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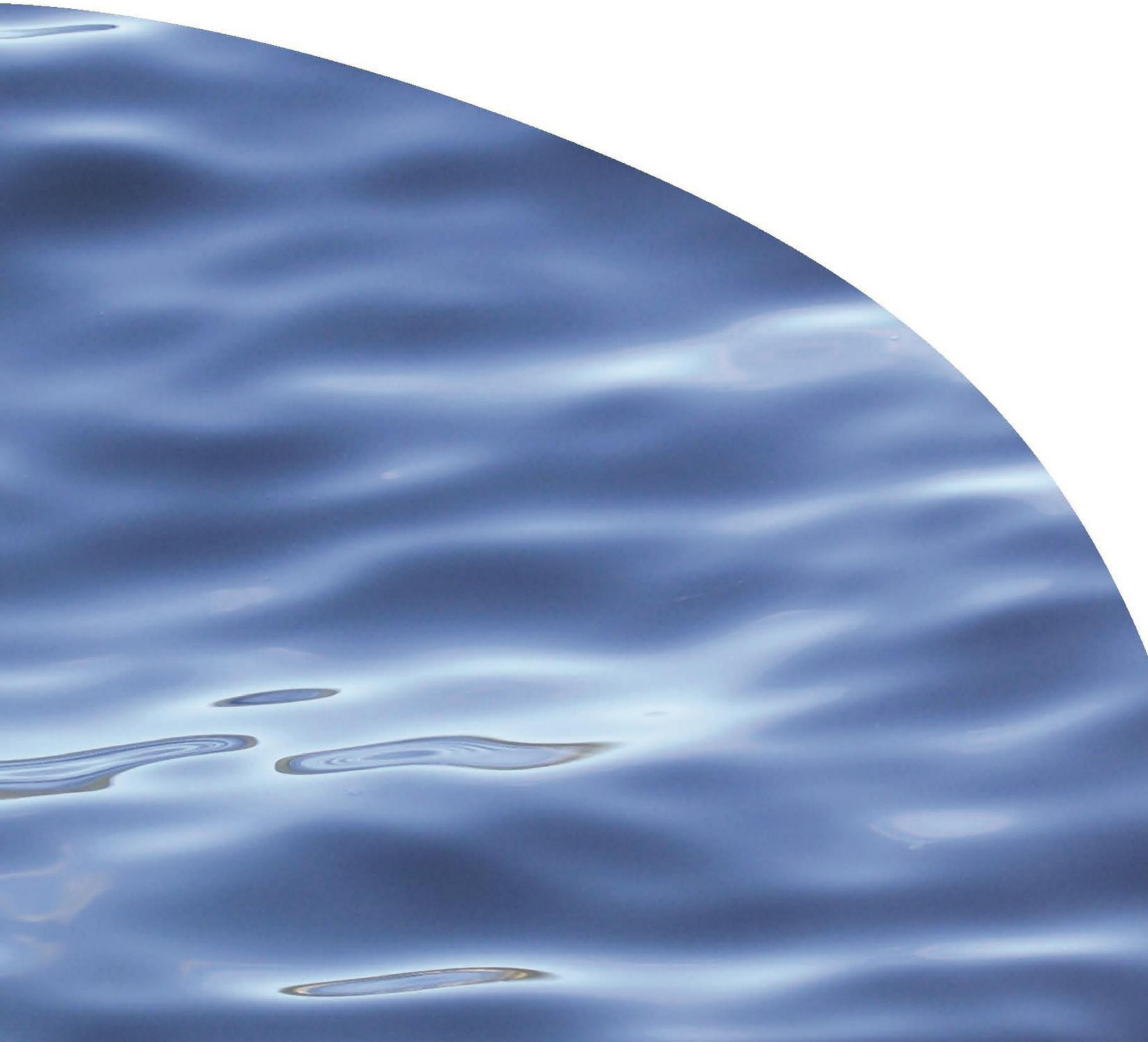
A SCOPING WORKSHOP FOR MONITORING THE EFFECTS OF WATER ALLOCATION



A SCOPING WORKSHOP FOR MONITORING THE EFFECTS OF WATER ALLOCATION

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Prepared for Northland Regional Council

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1. INTRODUCTION

The need for regional councils (and unitary authorities) to monitor the efficacy of their water allocation policy has been reinforced by the National Policy Statement for Freshwater Management (NPS-FM) (2014). The Ministry for the Environment (MfE) recently hosted a workshop (on 16 May 2018) focusing on monitoring the ecological effects of water allocation policy. The aim of the workshop was to begin scoping a national project to provide clear guidance, including monitoring protocols, to assess the effectiveness of minimum flow and allocation rules in regional plans in safeguarding the life-supporting capacity of rivers and streams (specifically aquatic biodiversity and ecosystem productivity). The workshop was organised by Northland Regional Council and the Cawthron Institute (Cawthron) and was also attended by staff from several other regional councils and unitary authorities, NIWA, Department of Conservation and MfE (attendees listed in Appendix 1). The workshop and production of this report were funded by Envirolink MAG 1855-NLRC205. This report provides a synthesis of the discussion and proposed action points from the workshop.

Key discussion topics at the workshop included:

- What needs to be monitored to understand the impacts of minimum flows and allocation limits on aquatic biodiversity and productivity? (i.e. what freshwater taxa / traits / life-stages will respond to flow and how)
- How should it be monitored? (i.e. what is the right scale to measure responses to determine effects of the magnitude and duration of low flows)
- Are new national monitoring protocols required to assess the ecological effects of altered flow regimes, and if so what avenues exist to facilitate development of these protocols?

The intent was that outputs from the workshop would be used to design an Envirolink Tools proposal (or similar) to develop national protocol/s for monitoring aquatic biodiversity and productivity in rivers/streams for assessing the effects of altered flow regimes.

2. PURPOSE OF MONITORING

There is a clear need for scientific evidence to support and inform environmental flows[1] and allocation limits. Information on ecological responses to flow alterations is required to monitor the efficacy of existing policy and to inform future policy.

[1] Environmental flow is a limit which describes the amount of water…which is required to meet freshwater objectives (intended environmental outcomes). From NPS-FM, Interpretation section.

The National Policy Statement for Freshwater Management (NPS-FM) (2014) requires regional councils to set limits, including minimum flows and allocation limits, to safeguard the life-supporting capacity, ecosystem processes and indigenous species of freshwater ecosystems. Councils are also required to develop monitoring plans to measure progress toward achieving freshwater objectives in their plans. In addition, the definition of over-allocation in the NPS-FM includes situations where freshwater objectives are no longer being met. Obviously, robust monitoring methods are required to ensure that appropriate information is collected to assess whether freshwater objectives are being met, or identify why they are not. As well as contributing to freshwater accounting systems required by the NPS-FM, monitoring results will help provide for the requirements of the Environmental Reporting Act 2015.

There was general consensus at the workshop that existing state of the environment (SoE) monitoring programmes, which are primarily focused on detecting changes in water quality, are unlikely to provide appropriate data to assess ecological impacts of flow alteration. For example, macroinvertebrate sampling in SoE monitoring often deliberately focuses solely on riffle habitat, in an attempt to isolate the influence of water quality on invertebrate communities from other potential influences. However, aside from reducing in width (and therefore habitat area), fast-flowing riffle habitat is the last place that effects of flow reduction are likely to manifest. Common macroinvertebrate indices and metrics of presence-absence, community composition and density are likely be insensitive to flow change in riffles compared with pools and runs. Also, existing SoE monitoring networks are often not aligned with flow monitoring and/or water use data, which is crucial for linking ecological change with flow alteration.

Consequently, there is a need to develop new monitoring programmes and methods designed specifically to detect the influence of flow alteration. Since there are inevitably constraints on council budgets, these monitoring programmes need to be efficient and pragmatic. A nationally coordinated approach to developing appropriate monitoring protocols ought to improve efficiency and consistency between regions. Also, by providing consistency of data collection, national protocols would facilitate collection of an essential strategic data set, enabling assessment of the effects of flow variation on aquatic biodiversity and productivity over space and time at a national level.

In addition to assessing policy effectiveness, ecological monitoring data ought to be useful for more general effects assessment and for helping to weigh the ecological costs and benefits of more run-of-river abstraction versus water storage schemes.

3. SCOPE OF MONITORING

It was recognised that the majority of water allocation in most regions is either from surface water or from groundwater that is closely linked with surface water (Booker 2018). On this basis, for pragmatic reasons, the initial focus of discussion around appropriate monitoring protocols was on instream life in flowing waters, particularly in gravel bed, rain-fed rivers. There was recognition that protocols may also need to be developed for other water bodies such as springs, lakes and wetlands. However, these may need to be the focus of a separate project in the future, to keep the scope manageable.

3.1. Expected effects of flow alteration

A potentially useful way to identify appropriate attributes for monitoring is by considering the expected effects of flow reduction. Expected effects of reducing flows in the low to median flow range include:

1. Reduction in wetted width, resulting in a reduction in the area of productive benthic habitat for periphyton and invertebrates. This reduces the food available to higher trophic levels, including fish.
2. Reduction in the transport capacity of a river, which decreases the drifting seston and invertebrate food supply for filter-feeding invertebrates and drift-feeding fish, respectively. These changes can be viewed as a reduction in life-supporting capacity.
3. Increased fluctuations in water temperature and dissolved oxygen, which may also influence life-supporting capacity. In extreme cases increased daily maximum water temperatures can be lethal, but even moderate increases in temperature can influence life-supporting capacity. For example, feeding by trout is inhibited by water temperatures between 18 °C and 22 °C, so trout will cease growing, lose condition and become more susceptible to disease if temperatures consistently exceed this threshold. Moreover, trout may lose condition even as temperatures approach these limits if the food supply does not keep pace with the metabolic demands of the fish, which increase exponentially with temperature. The same principle applies to all fish, not just trout, but temperature limits for feeding are species-specific.

A conceptual understanding of expected ecological changes in response to flow change can inform the design of monitoring programmes, including appropriate covariates of flow change that should be measured. If ecological changes are detected by monitoring, mechanisms for these changes can be hypothesised, and monitoring data can then be used to test these hypotheses. Without data on a broad range of covariates it may not be possible to tease out the effect of flow from other potential influences.

3.2. What needs to be monitored

Assessing the ecological effects of flow regime alteration requires monitoring of at least four categories of data:

1. Biological – measurements of instream life to quantify potential changes in life-supporting capacity, ecosystem processes and indigenous species (as stipulated in the NPS-FM), as well as valued introduced species (e.g. trout and salmon) where these are a focus of freshwater objectives.
2. Hydrological – measurement of stream discharge so that changes in biological and physico-chemical data can be correlated with, and ideally attributed to, changes in features of the flow regime (hydrology) (natural versus altered).
3. Physico-chemical – non-biological attributes of the aquatic ecosystem (e.g. water temperature, dissolved oxygen, depth) that are likely to vary with flow alteration and may mediate relationships between flow alteration and biological responses.
4. Habitat – physical attributes of the river / stream including wetted area and diversity of channel form to support biodiversity and life stages of fauna.

Biological data are likely to include monitoring of fish, invertebrates and periphyton. These trophic groups may relate to freshwater objectives (e.g. maintaining fisheries values) directly (i.e. specific to themselves), or indirectly through food web interactions. The ecosystem health assessment framework, currently being developed for MfE (Clapcott et al., in prep.), was identified as being a potentially useful reference for identifying the range of ecological indicators required to assess the influence of flow alteration on ecosystem health.

In the workshop the prospect of monitoring torrentfish as an indicator was discussed. Torrentfish were nominated as a flow-critical species due to the flow sensitivity of their preferred high-velocity habitats, and their high conservation status (currently listed as ‘Declining’ in Goodman et al. (2014)). This rationale has made maintenance of torrentfish habitat the focus of flow setting in several regions recently. Proposed monitoring of torrentfish serves as an example of the types of data required to detect the impact of flow alteration. Variables that might be included in a flow-monitoring programme for torrentfish include: presence or absence, abundance, biomass, growth or condition. However, to identify what is causing any observed changes in torrentfish, a broad range of other variables would also need to be monitored, e.g. flow, water chemistry (ideally including continuous water temperature and dissolved oxygen), periphyton and invertebrate communities, stream geomorphology and habitat availability.

A large number of hydrological indices could be used for investigating the link between flow alteration and ecological responses. However, these all depend on the key requirement to record flows and water use at the appropriate scale to allow ecological changes to be attributed to flow alteration. If flow is not recorded at the same site as other monitoring variables, then flow records will need to be synthesised for the site based on relevant hydrological data. In addition to stream flow, records of water use are required to elucidate the extent of flow alteration. There is often a mismatch between allocation in policy, in consents (which may predate current policy), and actual water use, since consents may not be fully exercised. Actual water use is most relevant to detecting ecosystem response to flow alteration, since the ecosystem will respond to flows actually experienced. Although data on actual use of consented abstractions are becoming more consistently available over time, information on water abstracted for permitted activities may still need to be estimated.

3.3. Scale

A key question posed at the workshop was whether research or monitoring to demonstrate generic effects of flow alteration would be sufficient for council managers, *or* whether detecting changes or trends for particular locations or catchments would be necessary? The latter was considered to be more useful to managers in dealing with communities and consent applicants/holders. However, it was recognised that very long-term monitoring (e.g. decades) may be required to have sufficient statistical power to detect anthropogenic effects in naturally variable systems.

Using nationally-coordinated, consistent monitoring protocols would allow generic effects of flow alteration to be detected between sites over shorter time scales. This would provide useful information until longer-term, local scale data can be collected to analyse variation over time at individual locations.

As mentioned above it was suggested that protocol development initially focus on rain-fed, gravel bed rivers, since they are subject to most existing abstraction pressure. While it is feasible and desirable from an ecological perspective to treat differing ecosystems separately, it is less feasible to separate the effects of abstraction from groundwater and surface water from a hydrological perspective. This distinction needs to be borne in mind when developing monitoring protocols.

4. NEXT STEPS

The original intent of the workshop was that it would be the first stage of scoping a larger project to develop national monitoring protocols with an Envirolink Tools grant. This remains an appropriate funding possibility to drive the development of protocols and anecdotally, there is strong support for an Envirolink Tools project of this kind from many regional councils (Susie Osbaldiston, pers. comm. – from canvassing opinion at the June 2018 regional council SWIM[2] meeting).

Other potential means of providing protocols on monitoring methods for assessing effects of flow alteration discussed at the workshop include an MfE guidance document for the NPS-FM, or a revamped version of the Proposed National Environmental Standard on Ecological Flows and Water Levels (2008).

The obvious next step is for regional councils to establish where this project sits with respect to their collective information priorities, and to explore potential avenues for funding.

If a nationally-coordinated monitoring programme was to be designed to facilitate national-scale analyses of flow alteration impacts, it would be important to first ascertain what resources would be available within regional councils to undertake the monitoring, since this would influence the design.

Regardless of whether a nationally-coordinated monitoring programme is developed, more streamlined sharing of data between councils and researchers would be very helpful for those interested in national-scale analyses. While this concept appears attractive and simple in principle, there remains a question as to how associated data management costs would be funded? This question requires further consideration by MfE, regional councils, and research providers. LAWA (Land, Air Water Aotearoa) was suggested as a potential database that might be expanded to include monitoring data for flow effects assessment.

Another question raised at the workshop was whether there is anything that council staff can begin to progress monitoring of the effect of flow rules in the short term, such as trialling different sampling methods. Discussion of this topic could be continued in the short term via email between workshop attendees and perhaps extended to a wider audience. Some such email exchange had already occurred prior to the workshop, focussed on the shortcomings of existing monitoring.

[2] Surface Water Integrated Management

5. REFERENCES

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6. APPENDIX

Appendix 1. Workshop attendees, Environment House, Wellington, 16 May 2018.

Susie Osbaldiston	Northland Regional Council
Ebrahim Hussein	Auckland Council
Paul Scholes	Bay of Plenty Regional Council
Harriet Roil	Gisborne District Council
Thomas Wilding	Hawke's Bay Regional Council
Raelene Mercer	Horizons Regional Council
Alton Perrie	Greater Wellington Regional Council
Mike Thompson	Greater Wellington Regional Council
Val Wadsworth	Marlborough District Council
Pete Hamill	Marlborough District Council
Paul Fisher	Nelson City Council
Shirley Hayward	Environment Canterbury
Dave West	Department of Conservation
Helli Ward	Ministry for the Environment
Kirsten Forsyth	Ministry for the Environment
Phil Jellyman	National Institute of Water and Atmospheric Research
Doug Booker	National Institute of Water and Atmospheric Research
John Hayes	Cawthron Institute
Joanne Clapcott	Cawthron Institute
Joe Hay	Cawthron Institute