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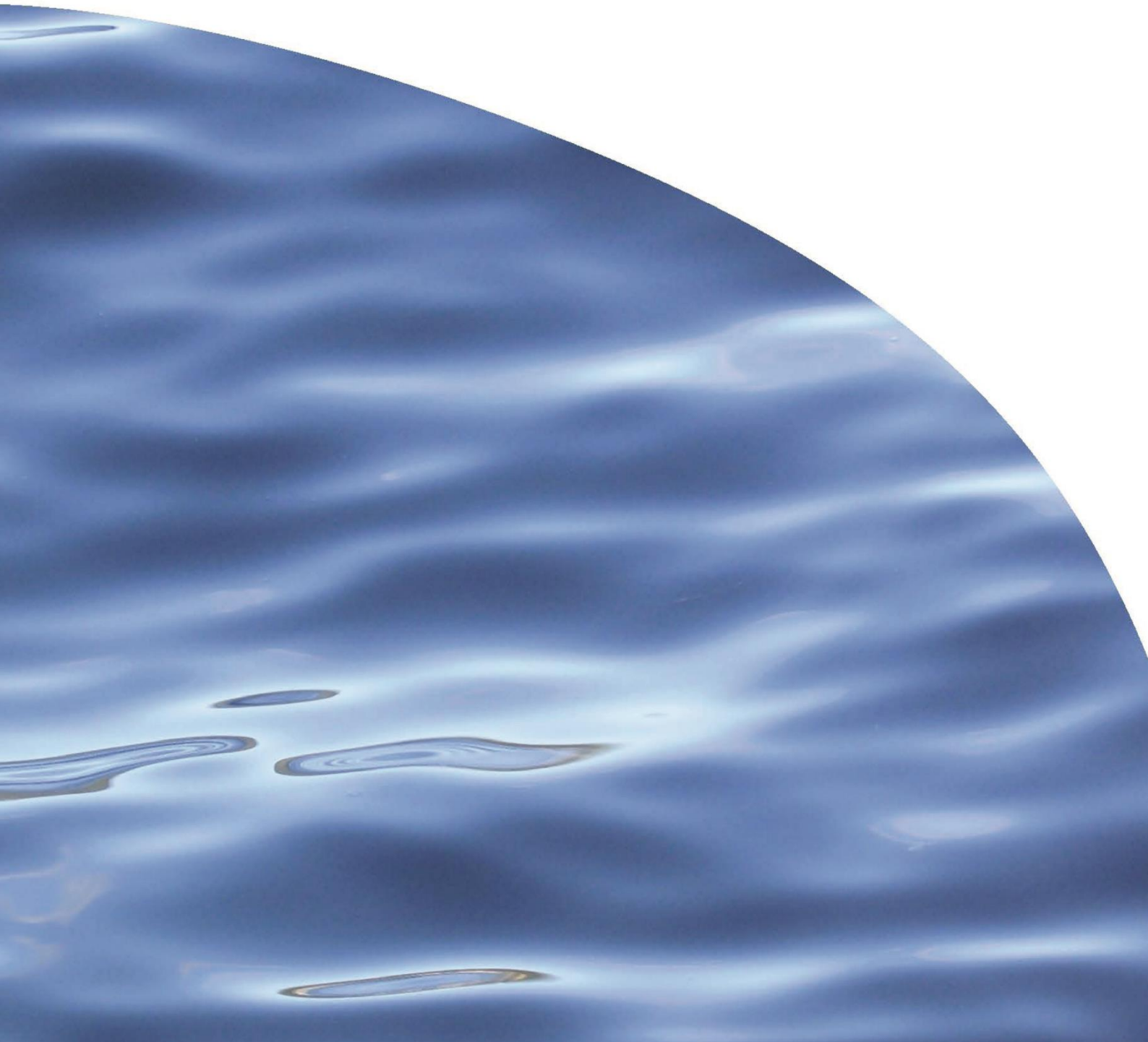

REVIEW OF RESOURCE CONSENT CONDITIONS FOR STORMWATER DISCHARGE FROM PORT LOG YARDS

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Prepared for Gisborne District Council

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1. OBJECTIVE OF THE REVIEW

The objectives of this study are to:

- collate and compare current consent monitoring conditions for stormwater discharges from log yards (and other facilities for storing raw-wood products) in ports across all regions of New Zealand
- identify methods by which consent conditions were developed and the values they are intended to protect
- identify consistencies and inconsistencies among consent conditions around the country and whether these relate to differences in operating or environmental conditions among different ports.

Information on consents for stormwater discharges from ports was obtained through the Cawthron Institute's own consulting work, advice from other science providers and with the generous assistance of staff of port companies and consenting authorities (see Acknowledgements). The scope and depth of this review were constrained by the limited resources available for consultation. It is intended that the present study will be the first phase of a larger study to develop guidance for consenting of log yards that may discharge to receiving waters. The proposed second phase will include opportunity for regulatory authorities and ports to review the information presented here and provide comment.

2. STORAGE OF LOGS / WOODCHIPS AT NEW ZEALAND PORTS

Approximately 16 million m^3 of logs and 241,000 m^3 (roundwood equivalent) of woodchips were exported from New Zealand ports in 2015[1]. The value of these products to the New Zealand economy was NZ$2 billion. Of the logs exported in 2016, 72% went to China, 14% to South Korea, 9% to India and 3% to Japan[2].

Among the eight main ports from which logs and woodchips are exported, Tauranga is by far the largest exporter (by volume: Table 1). All New Zealand ports that handle forestry products are maritime in nature. Once they arrive at the export port, logs and woodchips are stockpiled for varying periods until they can be loaded onto ships. They may also undergo treatment within the port, such as the application of fungicides (antisapstains, used to prevent staining of the wood by fungi, which renders it

[1] Source: New Zealand Forest Owners Association http://www.nzfoa.org.nz/images/stories/pdfs/ff_2016_web.pdf, accessed June 2017.
[2] Source: Champion Freight http://www.championfreight.co.nz/logs.pdf, accessed June 2017.

unsuitable for some applications). Stockpiles are generally uncovered, exposing them to rain that may potentially leach contaminants from the logs and woodchips.

Table 1. Volumes of logs exported quarterly from New Zealand ports in 2016. The 'other' ports are Bluff, Lyttelton, New Plymouth and Timaru.

	Tauranga	Whangarei	Gisborne	Napier	Wellington	Pt Chalmers	Picton	Nelson	Other
Volume (000 m^3)	1100–1500	600–800	500–600	200–300	200–300	200–300	100–200	100–200	400–500

Source of data: http://www.championfreight.co.nz/logs.pdf, accessed June 2017.

3. CONTAMINANTS ASSOCIATED WITH STORMWATER RUNOFF FROM LOG / WOODCHIP STORAGE

The various industrial activities that occur in and around port operational areas generally have a variety of potential contaminants associated with them that may be discharged as a component of stormwater runoff. Although some contaminants are specific to an individual activity or land use, many of them are ubiquitous to urban / industrial stormwater and could be present in the runoff from most of the activities represented. These include trace metals (e.g. cadmium, chromium, copper, lead, nickel and zinc), polycyclic aromatic hydrocarbons (PAHs), suspended particulate matter (Total Suspended Solids, TSS), nutrients (e.g. nitrogen and phosphorus), acids or bases (which may cause pH change), and pesticides (e.g. DDT). Contaminants associated with common land uses in ports are shown in Table 2.

Table 2. Common contaminants in stormwater and their likely presence in runoff from individual port activities. 'PAH' polycyclic aromatic hydrocarbons, 'TSS' total suspended solids, 'BOD & COD' biochemical and chemical oxygen demand, respectively.

	Log / woodchip storage	Light vehicle traffic	Heavy vehicle traffic	Car parking	Building / roof runoff	Workshops	Fuel storage and transfer	Container operations	Cement storage / transfer	Urban stormwater	Fertiliser loading	Vessel maintenance
Trace metals	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
PAHs		✓	✓	✓	✓	✓	✓			✓		✓
TSS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
pH change	✓								✓			
BOD & COD	✓								✓	✓	✓	
Nutrients	✓									✓	✓	
Pesticides										✓		✓

Modified from Sneddon 2005.

Log / woodchip storage areas may be sealed or metalled. Sealed surfaces do not allow infiltration of stormwater but facilitate both housekeeping (e.g. sweeping of woody debris) and the handling and treatment of stormwater. Yards may be watered to supress dust and screened sumps are used to collect bark and other debris. These and other aspects of yard management are specified in some consent conditions and / or stormwater management plans.

Log / woodchip storage runoff water will contain resin acids, phenolic compounds, fatty acids, phytosterols, tannins, suspended solids and dissolved nutrients (nitrogen and phosphorus) at potentially high concentrations (relative to the receiving environment). Resin acids are naturally occurring compounds but can be toxic at high concentrations. Tannins and suspended solids can affect the colour and clarity of the receiving environment, which will have an adverse effect on aesthetic values and may also impact on aquatic biota. The high level of organic material in runoff may result in increased biochemical and chemical oxygen demand (BOD and COD), which can potentially deplete the oxygen content of receiving waters and subsequently have adverse effects on aquatic biota. However, the severity of the effect will depend on the nature of the receiving environment. Oxygen demand is rarely an issue with coastal discharges given the high assimilative capacity of these receiving environments. Therefore, of the potential stressors in stormwater from log yards, the key constituents of most concern in terms of potential adverse ecological effects are resin acids and suspended solids. There may also be cumulative or interactive effects from two or more stressors.

Resin acids are derived from the cell tissue and bark of *Pinus radiata* and other commercial timbers (*P. radiata* represents 96% of plantation forestry area in the North Island and 76% in the South Island[3]). The most common resin acid found in log yard stormwater is dehydroabietic acid (DHAA) which usually accounts for 40-50% of total resin acids. Others commonly found include abietic, isopimaric, and pimaric acids. The toxicity of these compounds to aquatic organisms is well documented (at least for freshwaters). For example, DHAA has a 96-hour LC50 (i.e. the concentration required to kill 50% of the test organisms in 96 hours) for trout of 0.7–1.5 mg/L. The other resin acids exhibit similar LC50 concentrations, ranging from 0.4–1.8 mg/L. It is worth noting, however, that resin acids do not bioaccumulate, nor do they biomagnify through the food chain the way some contaminants do (e.g. mercury). Studies in the Port of Tauranga have shown that resin acids may accumulate in sediments around stormwater outfalls (Tian et al. 1998; D. Culliford, University of Waikato, unpublished data).

Some organic compounds derived from forestry products are taken up by fish through ingestion of water, sediment and biological materials. Resin acids have been identified in fish exposed to marine forestry discharges (bio-uptake) and can be excreted via bile, urine and faeces.

The use of fungicides and antisapstains on debarked logs and sawn timber for export is also a potential source of stormwater contamination. Since radiata pine has a high proportion of sapwood to heartwood, it is particularly susceptible to sapstain and is often treated prior to export. Logs are debarked and sprayed with such treatments before they are transported to some ports. In other ports, logs and sawn timber are treated with fungicides or antisapstains on site.

As examples, the principal active constituents of the fungicides Busan 30 WB and NP-1 are 2-(thiocyanomethylthio)-benzothiazole (TCMTB) for Busan 30 WB, and didecyl-dimethyl ammonium chloride (DDAC) and iodopropynyl butylcarbamate (IPBC) for NP-1. All are highly toxic to a range of aquatic organisms including fish (e.g. 96–hour rainbow trout LC_{50} of 2.81 mg/L and 0.8 mg/L for DDAC and IPBC respectively), crustaceans and algae. However, both products are resistant to washing off after application. Fungicidal treatments should not pose a significant threat to stormwater receiving environments when adequate dilution is available. KMA (1993) note that NP-1 is readily biodegradable once diluted and readily disperses in water. IPBC has an environmental half-life of 2 hours while its major degradation product (propynyl butyl carbamate [PBC]) breaks down after approximately four days (Szenasy 1998).

[3] Source: New Zealand Forest Owners Association http://www.nzfoa.org.nz/images/stories/pdfs/ff_2016_web.pdf, accessed June 2017.

4. REGULATION OF THE DISCHARGE OF STORMWATER IN PORTS

The present study reviewed information on consents to discharge stormwater from the following ports and log yards:

- CentrePort (Wellington: Kaiwharawhara and Aotea Quay log yards)
- Eastland Port (Gisborne: Southern and Wharfside log yards)
- Lyttelton Port of Christchurch
- Napier Port
- Northport (Whangarei: Marsden Point log yard)
- Port Marlborough (Port Shakespeare log yard)
- Port Nelson
- Port of Tauranga
- South Port (Bluff: Island Harbour log yards).

Other than Port Chalmers, these represent the major log-exporting ports in New Zealand (Table 1). The results of the review are summarised in the Appendix.

4.1. Values to be protected and development of consent conditions

In general, conditions present in current resource consents are intended to protect the values specified in Section 70 (*Rules about discharges*) and Schedule 3 (*Water quality classes*) of the Resource Management Act 1991: aesthetic effects (colour, clarity, films, scums, foams, floating or suspended materials, objectionable odour), and the protection of aquatic life. These requirements must also be satisfied when discharge of stormwater is allowed as a permitted activity. Limits on discharges of TSS, yellow substance and tannins are specified in many consents in order to protect visual water quality. Avoidance of conspicuous changes in water clarity is also likely to be protective of aquatic organisms (Ministry for the Environment 1994).

In some consents, conditions are included to protect specific receiving water uses. In the cases of the ports at Gisborne, Napier and Picton (Port Shakespeare), conditions are intended to prevent aquatic organisms becoming unfit for human consumption. Protection of the suitability of receiving waters for bathing is specified in the consent for the Southern Log yard in Eastland Port (Gisborne).

It should be noted that some log-related port activities may be carried out by other parties operating within ports. These parties may have their own resource consents relating to the discharge of contaminants (e.g. TSS and antisapstains).

4.2. Variation in the management of stormwater discharges

The principal difference among ports in terms of regulation of stormwater discharge from log yards (and other parts of port operational areas) is whether discharge is considered a permitted activity or requires a consent. Those ports that site within a planning framework that allows stormwater discharge as a permitted activity require that the discharge does not cause:

- the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials
- any conspicuous change in the colour or visual clarity of water
- any emission of objectionable odour
- any significant adverse effects on aquatic life.

Lyttelton Port and Port Nelson fall into the first category, while the Port of Tauranga has apparently operated without a consent in the past but is currently in the process of applying for one (pers. comm. Rowan Johnstone, Port of Tauranga Ltd).

In general, the requirement for a consent, the scope of conditions to protect the receiving environment and other users of the coastal marine area, and the level of monitoring required to assess compliance are more rigorous for more recently granted consents, such as those at North Port and Eastland Port.

For the majority of ports, stormwater discharge is regulated through a resource consent, with conditions applied to protect the receiving environment and other users of the coastal marine area. Some ports operate their stormwater discharge under a stormwater or environmental management plan, referenced in the consent conditions.

Conditions vary widely in terms of which potential stressors have limits placed upon them, whether monitoring is required to assess compliance with limits (or to obtain information on effects) and how such monitoring is done. Monitoring may be done within the stormwater system, at the point of discharge, or in the receiving environment. These and other differences among ports are summarised in Table 3.

Table 3. Differences among ports in the regulation of discharge of stormwater to the coastal marine area. 'S/EMP' stormwater / environmental management plan. 'WETT' whole effluent toxicity testing. * Port Nelson operates a Code of Practice.

	North Port (Whangarei)	Tauranga	Napier	Eastland Port (Gisborne)	CentrePort (Wellington)	Marlborough	Nelson	Lyttelton	South Port (Bluff)
Permitted activity?								✓	
Monitoring required?	✓		✓	✓		✓			✓
S/EMP?				✓	✓	✓			
Limits on (some) discharge variables?	✓			✓		✓		✓	✓
Monitor in discharge (d), receiving environment (re) or both (b)?	b		b	b		b		re	d
Monitoring of sediments and / or biota in receiving environment?				✓		✓			✓
Monitoring within the stormwater system?	✓		✓						
WETT testing required?	✓			✓					
Yard management conditions?	✓			✓	✓		✓*	✓	

5. SUMMARY

This review has identified varying approaches to the regulation of stormwater discharges from log yards at ports around the country. Associated with this variation are differences in the extent of the environmental monitoring required. A detailed review of conditions for all log yards around New Zealand was beyond the resources of the present study. Such a review, taking into account the nature of the individual receiving environments, and the development of guidelines for consent conditions, would be a valuable follow-up to the present study.

6. ACKNOWLEDGEMENTS

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8. APPENDIX

Appendix 1. Comparison of resource consent requirements and conditions for stormwater discharges from ports.

Port	Log yard	Permitted activity?	Treatment required?	SMP/EMP?
CentrePort	Kaiwharawhara (new yard)	No	All stormwater collected and first-flush is discharged to a soakage area. When capacity reached, discharges to CMA. Design of soakage area specified in consent.	SMP
	Aotea Quay	No - deemed to exceed permitted activity criteria. Application for consent on hold following earthquake damage to the stormwater system.		
Eastland Port	Southern Log yard			SMP
	Upper Log yard			
	Wharfside Log yard (new)	No (discretionary)	Area to be divided into 5 catchments with different levels of treatment. Sump and pipe storage and clarifier on one catchment, oil-water separator in second, nothing on third.	EMP
Lyttelton Port		Yes		
Napier Port		No (controlled)		
Northport	Marsden Point	No	Storage and settlement ponds	No
Port Marlborough	Port Shakespeare	No	"Construct and maintain stormwater treatment system to treat runoff from log yard to control the quality and quantity of stormwater (including any leachates generated from materials stored, handled or used on the site)."	Yes (Kingett Mitchell 1993)
Port Nelson		Yes		
Port of Tauranga		Yes(?). No consent has ever been issued for the discharge of stormwater from the port, for a variety of historical reasons. An application is currently in progress.		
South Port	Island Harbour (berths 5-8)		If monitoring of the quality of the discharge from the stormwater outlets indicates that the oxygen-reducing potential of the discharge is greater than the ANZECC[1] guideline, or the level of discolouration is of concern, the area from which the stormwater originated must be bunded within 12 months of notification of results.	

[1] ANZECC 2000. Australian and New Zealand guidelines for fresh and marine water quality 2000 Volume 1. National Water Quality Management Strategy Paper No. 4. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Conditions - RMA Section 70 and Schedule 3 ('MZ' mixing zone)

Port/Log yard	Temperature (beyond MZ)	pH (beyond MZ)	DO (beyond MZ)	Clarity (beyond MZ)	Colour (beyond MZ)	Oil/grease/scums/ foams/floatables/ suspended matter (beyond MZ)	Odour	Destruction of aquatic life
CentrePort Kaiwharawhara				Not conspicuous	Not conspicuous	Not conspicuous	No objectionable	No significant adverse effects
Aotea Quay								
Eastland Port Southern Log yard	≤ 3°C change	≤ 0.1 change and not < 6.7 or > 8.5		Not conspicuous	Not conspicuous		No objectionable	No destruction of natural aquatic life by reason of a concentration of toxic substances
Upper Log yard								
Wharfside Log yard (new)	≤ 3°C change	≤ 0.1 change and not < 6.7 or > 8.5	No trigger	Not conspicuous	Not conspicuous		No objectionable	No destruction of natural aquatic life by reason of a concentration of toxic substances
Lyttelton Port	≤ 3°C change or any change that causes temperature to exceed 25°C		≥ 80% sat	≤ 50% reduction	≤10 Munsell unit change.	Not conspicuous	No objectionable	No significant adverse effects on aquatic life or significant loss of indigenous biodiversity
Napier Port				Not conspicuous	Not conspicuous	Not conspicuous	No objectionable	No significant adverse effects
Northport Marsden Point	≤ 3°C change	≤ 0.2 change	≥ 80% sat	≤ 20% reduction	≤ 10 Munsell unit change from median background	Not conspicuous	No objectionable	No destruction of natural aquatic life by reason of a concentration of toxic substances
Port Marlborough (Port Shakespeare)								Aquatic organisms shall not be rendered unfit for human consumption
Port Nelson								
Port of Tauranga				≤ 33% reduction	See yellow substance trigger			
South Port				Not conspicuous	Not conspicuous	Not conspicuous	No objectionable	No significant adverse effects

Limits in discharge

Port	Log yard	pH	TSS/Turbidity	Cu	Pb	Zn	PAH	Other
CentrePort	Kaiwharawhara (new yard)							
	Aotea Quay							
Eastland Port	Southern Log yard	SMP to outline how results are to be assessed against receiving environment trigger values	TSS median ≤ 300 mg/L, 75%ile ≤ 450 mg/L	Receiving environment trigger x dilution factor at edge of MZ	Receiving environment trigger x dilution factor at edge of MZ	Receiving environment trigger x dilution factor at edge of MZ		TPH ≤15mg/L, COD no trigger, TOC no trigger, VSS no trigger, tannins no trigger. Where a clear and consistent relationship is found, that information shall be used to establish trigger levels for Total Suspended Solids and/ or tannins that avoid a change to the colour and clarity of the receiving waters to a conspicuous extent beyond the reasonable mixing zone.
	Upper Log yard							
	Wharfside Log yard (new)	pH no trigger	TSS median ≤ 300 mg/L, 75%ile ≤ 450 mg/L, VSS no trigger, tannins no trigger	Receiving environment trigger x dilution factor at edge of MZ	Receiving environment trigger x dilution factor at edge of MZ	Receiving environment trigger x dilution factor at edge of MZ		COD no trigger, TOC no trigger, TPH ≤ 15 mg/L, total phenols no trigger, total resin acids no trigger, dehydroabietic acid no trigger, TN no trigger
Lyttelton Port								
Napier Port			No trigger		No trigger	No trigger		Cd, no trigger, Ni no trigger, TPH no trigger, NO_3-N no trigger, SRP no trigger, SVOC no trigger
Northport	Marsden Point	6.5-9.0	TSS median ≤ 50 mg/L, 95%ile ≤ 100 g/m3, VSS, NTU		0.044 mg/m^3	0.150 mg/L	ANZECC x 10	Al 0.013 mg/L. Resin acids. Total N and Total P to be included if fertiliser products have been stored on site in the previous season.
Port Marlborough	Port Shakespeare		> 460 mg/L in no more than 2 monthly samples/year	0.52 mg/L	1.76 mg/L	6.0 mg/L		BOD5 95%ile ≤ (0.375 mg/L x dilution factor), DRP 95%ile ≤(0.001 mg/L x dilution factor), dissolved yellow substance 95%ile ≤ (0.01 m^{-1} x dilution factor), As 7.2 mg/L, Cd 0.28 mg/L, Cr 1.76 mg/L, Hg 0.04 mg/L, Ni 2.8 mg/L, total oil and grease, Kjeldahl-N, NO_3-N, NH_4-N, TN all no triggers
Port Nelson								
Port of Tauranga								
South Port	Island Harbour (berths 5-8)	ANZECC	TSS and turbidity, ANZECC-based	ANZECC-based	ANZECC-based	ANZECC-based	ANZECC-based	DO, TPH, Hazen colour, tannin, $cBOD_5$ ANZECC-based

Limits in receiving environment - Water

Port	Log yard	Mixing zone?	pH	Salinity	TSS/Turbidity	TOC	DO	Other	Cu	Pb	Zn	Monitoring Frequency	Notes
CentrePort	Kaiwharawhara (new yard)	30 m for post-first flush discharge.											
	Aotea Quay												
Eastland Port	Southern Log yard	50 m for northern discharge, 30 m for southern	6.7-8.5					Tannins no trigger. Where a clear and consistent relationship is found, that information shall be used to establish trigger levels for tannins that avoid a change to the colour and clarity of the receiving waters to a conspicuous extent beyond the reasonable mixing zone.	0.003 mg/L (northern discharge) and 0.0013 mg/L (southern discharge) or background, whichever is larger	0.0066 mg/L (northern discharge) and 0.0044 mg/L (southern discharge) or background, whichever is larger	0.023 mg/L (northern discharge) and 0.015 mg/L (southern discharge) or background, whichever is larger	The monitoring programme is to be included in the SMP, including the frequency (that will be at least once every three months)	ANZECC 90% level of protection used for the northern discharge receiving environment, 95% for southern. Concentrations of metals will be sampled within the stormwater system and calculate receiving-environment concentrations by applying the dilution factor for the mixing zone. TSS and metals to be measured in the receiving environment when port operations and weather conditions allow.
	Upper Log yard										(northern) &		
	Wharfside Log yard (new)	25 m (turbidity, tannins, clarity, colour) and 50 m (TSS, VSS, turbidity, tannins, TOC, DO, Cu, Pb, Zn, phenols, resin acids, dehydroabietic acid, TN, NO_2-N, NO_3-N, NH_4)	6.7-8.5	No trigger	TSS at 50 m boundary trigger to be determined after 2 years, VSS at 50 m boundary no trigger, turbidity at 25 m and 50 m boundaries no trigger, tannins at 25 m and 50 m boundaries triggers to be determined after 2 years	50 m boundary no trigger	50m boundary no trigger	Total phenols 50 m boundary 0.520 mg/L, total resin acids 50 m boundary no trigger, dehydroabietic acid 50 m boundary no trigger, TN	50 m boundary 0.003 mg/L or background	50 m boundary 0.0066 mg/L or background	0.015 g/m^3 (southern) or background concentration whichever is the higher value	Three-monthly at least. After two years of full compliance may be reduced to annual but reverts to three-monthly if any non-compliance occurs	
Lyttelton Port		Colour and clarity: the largest of 100 m, 100 times the average internal diameter of the discharge pipe or 100 times the average width of the culvert or drain used. Other variables: the largest of 20 m, 20 times the average internal diameter of the discharge pipe or 20 times the average width of the culvert or drain used.										Intermittent compliance checks by Canterbury Regional Council	

Limits in receiving environment – Water (continued)

Port	Log yard	Mixing zone?	pH	Salinity	TSS/Turbidity	TOC	DO	Other	Cu	Pb	Zn	Monitoring Frequency	Notes
Napier Port					No trigger			Cd, no trigger, Ni no trigger, TPH no trigger, NO3-N no trigger, SRP no trigger		No trigger	No trigger	Annual (may be reduced by agreement after first two samples). Every 3 years for SVOC	
Northport	Marsden Point	300 m (500 m for colour)							0.0013 mg/L	0.0044 mg/L	0.015 mg/L	First discharge per season, and two other discharge events each year	Advise NRC when ponds reach design discharge level for the first time each year prior to discharge occurring.
												Three samples spaced evenly over each day (operational hours) until discharge has ceased. First sample to be taken as close as possible to when discharge first occurs	Temperature and DO are considered not useful in this situation as they will reflect conditions intrinsic to the wetland and in any event cannot have any influence on water quality in this particular marine receiving environment
												Taken with first sample from first discharge event only	If the resin acid results for the first discharge of the season are below any applicable ANZECC effect threshold after theoretical mixing, resin acids need not be further analysed in that season. See 'Limits in discharge'. Resin acids, Total N and P concentrations will be assessed against available literature and previous concentrations to determine potential for adverse effects. All parameters to be assessed for any increasing trends over time
Port Marlborough	Port Shakespeare	100 m						95%iles: BOD_5 0.375mg/L, DRP 0.001 mg/L, dissolved yellow substance 0.01 m^{-1}				All variables monthly if discharging stormwater	All variables measured in the discharge. BOD5, DRP, yellow substance and metal triggers adjusted for 400:1 dilution at the edge of the mixing zone. Metal triggers based on ANZECC 95% level of protection. Cu, Pb and Zn triggers apply to log-handling operations, other metals and metalloids only apply if coal-handling commences at the port.
Port Nelson													Port Nelson and Nelson City Council jointly operate a Long Term Monitoring Programme to monitor the quality of seabed sediments potentially affected by port activities and other catchment land uses (including the discharge of stormwater) within the port operational area and Nelson Haven, and to evaluate effects of environmental management measures undertaken by the port to reduce contaminant inputs.
Port of Tauranga													
South Port	Island Harbour (berths 5-8)												In addition to annual measurement of contaminants in discharges from stormwater outlets and sediments (see separate columns in table), there are annual photographic surveys of the seabed and measurement of the height of the seabed around the wharf area to monitor accumulation of sediment on the seabed. Annual monitoring of biological assemblages growing on the wharves.

Limits in receiving environment – Sediment

Sediment						Pond influent			
Port	**Log yard**	**Location and frequency**	**Variables**	**Triggers**		**Frequency**	**Parameters**	**Criteria**	**Notes**
CentrePort	Kaiwharawhara (new yard)								
	Aotea Quay								
Eastland Port	Southern Log yard								
	Upper Log yard								
	Wharfside Log yard (new)	Shipping channel adjacent to wharves, in combination with monitoring for other log yards in port	As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn	ANZECC ISQG-Low					
Lyttelton Port									
Napier Port									
Northport	Marsden Point					First discharge per season	T, pH, DO, TSS, Cu, Pb, Zn, resin acids, phenols, PAH, VSS	Trend data only, no compliance limits.	Test to be used as an indication of pond effectiveness under different conditions e.g. size of storm, contributing area.
Port Marlborough	Port Shakespeare	Sediments and infauna at 2 locations on edge of mixing zone (100 m from discharge) and 2 control locations in similar habitat and depth, ≥ 200 m from discharge. Edible shellfish from radius of 100m from discharge and at 2 control locations in similar habitat and depth, ≥ 200 m from discharge. Edible shellfish from radius of 100 m from discharge and at 2 control locations ≥ 200m from discharge. All sampling at five-yearly intervals	Sediment texture, TOC, TBT, Cu, Pb, Zn, TPH, TOG, Kjeldahl-N, NO_3-N, $NH4\text{-}_N$, TN. Edible shellfish Cu, Pb, Zn, Hg, PAH	No significant effect (arising from the discharge of stormwater) at the mixing zone edge when compared to control sites					
Port Nelson									
Port of Tauranga									

Limits in receiving environment – Sediment (continued)

		Sediment				Pond influent			
Port	**Log yard**	**Location and frequency**	**Variables**	**Triggers**		**Frequency**	**Parameters**	**Criteria**	**Notes**
South Port	Island Harbour (berths 5-8)	Annual monitoring of sediments at 4 sites (including reference).	Sediment texture, Cd, Cr, Cu, Hg, Pb, Ni, Zn, P, PAH, TBT	ANZECC Low: Cd 1.5 mg/kg, Cr 80 mg/kg, Cu 65 mg/kg, Hg 0.15 mg/kg, Pb 50 mg/kg, Ni 21 mg/kg, Zn 200 mg/kg, PAH 4 mg/kg, TBT0.005 mg/kg or higher than baseline survey.					