

Notice

Environmental Protection Act 1994

Environmental Evaluation

Notice to conduct or commission an environmental evaluation

This notice to conduct or commission an environmental evaluation is issued by the administering authority pursuant to 326B of the *Environmental Protection Act 1994*.

Tox Free Australia Pty Ltd
Level 1, 31 Cliff Street
FREEMANTLE WA 6160

Tox Free Australia Pty Ltd
PO Box 119
NARANGBA QLD 4504

Your reference: 1780114-007

Our reference: CR78592 / STAT1204

27 September 2017

Take notice: that under the *Environmental Protection Act 1994* (the Act) a notice to conduct or commission an environmental investigation is issued to Tox Free Australia Pty Ltd ACN 127 853 561 (you) by the administering authority. The administering authority is the Chief Executive of the Department of Environment and Heritage Protection (the department).

The notice to conduct or commission an environmental investigation is issued in respect of your activities on land described as:

- 8-12 Krypton Street, Narangba QLD 4505 on land described as Lot 111 on CP909626 (the premises);
- The neighbouring property occupied by Queensland Organics at 65 Potassium Street, Narangba QLD 4505, on land described as Lot 112 on Plan CP867909 (Qld Organics site); and
- The receiving waterway at the rear of the premises on land described as Lot 535 on SP255151 (which is a tributary of Lagoon Creek), and downstream waterways including Lagoon Creek, Saltwater Creek, and Hays Inlet (the receiving waterways).

A. Grounds

The notice to conduct or commission an environmental investigation is issued on the following grounds:

- The administering authority is satisfied that the discharge of a reported 800 litres of aqueous film-forming foam (AFFF) at the premises is an event that has caused environmental harm while an activity was being carried out.

The facts and circumstances forming the basis for these grounds are:

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1. You carry out environmentally relevant activity (ERA) 56 - regulated waste storage and ERA 58 - regulated waste treatment at 8-12 Krypton Street, Narangba QLD 4505, on land described as Lot 111 on CP909626 (the premises), under the Environmental Authority EPPR004671413 (the EA).
2. The EA authorises treatment of regulated wastes at the premises, including organohalogens, providing treated waste can be sent to a facility lawfully able to receive that waste.
3. At 12.00pm on 28 April 2017, you notified the department that an intermediate bulk container (IBC), containing hazardous waste fell through the northern site fence into the Qld Organics site and approximately 800 litres has spilt on the Qld Organics site.
4. On 29 April 2017 authorised officers observed a foamy substance floating on top of the receiving waterway in the culvert beneath Potassium Street.
5. On 9 and 11 May 2017 you provided sample results for the recovered spilled contents and receiving waterway in the immediate vicinity of the spill.
6. Based on the information provided above (points 1 to 5), the department considers an event has occurred involving the release of per-fluoroalkyl and poly-fluoroalkyl substances; collectively termed "PFAS" from the premises to the Qld Organics site and the receiving waterways.
7. Environmental harm is defined in section 14 of the Act as follows:
 - (1) *Environmental harm is any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.*
 - (2) *Environmental harm may be caused by an activity—*
 - (a) *whether the harm is a direct or indirect result of the activity; or*
 - (b) *whether the harm results from the activity alone or from the combined effects of the activity and other activities or factors.*
8. An environmental value is defined in section 9 of the Act as follows:
 - (a) *A quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or*
 - (b) *Another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.*
9. Under the *Environmental Protection (Water) Policy 2009* (Water EPP), all Queensland waters have prescribed environmental values and water quality objectives. Environmental values and water quality objectives for the receiving waterway are listed in Schedule 1 of the Water EPP see:
<https://www.ehp.qld.gov.au/water/policy/pdf/documents/pine-rivers-ev-2010.pdf>
10. Public amenity and safety are environmental values prescribed under the Act that may be adversely affected by PFAS contaminated surface water (including sediments), PFAS contaminated biota and secondary transfer of PFAS contaminants into products e.g. where hazardous contaminants are released to soil and reused to make products such as soil conditioners.
11. Ecological health is an environmental value under the Act that may be adversely affected by release of PFAS into the environment, for example, bioaccumulation through food chains to aquatic and terrestrial organisms.

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12. The receiving waterway flows to Saltwater Creek, which flows south east into Moreton Bay (RAMSAR listed high ecological significance wetlands), via Hays Inlet. The Moreton Bay wetland is described as:
 - RE 12.3.5 and is defined as a wetland RE;
 - A palustrine wetland – vegetated swamp;
 - A coastal freshwater wetland likely to support migratory species;
 - Habitat for acid frogs;
 - Upstream of the High Ecological Significance (HES) Wetland associated with Saltwater Creek; and
 - Upstream of Hays Inlet is a highly protected zone of the Moreton Bay Marine Park, Fish Habitat Area and described as endangered RE 12.1.1.
13. PFAS are a group of man-made chemicals, which are of emerging international concern due to their toxicity, persistence and potential to bio-accumulate in the environment and people. Once released in the environment, many PFAS forms are quite mobile and can adversely affect a wide range of environmental values, including beneficial uses undertaken by people.
14. Poly-fluoroalkyl substances in AFFF such as fluorotelomers can be transformed in the environment to persistent end products. For such PFAS, the eventual transformation end-point compounds are highly persistent per-fluorinated compounds such as the perfluorocarboxylic acids (PFCAs) such as PFOA, including a range of its higher and lower homologous PFCAs. These may include C6 perfluorohexanoate (PFHxA), C9 perfluorononanoate (PFNA) and C10 perfluorodecanoate (PFDA).
15. Quality characteristics of the environment that are conducive to public amenity and safety include concentrations of PFAS in sediment, water and biota that are protective of human uses and safety.
16. PFAS can harm these environmental values by a variety of mechanisms including via concentration and accumulation in food stuff, contact and ingestion.
17. Quality characteristics conducive to ecological health are water, sediment and biota where concentrations of PFAS do not cause acute or chronic toxicity, or secondary poisoning through bio-concentration or bio-accumulation to the aquatic (including air breathing and non air breathing fauna) and terrestrial environment (e.g. avian fauna).
18. The department issued you a clean-up notice under section 363H of the Act on 12 May 2017 which was amended on 18 July 2017 (the clean-up notice). The clean-up notice required the clean-up and validation of the Qld Organics site and the receiving waterways and an investigation into the nature of extent of environmental harm (including potential harm) caused as a result of the PFAS spill incident.
19. On 9 August 2017, you notified the department of potential health risks associated based on whole organism biota results.
20. Concentrations to protect human consumption of seafood are very low as trigger points developed by Food Standards Australia New Zealand (FSANZ) for PFOS + PFHxS concentration in fish (ie. 5.2 micrograms/kg) and fish have been found to bio-accumulate PFOS by three to four orders of magnitude from the water column. Field-measured bioaccumulation factors range up to 9778 for marine waters and 95,000 for fresh water environments (See Appendix - Table A1.2 Aquatic field bioaccumulation data for PFOS via <http://www.rivm.nl/bibliotheek/rapporten/601714013.pdf> (accessed 7/9/2017)).

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21. On 15 August 2017, you provided a copy of the biota analysis which indicated all biota samples exceed the FSANZ criteria for PFOS + PFHxS. Sample analysis results relate to whole fish and/or composited samples, and these results indicated very high PFOS + PFHxS analysis results for biota samples taken from the receiving waterways. Edible portions provided for two eel samples are shown below:

Environmental Value	PFAS	(FSANZ criteria) Guideline value µg/kg	Eel edible portion (Area 4) downstream in Lagoon Creek	Times exceeds guideline value	Eel edible upstream Area 3 µg/kg Lagoon Creek	Times exceeds guideline value
Public Safety – human consumption of seafood	PFOS + PFHxS	5.2 ug/kg	267.7 ug/kg	51.48	25 ug/kg	4.81
	PFOA	41 ug/kg	Nil		Nil	

22. As a result of this analysis the department is satisfied the discharge of AFFF (containing PFAS) into the receiving waterway, a tributary of Lagoon Creek, which flows via Saltwater Creek to Hays Inlet, may cause potential environmental harm to environmental values of these waters, including suitability for human consumption and public safety.

23. On 18 August 2017 you submitted an investigation in response to requirement 4 of the clean-up notice. This investigation included analysis for surface waters. Examples of these results for surface waters are:

Environmental Value	PFAS	Guideline value µg/L	Rear of Tox Free (site SW01) µg/L	Times exceeds guideline value	Receiving waterway Downstream concentration (Site SW15) µg/L	Times exceeds guideline value	Upstream SWUP3 µg/L	Times exceed guideline value
Recreational contact with waters (e.g. children playing in creek) 1	PFOS + PFHxS	0.7	3.8 TOPA5 7.75	5.42 11.07	0.223 TOPA5 0.27	Nil	Not detected <0.01 TOPA5 0.01	Nil
	PFOA	5.6	.07 TOPA5 0.27	Nil	0.01 TOPA5 <0.01	Nil	Not detected <0.01	Nil
Aquatic ecosystem protection 2	PFOS	0.00023	3.6 TOPA5 7.5	15,652 32,608	0.18 TOPA5 0.22	1,173 956	<0.01 TOPA5 0.01	43
	PFOA	19	.07 TOPA5 0.27	Nil	0.01 TOPA5 <0.01	Nil	Not detected <0.01	Nil
Protect high order avian fauna 3	PFOS	0.047	3.6 TOPA5 7.5	76.59 159.57	0.18 TOPA5 0.22	3.82 4.68	<0.01 TOPA 0.01	Nil
Protect high order mammalian predators 4	PFOS	0.0026	3.6 TOPA5 7.5	1,384.61 2,884.61	0.18 TOPA 5 0.22	69.23 84.61	< 0.01 TOPA5 0.01	4

Notes:

Note 1: The Commonwealth Department of Health has calculated recreational water quality values based on the latest FSANZ recommended tolerable daily intake levels for PFOS+PFHxS and PFOA for Australia

Note 2: Draft ANZECC water quality objectives for PFOS and PFOA, 99% species protection level to account for bioaccumulation

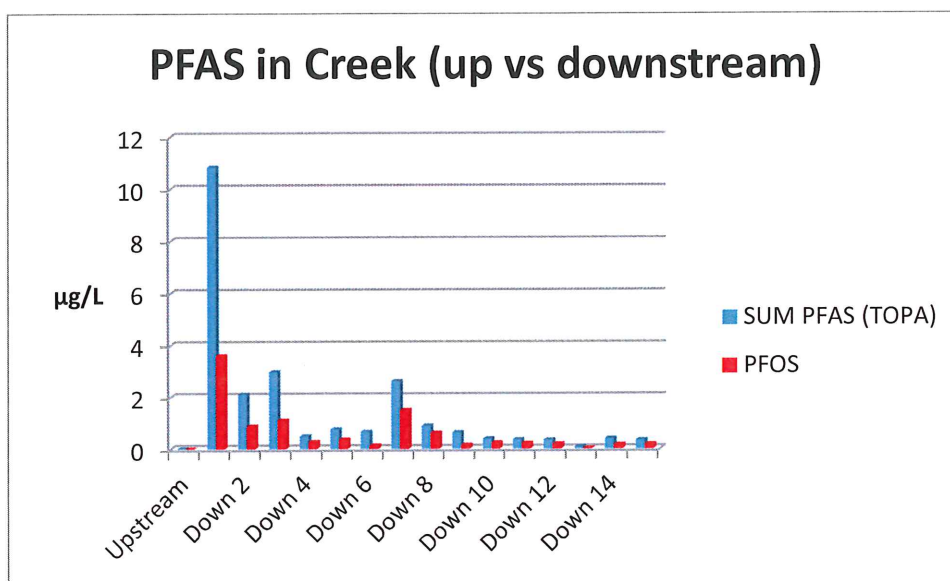
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Note 3: Guideline value calculated by Giesy et al 2010 Giesy, J. P. et.al. (2010) Aquatic Toxicology of Perfluorinated Chemicals in D.M. Whitacre (ed.), Reviews of Environmental Contamination and Toxicology, Reviews of Environmental Contamination and Toxicology 202, 1- 52. <http://www.usask.ca/toxicology/jgiesy/pdf/publications/JA-539.pdf>

Note 4: Guideline value for PFOS to protect against secondary poisoning Dutch RIVM 2010 Environmental risk limits for PFOS. A proposal for water quality standards in accordance with the Water Framework Directive. RIVM Report 601714013/2010.

Note 5: TOPA converts precursors to PFAS compounds not detected by the LMC/MS analytical method.

24. Concentrations of PFAS compounds at the upstream site (Lagoon Creek) is significantly below all downstream locations (up to 35 times to 1084 times higher than upstream concentrations)



25. The investigation concluded that PFAS contamination from the spill had travelled the entire length of the sampled waterway (down to Anzac Avenue), and the full extent of impacts to biota downstream of the spill are not considered to be fully delineated. PFAS was observed present upstream of the spill at SWUP1, SWUP2 and SWUP3, however all upstream locations were less than the PFOS + PFHxS at location SW15 at the downstream study extent (near Anzac Avenue).
26. Surface water results detected PFAS at concentrations above level of reporting (LOR) in all locations with concentrations generally decreasing with distance from the site. Whilst PFAS in all samples exceeded ecological guidelines, the PFAS signature in downstream locations was consistent with the signature of the spilt PFAS material.
27. The department considers that PFAS present in soil on Lot 111 on CP909626, Lot 535 on SP255151 and Lot 112 on CP867909, poses a risk of environmental harm from leaching of PFAS compounds. The clean-up notice issued by the department required soil remedial works to achieve the limits stated in Table 1 of that notice. Following excavation of impacted soil undertaken as part of the clean-up activities, PFAS was still detected in soils at Tox Free and the Qld Organics premises, and within the waterway flood areas.
28. The department considers that the risks of leaching of PFAS compounds from soil and impacted concrete to waters, including groundwater has not been addressed and further remediation and validation works are required.

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29. Further investigations are considered necessary to determine the extent of environmental harm to public safety, amenity and ecological health.

B. Requirements

The report on the environmental investigation must address the following relevant matters:

1. By 9 October 2017, you must engage suitably qualified person/s (SQP) to carry out the requirements of this notice.
2. By 31 October you must conduct interim monitoring comprising of a further round of sampling of surface waters and biota at each sampling locations selected for preparation of the Narangba incident – Investigation Report by Golder Associates dated 15 August 2017 and submit the results to the department.
3. By 16 October 2017, you must develop a monitoring plan to determine the nature and extent of environmental harm in downstream waters and provide a copy to the department. This plan must include the following:
 - (i) Provide for the carrying out of an additional round of monitoring of surface waters, groundwater, sediment and biota at the same sample locations used for the Narangba incident – Investigation Report by Golder Associates dated 15 August 2017;
 - (ii) Include additional sampling sites in a representative number of locations, (including but not limited to) upstream to the Bruce Highway and downstream extending at least downstream to Hays Inlet to the extent of the Houghton Highway Bridge (as shown on attached map); and
 - (iii) Be consented to by a Contaminated Land Auditor.
4. By 28 February 2018 you must ensure the SQP investigates and submits a report to the department that includes the following:
 - (a) The nature and extent of environmental harm (including potential harm) caused to receiving waters as a result of the contamination incident. This must include:
 - (i) The extent of PFAS contamination likely to have been caused by the release to water quality, biota, and sediments utilising techniques available to detect trace concentrations of PFAS in the environment;
 - (ii) The environmental harm and potential environmental harm caused to the freshwater and estuarine environmental values listed in Table 1;
 - (iii) The monitoring locations used to determine the extent of environmental harm must include representative locations upstream of the contamination incident, and downstream waters including Saltwater Creek and Hays Inlet.
 - (iv) Determination of PFAS concentrations in water, sediment and potentially affected biota at each of the sampling locations;
 - (v) Testing and analysis for the suite of 20 to 28 standard fluorinated organic compounds by liquid chromatography-mass spectrometry (LC/MS/MS) and total oxidisable precursor (TOP) assay, reported as the analyses for the resulting perfluorinated carboxylates for C4 to C14 carbon chain length (TOP C4-C14);

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- (vi) Where comparisons are to be made of PFAS sediment concentrations between locations, incorporate determination on the < 63 micron size fraction and organic carbon content to allow standardisation;
 - (vii) Use of portion sizes and trigger points to estimate risks of exceeding the tolerable daily intakes, portion sizes and trigger points recommended by FSANZ shall be utilised;
 - (viii) Include an analysis of the data collected in accordance with this requirement. All monitoring results must be produced and submitted to the department detailing the measures necessary to manage environmental and human risks, based on the results obtained under the monitoring program;
 - (ix) Screening of potential health risks associated with sediment data shall consider the following approaches:
 - screened for potential health risks of PFOS and PFHxS by using field-based biota-sediment bioaccumulation factors (Sediment BAF). These are obtained from studies that measure PFAS concentration in biota such as fish and the corresponding concentrations in the sediment. For example, if the concentration in fish is 100 units and that in the sediments 10 units, the sediment BAF is 10;
 - biota sediment accumulation factors for fish published by CRC CARE for PFAS;
 - use of paired (co-located) sediment and biota tissues from sessile organisms to calculate BAFs. Sessile organisms are preferred so that biota tissue concentrations of PFAS may be related to uptake from sediment concentrations. These BAFs can be used to make quantitative estimates of select PFAS levels in tissues of the same species from co-located sediment data. Potential health risks of consuming those organisms can be assessed based on estimated portion sizes of sessile organisms likely to be consumed by humans.
 - (x) Sampling and analysis of all environmental water must wherever practicable achieve the limits of reporting listed in Table 2.
- (b) Evaluation of extent of and risks posed by residual contaminants on Lot 112 on CP867909 and Lot 535 on SP255151:
- (i) ensuring compliance with quality control measures for contaminated site assessments prescribed in the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (NEPM);
 - (ii) evaluation of ecological and health risks as a result of residual PFAS leaching from soil and potential impacts to environmental values of surface waters and groundwater and risks to human and ecological health;
 - (iii) includes groundwater height data from groundwater bore(s) installed in the vicinity of the incident, characterisation of extent of vertical depth of soil contamination and lithology at the site and monitoring of groundwater quality for the current suite of 28 PFAS identifiable by LC/MSMS analysis both with and without digestion using the total oxidisable precursor assay; and
 - (iv) risks associated with leaching of contaminants from soils impacted by PFAS compounds.

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5. By 28 February 2018 you must submit to the department a critical review and assessment by a Contaminated Land Auditor.
6. In the event that environmental monitoring of receiving waters identifies a risk to public safety or human consumption of aquatic foodstuff, you must notify the department of the results and findings within 24 hours of becoming aware of the risk.
7. You must provide copies of laboratory analysis and tabulated data in electronic format to the department for surface water and biota within 5 days of receipt of those results.
8. Investigation and testing requirements
 - (a) All investigations are to be conducted in accordance with the Act, Water EPP, Queensland Water Quality Guidelines (2009) – see <http://www.ehp.qld.gov.au/water/pdf/water-quality-guidelines.pdf>, the Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009 Version 2 September 2010 see - <http://www.ehp.qld.gov.au/water/pdf/monitoring-man-2009-v2.pdf>, the National Environmental Protection (Assessment of Site Contamination) Measure 1999 – see <http://nepc.gov.au/nepms/assessment-site-contamination>, the Guidelines for Contaminated Land Professionals – see <http://www.ehp.qld.gov.au/licences-permits/contaminated-land/documents/guideline-contaminated-land-professionals.pdf> and the Tolerable Daily Intakes for PFOS, PFOA, and PFHxS recommended by Food Standards Australia New Zealand (FSANZ); The Canadian Federal Wildlife Guideline published by Environmental & Climate Change Canada, for PFOS screening to protect higher order mammalian and avian predators.
 - (b) Where TOP Assay is conducted, quality assurance checks must include that oxidant exhaustion has not occurred (e.g. reanalysis to determine presence of fluorotelomer);
 - (c) Wherever practical, all samples must be analysed by a NATA accredited laboratory;
 - (d) Biota samples must be analysed for TOPA; and
 - (e) Biota samples must include edible fish, prawns and crabs all of which would be targeted in areas open to fishing further downstream.

Definitions

'Suitably qualified person' (SQP) means

- (a) For assessment of land that is contaminated or is suspected of being contaminated, the person must be a SQP pursuant to Section 549 of the Act; and
- (b) a person or persons who has demonstrated professional qualifications, training, skills or experience relevant to PFAS and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.

'contaminated land auditor' means an auditor approved for a contaminated land investigation document under section 567 of the Act, who has relevant experience in PFAS that the report prepared by the SQP is in accordance with and meets the criteria listed in this notice.

'waters' includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial water course, ben and bank of any waters, dams, non tidal, or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater runoff, and groundwater and any part thereof.

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The environmental report must be submitted to the department on or before:

- **28 February 2018**

As the recipient of this notice, you are also required to provide a statutory declaration in the form attached, to accompany the environmental report submitted to the department. The auditor OR suitably qualified person who prepares the environmental report must also provide a statutory declaration in the form attached to accompany the environmental report submitted to the department.

You can view an electronic version of the statutory declaration for a recipient using the following search term ([ESR/2016/1997](#)).¹

An electronic version of the statutory declaration for a suitably qualified person form is available using the search term ([ESR/2016/2266](#)).

Take notice:

1. the requirements of the notice to conduct or commission an environmental investigation take effect immediately upon service of this notice;
2. this notice remains in force until further notice from the department; and
3. you are responsible for meeting the costs of conducting or commissioning the environmental evaluation, preparing the environmental report and providing any further information as requested by the department.

C. Reviews and appeals

The provisions regarding reviews of decisions and appeals are found in sections 519 to 539 of the Act.

A person who is dissatisfied with certain decisions of the department, may be able to apply to have the department review that original decision.

Generally, a request to have a decision reviewed must be made:

- within 10 business days of the decision being notified to the person;
- be supported by enough information to enable the department to decide the application for review; and
- be made using the application for review of an original decision form ([ESR/2015/1573](#)).

Where an application has been made for a decision to be reviewed, the applicant may also apply to the relevant court for a stay of the decision to secure the effectiveness of the review.

Once the original decision has been reviewed, a person who is dissatisfied with the review decision may be able to appeal against that decision to the relevant court within 22 business days after receiving notice of the review decision.

A person whose interests are or would be adversely affected by a decision of the department may also be able to request a statement of reasons for a decision or a statutory order review under the *Judicial Review Act 1991*.

For further information about reviews and appeals see the:

¹ This is the publication number. The publication number can be used as a search term to find the latest version of a publication at <www.ehp.qld.gov.au>.

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- Information sheet - internal review and appeal to the Planning and Environment Court ([ESR/2015/1572](#)).

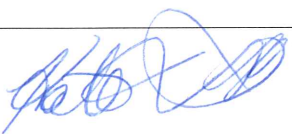
You may have other legal rights or obligations and should seek your own legal advice.

D. Penalty

Failure to comply with a notice to conduct or commission an environmental evaluation is an offence.

- The maximum penalty for an individual is 300 penalty units, totalling \$37,845 and the maximum penalty for a corporation is 1500 penalty units, totalling \$189,225.

Should you have any queries in relation to this notice, please contact Leonie Clough of the department on telephone number 07 5316 8410.



Signature

27 September 2017

Date

Kate Harbert
 Compliance Manager
 Delegate of the Chief Executive
 Department of Environment and Heritage Protection
Environmental Protection Act 1994

Enquiries:

Environmental Services and Regulation
 Department of Environment and Heritage Protection
 33 King Street, Caboolture QLD 4510
 Ph: (07) 5316 8402
 Email: ESCompliance-BrisbaneMoreton@ehp.qld.go.au

Attachments

Table 1 - Environmental values

Map of study extent

Table 2 - Limit of reporting requirements for water samples taken from fresh and marine environmental waters

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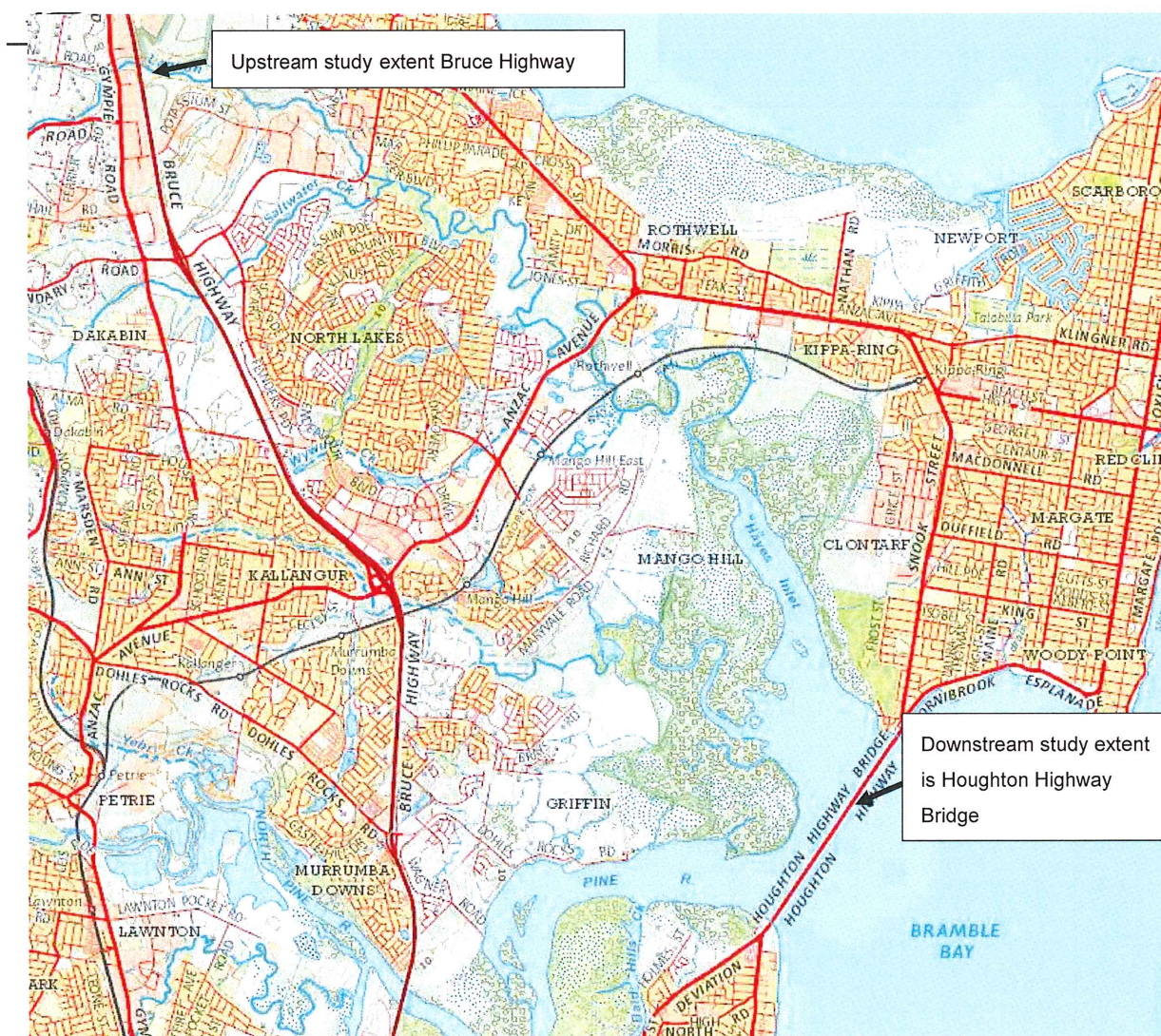
Table 1 –Environmental values

• Environmental value	• Effect types and criteria and/or approaches needed to protect environmental values
• Ecological health	<ul style="list-style-type: none"> • Potential adverse effects of chronic and acute toxicity to aquatic and terrestrial flora and fauna due to toxicity of PFAS compounds. The wetland to the north of Potassium Street is essential habitat for the wallum froglet (acid frog) and the koala. • Secondary poisoning of higher trophic level organisms e.g. higher level predators such as fish and dolphins due to due to high persistence and bioaccumulation characteristics of PFAS compounds. • Secondary poisoning of terrestrial fauna that consumes aquatic fauna e.g. high level avian predators, water rats.
• Public amenity	<ul style="list-style-type: none"> • Adverse effects on amenity of locality from pollution of areas enjoyed by the public
• Public safety	<ul style="list-style-type: none"> • Potential adverse effects on public health by increasing doses of PFAS compounds which contribute to persons accumulating persistent PFAS compounds in their bodies and where such compounds are not biologically required in the human body and the health effects of which are currently uncertain. • There is potential for exceedance in exposed persons of tolerable daily intakes values (TDI) for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) [or homologous PFAS substances] developed by the Food Standards Australia New Zealand (FSANZ) • Potential exposures include: <ul style="list-style-type: none"> • Contact with contaminated sediment, including incidental ingestion by children • Potential reuse of treated sewage effluent • Potential reuse of biosolids • Recreational and other uses of affected waters • Suitability for human consumption of aquatic food stuff
• Protection of an aquatic ecosystem	<ul style="list-style-type: none"> • Ecological health of an aquatic ecosystem – protect against chronic and acute toxic effects due to toxicity of PFAS compounds, including due to bioaccumulation • Ecological health of an aquatic ecosystem – protect against bio-accumulation in non-air breathing organisms e.g. higher level predators, sharks and rays • Ecological health of an aquatic ecosystem – protect against bio-accumulation in air breathing organisms e.g. water rats, birds, dolphins, turtles, dugong • Ecological health of benthic flora and fauna from effects of bioaccumulation of PFAS adsorbed to sediments and in pore water
• Suitability for recreation	<ul style="list-style-type: none"> • Use of water for recreation e.g. wading, swimming, boating
• Suitability for aquaculture	<ul style="list-style-type: none"> • Use to culture aquatic foods e.g. fish, crustaceans without breaching food standards due to bioaccumulation of PFAS

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	<ul style="list-style-type: none"> • Use to culture aquatic foods e.g. fish, crustaceans without causing ill-health in culture organisms, including brood stock due to PFAS toxicity
<ul style="list-style-type: none"> • Suitability for human consumer 	<ul style="list-style-type: none"> • Suitability to grow organisms in aquatic environments for wild harvest for human consumption, including benthic organisms exposed to sediments - Potential adverse effects on concentration of PFAS compounds in aquatic organisms used as for food (including commercial and recreational) • Environmental harm includes the that causes actual or potential loss or damage to property, namely actual or potential loss to commercial fisherman in the receiving environment
<ul style="list-style-type: none"> • Cultural and spiritual use 	<ul style="list-style-type: none"> • Any potential impact on species of special cultural significance

Map of Study Extent



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Table 2 – Limit of reporting requirements for water samples taken from fresh and marine environmental waters (see Notes)

Perfluoroalkyl and Polyfluoroalkyl Substances	Required Limit of Reporting µg/L
<i>Perfluoroalkyl Sulfonic Acids</i>	
Perfluorobutane sulfonic acid (PFBS)	0.0005
Perfluoropentane sulfonic acid (PFPeS)	0.0005
Perfluorohexane sulfonic acid (PFHxS)	0.0005
Perfluoroheptane sulfonic acid (PFHpS)	0.0005
Perfluorooctane sulfonic acid (PFOS)	0.0003
Perfluorodecane sulfonic acid (PFDS)	0.0005
<i>Perfluoroalkyl Carboxylic Acids</i>	
Perfluorobutanoic acid (PFBA)	0.002
Perfluoropentanoic acid (PFPeA)	0.0005
Perfluorohexanoic acid (PFHxA)	0.0005
Perfluoroheptanoic acid (PFHpA)	0.0005
Perfluorooctanoic acid (PFOA)	0.0005
Perfluorononanoic acid (PFNA)	0.0005
Perfluorodecanoic acid (PFDA)	0.0005
Perfluoroundecanoic acid (PFUnDA)	0.0005
Perfluorododecanoic acid (PFDoDA)	0.0005
Perfluorotridecanoic acid (PFTrDA)	0.0005
Perfluorotetradecanoic acid (PFTeDA)	0.0005
<i>Perfluoroalkyl Sulfonamides</i>	
Perfluorooctane sulfonamide (FOSA)	0.001
N-Methyl perfluorooctane sulfonamide (MeFOSA)	0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	0.001
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	0.001
<i>Fluorotelomer Sulfonic Acids</i>	
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	0.001
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	0.001
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	0.001

Notes: Does not apply to waste water samples. LOR for TOPA analysis may need to be adjusted for some samples due to matrix effects and degree/nature of any precursor presence.