Horowhenua District Council –Review notice associated with Permits for the Levin landfill

Water Quality Conferencing Notes from the 25th August 2016

Attendees:

Logan Brown (LB)	Horizons Regional Council, Freshwater and Partnerships Manager
Kate McArthur (KM)	Practice Leader – Water Quality, The Catalyst Group on behalf of Levin Landfill Neighbourhood Liaison Group
Olivier Ausseil (OA)	Principal Scientist Aquanet Consulting Ltd

All experts **agree** the following unless specifically noted:

This JWS has been prepared following an agreement to use the most relevant and recent datasets.

Signatures:

Logan Brown	Kate McArthur	Dr Olivier Ausseil

The following questions were generated during the Whakawatea Forum held on the 26th July and 2nd August 2016. The relevant water quality experts were asked to address the following questions and to confirm, in a written joint statement, the matters on which they agree and those on which they do not agree in answer to the questions.
In what follows, questions are in **bold**. Responses are agreed by all experts unless specified, in which case the initials of the expert(s) agreeing with specific statement are included at the start or the end (in brackets) of the statement.

1. **What are the likely sources and flow paths of leachate from the landfill (that is from all parts of the landfill: the old capped area and the current operating landfill)?**

a) Current landfill:

Working on the assumption that the current lining is intact (including the landfill and the storage pond) these are probably not contributing sources.

b) Closed landfill:

The closed landfill is unlined (but capped with a clay layer reducing the infiltration from surface run-off). No surface water pathway(s) between the closed landfill and the Tatana Drain were able to be identified (based on site visit).
Water quality results in the Tatana Drain and in monitoring bore nearby the Tatana Drain (high ammonia, high chloride) clearly indicate the presence of leachate in the Tatana Drain.

Therefore the most likely pathway for the leachate into the Tatana Drain is via shallow groundwater. The Tatana Drain is hydrologically connected (flows into) the Hokio Stream.
It is also possible that some leachate will reach the Hokio Stream via groundwater not intercepted by the Tatana Drain. We understand the general direction of shallow groundwater is to the North-Northwest. The Reach of the Hokio Stream receiving leachate via shallow groundwater would need to be assessed/confirmed by a groundwater specialist. This is relevant to determining whether the locations of the surface water monitoring sites on the Hokio Stream (HS1, HS2 and HS3) are adequate.

An additional pathway for the leachate is via deep groundwater. Our understanding is that the deep groundwater flows toward the coast. Whether any leachate actually reaches deep groundwater and what the effects/risks are would need to be determined by a groundwater expert.

2. **What are the constituents of leachate that are of concern in terms of:**

The composition of the leachate and the presence of specific contaminants of concern will depend on what refuse/waste went into the landfill. We do not know the nature of the waste that was disposed of in the landfill, so cannot exclude the presence of any particular contaminant.
Key components or markers of the presence of leachate include elevated chloride, ammonia and BOD/COD concentrations.
The presence of specific contaminants should be assessed on the basis of monitoring data.

a) Human health?

A wide range of microbiological, organic and inorganic contaminants that may be found in landfill leachate are of potential concern to human health. Appendix 1 contains tables for human health parameters in relation to drinking water as for the Drinking Water Standards for New Zealand 2005 (Revised 2008).
The other part of human health is contact recreation standards which are based on microbiological parameters, using *E.coli* as an indicator.

b) Ecosystem health?

Appendix 2 shows the One Plan targets that we consider relevant to leachate (note this refers to the ANZECC "Aquatic Ecosystem" guidelines).
Note that the other One Plan Schedule E water quality targets are also relevant to the receiving water, such as dissolved oxygen saturation, macroinvertebrate community index, and quantitative macroinvertebrate community index. In addition the NPSFM (2014) attributes for ammonia, nitrate toxicity, and dissolved oxygen concentration may need to be considered.

c) Flora and fauna and the habitats of fauna?

Captured in b above.

d) Whitebait, shellfish and the food chain generally?

Captured under a and b. Note that avoidance levels for toxicants where known need to be considered in relation to inward migration of whitebait.

3. **Is the current landfill monitoring regime capable of detecting these constituents of concern?**

The monitoring programme includes quarterly water quality sampling of groundwater and surface water (3 sites on the Hokio Stream).

Water samples are generally analysed for:

- General physico chemical parameters, including major ions (pH, temperature, suspended solids, alkalinity, conductivity, chloride, sulphate, Hardness, calcium, magnesium, potassium, sodium)
- Ammoniacal nitrogen, nitrate-N, dissolved reactive phosphorus
- Metals/metalloids: aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc
- Microbiological water quality indicator: faecal coliforms

As detailed in response to question 26, we have not been able to confirm whether any analytical results relative to organic microcontaminants (e.g. pesticides, PAHs, PCBs) are available. We suggest that organic contaminants (SVOCs, VOCs) should be analysed on an annual basis in water samples from bores known to intercept leachate from the landfill (e.g. BHC2, B1, B2, B3) to understand the risk of these contaminants being present (and at what concentrations) in the discharge.
Mercury should also be added to the list of metals analysed for in GW and SW samples.
Analytical results for metals should be provided in dissolved concentrations in surface water samples, and as Total concentrations in groundwater samples.

The adequacy of location and frequency of the groundwater monitoring programme should be assessed by a groundwater expert.

In terms of surface water sampling:

- As described (in response to question 1b above) the location of the surface water monitoring sites needs to be confirmed on the basis of advice from a groundwater expert;
- The current monitoring frequency is quarterly (four times per year), since 1994, which provides a sizeable dataset on which to assess the potential effects on the Hokio Stream;
- Advice from a groundwater scientist would be useful to understand whether there is a variability in the amount/location of groundwater reaching the Hokio Stream that may not be captured by quarterly sampling. This will enable better targeting monitoring and analysis of the results.
- In the current situation (where leachate is present in the Tatana Drain), we also recommend the addition of a surface water monitoring site in the Tatana Drain (Southeast corner of the drain) for same frequency and parameters as the Hokio Stream monitoring sites.

The microbiological water quality indicator currently measured is Faecal coliforms. We recommend that *Escherichia coli* (*E. coli*) be analysed instead in the future to ensure consistency with One Plan targets, drinking water standards, and microbiological water quality guidelines for recreational waters.

The current monitoring has no requirements to monitor biological communities within the Hokio Stream/Tatana Drain so the current monitoring regime won't detect effects on these systems. Biological monitoring is not required in the drain.

KM recommends that biological monitoring be undertaken in the Hokio Stream, following advice from a groundwater expert on suitable upstream and downstream monitoring locations, depending on suitability and safety of sites.

LB, OA: The need for biological communities monitoring in the Hokio Stream should be assessed following:

1. confirmation of suitable upstream/ downstream monitoring locations based on GW expert advice;
2. water quality monitoring at these locations
3. An analysis of the risk of effects based on water quality monitoring results.

4. **What is the likely impact of Horizons RC's proposed Condition 2A?**

a) What further on-site works or changes to landfill systems or infrastructure would be required to comply with the condition?

Proposed condition 2A states "Within six months of the commencement date of the decision of the 2015 review of conditions, the consent holder shall cease the discharge of landfill leachate to the Tatana Drain"

On this basis the discharge to the Tatana Drain would need to cease completely. We are not able to comment on whether this is achievable or not or what solution(s) could be developed - this would require a groundwater expert and design engineer with experience in this area to provide advice and assessment of effectiveness of any solution.

b) What will be the environmental outcome of implementing Condition 2A?

Assuming the leachate is effectively diverted from the Tatana Drain, then the surface water pathway of the leachate into the Hokio Stream will effectively be eliminated or reduced. The contaminant loads to the Hokio Stream particularly with respect to BOD and ammonia will be reduced, noting however that some leachate may still reach the Hokio Stream via shallow groundwater (advice from a groundwater expert required here).

In the event this is undertaken, water quality monitoring in the Hokio Stream and Tatana Drain may still be needed to assess the effectiveness of any remedial measures.

5. **What monitoring or other work would be required to characterise the sources and flow paths of leachate from the landfill site (or, alternatively, is there sufficient information available to do so)?**

As explained above, the groundwater pathways need to be assessed by a groundwater expert. There is clearly a direct surface water pathway from the Tatana Drain into the Hokio Stream.

6. **What is the likely impact of the deposition of drain diggings generated by the creation of the Tatana Drain and the use of the Tatana Drain itself on groundwater and surface water quality?**

We cannot assess the effects from the deposition of the drain diggings from the Tatana Drain as this would require information on the contaminant characteristics of the diggings.

We would expect some contamination of the drain from surrounding land use (including agriculture and wildfowl use) including *E.coli*, ammonia, and/or nitrate, total nitrogen, DRP, total phosphorus, and suspended sediment. In our experience the concentrations seen in similar drains especially for ammonia and BOD are significantly lower than those seen in the Tatana Drain (evidence of presence of leachate).

7. **What is the interaction between groundwater beneath the landfill and the Hokio Stream (and this question should explicitly address the interaction of landfill leachate that is potentially present in the groundwater and the Hokio Stream)?**

Refer to question 1b.

Groundwater pathway should be assessed by a groundwater expert using contaminant transport modelling.

8. **What is the interaction between groundwater beneath and immediately adjacent to the landfill and down-gradient groundwater, including down-gradient groundwater and aquifers beneath Hokio Beach residential properties that could potentially be sources of drinking water?**

Refer to question 1b.

Groundwater pathway should be assessed by a groundwater expert using contaminant transport modelling.

9. **What is the potential for leachate from the landfill to enter groundwater or aquifers that are used for human drinking water supply?**

   Refer to question 1b.

   Groundwater pathway should be assessed by a groundwater expert using contaminant transport modelling.

10. **What is the potential for heavy metals (for example, but not exclusively, cadmium and mercury) from electronic waste in the landfill to emerge in future leachate from the landfill?**

    All landfill leachate has the potential to contain metals or metalloids depending on the nature of the refuse.
    Existing groundwater quality data in bores known to contain some leachate from the closed landfill (e.g. C2, B1, B2 B3) should be analysed to assess the actual presence/concentrations of these contaminants and the risk of their release in the environment.
    Mercury should be added to the metals analysed for in GW samples.

11. **What would be the indicators of contamination from e-waste in the landfill leachate contaminant profile (i.e. how would one monitor/measure for e-waste contamination in the future)?**

    As above – primarily metals and metalloids.

12. **What are the appropriate locations for monitoring the presence of landfill leachate in:**

    a) **The groundwater (including groundwater near the coast and coastal Hokio Beach settlement);**

    This question would be more appropriate for a groundwater expert.
    OA the method used by the GW expert to provide the advice is for the GW expert to determine.
    KM/LB: The assessment should preferably use a groundwater contaminant transport model.

    b) **The Hokio Stream;**

    See question 1b.

    c) **The Tatana Drain (if this drain is to be retained).**

    See question 3: SE corner unless advice provided by GW expert suggest a better alternative location.

13. **What are the appropriate limits or standards for water quality in the Hokio Stream (bearing in mind the One Plan objectives, policies and Scheduled values for this catchment)?**

    The Hokio Stream is a natural stream, and in our opinion, One Plan Schedule E targets including the ANZECC toxicants (refer Appendix 4) should apply.

The question of whether the One Plan targets should apply to the Tatana Drain will depend on whether it is a natural (including modified) watercourse or not.
Based on local landform, it is likely that the flats bounded by the sand dunes to the north and south would have historically formed part of a floodplain/wetland complex.
Aerial photographs of the landfill and paddock in which the Tatana Drain currently is, dating back 1942 were examined. The photographs indicate that the area which now forms the Tatana paddock was drained (various artificial drains in various locations/directions) towards the road/Hokio Stream. (all agree)

OA There is no clear evidence of a surface stream within the paddock on the older photographs. On that basis, the conclusion is that the Tatana Drain is an artificial watercourse (OA).

LB agrees that the drain is not a natural water course, but is rather a modified watercourse as outlined in his s42A report.

KM agrees that the drain is not a natural watercourse and that photographs examined on the day of conferencing did not clearly show a surface stream. However, the photo circulated by LB from his s42A report shows some evidence of what appears to be a former flow path that may have resulted from stream flow at the base of the dunes, or alternatively could be a former flow path of the Hokio Stream. It is unclear whether Tatana Drain is a modified or artificial watercourse, based on the available evidence.

14. **What are the alternative and best practice methods for addressing landfill leachate?**

A question more appropriately directed to a solid waste engineer.

15. **In terms of RMA section 105, how would the experts characterise the sensitivity of the Hokio Stream and groundwater receiving environments?**

Refer to the identified values in Appendix 3 taken from the One Plan Schedule B. Also need to consider the SOS-A values upstream (Patiki Stream) and the requirement for migratory fish to move freely between the coast and the lake and tributaries. Some migratory native fish species found upstream in the catchment (tributaries of and wetland margins of lake Horowhenua) have threat classification (giant kokopu, longfin eel, inanga – declining). Juvenile migratory fish e.g. elvers/ whitebait) are generally particularly sensitive to contaminants. If juveniles were subject to significant adverse effects, this would have the potential to have flow on effects on population dynamics.

As the Hokio Stream is a coastal dune lake outflow, it has high potential for indigenous biodiversity. Dune lake systems are regionally and nationally rare and internationally vulnerable (KM: Ramsar Convention Secretariat, 2010; Dudgeon et al. 2006).

The Hokio Stream and estuary and the coastal environment are sensitive to the range of contaminants potentially present in landfill leachate. Some of these contaminants are persistent in sediment and/or can accumulate.
Ammonia can be toxic to fish, insects and molluscs. Freshwater mussels are particularly sensitive to ammonia toxicity.
Organic loads (measured as BOD COD) can cause oxygen depletion.

Whether any adverse effects actually occur will depend on the presence and concentration of the contaminants in the receiving environment.

16. **What are the projected leachate contaminant concentrations and volumes of leachate over the long term likely to be generated from all parts of the landfill (i.e. including the old capped landfill and the current operating landfill)?**

Outside our field of expertise to answer this question.

17. **What, therefore, are the potential adverse effects on down-gradient groundwater and on the Hokio Stream?**

Effects on groundwater are outside our field of expertise, and should be covered by a groundwater expert.

With regards to the Hokio Stream, potential effects include:

- Effects on contact recreation, and human health in the Hokio Stream
- Effects on ecosystem health as described above.

Whether any adverse effects actually occur will depend on the presence and concentration of the contaminants in the receiving environment.

Given experience in determining effects on tangata whenua values for freshwater, Ms McArthur adds that adverse effects on mauri (identified within Schedule E of the One Plan) are also likely as a result of the discharge[1].

18. **How does that potential environmental outcome (under 17 above) align with the One Plan objectives, policies and Scheduled values for this water management unit?**

This is a planning question, therefore mostly outside our field of expertise.
Whether the effects of the activity are consistent with One Plan objectives, policies and scheduled values will depend on nature and scale of <u>actual</u> effects. The above question deals with <u>potential</u> effects.

19. **What would be required to effectively intercept surface water and groundwater from the landfill site so as to comprehensively intercept, capture and divert leachate for treatment?**

It is our opinion that total capture of leachate is not possible. Determining the most effective method for capture is a matter for a suitably qualified engineering expert.

20. **What would be the order of cost of the work required under 19 above?**

Outside our field of expertise to answer this question.

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[1] Ms McArthur is happy to qualify her experience in matters of cultural values for freshwater before a hearing panel for this matter, this is an area within Ms McArthur's expertise in her opinion

21. **What difference is there, in terms of impacts from landfill leachate present in either groundwater or in the Hokio Stream, for children as opposed to adults?**

    Generally children are more sensitive to contaminants than adults because they are smaller and are in a growth/development stage. Some drinking water and/or contact recreation standards take this into account; others do not, depending on how they have been developed and data available at the time they were developed. This is also relevant to immuno-compromised individuals. This is an area of public health expertise and is beyond our ability to comment further.

22. **What effects would HDC's proposed in-stream and riparian planting of the Tatana Drain have in treating run-off of leachate from the landfill site?**

    Wetlands are generally not effective at reducing concentrations of ammoniacal nitrogen. They can provide some removal of solids and metals.
    Design of the wetland is important to ensure treatment.
    We understand the proposed design involves the planting of the margins of the drain. If this is correct, in our opinion there is likely to be very little treatment benefit unless the planted wetland intercepts the full flow of the leachate under all flow conditions, has a long residence time to reduce soluble contaminants and is correctly planted and maintained. Even then, benefits can be marginal at times when growth is low.

23. **In the Hokio Stream, what opportunities are there for 'biodiversity offset' type improvements to be made to improve water quality?**

    Actual effects need to be adequately described/understood first. Due to the sensitivity and uniqueness of the receiving environment (Hokio Stream), should effects requiring avoidance, remediation or mitigation be identified then we think opportunities to address the effects should be examined first before considering biodiversity offset.

    Given the contaminants of concern, and the sensitivity of the receiving environment a biodiversity offset is inappropriate (KM, LB).

24. **What facilities are available to HDC to treat all or any of the leachate from the landfill?**

    For HDC to answer.

25. **What is the treatment train for leachate treated via HDC's treatment facility?**

    We understand the leachate from the active landfill site is treated through the Levin Sewage Plant and discharged to land via the 'pot' (spray irrigation to pine forest plantation). We are not familiar with the treatment process and the effectiveness of the sewage plant. However, we know the ultimate discharge environment is the land adjacent to the Waiwiri Stream outflow from Lake Papaitonga, and therefore is of a similar sensitivity to that of the Hokio Stream.

26. **Has the historical groundwater monitoring included testing to determine the presence of organic toxins and agrichemicals such as dieldrin, 24D, 24T, DDT, 'PCBs' and 'POPs'?**

    Most of these contaminants are covered by the pesticide/SVOC testing required by conditions of consent. However, we are unaware if this monitoring requirement has ever been triggered, given the nature of the wording of the consent condition (Tables A and B) which makes pesticide testing conditional on indicator parameters showing an influence of leachate over 3 consecutive sampling rounds in groundwater bores (see Q28 below). If this monitoring (particularly SVOCs) has not been undertaken, we recommend it is (refer to question 3 above).

27. **What does the historical groundwater monitoring data tell us about the presence of the above chemicals of concern?**

    We are unsure of whether this monitoring has been triggered or not.

28. **Tables 'A' and 'B' in Condition 3 of Discharge Permit 6010 set out the groundwater monitoring locations, parameters and frequency for deep and shallow aquifer monitoring wells: Are the locations, parameters and frequency specified in Tables 'A' and 'B' sufficient to identify the presence of the chemicals of concern identified in question (a) above?**

    The conditional requirement potentially means that pesticide monitoring is never required to be undertaken (see above). An annual requirement for testing down gradient bores for the presence of pesticides/SVOCs would be appropriate and we would look for advice from a groundwater expert as to which bores are tested and whether annual monitoring is considered adequate.

29. **Table 'E' in Condition 3 of Discharge Permit 6010 defines the 'Comprehensive Analysis List': At what frequency should the monitoring of the parameters on that Comprehensive Analysis List be undertaken?**

    See Question 3 above.

Appendix 1

Table 2.1: Maximum acceptable values for microbial determinands

Micro-organism	Maximum acceptable value[1]
Escherichia coli[2]	Less than one in 100 mL of sample[3]
viruses	No values have been set due to lack of reliable evidence
total pathogenic protozoa	Less than one infectious (oo)cyst per 100 L of sample[4]

Table 2.2: Maximum acceptable values for inorganic determinands of health significance

Name	MAV (mg/L)	Remarks
antimony	0.02	
arsenic	0.01	For excess lifetime skin cancer risk of 6 x 10^{-4}. PMAV, because of analytical difficulties
barium	0.7	
boron[1]	1.4	
bromate	0.01	For excess lifetime cancer risk of 7 x 10^{-5}. PMAV
cadmium	0.004	
chlorate	0.8	PMAV. Disinfection must never be compromised. DBP (chlorine dioxide)
chlorine	5	Free available chlorine expressed in mg/L as Cl_2. ATO. Disinfection must never be compromised
chlorite	0.8	Expressed in mg/L as ClO_2. PMAV. Disinfection must never be compromised. DBP (chlorine dioxide)
chromium	0.05	PMAV. Total. Limited information on health effects
copper	2	ATO
cyanide	0.6	Total cyanides, short-term only
cyanogen chloride	0.4	Expressed in mg/L as CN total. DBP (chloramination)
fluoride[2]	1.5	
lead	0.01	
manganese	0.4	ATO
mercury	0.007	Inorganic mercury
molybdenum	0.07	
monochloramine	3	DBP (chlorination)
nickel	0.08	
nitrate, short-term[3]	50	Expressed in mg/L as NO_3. The sum of the ratio of the concentrations of nitrate and nitrite to each of their respective MAVs must not exceed one
nitrite, long-term	0.2	Expressed in mg/L as NO_2. PMAV (long term)
nitrite, short-term[3]	3	Expressed in mg/L as NO_2. The sum of the ratio of the concentrations of nitrate and nitrite to each of their respective MAVs must not exceed one

selenium	0.01	
uranium	0.02	PMAV

Notes:

1. The WHO guideline value (provisional) is 0.5 mg/L.
2. For oral health reasons, the Ministry of Health recommends that the fluoride content for drinking-water in New Zealand be in the range of 0.7–1.0 mg/L; this is *not* a MAV.
3. Now short-term only. The short-term exposure MAVs for nitrate and nitrite have been established to protect against methaemoglobinaemia in bottle-fed infants.
4. For information about determinands of possible health significance but which do not have a MAV, refer to the datasheets in the Guidelines.

Table 2.3: Maximum acceptable values for organic determinands of health significance (including cyanotoxins and pesticides)

Name	MAV (mg/L)	Remarks
acrylamide	0.0005	For excess lifetime cancer risk of 10^{-5}
alachlor	0.02	Pesticide. For excess lifetime cancer risk of 10^{-5}
aldicarb	0.01	Pesticide
aldrin + dieldrin	0.00004	Pesticide. The sum of, not each
anatoxin-a	0.006	Cyanotoxin. PMAV
anatoxin-a(s)	0.001	Cyanotoxin. PMAV
atrazine	0.002	Pesticide. Cumulative for atrazine and congeners
azinphos methyl	0.004	Pesticide. PMAV
benzene	0.01	For excess lifetime cancer risk of 10^{-5}
benzo(α)pyrene	0.0007	For excess lifetime cancer risk of 10^{-5}
bromacil	0.4	Pesticide. PMAV.
bromodichloromethane	0.06	For excess lifetime cancer risk of 10^{-5}. THM
bromoform	0.1	THM
carbofuran	0.008	Pesticide
carbon tetrachloride	0.005	
chlordane	0.0002	Pesticide
chloroform	0.4	THM
chlorotoluron	0.04	Pesticide
chlorpyriphos	0.04	Pesticide
cyanazine	0.0007	Pesticide
cylindrospermopsin	0.001	Cyanotoxin. PMAV
2,4-D	0.04	Pesticide
2,4-DB	0.1	Pesticide
DDT + isomers	0.001	Pesticide. Sum of all isomers
di(2-ethylhexyl)phthalate	0.009	
1,2-dibromo-3-chloropropane	0.001	Pesticide. For excess lifetime cancer risk of 10^{-5}
dibromoacetonitrile	0.08	DBP (chlorination)
dibromochloromethane	0.15	THM
1,2-dibromoethane	0.0004	Pesticide. PMAV, for excess lifetime cancer risk of 10^{-5}
dichloroacetic acid	0.05	PMAV. DBP (chlorination)
dichloroacetonitrile	0.02	PMAV. DBP (chlorination)
1,2-dichlorobenzene	1.5	ATO
1,4-dichlorobenzene	0.4	ATO
1,2-dichloroethane	0.03	For excess lifetime cancer risk of 10^{-5}
1,2-dichloroethene	0.06	Total of cis and trans isomers
dichloromethane	0.02	
1,2-dichloropropane	0.05	Pesticide. PMAV
1,3-dichloropropene	0.02	Pesticide. Total of cis and trans isomers. For excess lifetime

Name	MAV (mg/L)	Remarks
		cancer risk of 10^{-5}
dichlorprop	0.1	Pesticide
dimethoate	0.008	Pesticide
1,4-dioxane	0.05	For excess lifetime cancer risk of 10^{-5}
diuron	0.02	Pesticide. PMAV
EDTA (editic acid)	0.7	
endrin	0.001	Pesticide
epichlorohydrin	0.0005	PMAV
ethylbenzene	0.3	ATO
fenoprop	0.01	Pesticide
hexachlorobutadiene	0.0007	
hexazinone	0.4	Pesticide. PMAV
homoanatoxin-a	0.002	Cyanotoxin. PMAV
isoproturon	0.01	Pesticide
lindane	0.002	Pesticide
MCPA	0.002	Pesticide
mecoprop	0.01	Pesticide
metalaxyl	0.1	Pesticide. PMAV
methoxychlor	0.02	Pesticide
metolachlor	0.01	Pesticide
metribuzin	0.07	Pesticide. PMAV
microcystins	0.001	Cyanotoxin. PMAV. Expressed as MC-LR toxicity equivalents
molinate	0.007	Pesticide
monochloroacetic acid	0.02	DBP (chlorination)
nitrilotriacetic acid (NTA)	0.2	
nodularin	0.001	Cyanotoxin. PMAV
oryzalin	0.4	Pesticide. PMAV
oxadiazon	0.2	Pesticide. PMAV
pendimethalin	0.02	Pesticide
pentachlorophenol	0.009	Pesticide. PMAV
picloram	0.2	Pesticide. PMAV
pirimiphos methyl	0.1	Pesticide. PMAV
primisulfuron methyl	0.9	Pesticide. PMAV
procymidone	0.7	Pesticide. PMAV
propazine	0.07	Pesticide. PMAV
pyriproxifen	0.4	Pesticide
saxitoxins	0.003	Cyanotoxin. Expressed as STX eq. PMAV
simazine	0.002	Pesticide
styrene	0.03	ATO
2,4,5-T	0.01	Pesticide

Name	MAV (mg/L)	Remarks
terbacil	0.04	Pesticide. PMAV.
terbuthylazine	0.008	Pesticide
tetrachloroethene	0.05	
thiabendazole	0.4	Pesticide. PMAV
toluene	0.8	ATO
trichloroacetic acid	0.2	DBP (chlorination)
trichloroethene	0.02	PMAV
2,4,6-trichlorophenol	0.2	For excess lifetime cancer risk of 10^{-5}. ATO
triclopyr	0.1	Pesticide. PMAV
trifluralin	0.03	Pesticide. Technical grade may contain carcinogens
trihalomethanes (THMs)		The sum of the ratio of the concentration of each THM to its respective MAV must not exceed one. The individual members of this group are indicated in the table as THM
vinyl chloride	0.0003	For excess lifetime cancer risk of 10^{-5}
xylenes (total)	0.6	ATO
1080	0.0035	Pesticide. PMAV

Notes:

1. Abbreviations are explained in section 2.4.
2. For information about determinands of possible health significance but which do not have a MAV, refer to the datasheets in the Guidelines.

Table 2.4: Maximum acceptable values in Becquerel per litre for radiological determinands

Radioactive constituents	MAV	Unit
total alpha activity	0.10	Bq/L excluding radon
total beta activity	0.50	Bq/L excluding potassium-40
radon	100	Bq/L

2.4 Abbreviations used in Tables 2.1–2.5

The following abbreviations are used in Tables 2.1–2.5.

ATO Concentrations of the substance at or below the health-based guideline value that may affect the water's appearance, taste or odour, see Table 2.5

DBP Disinfection by-product. Any difficulty meeting a DBP MAV must never be a reason to compromise adequate disinfection. Trihalomethanes and haloacids are DBPs. Some DBPs may also have other sources

GV	Guideline value
MAV	Maximum acceptable value
MC-LR	Microcystin-LR
NTU	Nephelometric turbidity unit
PMAV	Provisional MAV (because it is provisional in the WHO Guidelines (GDWQ) or the WHO has no guideline value but the DWSNZ has retained a MAV or developed its own)
STXeq	Saxitoxin-equivalent
TCU	True colour unit. The colour after the sample has been filtered. One TCU is equivalent to 1 Hazen unit and to 1 Pt/Co unit. For more information, see the Guidelines, section 18.2.1
THM	Trihalomethane, of which there are four: bromoform, bromodichloromethane, chloroform and dibromochloromethane
WHO	World Health Organization

For a listing of determinand abbreviations and synonyms, see the Guidelines, Appendix 6.

Appendix 2:

Water Quality targets which are potentially presence in leachate.

Abbreviations used in Tables D.1A to D.4A		Full Wording of the Target
pH	Range	The pH of the *water*^ must be within the range 7 to 8.5 unless natural levels are already outside this range.
	Δ	The pH of the *water*^ must not be changed by more than 0.5.
$sCBOD_5$ (g/m^3)	<	The monthly average five-days filtered / soluble carbonaceous biochemical oxygen demand ($sCBOD_5$) when the *river*^ flow is at or below the 20th *flow exceedance percentile** must not exceed 2 grams per cubic metre.
POM (g/m^3)	<	The average concentration of particulate organic matter when the *river*^ flow is at or below the 50th *flow exceedance percentile** must not exceed 5 grams per cubic metre.
DRP (g/m^3)	<	The annual average concentration of dissolved reactive phosphorus (DRP) when the *river*^ flow is at or below the 20th *flow exceedance percentile** must not exceed 0.015 grams per cubic metre, unless natural levels already exceed this target.
SIN (g/m^3)	<	The annual average concentration of soluble inorganic nitrogen (SIN)[2] when the *river*^ flow is at or below the 20th *flow exceedance percentile** must not exceed 0.167 grams per cubic metre, unless natural levels already exceed this target.
Ammoniacal nitrogen[3] (g/m^3) (*rivers*^)	<	The average concentration of ammoniacal nitrogen must not exceed 0.4 grams per cubic metre.
	Max	The maximum concentration of ammoniacal nitrogen must not exceed 2.1 grams per cubic metre.
Tox. or Toxicants	%	For toxicants not otherwise defined in these targets, the concentration of toxicants in the *water*^ must not exceed the trigger values for freshwater defined in the 2000 ANZECC guidelines Table 3.4.1 (refer to appendix 4) for the level of protection of 95 % of species. For metals the trigger value must be adjusted for hardness and apply to the dissolved fraction as directed in the table.

2 Soluble inorganic nitrogen (SIN) concentration is measured as the sum of nitrate nitrogen, nitrite nitrogen, and ammoniacal nitrogen or the sum of total oxidised nitrogen and ammoniacal nitrogen.

3 Ammoniacal nitrogen is a component of SIN. SIN target should also be considered when assessing ammoniacal nitrogen concentrations against the targets.

Appendix 3:

The leachate from unlined proportion of the Levin landfill occurs within the Hokio (Hoki_1b) sub-zone, which is a water management Sub-zone of the Lake Horowhenua (Hoki_1) water management zone. The following values have been identified in the Hokio Stream and Tatana Drain in the vicinity of the discharge point:

- Life Supporting Capacity – Lowland Sand (LS) geology;
- Amenity (approximately 3.5 km upstream of the discharge);
- Whitebait migration;
- Domestic food supply;
- Inanga spawning (approximately 3.5 km downstream of the discharge);
- Flood control/drainage;
- Aesthetics;
- Mauri;
- Contact Recreation;
- Stockwater;
- Water Supply;
- Industrial Abstraction;
- Existing infrastructure;
- Irrigation; and
- Capacity to Assimilate Pollution.

Appendix 4:

Table 3.4.1 Trigger values for toxicants at alternative levels of protection. Values in grey shading are the trigger values applying to typical *slightly–moderately disturbed systems*; see table 3.4.2 and Section 3.4.2.4 for guidance on applying these levels to different ecosystem conditions.

Chemical		Trigger values for freshwater (μgL^{-1})				Trigger values for marine water (μgL^{-1})			
		Level of protection (% species)				Level of protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
METALS & METALLOIDS									
Aluminium	pH >6.5	27	55	80	150	ID	ID	ID	ID
Aluminium	pH <6.5	ID	ID	ID	ID	ID	ID	ID	ID
Antimony		ID	ID	ID	ID	ID	ID	ID	ID
Arsenic (As III)		1	24	94 [C]	360 [C]	ID	ID	ID	ID
Arsenic (AsV)		0.8	13	42	140 [C]	ID	ID	ID	ID
Beryllium		ID	ID	ID	ID	ID	ID	ID	ID
Bismuth		ID	ID	ID	ID	ID	ID	ID	ID
Boron		90	370 [C]	680 [C]	1300 [C]	ID	ID	ID	ID
Cadmium	H	0.06	0.2	0.4	0.8 [C]	0.7 [B]	5.5 [B,C]	14 [B,C]	36 [B,A]
Chromium (Cr III)	H	ID	ID	ID	ID	7.7	27.4	48.6	90.6
Chromium (CrVI)		0.01	1.0 [C]	6 [A]	40 [A]	0.14	4.4	20 [C]	85 [C]
Cobalt		ID	ID	ID	ID	0.005	1	14	150 [C]
Copper	H	1.0	1.4	1.8 [C]	2.5 [C]	0.3	1.3	3 [C]	8 [A]
Gallium		ID	ID	ID	ID	ID	ID	ID	ID
Iron		ID	ID	ID	ID	ID	ID	ID	ID
Lanthanum		ID	ID	ID	ID	ID	ID	ID	ID
Lead	H	1.0	3.4	5.6	9.4 [C]	2.2	4.4	6.6 [C]	12 [C]
Manganese		1200	1900 [C]	2500 [C]	3600 [C]	ID	ID	ID	ID
Mercury (inorganic)	B	0.06	0.6	1.9 [C]	5.4 [A]	0.1	0.4 [C]	0.7 [C]	1.4 [C]
Mercury (methyl)		ID	ID	ID	ID	ID	ID	ID	ID
Molybdenum		ID	ID	ID	ID	ID	ID	ID	ID
Nickel	H	8	11	13	17 [C]	7	70 [C]	200 [A]	560 [A]
Selenium (Total)	B	5	11	18	34	ID	ID	ID	ID
Selenium (SeIV)	B	ID	ID	ID	ID	ID	ID	ID	ID
Silver		0.02	0.05	0.1	0.2 [C]	0.8	1.4	1.8	2.6 [C]
Thallium		ID	ID	ID	ID	ID	ID	ID	ID
Tin (inorganic, SnIV)		ID	ID	ID	ID	ID	ID	ID	ID
Tributyltin (as µg/L Sn)		ID	ID	ID	ID	0.0004	0.006 [C]	0.02 [C]	0.05 [C]
Uranium		ID	ID	ID	ID	ID	ID	ID	ID
Vanadium		ID	ID	ID	ID	50	100	160	280
Zinc	H	2.4	8.0 [C]	15 [C]	31 [C]	7	15 [C]	23 [C]	43 [C]
NON-METALLIC INORGANICS									
Ammonia	D	320	900 [C]	1430 [C]	2300 [A]	500	910	1200	1700
Chlorine	E	0.4	3	6 [A]	13 [A]	ID	ID	ID	ID
Cyanide	F	4	7	11	18	2	4	7	14
Nitrate	J	17	700	3400 [C]	17000 [A]	ID	ID	ID	ID
Hydrogen sulfide	G	0.5	1.0	1.5	2.6	ID	ID	ID	ID
ORGANIC ALCOHOLS									
Ethanol		400	1400	2400 [C]	4000 [C]	ID	ID	ID	ID
Ethylene glycol		ID	ID	ID	ID	ID	ID	ID	ID
Isopropyl alcohol		ID	ID	ID	ID	ID	ID	ID	ID
CHLORINATED ALKANES									
Chloromethanes									
Dichloromethane		ID	ID	ID	ID	ID	ID	ID	ID
Chloroform		ID	ID	ID	ID	ID	ID	ID	ID
Carbon tetrachloride		ID	ID	ID	ID	ID	ID	ID	ID
Chloroethanes									
1,2-dichloroethane		ID	ID	ID	ID	ID	ID	ID	ID
1,1,1-trichloroethane		ID	ID	ID	ID	ID	ID	ID	ID

Chemical	Trigger values for freshwater (µgL⁻¹)				Trigger values for marine water (µgL⁻¹)			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
1,1,2-trichloroethane	5400	6500	7300	8400	140	1900	5800 C	18000 C
1,1,2,2-tetrachloroethane	ID	ID	ID	ID	ID	ID	ID	ID
Pentachloroethane	ID	ID	ID	ID	ID	ID	ID	ID
Hexachloroethane B	290	360	420	500	ID	ID	ID	ID
Chloropropanes								
1,1-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
1,2-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
CHLORINATED ALKENES								
Chloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
1,1-dichloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
1,1,2-trichloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
1,1,2,2-tetrachloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
3-chloropropene	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dichloropropene	ID	ID	ID	ID	ID	ID	ID	ID
ANILINES								
Aniline	8	250 A	1100 A	4800 A	ID	ID	ID	ID
2,4-dichloroaniline	0.6	7	20	60 C	ID	ID	ID	ID
2,5-dichloroaniline	ID	ID	ID	ID	ID	ID	ID	ID
3,4-dichloroaniline	1.3	3	6 C	13 C	85	150	190	260
3,5-dichloroaniline	ID	ID	ID	ID	ID	ID	ID	ID
Benzidine	ID	ID	ID	ID	ID	ID	ID	ID
Dichlorobenzidine	ID	ID	ID	ID	ID	ID	ID	ID
AROMATIC HYDROCARBONS								
Benzene	600	950	1300	2000	500 C	700 C	900 C	1300 C
Toluene	ID	ID	ID	ID	ID	ID	ID	ID
Ethylbenzene	ID	ID	ID	ID	ID	ID	ID	ID
o-xylene	200	350	470	640	ID	ID	ID	ID
m-xylene	ID	ID	ID	ID	ID	ID	ID	ID
p-xylene	140	200	250	340	ID	ID	ID	ID
m+p-xylene	ID	ID	ID	ID	ID	ID	ID	ID
Cumene	ID	ID	ID	ID	ID	ID	ID	ID
Polycyclic Aromatic Hydrocarbons								
Naphthalene	2.5	16	37	85	50 C	70 C	90 C	120 C
Anthracene B	ID	ID	ID	ID	ID	ID	ID	ID
Phenanthrene B	ID	ID	ID	ID	ID	ID	ID	ID
Fluoranthene B	ID	ID	ID	ID	ID	ID	ID	ID
Benzo(a)pyrene B	ID	ID	ID	ID	ID	ID	ID	ID
Nitrobenzenes								
Nitrobenzene	230	550	820	1300	ID	ID	ID	ID
1,2-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,4-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3,5-trinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-methoxy-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-methoxy-4-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-3-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-4-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-2,4-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,2-dichloro-3-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dichloro-5-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,4-dichloro-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
2,4-dichloro-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID

Chemical		Trigger values for freshwater (µgL⁻¹)				Trigger values for marine water (µgL⁻¹)			
		Level of protection (% species)				Level of protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
1,2,4,5-tetrachloro-3-nitrobenzene		ID	ID	ID	ID	ID	ID	ID	ID
1,5-dichloro-2,4-dinitrobenzene		ID	ID	ID	ID	ID	ID	ID	ID
1,3,5-trichloro-2,4-dinitrobenzene		ID	ID	ID	ID	ID	ID	ID	ID
1-fluoro-4-nitrobenzene		ID	ID	ID	ID	ID	ID	ID	ID
Nitrotoluenes									
2-nitrotoluene		ID	ID	ID	ID	ID	ID	ID	ID
3-nitrotoluene		ID	ID	ID	ID	ID	ID	ID	ID
4-nitrotoluene		ID	ID	ID	ID	ID	ID	ID	ID
2,3-dinitrotoluene		ID	ID	ID	ID	ID	ID	ID	ID
2,4-dinitrotoluene		16	65[C]	130[C]	250[C]	ID	ID	ID	ID
2,4,6-trinitrotoluene		100	140	160	210	ID	ID	ID	ID
1,2-dimethyl-3-nitrobenzene		ID	ID	ID	ID	ID	ID	ID	ID
1,2-dimethyl-4-nitrobenzene		ID	ID	ID	ID	ID	ID	ID	ID
4-chloro-3-nitrotoluene		ID	ID	ID	ID	ID	ID	ID	ID
Chlorobenzenes and Chloronaphthalenes									
Monochlorobenzene		ID	ID	ID	ID	ID	ID	ID	ID
1,2-dichlorobenzene		120	160	200	270	ID	ID	ID	ID
1,3-dichlorobenzene		160	260	350	520[C]	ID	ID	ID	ID
1,4-dichlorobenzene		40	60	75	100	ID	ID	ID	ID
1,2,3-trichlorobenzene	B	3	10	16	30[C]	ID	ID	ID	ID
1,2,4-trichlorobenzene	B	85	170[C]	220[C]	300[C]	20	80	140	240
1,3,5-trichlorobenzene	B	ID	ID	ID	ID	ID	ID	ID	ID
1,2,3,4-tetrachlorobenzene	B	ID	ID	ID	ID	ID	ID	ID	ID
1,2,3,5-tetrachlorobenzene	B	ID	ID	ID	ID	ID	ID	ID	ID
1,2,4,5-tetrachlorobenzene	B	ID	ID	ID	ID	ID	ID	ID	ID
Pentachlorobenzene	B	ID	ID	ID	ID	ID	ID	ID	ID
Hexachlorobenzene	B	ID	ID	ID	ID	ID	ID	ID	ID
1-chloronaphthalene		ID	ID	ID	ID	ID	ID	ID	ID
Polychlorinated Biphenyls (PCBs) & Dioxins									
Capacitor 21	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1016	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1221	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1232	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1242	B	0.3	0.6	1.0	1.7	ID	ID	ID	ID
Aroclor 1248	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1254	B	0.01	0.03	0.07	0.2	ID	ID	ID	ID
Aroclor 1260	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1262	B	ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1268	B	ID	ID	ID	ID	ID	ID	ID	ID
2,3,4'-trichlorobiphenyl	B	ID	ID	ID	ID	ID	ID	ID	ID
4,4'-dichlorobiphenyl	B	ID	ID	ID	ID	ID	ID	ID	ID
2,2',4,5,5'-pentachloro-1,1'-biphenyl	B	ID	ID	ID	ID	ID	ID	ID	ID
2,4,6,2',4',6'-hexachlorobiphenyl	B	ID	ID	ID	ID	ID	ID	ID	ID
Total PCBs	B	ID	ID	ID	ID	ID	ID	ID	ID
2,3,7,8-TCDD	B	ID	ID	ID	ID	ID	ID	ID	ID
PHENOLS and XYLENOLS									
Phenol		85	320	600	1200[C]	270	400	520	720
2,4-dimethylphenol		ID	ID	ID	ID	ID	ID	ID	ID
Nonylphenol		ID	ID	ID	ID	ID	ID	ID	ID
2-chlorophenol	T	340[C]	490[C]	630[C]	870[C]	ID	ID	ID	ID
3-chlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
4-chlorophenol	T	160	220	280[C]	360[C]	ID	ID	ID	ID
2,3-dichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
2,4-dichlorophenol	T	120	160[C]	200[C]	270[C]	ID	ID	ID	ID

Chemical	Trigger values for freshwater (µgL⁻¹)				Trigger values for marine water (µgL⁻¹)			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
2,5-dichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
2,6-dichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
3,4-dichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
3,5-dichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
2,3,4-trichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
2,3,5-trichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
2,3,6-trichlorophenol T	ID	ID	ID	ID	ID	ID	ID	ID
2,4,5-trichlorophenol T,B	ID	ID	ID	ID	ID	ID	ID	ID
2,4,6-trichlorophenol T,B	3	20	40	95	ID	ID	ID	ID
2,3,4,5-tetrachlorophenol T,B	ID	ID	ID	ID	ID	ID	ID	ID
2,3,4,6- tetrachlorophenol T,B	10	20	25	30	ID	ID	ID	ID
2,3,5,6- tetrachlorophenol T,B	ID	ID	ID	ID	ID	ID	ID	ID
Pentachlorophenol T,B	3.6	10	17	27 [A]	11	22	33	55 [A]
Nitrophenols								
2-nitrophenol	ID	ID	ID	ID	ID	ID	ID	ID
3-nitrophenol	ID	ID	ID	ID	ID	ID	ID	ID
4-nitrophenol	ID	ID	ID	ID	ID	ID	ID	ID
2,4-dinitrophenol	13	45	80	140	ID	ID	ID	ID
2,4,6-trinitrophenol	ID	ID	ID	ID	ID	ID	ID	ID
ORGANIC SULFUR COMPOUNDS								
Carbon disulfide	ID	ID	ID	ID	ID	ID	ID	ID
Isopropyl disulfide	ID	ID	ID	ID	ID	ID	ID	ID
n-propyl sulfide	ID	ID	ID	ID	ID	ID	ID	ID
Propyl disulfide	ID	ID	ID	ID	ID	ID	ID	ID
Tert-butyl sulfide	ID	ID	ID	ID	ID	ID	ID	ID
Phenyl disulfide	ID	ID	ID	ID	ID	ID	ID	ID
Bis(dimethylthiocarbamyl)sulfide	ID	ID	ID	ID	ID	ID	ID	ID
Bis(diethylthiocarbamyl)disulfide	ID	ID	ID	ID	ID	ID	ID	ID
2-methoxy-4H-1,3,2-benzodioxaphosphorium-2-sulfide	ID	ID	ID	ID	ID	ID	ID	ID
Xanthates								
Potassium amyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Potassium ethyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Potassium hexyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Potassium isopropyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Sodium ethyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Sodium isobutyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Sodium isopropyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
Sodium sec-butyl xanthate	ID	ID	ID	ID	ID	ID	ID	ID
PHTHALATES								
Dimethylphthalate	3000	3700	4300	5100	ID	ID	ID	ID
Diethylphthalate	900	1000	1100	1300	ID	ID	ID	ID
Dibutylphthalate B	9.9	26	40.2	64.6	ID	ID	ID	ID
Di(2-ethylhexyl)phthalate B	ID	ID	ID	ID	ID	ID	ID	ID
MISCELLANEOUS INDUSTRIAL CHEMICALS								
Acetonitrile	ID	ID	ID	ID	ID	ID	ID	ID
Acrylonitrile	ID	ID	ID	ID	ID	ID	ID	ID
Poly(acrylonitrile-co-butadiene-co-styrene)	200	530	800 [C]	1200 [C]	200	250	280	340
Dimethylformamide	ID	ID	ID	ID	ID	ID	ID	ID
1,2-diphenylhydrazine	ID	ID	ID	ID	ID	ID	ID	ID
Diphenylnitrosamine	ID	ID	ID	ID	ID	ID	ID	ID
Hexachlorobutadiene	ID	ID	ID	ID	ID	ID	ID	ID
Hexachlorocyclopentadiene	ID	ID	ID	ID	ID	ID	ID	ID

Chemical		Trigger values for freshwater (µgL⁻¹)				Trigger values for marine water (µgL⁻¹)			
		Level of protection (% species)				Level of protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
Isophorone		ID	ID	ID	ID	ID	ID	ID	ID
ORGANOCHLORINE PESTICIDES									
Aldrin	B	ID	ID	ID	ID	ID	ID	ID	ID
Chlordane	B	0.03	0.08	0.14	0.27 [C]	ID	ID	ID	ID
DDE	B	ID	ID	ID	ID	ID	ID	ID	ID
DDT	B	0.006	0.01	0.02	0.04	ID	ID	ID	ID
Dicofol	B	ID	ID	ID	ID	ID	ID	ID	ID
Dieldrin	B	ID	ID	ID	ID	ID	ID	ID	ID
Endosulfan	B	0.03	0.2 [A]	0.6 [A]	1.8 [A]	0.005	0.01	0.02	0.05 [A]
Endosulfan alpha	B	ID	ID	ID	ID	ID	ID	ID	ID
Endosulfan beta	B	ID	ID	ID	ID	ID	ID	ID	ID
Endrin	B	0.01	0.02	0.04 [C]	0.06 [A]	0.004	0.008	0.01	0.02
Heptachlor	B	0.01	0.09	0.25	0.7 [A]	ID	ID	ID	ID
Lindane		0.07	0.2	0.4	1.0 [A]	ID	ID	ID	ID
Methoxychlor	B	ID	ID	ID	ID	ID	ID	ID	ID
Mirex	B	ID	ID	ID	ID	ID	ID	ID	ID
Toxaphene	B	0.1	0.2	0.3	0.5	ID	ID	ID	ID
ORGANOPHOSPHORUS PESTICIDES									
Azinphos methyl		0.01	0.02	0.05	0.11 [A]	ID	ID	ID	ID
Chlorpyrifos	B	0.00004	0.01	0.11 [A]	1.2 [A]	0.0005	0.009	0.04 [A]	0.3 [A]
Demeton		ID	ID	ID	ID	ID	ID	ID	ID
Demeton-S-methyl		ID	ID	ID	ID	ID	ID	ID	ID
Diazinon		0.00003	0.01	0.2 [A]	2 [A]	ID	ID	ID	ID
Dimethoate		0.1	0.15	0.2	0.3	ID	ID	ID	ID
Fenitrothion		0.1	0.2	0.3	0.4	ID	ID	ID	ID
Malathion		0.002	0.05	0.2	1.1 [A]	ID	ID	ID	ID
Parathion		0.0007	0.004 [C]	0.01 [C]	0.04 [A]	ID	ID	ID	ID
Profenofos	B	ID	ID	ID	ID	ID	ID	ID	ID
Temephos	B	ID	ID	ID	ID	0.0004	0.05	0.4	3.6 [A]
CARBAMATE & OTHER PESTICIDES									
Carbofuran		0.06	1.2 [A]	4 [A]	15 [A]	ID	ID	ID	ID
Methomyl		0.5	3.5	9.5	23	ID	ID	ID	ID
S-methoprene		ID	ID	ID	ID	ID	ID	ID	ID
PYRETHROIDS									
Deltamethrin		ID	ID	ID	ID	ID	ID	ID	ID
Esfenvalerate		ID	0.001*	ID	ID	ID	ID	ID	ID
HERBICIDES & FUNGICIDES									
Bypyridilium herbicides									
Diquat		0.01	1.4	10	80 [A]	ID	ID	ID	ID
Paraquat		ID	ID	ID	ID	ID	ID	ID	ID
Phenoxyacetic acid herbicides									
MCPA		ID	ID	ID	ID	ID	ID	ID	ID
2,4-D		140	280	450	830	ID	ID	ID	ID
2,4,5-T		3	36	100	290 [A]	ID	ID	ID	ID
Sulfonylurea herbicides									
Bensulfuron		ID	ID	ID	ID	ID	ID	ID	ID
Metsulfuron		ID	ID	ID	ID	ID	ID	ID	ID
Thiocarbamate herbicides									
Molinate		0.1	3.4	14	57	ID	ID	ID	ID
Thiobencarb		1	2.8	4.6	8 [C]	ID	ID	ID	ID
Thiram		0.01	0.2	0.8 [C]	3 [A]	ID	ID	ID	ID
Triazine herbicides									
Amitrole		ID	ID	ID	ID	ID	ID	ID	ID
Atrazine		0.7	13	45 [C]	150 [C]	ID	ID	ID	ID

Chemical	Trigger values for freshwater (µgL⁻¹)				Trigger values for marine water (µgL⁻¹)			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Hexazinone	ID	ID	ID	ID	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID
Urea herbicides								
Diuron	ID	ID	ID	ID	ID	ID	ID	ID
Tebuthiuron	0.02	2.2	20	160 C	ID	ID	ID	ID
Miscellaneous herbicides								
Acrolein	ID	ID	ID	ID	ID	ID	ID	ID
Bromacil	ID	ID	ID	ID	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600 A	ID	ID	ID	ID
Imazethapyr	ID	ID	ID	ID	ID	ID	ID	ID
Ioxynil	ID	ID	ID	ID	ID	ID	ID	ID
Metolachlor	ID	ID	ID	ID	ID	ID	ID	ID
Sethoxydim	ID	ID	ID	ID	ID	ID	ID	ID
Trifluralin B	2.6	4.4	6	9 A	ID	ID	ID	ID
GENERIC GROUPS OF CHEMICALS								
Surfactants								
Linear alkylbenzene sulfonates (LAS)	65	280	520 C	1000 C	ID	ID	ID	ID
Alcohol ethoxyolated sulfate (AES)	340	650	850 C	1100 C	ID	ID	ID	ID
Alcohol ethoxylated surfactants (AE)	50	140	220	360 C	ID	ID	ID	ID
Oils & Petroleum Hydrocarbons	ID	ID	ID	ID	ID	ID	ID	ID
Oil Spill Dispersants								
BP 1100X	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 7664	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 8667		ID	ID	ID	ID	ID	ID	ID
Corexit 9527	ID	ID	ID	ID	230	1100	2200	4400 A
Corexit 9550	ID	ID	ID	ID	ID	ID	ID	ID

Notes: Where the final water quality guideline to be applied to a site is below current analytical practical quantitation limits, see Section 3.4.3.3 for guidance.

Most trigger values listed here for metals and metalloids are *High reliability* figures, derived from field or chronic NOEC data (see 3.4.2.3 for reference to Volume 2). The exceptions are *Moderate reliability* for freshwater aluminium (pH >6.5), manganese and marine chromium (III).

Most trigger values listed here for non-metallic inorganics and organic chemicals are *Moderate reliability* figures, derived from acute LC_{50} data (see 3.4.2.3 for reference to Volume 2). The exceptions are *High reliability* for freshwater ammonia, 3,4-DCA, endosulfan, chlorpyrifos, esfenvalerate, tebuthiuron, three surfactants and marine for 1,1,2-TCE and chlorpyrifos.

* = *High reliability* figure for esfenvalerate derived from mesocosm NOEC data (no alternative protection levels available).

A = Figure may not protect key test species from acute toxicity (and chronic) — check Section 8.3.7 for spread of data and its significance. 'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure (Section 8.3.4.4).

B = Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered (see Sections 8.3.3.4 and 8.3.5.7).

C = Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) — check Section 8.3.7 for spread of data and its significance. Where grey shading and 'C' coincide, refer to text in Section 8.3.7.

D = Ammonia as TOTAL ammonia as [NH_3-N] at pH 8. For changes in trigger value with pH refer to Section 8.3.7.2.

E = Chlorine as total chlorine, as [Cl]; see Section 8.3.7.2.

F = Cyanide as un-ionised HCN, measured as [CN]; see Section 8.3.7.2.

G = Sulfide as un-ionised H_2S, measured as [S]; see Section 8.3.7.2.

H = Chemicals for which algorithms have been provided in table 3.4.3 to account for the effects of hardness. The values have been calculated using a hardness of 30 mg/L $CaCO_3$. These should be adjusted to the site-specific hardness (see Section 3.4.3).

J = Figures protect against toxicity and do not relate to eutrophication issues. Refer to Section 3.3 if eutrophication is the issue of concern.

ID = Insufficient data to derive a reliable trigger value. Users advised to check if a low reliability value or an ECL is given in Section 8.3.7.

T = Tainting or flavour impairment of fish flesh may possibly occur at concentrations below the trigger value. See Sections 4.4.5.3/3 and 8.3.7.