LAKE COCHRAN WATER TREATMENT PLANT

resource management synergy

CLIENT
DEPARTMENT OF DEFENCE

LOCATION
RAAF BASE WILLIAMTOWN | NEWCASTLE | NSW

ROLE
WATER TREATMENT

VALUE
22.4 MILLION

TIMELINE
NOV 2016 - **MAR** 2021

STATISTICS

- **1.2 BILLION** LITRES OF WATER TREATED
- **100%** SUCCESS RATE CONTRACTUAL CRITERIA
- UP TO **70 LITRES** PER SECOND FLOW RATE
- **> 7 BILLION** MICROGRAMS PFAS REMOVED
- **99%** PFAS BELOW DETECTION LIMITS

PROJECT SCOPE

Synergy developed a large-scale multi-barrier water treatment plant to treat the overflow of Lake Cochran where a large volume of PFAS contaminated surface and ground water flows into prior leaving the RAAF Base Williamtown.

Synergy's bespoke WTP has been operational on the Lake Cochran (LC) project since December 2016 and has successfully treated over 1.2 billion litres of PFAS impacted water.

The WTP is achieving significant removal of PFAS contaminants to less than 0.01 µg/L, using a 3-stage multi-barrier process. The WTP consists of two systems in parallel to allow uninterrupted operation during maintenance with a flow range of 15 to 70 litres per second. After full treatment 99.83% of PFAS was removed

The WTP has reduced PFAS contamination to achieve NSW EPA, Department of Health and Department of Defence approved criteria for 100% of results. 99% of results were below detection limits (<0.01 µg/L) for Total PFAS (455 samples).

INNOVATIONS

Synergy have treated over 1.2 Billion litres of PFAS contaminated water with the LCWTP without disposal of any ion exchange resin by using robust pretreatment to extend filtration media lifespan and various regeneration techniques.

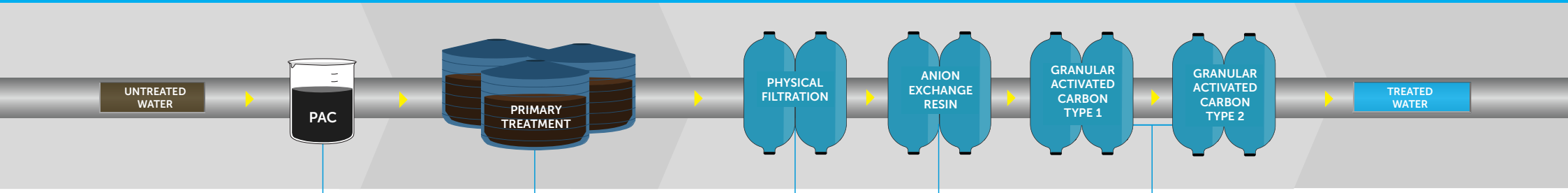
Pretreatment and effective primary treatment reduce the concentration of PFAS and other contaminants during the early stages of treatment allowing the resin to reduce PFAS concentrations to extremely low levels consistently for long durations of time. This also lengthens the resin lifespan which is important due to the high cost of replacement. AIX resin filtration is a highly successful method for PFAS removal, however it is known that after a resin becomes loaded with PFAS, regeneration is required to restore its functionality and anion exchange properties.

Synergy and associated partners have developed regeneration methods to avoid damaging the structure, and subsequently reducing the lifespan, of the resin. Regeneration of AIX resin may be done in a number of ways however some regeneration techniques are better suited to different scenarios.

Development and optimisation of these resin techniques has allowed Synergy to maximise the lifespan of media within the WTP resulting in economic benefit to the client and environmental benefit through waste reduction.

Synergy are mitigating the migration of PFAS offsite through treating high volumes of water. From April 2018, Synergy began treating over 40 million litres of water per month through the LC WTP.

PRETREATMENT	PRIMARY TREATMENT	SECONDARY TREATMENT		TERTIARY TREATMENT		DISCHARGE
Injection of Powder Activated Carbon into process water	*Bulk contaminant removal Coagulation, Flocculation & Settlement*	*Physical filtration using sand and gravel*		*Deep bed media filters containing a variety of proprietary media*		*Fully treated water discharged*
PERCENTAGE OF PFAS REMOVED	88.13%	1.31%	10.4%	0.04%	0%	TOTAL = 99.9%



Powdered Activated Carbon (PAC) is an extremely fine activated carbon which Synergy mix with clean water to create a 'slurry'. The PAC slurry is dosed into the treatment water at varying rates depending on contaminant and particulate loading.

Due to the high adsorption kinetics, PAC is able to adsorb a wide variety of contaminants, including heavy metals, PFAS, nutrients and inorganics.

Primary Treatment employs coagulation, flocculation and settlement to remove PAC, contaminants & particulates from the process water. PAC is the key driver of PFAS removal during this treatment phase.

Primary Treatment increases the lifespan of the filtration media downstream and enables removal of high concentrations of contaminants at high flowrates.

Secondary Treatment employs physical filtration to mechanically trap fine suspended particulates carried over from the Primary Stage using sand and various sizes of gravel.

Tertiary Treatment 1 – Anion Exchange (AIX) Resin. Synergy use a weak based macroporous resin for the Lake Cochran WTP which is selective for PFAS and is resistant to organic fouling. This is important due to the high content of organic material including tannins within the water.

The resin has a high capacity for PFAS recovery and can be easily regenerated and therefore is a long term solution for water treatment.

Tertiary Treatment 2 – Granular Activated Carbon. The final treatment stage uses multiple GAC filters to remove any low level concentrations of PFAS that possibly passed through the earlier treatment stages.

Coal-based GAC is selected to remove large chain PFAS or large molecular weight contaminants from the process water. Coconut-based GAC is used as a final polishing stage with micro, meso and macro pores to capture PFAS of varying chain length.

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LAKE COCHRAN WTP
NOVEMBER 2016 - CURRENT

Analytical Data Current to: 17/08/2020	Volume Data Current to: 17/08/2020
Dates of operation	
Date commissioned	30th November 2016
Date operation ceased	17th August 2020
Number of days operational	1357 days
Flowrates (L/s)	
Average flowrate to Dawsons Drain	13.93 L/s
Maximum flowrate to Dawsons Drain	24.9 L/s
Volumes	
Average treatment volume per month	6,056,026 L
Total volume water treated	1,173,137,000 L
PFAS removal (micrograms µg)	
Influent (untreated) maximum total PFAS	958 µg/L
Influent (untreated) mean total PFAS	6.60 µg/L
Effluent (treated) maximum total PFAS	0.08 µg/L
Effluent (treated) mean total PFAS	< 0.01 µg/L
Estimated total PFAS removed	**6,963,874,289 µg**

Discharge Criteria	
Number of samples	455 samples
% Passed contractual criteria DoH Health Based Guideline Values (Sum of PFOS + PFHxS 0.07 µg/L, PFOA 0.56 µg/L)[1]	**100% pass**
% Passed target criteria (PFOS < 0.02 µg/L, PFOA <0.02 µg/L, PFHxS <0.02 µg/L, 6:2 FTS <0.05 µg/L)	**99.83% pass**
PFAS recovery through multi barrier WTP (%)	
Pretreatment adsorption to Powdered Activated Carbon (PAC)	82.94%
Settlement & clarification (pH correction, coagulation flocculation)	5.19%
Deep bed media filtration with Gravel and Sand	0%
Deep bed media filtration with Anion Exchange Resin (AIX)	11.71%
Deep bed media filtration with Granular Activated Carbon (GAC)	0.04%
PFAS removal after full treatment	**99.88%**
Waste generated (tonnes) - Current to 18th February 2020	
Liquid Waste (AIX regeneration fluid)[2]	0 L
General Solid Waste (GSW) Landfill Disposal (Suez Raymond Terrace NSW)[3] Gravel and Sand	78.4 t
Restricted Solid Waste (RSW) Landfill Disposal (Suez Kemps Creek NSW)[3] Granular Activated Carbon (GAC)	0 t
Hazardous Solid Waste (HSW) Beneficially reused after thermal treatment (Renex Dandenong VIC)[4] Powdered Activated Carbon (PAC)	751.04 t
Total Waste (tonnes)	829.44 t
Total waste vs total volume water treated %	**0.074%**

1. Department of Health (DoH) 2016 Health Based Guidance Values for PFAS Food Standards Australia New Zealand
2. AIX regeneration fluid reprocessed through WTP and converted to solid waste
3. Waste classified using NSW EPA 2016 Addendum to the Waste Classification Guidelines (2014) Part 1
4. Thermally destructed at Renex Dandenong VIC in accordance with the HEPA 2018 PFAS National Environmental Management Plan (NEMP)