following rain events. Post-wet season inspections of all project locations and rectification of emerging erosion issues.	Internal records of ESCP inspections, as stipulated in ESCPs. Internal reporting on environmental performance. External reporting in accordance with environmental approval conditions.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Increased contamination outside of PFAS Management Area due to spread of contaminated soil or sediment.	No sediment will be removed from Tindal Creek or Katherine River. OHTL conductor wires will span the Tindal Creek and Katherine River, avoiding works within the watercourses. The OHTL Access Track will not be constructed through Tindal Creek or Katherine River – those watercourses will be accessed from either side, via existing tracks where available. No trenching will occur along the OHTL Corridor, including within the PFAS Management Area.	The OHTL construction corridor will be as narrow as possible within the PFAS Management Area, to minimise the disturbance footprint. AI will not be located within the PFAS Management Area. Soil hygiene stations will be established at the boundary of the PFAS Management Area (see Figure 6-2). All machinery and equipment will be cleaned at these hygiene stations to avoid spreading contaminated soil along the OHTL Corridor. An ESCP will be developed consistent with best practice and International Erosion Control Association (IECA, 2008) guidelines, to minimise risk of erosion of soils within PFAS Management Area. Soil/Sediment within the PFAS Management Area will not be stockpiled and the PFAS NEMP guidelines for stockpiling of soils contaminated with PFAS will be adhered to.	Visual monitoring of the construction footprint within the PFAS Management Area, to ensure clearing is minimal. Visual inspections of machinery and equipment at soil hygiene stations, to ensure all soil is removed prior to leaving the PFAS Management Area.	Reporting in accordance with the CEMP and OEMP.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Increased contamination in Katherine River or Tindal Creek due to erosion or contaminated soils from OHTL.	The OHTL construction corridor will be as narrow as possible within the PFAS Management Area, to minimise the disturbance footprint. AI will not be located within the PFAS Management Area.	An ESCP will be developed consistent with IECA 2008, and implemented to minimise erosion of soils, and therefore minimise spread of contaminated soil. Most of the construction footprint will be reinstated, to minimise ongoing erosion risk. The reinstated construction footprint and operational footprint will be visually inspected monitored and any erosion identified will be rectified. Dust suppression will be implemented during construction.	Monitoring as per the ESCP. This includes visual inspections of the reinstated areas and operational footprint.	Reporting in accordance with the ESCP.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Increased PFAS contamination due to use of contaminated groundwater and surface water.	No groundwater will be extracted from bores located within the Katherine PFAS Management Area. No surface water will be extracted from Tindal Creek or Katherine River. The OHTL Access Track will not be constructed through Tindal Creek or Katherine River – those watercourses will be accessed from either side, via existing tracks where available. OHTL conductor wires will span the Tindal Creek and Katherine River, avoiding works within the watercourses.	No works will occur within the waterbody of Tindal Creek or Katherine River to avoid interaction with surface water in those watercourses. The OHTL conductor wires will span both watercourses. Water to supply construction activities will be sourced from supplies outside of the PFAS Management Area and trucked to site as required.	Visual monitoring of construction works within the PFAS Management Area, to ensure works are not undertaken in watercourses. Records of water supply volumes and extraction locations.	Reporting in accordance with the CEMP and OEMP.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Increased PFAS contamination in Katherine River or Tindal Creek due to runoff of contaminated groundwater or surface water used during construction.	The OHTL construction corridor will be as narrow as possible within the PFAS Management Area, to minimise the disturbance footprint. AI will not be located within the PFAS Management Area.	An ESCP will be developed consistent with IECA 2008, and implemented to minimise erosion of soils, and therefore minimise spread of contaminated soil. Most of the construction footprint will be reinstated, to minimise ongoing erosion risk. The reinstated construction footprint and operational footprint will be visually inspected monitored and any erosion identified will be rectified. Dust suppression will be implemented during construction.	Monitoring as per the ESCP. This includes visual inspections of the reinstated areas and operational footprint.	Reporting in accordance with the ESCP.
Alteration to surface water flows in watercourses and wetlands caused by land development within the electrode footprints.	Powell Creek and DCS Electrode locations selection process included avoidance of major watercourses.	Drainage, erosion, and sediment controls installed and maintained in accordance with ESCPs that align with the IECA 2008. Design criteria for engineered stormwater management systems installed at the Solar Precinct and DCS is to discharge water to similar locations and at similar volumes to pre-development conditions.	During construction, visual inspections will be undertaken of disturbed areas and ESCs as per ESCP. Annual post-wet season monitoring of reinstatement success until disturbed areas are stabilised. Visual inspections of drainage structures, discharge points and site boundaries following rain events. Visual inspection of seasonal swamp at DCS for evidence of sedimentation; implement WQ monitoring if required.	Internal records of ESCP inspection, as stipulated in ESCPs. Internal reporting on environmental performance. External reporting in accordance with environmental approval conditions.

Impact	Avoidance	Mitigation	Monitoring	Reporting
			Post-wet season inspections of all project locations and rectification of emerging erosion issues.	
Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance.	Powell Creek Solar Precinct AI, OHTL, and the electrodes at the Powell Creek and DCS avoid watercourses. Progressive clearing, construction and reinstatement will be undertaken. Stormwater drainage will be installed to capture and manage runoff.	Drainage, erosion, and sediment controls will be installed and maintained in accordance with ESCP that align with the IECA 2008. Develop and implement a Reinstatement Plan for post-construction reinstatement of works area to stabilise soils and promote regrowth of native vegetation. Rectification of emerging erosion issues after each wet season.	During construction, visual inspections will be undertaken of disturbed areas and ESCs as per ESCP. Annual post-wet season monitoring of reinstatement success until disturbed areas are stabilised. Visual inspections of drainage structures, discharge points and site boundaries following rain events. Visual inspection of seasonal swamp at DCS for evidence of sedimentation; implement WQ monitoring if required. Post-wet season inspections of all project locations and rectification of emerging erosion issues.	Internal records of ESCP inspection, as stipulated in ESCPs. Internal reporting on environmental performance. External reporting in accordance with environmental approval conditions.

6.7 Residual Impact

The residual impact of the Project to hydrology is summarised below, assuming the adoption of the impact avoidance, mitigation and monitoring measures described in this chapter.

Each impact to hydrology was assigned a residual impact rating taking into consideration the scale, magnitude and duration of the impacts, the presence/absence of environmental values and/or sensitive receptors and the level of certainty with respect to the intensity of the impact and the effectiveness of the mitigation measures. The residual impact ratings adopted in the assessment are provided in Table 6-2 for construction and Table 6-3 for operation.

Table 6-2: Summary of SEIA results – Hydrology – Construction

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Alteration to surface water flows in watercourses and wetlands caused by land development.	Solar Precinct – AI area	**Possible** Overland flows could be altered within direct disturbance footprint.	**Localised** No watercourses present in footprint.	**Long Term** Hydrology will be altered for the construction and operational phases.	**Negligible** No watercourses present in footprint.	**Medium** Hydrology supports aquatic ecosystems and other beneficial uses of watercourses.	**Low** Stormwater management plan yet to be developed.	**Moderate**
Groundwater use from fractured Proterozoic basement exceeds the volume of water available.	Solar Precinct.	**Unlikely** Since these aquifers have limited groundwater supply potential and are unlikely to support the construction water requirement in the east area of the Project, water will not be extracted from this aquifer and will instead be pumped from the Solar Precinct to the location of AI.					**Low** A desktop review has been conducted, however ground truthing must occur.	**No impact**
Changes to groundwater levels associated with extraction from the Montejinni Limestone aquifer.	Solar Precinct.	**Unlikely** There will be no impact utilising the volumes of groundwater detailed above in the Montejinni Limestone aquifer.	**Widespread** The Wiso Basin is 160,000 km^2.	**Short Term** 8,040 ML of groundwater required, which is within the capacity of the groundwater availability.	**Minor** Requirements will be met by existing bore yields.	**Medium** Groundwater in the region support pastoral uses and, in the broader aquifer, many beneficial uses.	**Low** A desktop review has been conducted, however ground truthing must occur.	**Moderate**
Changes to groundwater levels	Solar Precinct.	**Unlikely** Lake Woods likely represents	**Widespread** The Wiso Basin is 160,000 km^2.	**Short Term** 8,040 ML of groundwater	**Minor**	**Medium** Groundwater in the region	**Low** A desktop review has been	**Moderate**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
associated with recharge of the Montejinni Limestone aquifer.		the major recharge mechanism to the Wiso Basin on Powell Creek, which is not being altered for the Project.		required, which is within the capacity of the groundwater availability. However, will need to be confirmed through monitoring.	Requirements will be met by existing bore yields.	support pastoral uses and, in the broader aquifer, many beneficial uses.	conducted however, ground truthing must occur.	
Installation of a water pipeline from the Solar Precinct to the AI.	Solar Precinct	**Unlikely** Pipeline will be installed alongside the sealed and unsealed Access Roads as necessary.	**Localised** This will only affect the Access Roads.	**Long Term** The pipeline is permanent infrastructure.	**Negligible** Disturbance will already occur with the construction of the Access Roads.	**Low** The area will already be disturbed from the construction of the road.	**High** The impacts of the access roads have already been assessed in the Draft EIS.	**Minor**
Contamination by release of fuels and hazardous substances within the AI area.	Solar Precinct – AI	**Possible** Bulk storage required for aviation fuel and other hazardous materials will be stored at the Aerodrome in accordance with AS 1940 – The Storage and Handling of Flammable and Combustible Liquids.	**Limited** Spills may occur but storage and handling procedures mean a spill will be limited to the ground around spill and will not enter a watercourse or groundwater aquifer.	**Short Term** Spills to ground will occur intermittently. Spills will be detected and remediated immediately.	**Negligible** No change in WQ as a result of spills.	**High** WQ in watercourses and groundwater is sensitive to contamination and supports numerous beneficial uses.	**High** AS/NZS are established and proven effective for mitigating risk. No underground storage, or storage within 200 m of a watercourse.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Contamination from waste storage and disposal within the AI area.	Solar Precinct – AI	**Unlikely** Inert and putrescible waste will be disposal of onsite at the Solar Precinct. All other waste will be temporarily stored and disposed at a licenced facility.	**Limited** Any contamination form waste storage and disposal will be limited to soil in immediate surrounds.	**Long Term** Waste will be disposed at the Solar Precinct for construction and operation phases.	**Negligible** No change in WQ as a result of waste storage and disposal.	**Low** No watercourses or groundwater proximate to waste storage and disposal areas.	**High** Compliance with NT guidelines and regulations proven effective for mitigating risk.	**Minor**
Changes to surface water flows from land clearing and development.	OHTL Corridor	**Possible** OHTL crosses 128 watercourses. Lower order drainage lines will be crossed by the access track. Pole placement will avoid disturbance to watercourses and wetlands.	**Limited** Altered surface water flow paths limited to within the direct disturbance footprint.	**Short Term** Minor changes to overland flow paths could occur intermittently during significant rainfall events.	**Negligible** No offsite impacts to hydrological regimes in watercourses or wetlands.	**Medium** Hydrology supports aquatic ecosystems and other beneficial uses of watercourses.	**High** Construction design avoids disturbance of major watercourses. Temporary drainage as per ESCP developed in accordance with IECA guidelines.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Increased turbidity in watercourses caused by soil disturbance and erosion.	OHTL Corridor	**Possible** OHTL crosses 128 watercourses. Works will disturb soils, which may erode along the OHTL and increase turbidity in watercourses.	**Limited** WQ may be impacted for a several hundred metres downstream of crossings.	**Short Term** WQ impacts would only occur for days immediately following a rainfall event.	**Minor** Watercourses are naturally turbid, particularly following rainfall and runoff events.	**Medium** WQ supports values such as aquatic ecosystem health, pastoral, agricultural, cultural, social and amenity.	**High** Erosion hazard assessment and ESCP in accordance with IECA guidelines.	**Minor**
Increased contamination outside of PFAS Management Area due to spread of contaminated soil of sediment.	OHTL Corridor	**Unlikely** Construction will result in disturbance and movement of soils within OHTL footprints. Soils are unlikely to be contaminated. Sediment may be contaminated but works will avoid disturbance of sediments in watercourses. Avoidance and mitigation measures will be implemented to avoid the spread of soil/sediment.	**Localised** Impact could occur for some distance along the OHTL Corridor if soils or sediment were spread.	**Medium Term** Impacts could only occur during construction phase.	**Minor** Soil is unlikely to be contaminated within OHTL Corridor. Sediment is likely to be contaminated within OHTL Corridor, but well below the human health investigation levels in the PFAS NEPM, for all land uses (including industrial/commercial).	**Medium** There are land uses outside of the PFAS NEMP that could be sensitive to contamination (e.g., residential, rural, and agricultural).	**High** Significant previous investigations have been undertaken within the PFAS Management Area to inform impact assessment. High confidence in impact avoidance and mitigation measures.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Increased PFAS contamination in Katherine River or Tindal Creek due to erosion of contaminated soils from OHTL.	OHTL Corridor	**Unlikely** Erosion could occur, but soils are unlikely to be contaminated, particularly compared to sediment and WQ within the receiving environment.	**Limited** Minor erosion could occur within the narrow OHTL construction footprint.	**Medium Term** Erosion could occur intermittently during construction and operations – wet season only. Any erosion would be identified and rectified.	**Negligible** Soils within OHTL Corridor are likely less contaminated than the sediment in Tindal Creek and Katherine River and WQ within both watercourses is already contaminated.	**Very Low** Receiving environment (Katherine River and Tindal Creek) is known to be contaminated with PFAS. Soils are unlikely to be contaminated.	**High** Significant previous investigations have been undertaken within the PFAS Management Area to inform impact assessment. High confidence in impact avoidance and mitigation measures.	**Minor**
Increased PFAS contamination due to use of contaminated groundwater and surface water.	OHTL Corridor and disturbance footprint.	**Unlikely** No surface water or groundwater used for construction will be sourced from bores or watercourses within the PFAS Management Area. No water use required for operations.	**Localised** Water will be used for construction and dust suppression within the construction footprint (OHTL Corridor).	**Medium Term** Impacts could only occur during construction phase.	**Minor** Use of contaminated water could result in soil contamination within OHTL footprints but would be unlikely to exceed PFAS NEMP human health investigation levels for soil.	**Low** Land use (industrial use for the Project) is not sensitive and existing soil/sediment contaminant in region is below PFAS NEMP human health investigation levels.	**High** Significant previous investigations have been undertaken within the PFAS Management Area to inform impact assessment. High confidence in impact avoidance and mitigation measures.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Increased PFAS contamination in Katherine River or Tindal Creek due to runoff of contaminated groundwater or surface water used during construction.	OHTL Corridor and disturbance footprint.	**Unlikely** No surface water or groundwater used for construction will be sourced from bores or watercourses within the PFAS Management Area. No water use required for operations.	**Localised** Water will be used for construction and dust suppression within the construction footprint (OHTL Corridor).	**Medium Term** Impacts could only occur during construction phase.	**Negligible** WQ within Katherine River and Tindal Creek is known to be contaminated. Contamination is unlikely to increase due to water use by the Project.	**Very low** The downstream watercourses (Katherine River and Tindal Creek) are known to be contaminated with PFAS.	**High** Significant previous investigations have been undertaken within the PFAS Management Area to inform impact assessment. High confidence in impact avoidance and mitigation measures.	**Minor**
Alteration to surface water and flooding potential flows in watercourses and wetlands caused by land development.	Solar Precinct	**Possible** There are no watercourses within the 10 ha footprint.	**Limited** The electrode areas assessed is a 10 ha AOI.	**Short Term** There should be not changes to surface water flow.	**Minor** No disturbance of watercourses will occur.	**Low** The environment is intact but there are not sensitive receptors.	**High** Roads and crossings will adhere to Austroads, which is proven effective in mitigating impacts to surface water flows. Temporary drainage and potential drainage installed around the electrode as per ESCP developed in	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
							accordance with IECA 2008.	
Alteration to surface water flows in watercourses and wetlands caused by land development.	DCS.	**Possible** Overland flows progressively altered within direct disturbance footprint over construction period.	**Limited** Altered surface water flow paths limited to direct disturbance footprint at crossings.	**Short Term** Once crossings are installed surface water flows will be unimpeded due to road and drainage design.	**Minor** Watercourse crossings will be constructed but not during periods of flow.	**Medium** Hydrology supports aquatic ecosystems and other beneficial uses of watercourses.	**High** Roads and crossings will adhere to Austroads design standards, which are proven effective in mitigating impacts to surface water flows. Temporary drainage and potential drainage installed around the electrode as per ESCP developed in accordance with IECA 2008.	**Minor**
Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance.	Solar Precinct	**Unlikely** There are no watercourses within the 10 ha footprint.	**Limited** The electrode areas assessed is a 10 ha AOI.	**Long Term** The Electrode is permanent infrastructure required for the Project.	**Minor** No disturbance of watercourses will occur.	**Low** The environment is intact but there are not sensitive receptors.	**High** Desktop surveys conducted.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance.	DCS.	**Unlikely** There are no watercourses within the 10 ha footprint.	**Limited** The electrode areas assessed is a 10 ha AOI.	**Long Term** The Electrode is permanent infrastructure required for the Project.	**Minor** No disturbance of watercourses will occur.	**Medium** Site is in proximity to watercourses and the shoreline.	**High** Desktop surveys conducted.	**Minor**

Table 6-3: Summary of SEIA results – Hydrology– Operation

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Flooding and alteration to surface water flows in watercourses and wetlands caused by land development.	Solar Precinct.	**Possible** The AI could alter overland flow paths.	**Limited** No watercourses within the AI.	**Long Term** Overland flow paths will be altered for the duration of operations.	**Negligible** Alteration of overland flow paths within AI will have negligible impact on hydrological regime of Lake Woods.	**Medium** Hydrology supports aquatic ecosystems and other beneficial uses of watercourses.	**High** Stormwater management plan yet to be developed.	**Minor**
Groundwater use from fractured Proterozoic basement exceeds the volume of water available.	Solar Precinct.	**Likely** There may be an impact utilising the volumes of groundwater detailed above in this aquifer.	**Widespread** The Proterozoic basement aquifers span more than 10 km.	**Long Term** 11.4 ML/year of groundwater required which is within the capacity of the groundwater availability.	**Major** Requirements will not be met by existing bore yields.	**Medium** Groundwater in the region support pastoral uses and, in the broader aquifer, many beneficial uses.	**Low** A desktop review has been conducted however, ground truthing must occur.	**No impact**
Changes to groundwater levels associated with extraction from the Montejinni Limestone aquifer.	Solar Precinct.	**Unlikely** There will be no impact utilising the volumes of groundwater detailed above in the Montejinni Limestone aquifer.	**Widespread** The Wiso Basin is 160,000 km^2.	**Short Term** 11.4 ML/year of groundwater required which is within the capacity of the groundwater availability.	**Minor** Requirements will be met by existing bore yields.	**Medium** Groundwater in the region support pastoral uses and, in the broader aquifer, many beneficial uses.	**Low** A desktop review has been conducted however, ground truthing must occur.	**Moderate**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Changes to groundwater levels associated with recharge of the Montejinni Limestone aquifer.	Solar Precinct.	**Unlikely** Lake Woods likely represents the major recharge mechanism to the Wiso Basin on Powell Creek, which is not being altered for the Project.	**Widespread** The Wiso Basin is 160,000 km^2.	**Short Term** 11.4 ML/year of groundwater required which is within the capacity of the groundwater availability.	**Minor** Requirements will be met by existing bore yields.	**Medium** Groundwater in the region support pastoral uses and, in the broader aquifer, many beneficial uses.	**Low** A desktop review has been conducted however, ground truthing must occur.	**Moderate**
Installation of a water pipeline from the Solar Precinct to AI.	Solar Precinct	**Unlikely** – once installed there should be no operational impacts.					**High** ESCP in accordance with IECA guidelines, and ongoing monitoring and maintenance.	**Minor**
Contamination by release of fuels and hazardous substances within the AI area.	Solar Precinct – AI	**Possible** Bulk storage required for aviation fuel and other hazardous materials will be stored at the Aerodrome in accordance with AS 1940 – The Storage and Handling of Flammable and Combustible Liquids.	**Limited** Spills may occur but storage and handling procedures mean a spill will be limited to ground around the spill and will not enter a watercourse or groundwater aquifer.	**Short Term** Spills to ground will occur intermittently. Spills will be detected and remediated immediately.	**Negligible** No change in WQ as a result of spills.	**High** WQ in watercourses and groundwater is sensitive to contamination and supports numerous beneficial uses.	**High** AS/NZS are established and proven effective for mitigating risk. No underground storage, or storage within 200 m of a watercourse.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Contamination from waste storage and disposal within the AI area.	Solar Precinct – AI	**Unlikely** Inert and putrescible waste will be disposed of onsite at the Solar Precinct. All other waste will be temporarily stored and disposed at a licenced facility.	**Limited** Any contamination from waste storage and disposal will be limited to soil in immediate surrounds.	**Long Term** Waste will be disposed at Solar Precinct for operations phase (70 years).	**Negligible** No change in WQ as a result of waste storage and disposal.	**Low** No watercourses or groundwater proximate to waste storage and disposal areas.	**High** Compliance with NT guidelines and regulations proven effective for mitigating risk.	**Minor**
Changes to surface water flows from land clearing and development.	OHTL Corridor	**Unlikely** Majority of OHTL will be reinstated following construction with drainage as required	**Limited** Overland flows may be altered in limited areas due to erosion	**Short Term** Erosion would be identified and rectified.	**Negligible** No impacts to flows in watercourses or wetlands.	**Medium** OHTL does cross watercourses and wetland which support numerous beneficial uses.	**High** OHTL will be reinstated, and drainage as per an ESCP developed in accordance with IECA guidelines.	**Minor**
Increased turbidity in watercourses caused by soil disturbance and erosion.	OHTL Corridor	**Possible** OHTL crosses 128 watercourses. Maintenance of a cleared 6 m wide access along a linear footprint could result in erosion and turbidity in watercourses.	**Limited** WQ may be impacted for a several hundred metres downstream of crossings.	**Short Term** Erosion will be identified and rectified, and WQ impacts would only occur for days immediately following a rainfall event.	**Minor** Watercourses are naturally turbid, particularly following rainfall and runoff events.	**Medium** WQ supports values such as aquatic ecosystem health, pastoral, agricultural, cultural, social and amenity.	**High** ESCP in accordance with IECA guidelines, and ongoing monitoring and maintenance.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Increased PFAS contamination due to use of contaminated groundwater and surface water.	OHTL Corridor	**Unlikely** – groundwater and surface water from the PFAS Management Area will not be used.					**High** Significant previous investigations have been undertaken within the PFAS Management Area to inform impact assessment. High confidence in impact avoidance and mitigation measures.	**Minor**
Increased PFAS contamination in Katherine River or Tindal Creek due to runoff of contaminated groundwater or surface water used during construction.	OHTL Corridor	**Unlikely** – groundwater and surface water from the PFAS Management Area will not be used.					**High** Significant previous investigations have been undertaken within the PFAS Management Area to inform impact assessment. High confidence in impact avoidance and mitigation measures.	**Minor**
Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance.	Powell Creek Solar Precinct AI area.	**Possible** Minor occurrences of erosion may occur.	**Limited** WQ may be impacted for a several hundred metres downstream.	**Short Term** Erosion will be identified and rectified, and WQ impacts would only occur for days immediately following a rainfall event.	**Minor** Watercourses are naturally turbid, particularly following rainfall and runoff events.	**Medium** WQ supports values such as aquatic ecosystem health, pastoral, agricultural, cultural, social and amenity.	**High** ESCP in accordance with IECA guidelines, and ongoing monitoring and maintenance.	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Increased turbidity in surface waters from erosion and sedimentation caused by soil disturbance.	DCS Electrode	**Possible** Erosion at the DCS Electrode could result in increased turbidity and sedimentation of the seasonal swamp.	**Localised** WQ impacts may occur in the swamp, but not further downstream.	**Short Term** Erosion will be identified and rectified, and WQ impacts would only occur for days immediately following a rainfall event.	**Moderate** Turbidity is naturally low in similar swamps and lagoons, expect when water levels are low, and it dries up.	**Medium** WQ in the swamp supports aquatic ecosystem health.	**High** ESCP in accordance with IECA guidelines, and ongoing monitoring and maintenance.	**Minor**

6.8 Cumulative Impact Assessment

The framework used to assess cumulative impacts is described in Chapter 3 of the Draft EIS. The process involves considering the cumulative or combined impacts to hydrology associated with the residual impacts from the Project, residual impacts from existing activities and impacts associated with reasonably foreseeable developments described in Chapter 3 of the Draft EIS. Through the SEIS process no additional areas of potential cumulative impacts to hydrological processes were identified.

The groundwater study detailed above demonstrates that groundwater extraction has the potential to meet construction water demand will not have an impact on other uses in the Solar Precinct. However, further studies and ground truthing of data is required prior to Water Extraction Licence applications. Further, Groundwater Management Plans will be created and implemented for the construction and operations phases of the Project.

The statements made in the Draft EIS regarding cumulative impacts remain accurate, the Project is unlikely to contribute to cumulative impacts to environmental values or beneficial uses supported and maintained by surface water and/or groundwater quality. There are not predicted to be any long-term residual impacts to WQ from the Project's activities and therefore limited potential for cumulative impacts to occur.

Due to the low level of residual impact to hydrology associated with the Project there is no change from the Draft EIS, therefore there is limited potential for cumulative impacts to occur.

6.9 Conclusion

Four submissions were received relating to hydrology during the public submissions period (Section 6.10). Two were also received from the NT EPA Direction (Section 6.11). A review of the project refinements detailed in Chapter 2 has not identified any new significant impacts. All residual impacts have a rating of 'minor' or 'moderate' and any identified uncertainties are addressed with avoidance, monitoring, and mitigating measures. Thus, the Project can achieve the following objectives:

- *Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained*
- *Protect the quality of groundwater and surface water so that the environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

6.10 Submission Response

During the Draft EIS Public Exhibition period, the DEPWS, ECNT, NT Field and Game Association and one anonymous community submitter made comments relating to hydrology. These comments relate to the key themes of water drawdown impacts to landholders and environmental systems, as well as water extraction licencing.

The Proponent's responses to these submissions are provided in Sections 6.10.1.2 to 6.10.4.2.

6.10.1 DEPWS Submission

6.10.1.1 Hydrological Impacts to Wetland

It is also noted that the draft EIS does not include a proposed groundwater monitoring program for the Solar Precinct and the DCS. However, it is anticipated that the Surface and Groundwater Management Plan completed as part of the CEMP will include a groundwater monitoring program outlined for the construction and operational stages of the Project.

6.10.1.2 Response

In the Draft EIS it is stated: 'To manage and mitigate any impacts to hydrological processes during the construction phase, a Surface and Groundwater Management Plan will be developed as a sub-plan under the CEMP. This plan will include guidance on applicable legislation, regulations, and required permits and strategies and management measures to be used to mitigate and/or avoid impacts to surface water during construction of the Project' (refer to page 17-13 of Draft EIS). Although groundwater monitoring is not specifically mentioned, it will be included in the CEMP for the Solar Precinct and the DCS. In addition, it is stated in Chapter 17 of the Draft EIS that groundwater quality sampling and analysis of springs near the Solar Precinct and the aquifer targeted for groundwater extraction will occur to ensure there is no connectivity. The results from the desktop Groundwater Assessment suggests there is no connectivity between the aquifer that the Project intends to draw from and the springs surrounding the Solar Precinct and Ashburton Ranges.

All the groundwater studies for the Draft EIS and this SEIS have been desktop studies and are therefore theoretical. The recommendations from the Groundwater Assessment - Solar Precinct (Appendix 6.1) are detailed above (Section 6.5.1) and include the development of a Groundwater Monitoring Plan.

No groundwater studies have been completed for the DCS at this point and are proposed to be completed prior to applications for a Water Extraction Licence. The groundwater use at the DCS is estimated to be 33 ML/year during construction and was determined to have a minor residual impact. The groundwater use at the DCS is estimated to be 0.05 ML/year during operation and was determined to have a minor residual impact.

It is also important to note that the Proponent will be required to apply for bore permits and groundwater extraction licences to establish a water supply for construction and operation of the Solar Precinct and the DCS, which will specify any monitoring requirements.

6.10.1.3 Future Groundwater Modelling

The Proponent states that additional hydrogeological investigations will be undertaken prior to drilling and installation of water supply bores at the Powell Creek Station Solar Precinct as well as the DCS. These additional hydrogeological investigations should include groundwater modelling to demonstrate that groundwater extraction for water supply will have no deleterious impact on groundwater levels at nearby receptors (e.g., stock bores and nearby springs). These additional investigations should be provided to the Minister/Department for assessment and review.

6.10.1.4 Response

Further hydrological investigations have been completed for the SEIS for groundwater extraction at the Solar Precinct (Appendix 6.1). All the groundwater studies for the Draft EIS and SEIS have been desktop studies and are therefore theoretical, however the conclusions drawn provide a level of detail suitable for impact assessment. The aquifer located under the west of the Solar Precinct is substantial. However, information about it is limited. Prior to applying for Water Extraction Licences, further investigations will be carried out involving ground truthing of the desktop studies through pastoral bores and installing dedicated monitoring bores for investigation prior to establishing targeted production bores. This is identified in the Table 6-1.

6.10.2 ECNT Submission

6.10.2.1 Flood Modelling

Appendix N contains modelling that shows the possibility of flooding during extreme weather events could see Lake Woods "swell such that it would inundate a small portion of the north-east corner of the Solar Precinct." As have been observed with floods around Australia recently, the frequency of extreme weather events has increased and will continue to increase as a result of climate change, and so the possibility of flooding of the Solar Precinct Site must be seriously engaged with.

ECNT notes that climate change assessment in Appendix N is based on "the midpoint of the percentage rainfall increase" from IPCC modelling. However, modelling under different, including more severe, scenarios should be conducted.

6.10.2.2 Response

The modelled flood extent around the Solar Precinct is further discussed in Figure 6-1 in the Draft EIS and illustrates that most of the footprint is outside of any mapped flood extents, including in the modelled extreme flood events (i.e., 1 in 1 000-year event). Watercourse crossings (along the Access Roads) and stormwater drainage infrastructure will be designed in accordance with Austroads standards and Best Practice ESC Guidelines (EICA, 2008). The Draft EIS also states that design of the Solar Precinct will ensure that infrastructure that is flood sensitive will be located outside of mapped flood extents and/or on raised pads, for climate change resilience. Most importantly the predicted 1% AEP (standard 1 in 100 design event) by the year 2140 still has no impact on the site.

6.10.3 NT Field and Game Submission

6.10.3.1 Hydrological Impacts to Swamp

Other issues that I have noted in the EIS are that the AAPowerLink project could have a residual impact associated with alteration of the hydrological regime of the seasonal swamp located immediately south-west of the DCS at Gunn Point, and could have a residual impact to WQ in the seasonal swamp located immediately south-west of the DCS associated with increases in turbidity caused by erosion impacts predicted under the TEQ factor.

6.10.3.2 Response

Increased turbidity in watercourses during caused by soil disturbance and erosion at the DCS was given a residual impact of moderate (Table 7-2 and 7-3 in the Draft EIS). The swamp was considered in detail as part of the Draft EIS in Chapter 6 Hydrological Processes and in Chapter 7 Inland Water Environmental Quality.

Avoidance measures listed in the Draft EIS for the DCS for increased turbidity in watercourses caused by soil disturbance and erosion include:

- The footprint is located on flat land above the maximum modelled flood extent

(1 % AEP/1 - in 1,000-year flood event) and outside of mapped storm surge zones

- Footprint avoids watercourses
- Progressive clearing, construction and reinstatement will be undertaken
- Stormwater drainage will be installed to capture and manage runoff. Stormwater captured within facilities will discharge to land, via ESCs.

Mitigation measures listed in the Draft EIS for the DCS for increased turbidity in watercourses caused by soil disturbance and erosion include:

- Design criteria for engineered stormwater management systems installed at the DCS is to discharge water to similar locations and at similar volumes to pre-development conditions
- Drainage, erosion, and sediment controls will be installed and maintained in accordance with ESCPs that align with the Best Practice ESC Guidelines (IECA, 2008)
- Develop and implement a Reinstatement Plan for post-construction reinstatement of works areas to stabilise soils and promote regrowth of native vegetation
- Rectification of emerging erosion issues after each wet season.

Monitoring measures listed in the Draft EIS for the DCS for increased turbidity in watercourses caused by soil disturbance and erosion include:

- During construction, visual inspections will be undertaken of disturbed areas and ESCs as per ESCPs (after significant rainfall events, at a minimum)
- Annual post wet season monitoring of reinstatement success until disturbed areas are stabilised
- Visual inspections of drainage structures, discharge points and site boundaries following rain events
- Visual inspections of seasonal swamp at the DCS for evidence of sedimentation; implement WQ monitoring if required
- Post-wet season inspections of all project locations and rectification of emerging erosion issues.

Reporting measures listed in the Draft EIS for the DCS for increased turbidity in watercourses caused by soil disturbance and erosion include:

- Internal reports of ESCP inspections, as stipulated in ESCPs
- Internal reporting on environmental performance
- External reporting in accordance with environmental approval conditions.

6.10.4 Anonymous Submission

6.10.4.1 Bore Use and Water Extraction Licences

I have some concerns regarding the use of water in construction by way of private landowner permission to tap into existing bores. Will there be extensions of existing water extraction licences in order to fulfil their responsibilities and monitor groundwater consumption and forecasts?

6.10.4.2 Response

It is anticipated that existing bores might be used for ground truthing of the current studies. If this is the case, then the proper consultation and permission will be sought with landowners. The utilisation of existing bores is not adequate for the construction or operation of this Project.

There are no existing water extraction licences within the Solar Precinct. The closest water extraction licence is 70 km from the Solar Precinct and is owned by Power and Water Corporation.

The Proponent will be required to obtain permission to create bores, utilise existing bores and seek water extraction licences for the construction and operation of the bores required for this Project.

6.11 NT EPA Direction Responses

6.11.1 Hydrological processes, inland water environmental quality and aquatic ecosystems – Comment 24

The draft EIS identifies that water is to be sources from groundwater at the Solar Precinct and DCS and finalisation of the water source is reliant on the completion of the detailed water balance.

Impact on nearby receptors at the DCS considered low due to no nearby receptors; however, this may change during the 5-year construction period and subsequent years post construction required for groundwater to recharge.

The draft EIS (Chapter 7) recognises that poly-fluoroalkyl substances (PFAS) occurs near Katherine without assessing the potential for impacts arising from sourcing water, land clearing and construction activities where PFAS may occur.

Relevant material to be considered when addressing potential for PFAS contamination includes:

- *ANZECC (2000) Australia and New Zealand Guidelines for Fresh and Marine WQ – superseded by the revised WQ Guidelines ANZG (2019) https://www.waterquality.gov.au/anz-guidelines*
- *National Environmental Protection (NEPC, as amended 2013) Assessment of Site contamination http://www.nepc.gov.au/nepms/assessment-site-contamination*
- *NHMRC (2011) Australian Drinking Water Guidelines https://www.nhmrc.gov.au/aboutus/publications/australian-drinking- water-guidelines*
- *PFAS National EMP (HEPA 2018) health based guidelines for drinking water and recreational water https://www.epa.vic.gov.au/your-environment/land- and-groundwater/pfas-invictoria/pfas-national-environmental- management-plan.*

6.11.2 Information required in the Supplement

Provide a detailed water balance for the proposed action that includes but is not limited to:

- *Modelling to be included in hydrogeological investigations at the Solar Precinct and the DCS demonstrate that groundwater extraction for water supply will have no impact on groundwater levels at nearby receptors including future land use during the construction and operation stages as relevant.*
- *Groundwater monitoring programs for construction and operational stages of the proposed action.*

Provide further information to inform avoidance and mitigation measures as well as contamination management of water and soil disturbing activities in areas where PFAS may occur, including but not limited to:

- *Previous contaminating activities in the railway corridor and alternative routes about Katherine*
- *Describe existing levels in context of guideline values*
- *Source and quality of water and land fill to avoid PFAS*
- *Extent and location of excavation works*
- *Assessment of potential impacts.*

6.11.3 Response

1. **Modelling to be included in hydrogeological investigations at the Solar Precinct and the DCS demonstrates that groundwater extraction for water supply will have no impact on groundwater levels at nearby receptors including future land use during the construction and operation stages as relevant.**

The Groundwater Assessment – Solar Precinct (Appendix 6.1) was conducted in the preparation of this SEIS, which includes a desktop groundwater assessment of the Solar Precinct and surrounding area. Existing groundwater uses are mostly for cattle, one bore is used for domestic water supply and two bores were drilled to supply water for the construction of the Alice Springs to Darwin railway line. There is no licenced groundwater extraction in the vicinity of the Solar Precinct and the nearest groundwater extraction licence taking water from the Wiso Basin is 85 km north of the Solar Precinct at Newcastle Waters.

The Solar Precinct and the western half of the project area overlie the Wiso Basin, a regional scale aquifer system with a reported bore yield range of 5 – 15 L/s. Groundwater resources hosted in the Montejinni Limestone aquifer have the potential to meet the construction water requirement of the Solar Precinct.

Environmental receptors in the form of springs and permanent waterholes are mapped along several water courses in the east of the project area. These GDEs are associated with groundwater discharge from the fractured basement aquifers. The depth to groundwater in the Montejinni Limestone aquifer ranges from 34 – 44 mBGL. No GDEs have been identified in the Montejinni Limestone and the aquifer is unlikely to support GDEs because the water Table depth exceeds 20 mBGL.

Analytical borefield modelling estimates the drawdown impact on existing bores from the proposed Solar Precinct ground water extraction will range from 0.27 to 0.84 m. This represents 0.5 – 14 % of the available drawdown and suggests the Solar Precinct pumping will not have an appreciable impact on drawdown or on groundwater availability in the existing bores. However, drawdown and drawdown impact must be ground truthed in the future. Drawdown impacts on environmental receptors are not expected as these occur in a separate aquifer system.

The Draft EIS details cumulative impacts of groundwater extraction at the Solar Precinct and explored the future potential use of groundwater in the area. Groundwater in the Wiso Basin is primarily hosted in the Montejinni Limestone aquifer within the project area. Along with correlative units in the Georgina Basin (Gum Ridge Formation) and the Daly Basin (Tindal Limestone), the Montejinni Limestone forms a regional scale aquifer system, the CLA, which hosts a major groundwater resource in the NT. The sustainable yield of the Georgina Basin component of the CLA is estimated to be 100,000 ML/year, of which approximately 6,000 ML/year is currently used. The annual water requirement during construction peaks in the second year of construction at 1,860 ML (note: this was estimated in the Draft EIS as 1,000 ML/year) which is 1.8 % of the estimated sustainable yield.

Groundwater use at the DCS is estimated at 33 ML/year for construction and 0.05 ML/year for operation (Draft EIS Chapter 6). This is a very minimal use and was determined to have a minor residual impact in the Draft EIS. Any further studies deemed necessary and any information required for the water licence will be obtained at the relevant time.

1. **Groundwater monitoring programs for construction and operational stages of the proposed action.**

See Section 6.10.1.2 response to a comment from DEPWS.

Provide further information to inform avoidance and mitigation measures as well as contamination management of water and soil disturbing activities in areas where PFAS may occur, including but not limited to:

2. **Previous contaminating activities in the railway corridor and alternative routes about Katherine**

The presence and extent of contamination has been established through detailed investigations, and groundwater and surface water are known to be contaminated within the zones shown on Figure 6-1. Soils in certain locations and sediments within Tindal Creek and Katherine River, are also known to be contaminated.

Sources of contamination are located at the RAAF Base Tindal and include the Fire Training Area and Fire Station. Pathways of contamination include groundwater, surface water and soils/sediments within the PFAS Management Area. Receptors of contamination include aquatic ecosystems and biota, plants, birds and mammals, and humans (through interaction with PFAS contaminated water, consumption of PFAS contaminated water, or consumption of PFAS contaminated food).

3. Describe existing levels in context of guideline values

The latest publicly available Interpretive Report for the PFAS Ongoing Monitoring Program – RAAF Base Tindal summarises the surface water and groundwater quality monitoring data collected until February 2020 (see AECOM 2020). Soil and sediment quality data has been sourced from the RAAF Base Tindal Detailed Site Investigation (Coffey 2018). The findings of previous sampling and investigations are summarised in Table 6-4, for the area within and proximate to the OHTL Corridor. Note that the information presented in Table 6-4 is based on previous (and ongoing) monitoring undertaken on behalf of the Department of Defence (see Department of Defence 2022), and so targeted sampling has not been undertaken within the footprint of the OHTL Corridor. Nearby sampling results have been used to infer likely contamination within the footprint of the OHTL Corridor and the precautionary principle has been applied, and the highest known level of contamination proximate to the OHTL assumed, to apply to the OHTL Corridor.

Table 6-4: Summary of PFAS monitoring results proximate to OHTL, based on Department of Defence data

Location	Surface Water	Groundwater	Soil/Sediment
Katherine River (~ KP 455.5)	Proximate to the OHTL crossing PFAS concentrations exceed the guideline value* for: • Human health - drinking water • Ecological freshwater quality – 99% species protection. Upstream and downstream of the OHTL crossing, concentrations exceed the guideline value for: • Human health – drinking water and recreational water • Ecological freshwater quality – 90% species protection.	-	Proximate to the OHTL Corridor, PFAS concentrations are detectable but below: • All human health investigation guidelines • The ecological guideline for indirect exposure. However, concentrations exceed guideline values downstream of OHTL crossing.

Location	Surface Water	Groundwater	Soil/Sediment
Tindal Creek (~KP 454)	Proximate to the OHTL crossing PFAS concentrations exceed the guideline value for: • Ecological freshwater quality – 99% species protection. Upstream and downstream of the OHTL crossing, concentrations exceed the guideline value for: • Human health – drinking water and recreational water • Ecological freshwater quality – 90% species protection.	-	Proximate to the OHTL Corridor, PFAS concentrations are detectable but below: • All human health investigation guidelines • The ecological guideline for indirect exposure.
KP 453 – 456 (General OHTL Corridor)	-	Proximate to the OHTL crossing, concentrations exceed the guideline value for: • Ecological freshwater quality – 99% species protection. In the broader PFAS Management Area, concentrations exceed the guideline values for: • Human health – drinking water and recreational water • Ecological freshwater quality – 90% species protection.	No general soil sample results available within OHTL Corridor. Soils will be assumed to have potential for contamination.

*Note ‘guideline values’ discussed in Table 1 are the PFAS NEMP guideline values.

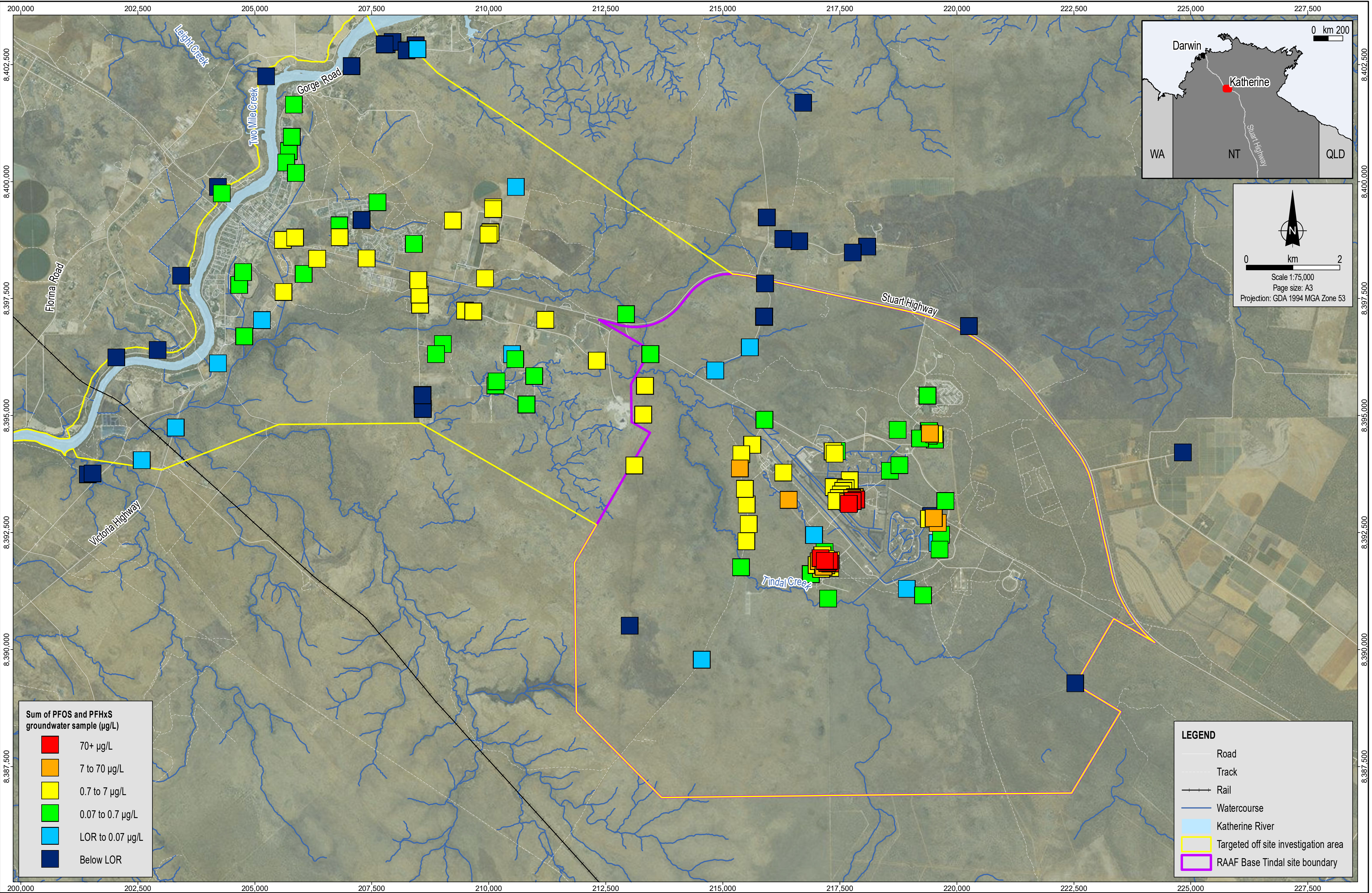
Figure 6-3 to Figure 6-5 shows the extent of contamination and known concentrations within and/or proximate to the OHTL Corridor, based on previous investigations.

In addition to contamination within or near the OHTL Corridor, the general findings of previous and ongoing monitoring and investigations are summarised as follows:

- Groundwater within the PFAS Management Area is contaminated, with PFAS concentrations exceeding the PFAS NEMP guideline values for recreational or drinking water criteria (see Figure 6-3). The ongoing monitoring indicates the concentration of PFAS in groundwater is not changing significantly in nature or extent (i.e., concentrations are relatively stable).
- Surface waters in Tindal Creek and Katherine River are contaminated, with PFAS concentrations exceeding the PFAS NEMP drinking water guidelines, recreational water guidelines and/or freshwater guidelines for 90% species protection at several monitoring sites. Within Tindal Creek, concentrations are higher in the wet season (and the creek tends to cease to flow in the dry season) as the creek receives surface water runoff from RAAF Base Tindal.

Within Katherine River, concentrations fluctuate seasonally depending on the proportion of flow that is groundwater fed (i.e., concentrations tend to increase in the dry season and are diluted in the wet season).

- PFAS concentrations in sediment exceed the PFAS NEMP human health investigation levels and ecological guideline values for indirect exposure at some locations along the Katherine River and Tindal Creek (see Figure 6-5) including within the Katherine River downstream of the OHTL crossing. Concentrations proximate to the OHTL Corridor are generally detectable but below guideline values (based on sample locations nearby, but not within, the OHTL Corridor). Consistent with the precautionary principle, it will be assumed that sediment within the OHTL Corridor, at the Tindal Creek and Katherine River crossings, has the potential to be contaminated.
- No soil sampling has been undertaken within the OHTL Corridor. In general, soils within the PFAS Management Area are contaminated where they have been irrigated with contaminated groundwater or surface water, or within the RAAF Base Tindal where PFAS was used (see Coffey, 2018). Nevertheless, consistent with the precautionary principle, it will be assumed that soil within the OHTL Corridor (within the PFAS Management Area) has the potential to be contaminated.
- PFAS concentrations in soil and sediment samples taken proximate to the OHTL Corridor as part of the Detailed Site Investigation Report (see Coffey, 2018) were below the human health guideline values for all land uses (see sampling locations on Figure 6-5)
- Importantly, PFAS concentrations were well below the PFAS NEMP human health investigation levels for industrial/commercial land uses, which would apply to AAPowerLink. Therefore, PFAS concentrations in soil and sediment within the OHTL Corridor are not considered a constraint for AAPowerLink.



Stage 2: DSI - PFAS in Groundwater

Figure 6-3: Groundwater Sampling Results (Coffey 2018)

coffey
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Date: 01.12.2017
Project: 754-MELEN199420
File Name: 199420_DSI_CWIS_F002_GIS

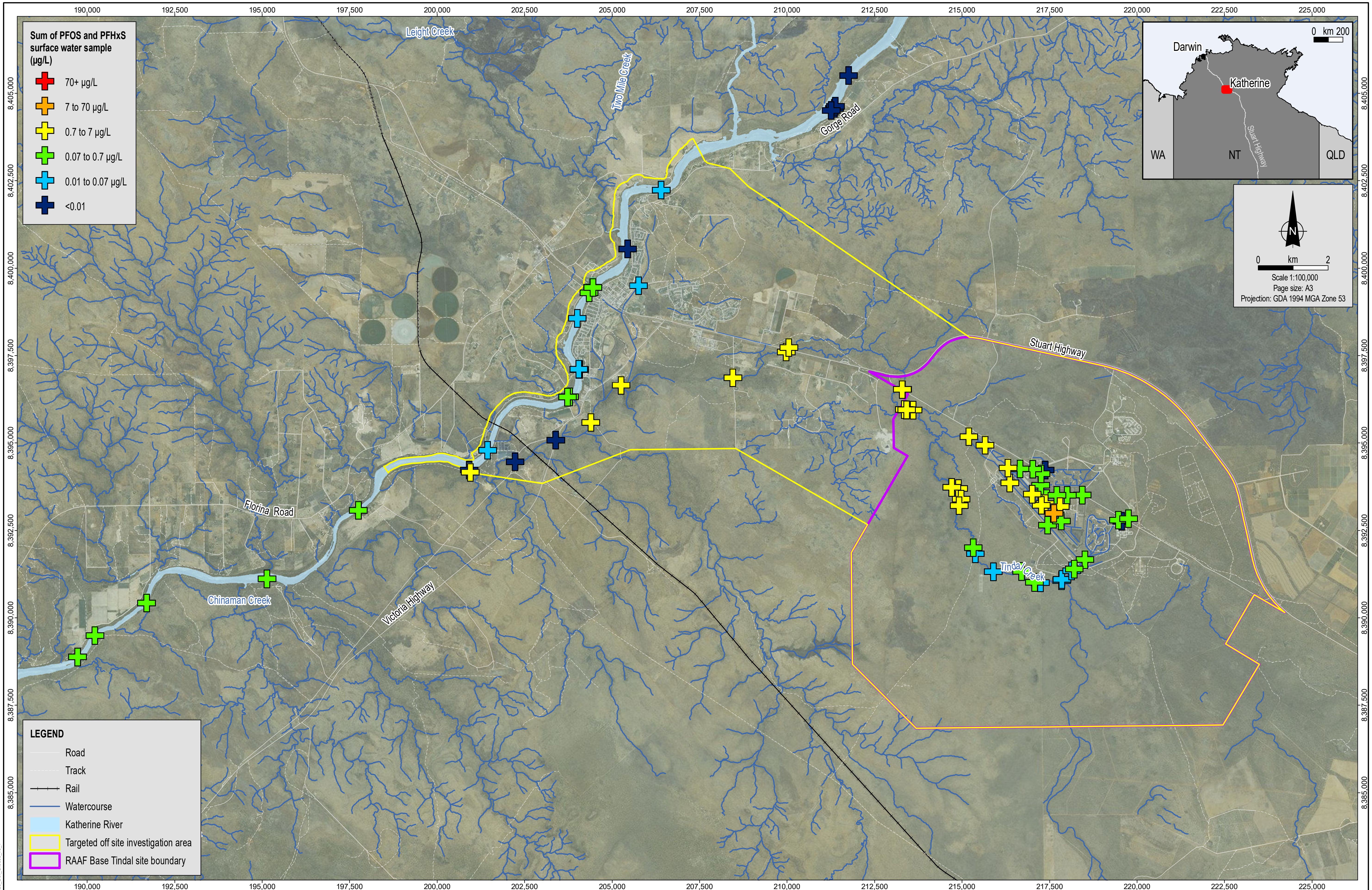
Department of Defence

PFAS Assessment

Source:
Sampling results and investigation area from Coffey.
Roads, rail, watercourses and site boundary from DoD.
Imagery from ArcGIS Online (capture date unknown).

Figure No: 6-3

Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.



Stage 2: DSI - PFAS in Surface Water

Figure 6-4: Surface Water Sampling Results (Coffey 2018)

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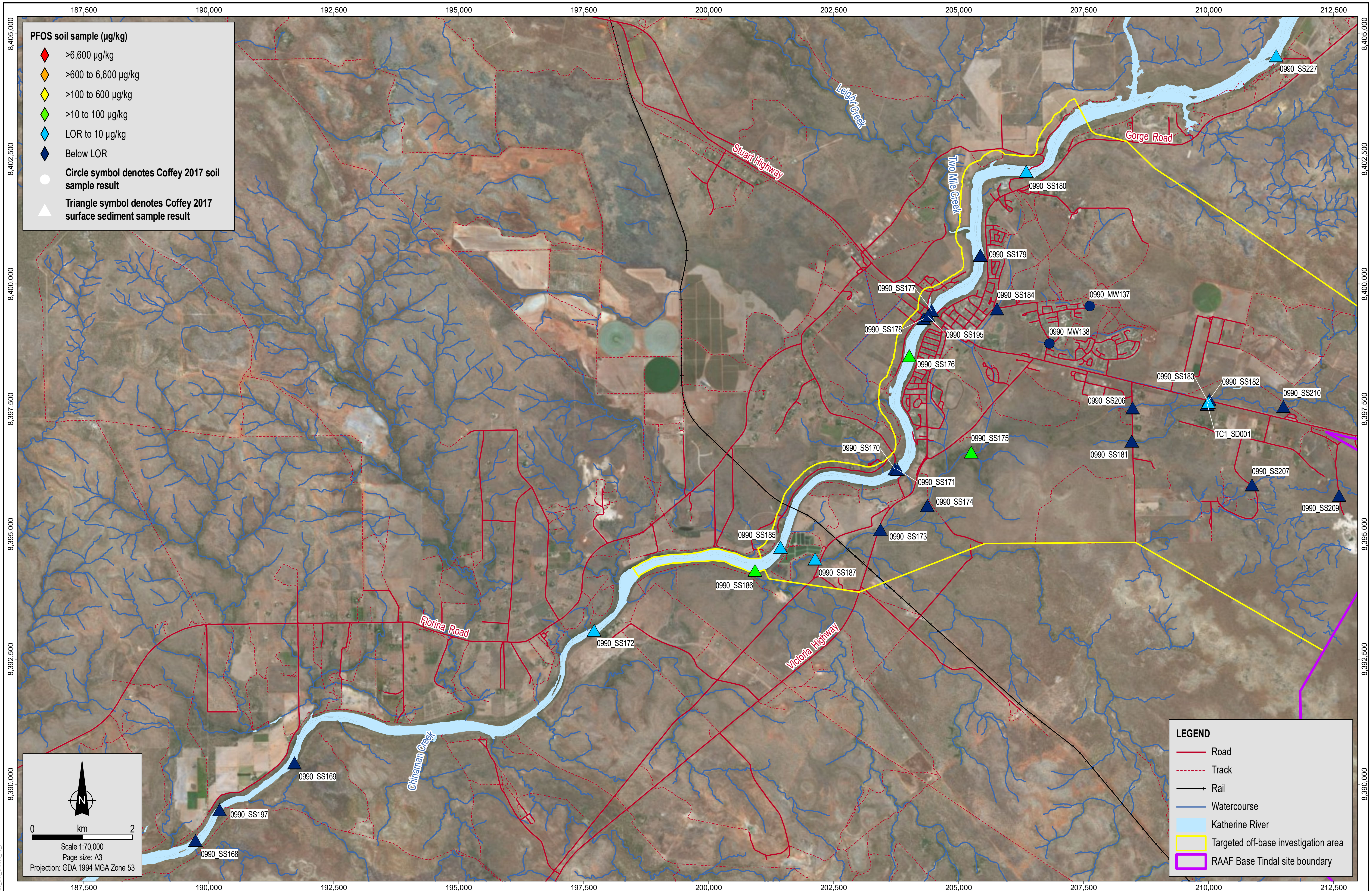
Date: 01.12.2017
Project: 754-MELEN199420
File Name: 199420_DSI_CWIS_F003_GIS

Department of Defence

PFAS Assessment

Source:
Sampling results and investigation area from Coffey.
Roads, rail, watercourses and site boundary from DoD.
Imagery from ArcGIS Online (capture date unknown).

Figure No: 6-4



MXD Reference: 199420_DSI_GIS065_v0_3

Off-Base - Soil and Sediment Analytical Results - PFOS

Figure 6-5: Soil and Sediment Results (Coffey 2018)

coffey
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Date: 06.02.2018
Project: 754-MELEN199420
File Name: 199420_DSI_F022a_GIS

Department of Defence

PFAS Assessment

Source:
Sampling results and investigation area from Coffey.
Roads, tracks, rail, watercourses and site boundary from DoD.
Imagery from ArcGIS Online (capture date unknown).

Figure No: 6-5

4. Source and quality of water and land fill to avoid PFAS

As detailed in Table 6-1 above, the following actions will be avoided:

- No groundwater will be extracted from bores located within the Katherine PFAS Management Area
- No surface water will be extracted from Tindal Creek or Katherine River.

In addition, as detailed in Table 6-1, the following actions will be avoided:

- No sediment will be removed from Tindal Creek or Katherine River
- OHTL conductor wires will span the Tindal Creek and Katherine River, avoiding works within the watercourses
- The OHTL Access Track will not be constructed through Tindal Creek or Katherine River – those watercourses will be accessed from either side, via existing tracks where available
- No trenching will occur along the OHTL, including within the PFAS Management Area.
- 10 15 OHTL structures over 3 km of the OHTL route runs through the PFAS Management Area, where excavation will occur for the pole/tower foundations. Foundation excavation material would need to be tested for any PFAS contamination. If the excavation area does not contain PFAS the excavated spoil will be left on the pole/tower pad (which is the general practice for the other structures along the OHTL). If the excavation area does contain PFAS then the material will be disposed of at a nominated PFAS disposal location.

5. Extent and location of excavation works

There are approximately 10 - 15 OHTL structures over 3 km of the OHTL Corridor that are within the Katherine PFAS Management Zone. Excavation needs to occur during installation of the pole/tower foundations and possibly a pile cap. If soil stockpiling is required, it will be in accordance with the PFAS NEMP to avoid any contaminated runoff, which would in turn contaminate surface and potentially surface water.

6. Assessment of potential impacts

An assessment of the potential impacts, a discussion of the residual impacts and a discussion of the cumulative impacts can be found above in the above Sections 6.5, 6.7 and 6.8, respectively.

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