

# What are the environmental effects of predicted nutrient increases for the Waiau River catchment?

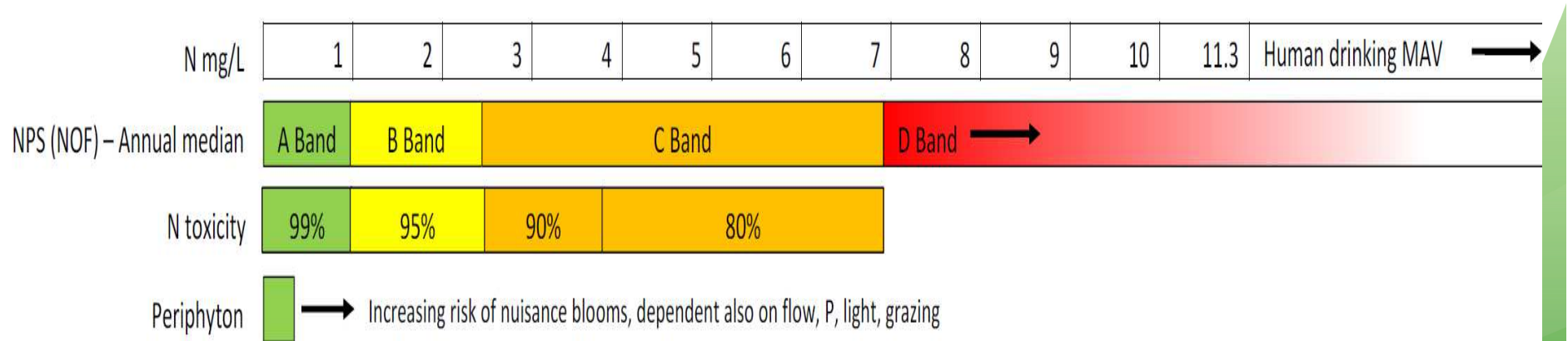
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Environment Canterbury  
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# Potential Environment Effects

- Nuisance periphyton
  - Smothers benthic habitat, reduces available habitat for aquatic sp. (flow on impacts for invertebrates and fish)
  - Some species can be toxic e.g. *Phormidium* (cyanobacteria)
- Nitrate toxicity
  - Impacts on aquatic organism life traits such as growth, reproduction, mortality

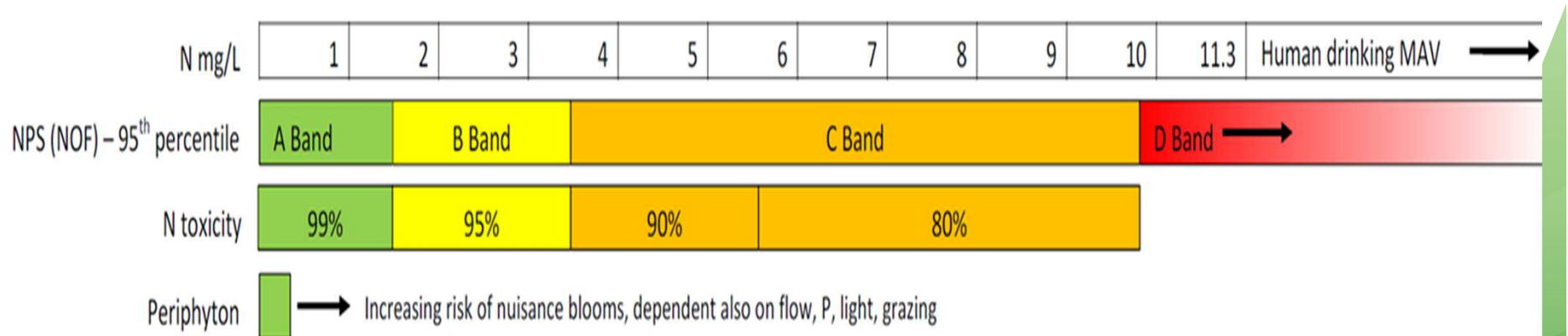
# Nitrate for periphyton vs chronic toxicity vs acute toxicity

- Using median concentrations...



# Nitrate for periphyton vs chronic toxicity vs acute toxicity

- Using 95<sup>th</sup> percentile concentrations...



# Predicted Nutrient Increases from future development

- Irrigation development:
  1. Development of land that is already consented but unimplemented in the Waiau River catchment.
  2. The predicted increase in nutrient losses from a proposed further 3500 ha irrigated area in the Emu Plains Irrigation Scheme command area. Emu Plains Irrigation (EPI) already has consent for 4000 ha of existing irrigation.
- Permitted Dryland Development
  - Predicted nitrogen root-zone losses from dryland winter forage area on in-river loads
  - requires more work

# Key Messages

- Both nutrients and flow key factors of periphyton regulation
- Predicted nutrient increases have potential to influence periphyton growth for the lower Waiau River and Mason River
- Small streams at risk of nitrate toxicity

# Key Messages

- Upper Waiau River = shorter accrual periods, nutrient concentrations do not indicate high risk of exceeding plan Chlorophyll A objectives
- Lower Waiau River = shorter accrual periods however DIN concentrations indicate risk of exceeding Chl A objectives
  - Predicted nutrient increases show potential to further exacerbate periphyton risk by a 5% increase

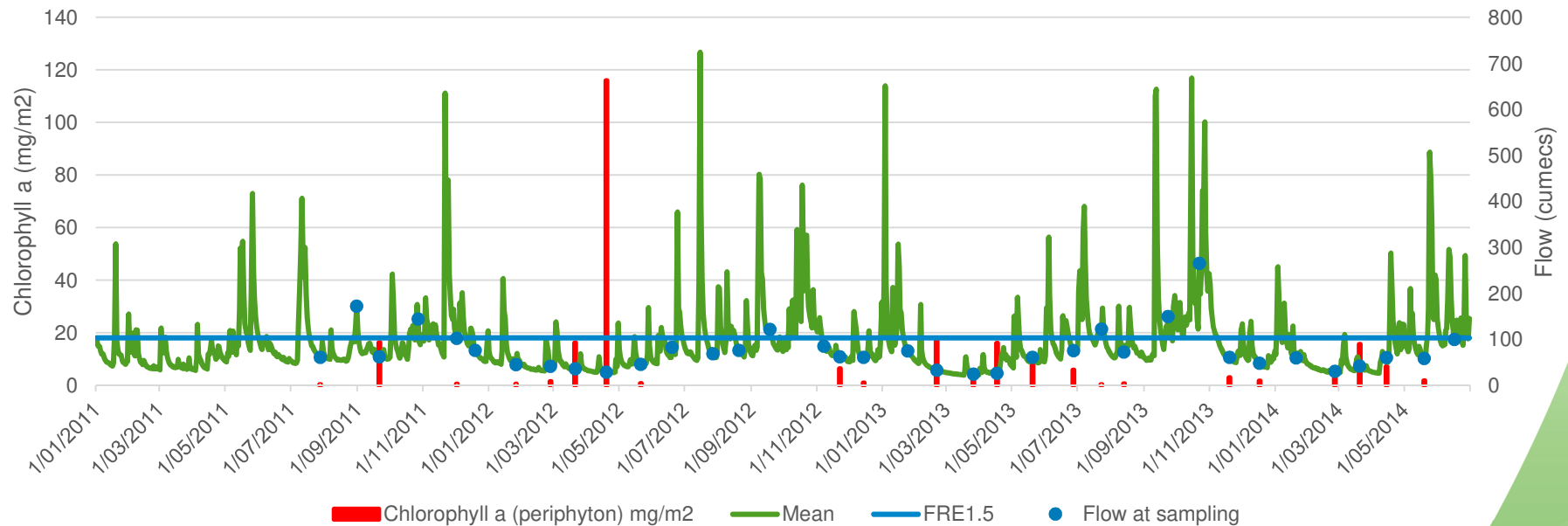
# Key Messages

- Mason River
  - = longer accrual periods and less frequent flushing flows
  - = nutrient concentrations indicate potential for Chl A national bottom line objectives to be exceeded
  - Predicted nutrient increases show potential to further exacerbate periphyton risk by an 18% increase



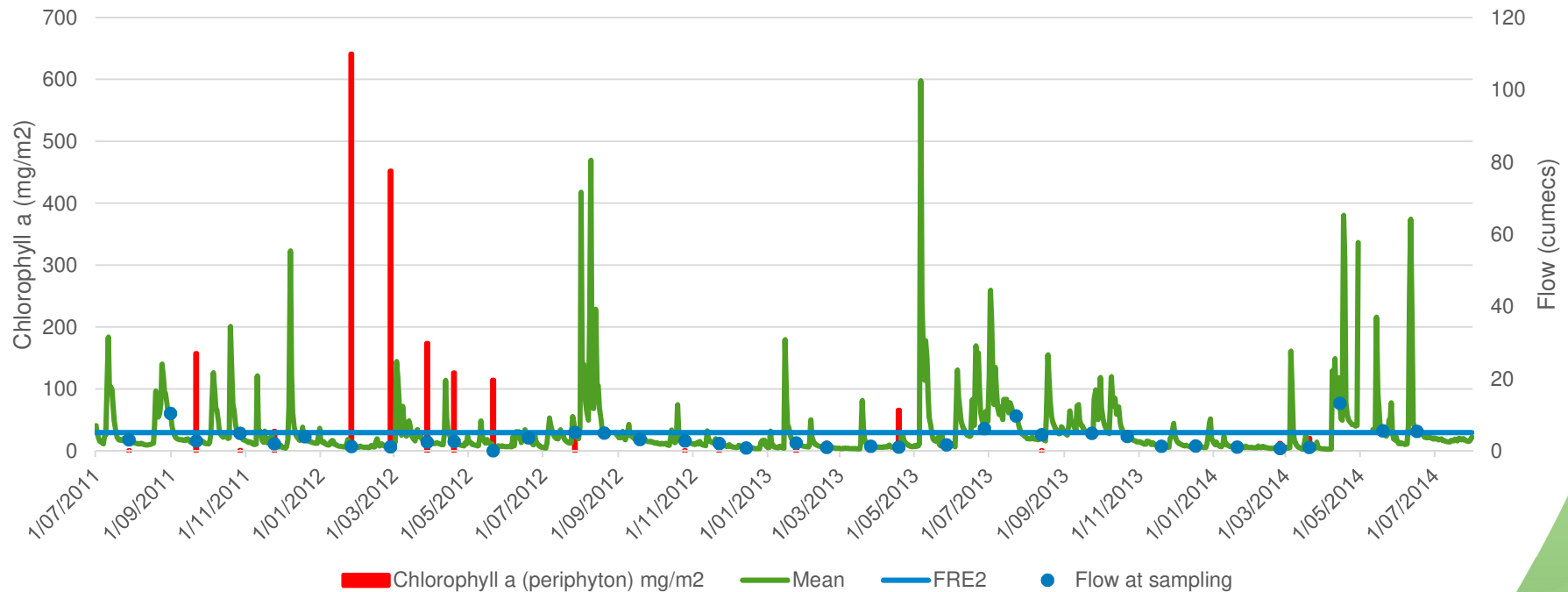
**What makes the Waiaiu River and  
tributaries susceptible to  
periphyton growth from nutrient  
increases?**

# Flow – Waiau River



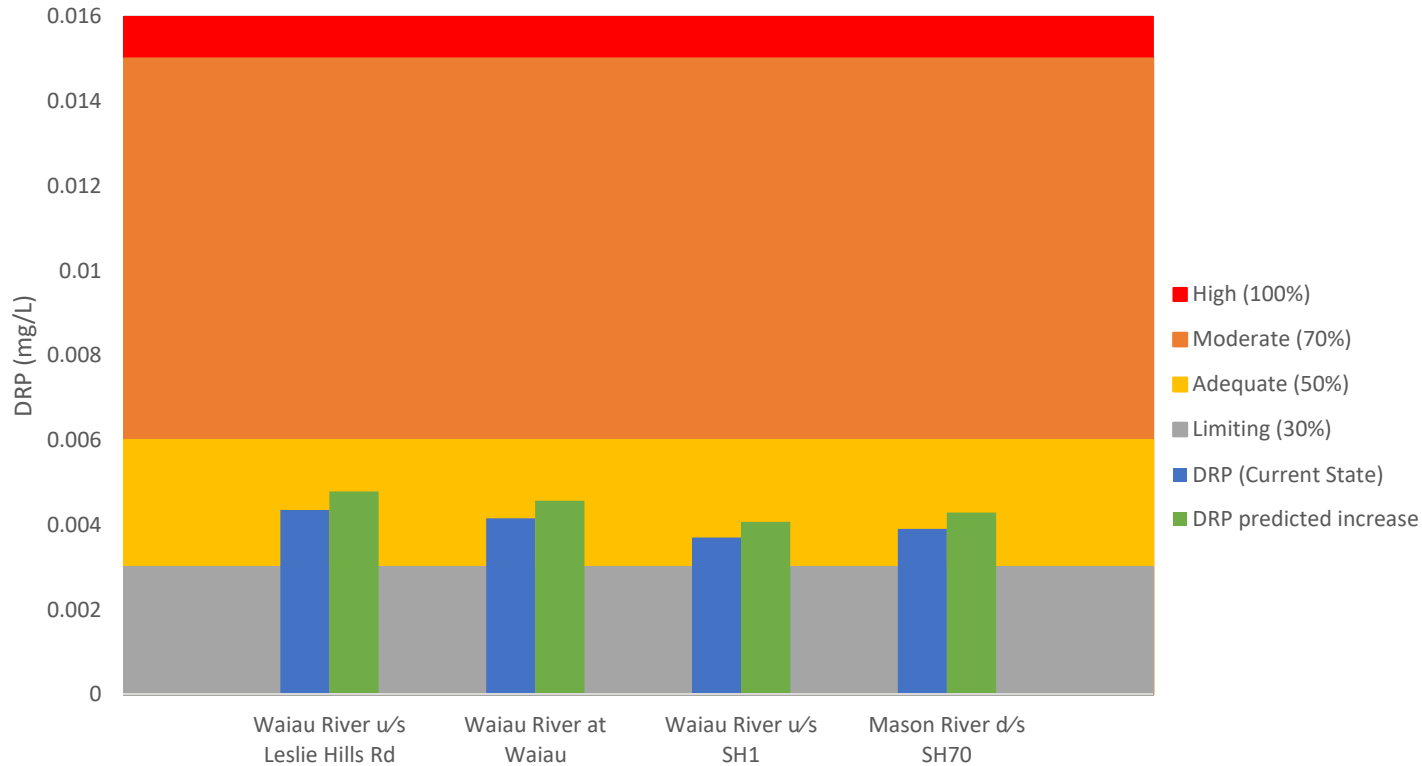
- Frequent effective flushing flows and short annual average accrual periods of less than 30 days
- Risk of periphyton growth was greater during longer individual accrual periods e.g AP of 47 days preceded max chlorophyll A observation

# Flow – Mason River



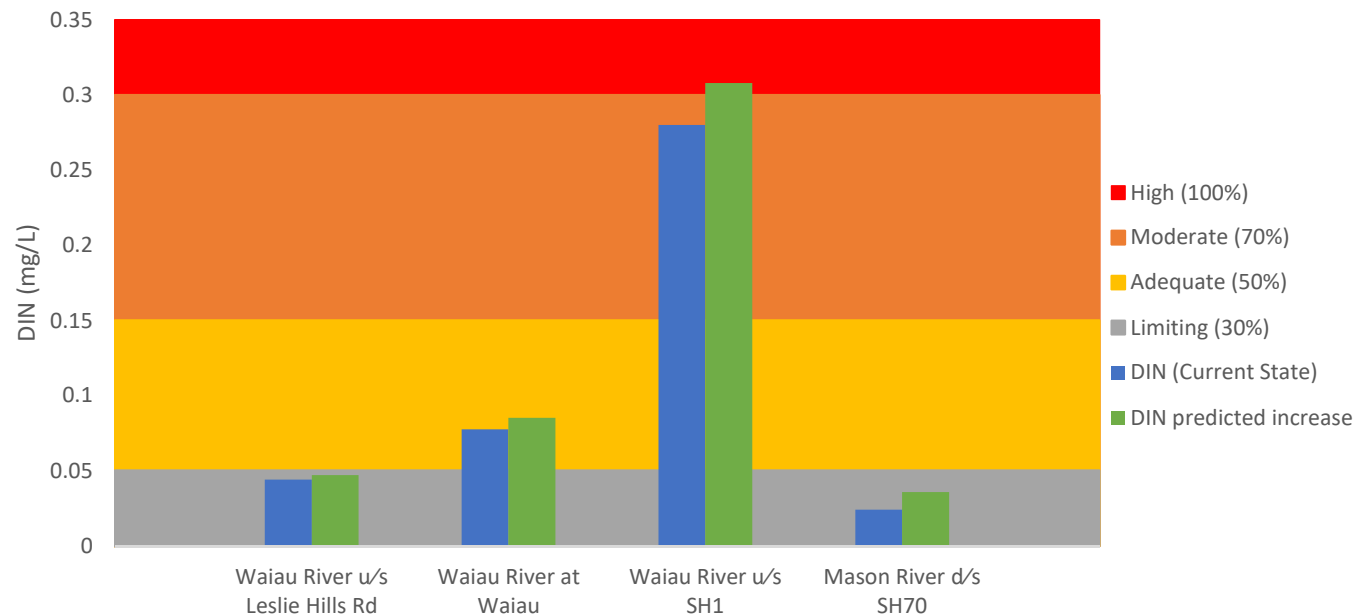
- less frequent effective flushing flows and long annual average accrual periods
- Well established periphyton blooms may require more than the effective flushing flow

# Nutrients



- DRP - All sites indicate moderate risk of nuisance periphyton
  - Despite predicted increases

# Nutrients



- DIN - Increases with distance downstream in Waiau
  - = increasing periphyton risk under suitable conditions e.g flow
  - Waiau SH1 predicted nutrient increase indicates increased risk of nuisance periphyton

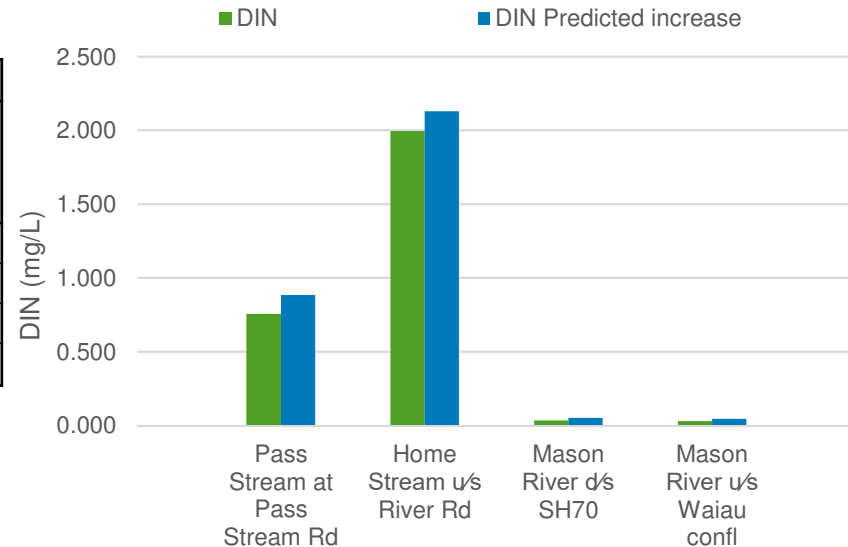
# Nutrients

	DRP					DIN				
	Biggs Nutrient Threshold	DRP (Current State)	DRP predicted increase	95th %ile	95th %ile predicted increase	Biggs Nutrient Threshold	DIN (Current State)	DIN predicted increase	95th %ile	95th %ile predicted increase
Waiau River u/s Leslie Hills Rd	0.0153	0.0044	0.0048	0.0065	0.0072	0.1522	0.0440	0.0471	0.1326	0.1419
Waiau River at Waiau	-	0.0042	0.0046	0.0071	0.0078	-	0.0775	0.0853	0.2445	0.2690
Waiau River u/s SH1	0.0069	0.0037	0.0041	0.0078	0.0086	0.0712	0.2800	0.3080	0.8930	0.9823
Mason River d/s SH70	0.0012	0.0039	0.0043	0.0118	0.0130	0.0122	0.0240	0.0358	0.3250	0.4843

- Waiau SH1 and Mason SH70 exceed DIN objectives
- Susceptible to periphyton growth, especially under low flow conditions
- Further increases to dissolved nutrient concentrations may exacerbate the situation

# Nutrients: Emu Plains Irrigation Proposed Development

	DIN			
	DIN	DIN Predicted increase	95 %ile	95 %ile predicted increase
Pass Stream at Pass Stream Rd	0.755	0.883	-	-
Home Stream u/s River Rd	1.995	2.129	3.525	3.761
Mason River d/s SH70	0.034	0.051	0.386	0.575
Mason River u/s Waiau confl	0.030	0.044	0.422	0.629



- Smaller streams likely already impacted
- Home Stream at risk of not meeting policy 5.3A with predicted nutrient increases
  - Predicted increase estimate does not meet the 95<sup>th</sup> %ile value of 3.6mg/L, predicted median close to 2.3 mg/L
- Nitrate concentrations may be lower than “average” during dry year

# Predicted modelled periphyton biomass

Chlorophyll a Predictions based on nutrient data		
	Chl A (modelled based on DIN) (mg/m <sup>2</sup> )	Chl A (modelled based on DRP) (mg/m <sup>2</sup> )
<b>Waiau River at Leslie Hills</b>		
Current state	64	64
Predicted nutrient increases	66	68
% increase in Chl A	3%	5%
<b>Waiau River at SH1</b>		
Current state	239	88
Predicted nutrient increases	251	92
% increase in Chl A	5%	5%
<b>Mason River at SH70</b>		
Current state	281	355
Predicted nutrient increases	344	372
% increase in Chl A	18%	5%

- Waiau SH1 chlorophyll a estimated to exceed plan objectives based on DIN
  - Cyanobacteria may source P requirements from particulate P e.g attached to sediment
- Mason SH70 chlorophyll a estimated to exceed NPS-FM based on DIN & DRP



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<b>Mason River at SH70</b>		
Current state	281	355
Predicted nutrient increases	344	372
% increase in Chl A	18%	5%

- Waiau SH1 = 5% predicted chlorophyll a increase based on DIN concentrations
- Mason SH70 = 18% predicted chlorophyll a increase based on DIN

# Key Messages

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