Executive Summary – Detailed Site Investigation (DSI)

Senversa was engaged by the Department of Infrastructure, Transport, Cities and Regional Development (DITCRD) now the Department for Infrastructure, Transport, Regional Development and Communications (DITRDC) to prepare a Detailed Environmental Investigation of per- and poly-fluoroalkyl substances (PFAS) site conditions at Norfolk Island Airport (the site) and surrounding catchments.

The investigation was initiated after a CSIRO led investigation identified elevated levels of PFAS in the Mission Creek surface water catchment in December 2019. A preliminary site investigation (PSI) with targeted sampling was then undertaken in January 2020 and resulted in the identification of PFAS sources areas and provision of alternative water supplies and PFAS management measures on Norfolk Island Airport, properties within the Mission Creek Catchment, the hospital and council works depot. The PSI results included in this assessment refer to conditions before PFAS management measures were implemented.

The key objectives of this detailed site investigation (DSI) were to confirm key PFAS source areas, pathways and receptors of PFAS contamination identified within the PSI.

The scope of the DSI included grid based surficial assessment of PFAS source areas; targeted deeper soils assessment; assessment of the waste water treatment plant; sequential paired sediment and surface water sampling along Mission and Watermill Creeks, further confirmatory sampling of on and off-site drinking water sources and assessment of produce in the Mission Creek Catchment. The DSI comprised laboratory analysis of 235 soil, 40 sediment, 26 surface water, 5 groundwater, 41 water and tap, 22 grass and 7 biota (produce) samples. These results refer to conditions after PFAS management measures were implemented.

Through completion of this scope of work, Senversa was able to achieve the objectives outlined in **Section 1.2** and draw the following conclusions:

PFAS Source Area Identification

- Six PFAS primary source areas (Group 1 Source Areas) were confirmed within the Airport, with Primary Sources 1 (Former Fire Station and Foam Shed) and 2 (Former Flushing Out Area) considered to represent the main sources of PFAS identified within Mission Creek surface water. All six sources were associated with the training, storage and / or maintenance of fire trucks that historically used Legacy AFFF.
- Concentrations of PFOS+PFHxS were highest in soils within Source Area 4 (Current Drill Ground) which is expected as this was where Legacy AFFF was used most recently. However, there was limited evidence of surface water impacted down-gradient of Source Zone 4 within Mission Creek.
- Assessment of sub-surface conditions within PFAS source areas found higher concentrations of PFAS were generally present at depth (between 0.5 and 1.5+ m) when surficial soil concentrations exceed 0.05 mg/kg, indicative of vertical washing into the soil profile and/or surface removal by rainfall flushing.
- PFAS was identified in wastewater at the WWTP, with a PFOS+PFHxS concentration of 0.24 µg/L. The source of the PFAS in WWTP wastewater has not been confirmed, however it is likely to be a combination of different domestic sources and potentially a portion of inflow from identified airport source zones. The presence of PFAS within wastewater should be taken into account as a part of planned upgrades to the WWTP.

Impact to Utilised Water

- All privately owned drinking water sources that were sampled by Senversa reported PFAS (PFOS+PFHxS) concentrations below the adopted health based guidance value (HBGV).
- Concentrations of PFAS in internal water taps at three public facilities (hospital, works depot and fire station) that were previously found to be:
  - Above the adopted HBGV in January 2020 (before PFAS management measures were implemented)
  - Below adopted HBGV in March 2021 (after PFAS management measures were implemented).
- Concentrations of PFAS exceeded the HBGV in one sample collected in 2021 (after PFAS management measures were implemented) from a kitchen tap at airport mechanical/maintenance building in the former fire station (A_TAP4: PFOS+PFHxS: 0.11 µg/L). Reticulated water in this facility was known to have be historically connected to the Airport Bore. The supply of alternate drinking water and signage is considered to mitigate this risk.
- Historically extracted “Airport Bore” water is still present in tanks servicing public toilets within two locations on the island, however the potential for exposure during hand washing is considered relatively low given the frequency and duration of exposure, the limited potential for PFAS adsorption through the skin and the non-volatile nature of PFAS.
- Extracted bore and surface water used for stock watering with the Mission Creek Catchment in March 2021 were lower than January 2021 but still elevated, with concentrations of PFOS+PFHxS ranging up to approximately 2 µg/L.

PFAS in Surface Water Catchments

- Concentrations of PFAS in surface water and groundwater generally decreased by between a half and one third between January 2020 and March 2021. This reduction in concentration is considered likely to have been primarily through ‘flushing’, driven by the increase in rainfall post January 2020 (i.e. dilution driven) and therefore PFAS concentrations may rebound in future periods of lower rainfall. However, cessation in the use of the Airport Bore, supply of PFAS free alternative water supplies and further time since legacy PFAS containing AFFF was last used and may also have contributed to this reduction.

Mission Creek Surface Water Catchment (after PFAS management measures were implemented)

- Surface water in Mission Creek was found to have the highest concentrations in the World War II Dam (PFOS+PFHxS: 34.6 µg/L) located in the upper southern portion of the catchment close to source zones PS01 and PS02 at the Airport.
- PFAS concentrations consistently decreased with distance at the eight sample locations downstream of the World War II Dam, with the lowest reported concentration of PFOS+PFHxS (1.26 µg/L) reported up-stream of the Mission Pool at MC_SW04.
- Sediment samples from the Mission Creek catchment reported the highest PFAS concentrations adjacent to identified on and off-site PFAS Source Zones. An increase in PFAS concentrations south of the Mission Pool may be associated with higher rates of evaporation in this area.

Watermill / Town Creek Water Catchment (after PFAS management measures were implemented)

- All water samples obtained from within the KAVHA World Heritage Area were found to be below the drinking / stock watering water HBGV.
- PFAS concentrations were below detection limits at the point of discharge into Emily Bay.
- Within the Watermill / Town Creek catchment, the highest PFAS concentration in surface water (PFOS+PFHxS: 1.14 µg/L) was identified downstream of the Airport Maintenance Sheds (PFAS Source Zone 5) at TC_SW06.
- PFAS concentrations consistently decreased at each downstream location away from the airport, however they generally exceeded drinking / stock watering water HBGV until after the “Watermill / Duck Dam”.

Other Surface Water Catchments (after PFAS management measures were implemented)

- Concentrations in surface water were below the drinking / stock watering water HBGV in all other catchments with the exception of one marginal exceedance (PFOS+PFHxS: 0.08 µg/L) at ID012_SW03 downstream of the Council works depot in Cascade Creek.

PFAS in Groundwater

- As per the PSI targeted assessment undertaken in January 2020, the highest reported PFAS concentration in groundwater in 2021 (after PFAS management measures were implemented) was in the 'Airport Bore', located near the top of the upper south branch of Mission Creek.
- Similar to the reduction seen in surface water at the World War II Dam, concentrations of PFAS in groundwater collected from the Airport Bore in March 2021 (PFOS+PFHxS: 24.9 µg/L) reduced by between one half to a third from the concentration measured January 2020.
- DITRDC propose to install a point of entry (commonly known as POET) filtration system on the Airport bore to ensure this valuable resource can continue to provide water to the community for non-potable sources.

PFAS in Produce (after PFAS management measures were implemented)

- No PFAS was detected in fruit and vegetables assessed and PFAS reported in egg was below adopted criteria for the human consumption of eggs.
- Marginal (at detection limit) concentrations of PFAS were detected in grass on the airport that is commonly cut and fed to cattle.

Confirmation of Risk

The works undertaken as part of the DSI and PSI have allowed a good understanding of the ways in which people and wildlife on-island might be exposed to PFAS. Based on this information, it has been possible to determine that risks are now low and acceptable for many of the ways in which people might be exposed to PFAS in the environment. This includes drinking water; drinking water is often (on other sites) the most significant PFAS exposure pathway, but on Norfolk Island, concentrations of PFAS in the water people currently drink is below the HBGV, and the risks are therefore assessed to be low.

While it has been possible to rule out potential risks for many of the pathways by which people might be exposed, there are a small number of pathways for which further assessment is required to better assess potential risks. Completion of a human health and ecological risk assessment (HHERA) is recommended to further assess the risks and confirm potentially complete source-pathway-receptor linkages.

Furthermore, to address the identified risks in complete pathways, a PFAS Management Plan (PMP) plan should be prepared and approved, which details all physical and administrative preventative measures required to reduce or eliminate exposure to PFAS. The PFAS Management Plan will detail the ongoing management which is required for each identified source area, and for identified potential exposure pathways (both those pathways which are currently managed, and those for which additional management is identified to be required within the HHERA).