ARE NOF'S THE SILVER BULLET?

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ABSTRACT

In New Zealand incremental degradation of our once pristine natural environment has slowly been occurring with the increase population and intensive agriculture/horticulture. In studies assessing the water quality of New Zealand streams and rivers a steady increase in nutrient levels has been observed over time. This is despite the stance taken by many Regional Councils to target point sources (typically wastewater treatment plants) and require lower, and lower loads and concentrations of nutrients discharged during consent renewal processes, since the implementation of the Resource Management Act. Confounding the issue is the significant economic cost, which will either be borne by rural contributors or ratepayers from the improvements required in management and treatment of the wastewater to achieve a measurable improvement in waterway health.

To provide a clear pathway for the improvements moving forward, the National Objective Framework (NOF's) has been released and requires Regional Councils to set freshwater objectives and limits in their regional plans. The aim of the national framework is to ensure that the best science is applied across the country, that iwi values are understood and considered appropriately, and that freshwater objectives and limits are set in a consistent and well-targeted way.

This conflict between a number of differing contributors and the economic cost of improving water quality has been played out in other countries such as Australia and Europe, where population pressures occurred earlier than New Zealand. In Europe in the 1960s and 70s, water pollution was a significant problem. This was demonstrated by massive fish mortality, bad odours and polluted lake beds, river beds and sea beds. Due to the number of countries and contributors to each water system this problem required centralised strategy to address this.

The first wave of European water legislation began with the Surface Water Directive in 1975 and culminated in the Drinking Water Directive in 1980. Legislation focused mainly on water quality objectives for particular water types and uses, such as fishing waters, shellfish water, bathing waters and groundwater. In 1991 an emission limit value approach was introduced, which resulted in new directives on urban wastewater treatment and on the protection of waters against pollution by nitrates from agricultural sources. In 2000 the "Water Framework Directive" was adopted this requires integrated water management planning in river based on a combined approach of water quality standards and emission limit values.

This paper will look at the process the European water legislation undertook and how this compares with current measures undertaken with the introduction of the NOF's "bottom line" limits for water quality.

KEYWORDS

Nutrients, Reform, National Objective Framework

1 INTRODUCTION

In New Zealand incremental degradation of our pristine natural environment has slowly been occurring with the increase in population and intensification of agriculture/horticulture. In studies assessing the water quality of New Zealand streams and rivers a steady increase in nutrient levels can be observed during the 2001 to 2011 period. This decrease in water quality can clearly be seen in the increasing nitrate concentrations in figure 1 below.

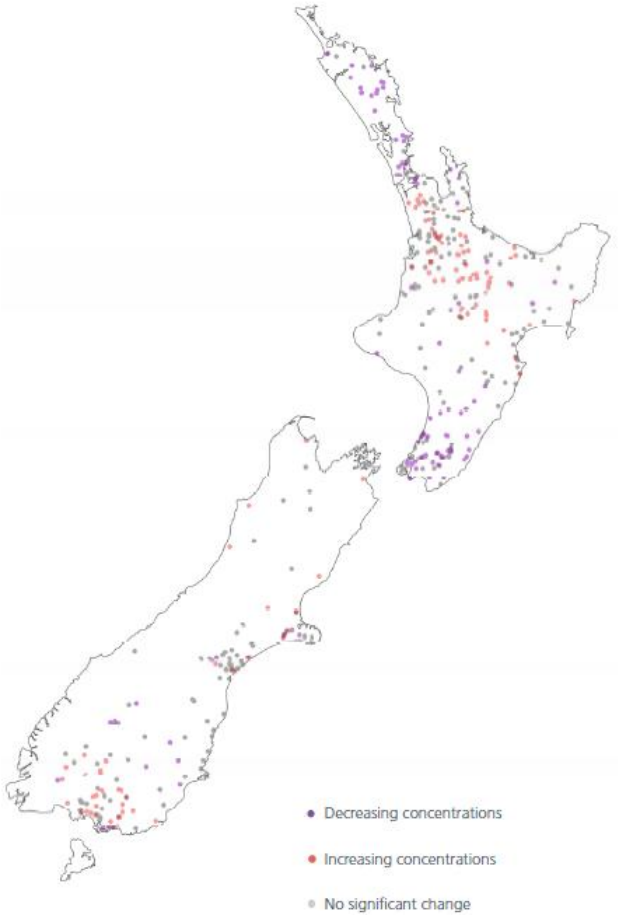

Figure 1: Changes in Nitrate Concentrations 2001 and 2011 (Source MfE Website)

This is decrease in water quality, and the potential eutrophication associated with the increased nutrient loads is against the "clean green image" that New Zealand prides itself on and trades on in the international stage. Since 1991 the Resource Management Act has been active and enabled Regional Councils to place controls or stop discharges directly to water ways or through groundwater contamination. Typically resource consents for point source discharges such as municipal wastewater treatment plants and industrial users have required an incremental improvement in discharge quality over time.

However while restrictions and monitoring are in place for point source discharges, diffuse sources are not typically monitored or restricted. Diffuse sources of pollution typically come from the food production industry. Environmental impacts from agricultural/horticulture activities can include impairment of water resources, which includes losses of nitrogen (N) and phosphorus (P) from land to water and resulting declines in water quality through eutrophication. In New Zealand food production plays an important role in our economy and therefore any restrictions on producers must be balanced against the economic good.

In 2014 amendments to the National Policy Statement for Fresh Water Management added the National Objectives Framework. The intention of the National Objectives Framework is to provide a nationally consistent approach to establish freshwater objectives that also regional and local circumstances.

The European Union was originally formed in 1987, originally seeded from the Treaty of Paris and Treaty of Rome which were designed to help reconstruct the economies of the European continent and ensure a lasting peace. From a Union born out of conflict the European Union has developed its role legislating amongst other things currency control and water quality. Europe waterways suffer similar pressures that New Zealand waterways are now facing, but on a much larger scale with complicating factor of a number of countries contributing the same water source. In order to predict or attempt to assess the potential future effectives of the National Objectives Framework, this paper evaluates the changes in legislation in Europe that have occurred since the 1980's. .

2 EUROPEAN WATER LEGISLATION

In Europe water quality is and has historically been under pressure from economic activities, population growth and agricultural intensification. Water pollution in the 1960s and 70s, was a significant problem, with massive fish mortality, bad odours and polluted lake beds, river beds and sea beds. Compounding this problem was the number of countries that had shared fresh water resources. Therefore a centralised strategy was required to address this.

The European Water Legislation started in 1975 with the Surface Water Directive which set standards for rivers and lakes used for drinking water abstraction. This was swiftly followed in the Drinking Water Directive in 1980 which set binding quality targets for the drinking water.

This legislation was reviewed in 1988, which resulted in the adoption of the Urban Waste Water Treatment Directive 1991(which provided for secondary wastewater treatment, and even more stringent treatment where necessary) and the Nitrates Directive (targeted at addressing water pollution by nitrates from agriculture).

Following this second period of legislation further recommendations were made for other proposals for action, and these were a new Drinking Water Directive, a review of the quality standards (new tighter standards adopted November 1998), a Directive for Integrated Pollution and Prevention Control (IPPC), adopted in 1996, addressing pollution from large industrial installations.

Today the water policy of the EU is primarily covered by the following directives:

- The Bathing Waters Directive (76/160/EEC) of 1976 replaced by the Directive 2006/7/EC
- The Urban Waste Water Treatment Directive (91/271/EEC) of 21 May 1991 covers discharges of municipal and some industrial waste waters;
- The Drinking Water Directive (98/83/EC) of 3 November 1998 covers potable water quality;
- Nitrates Directive (91/676/EEC) of 12 December 1991 covering the protection of waters against pollution caused by nitrates from agricultural sources;
- The Water Framework Directive (2000/60/EC) of 23 October 2000 covering water resources management.

Each European member states has its own national legislation in accordance with these directives. Described in further detail below are the Urban Waste Water Treatment Directive, Nirates Directive and the Water Framework Directive.

2.1 URBAN WASTE WATER TREATMENT DIRECTIVE

The Urban Waste Water Treatment Directive covers the collection, treatment and discharge of urban waste water and the treatment and discharge of waste water from certain industrial sectors. The directive was adopted on 21 May 1991.

The directive requires the collection and treatment of waste water in "agglomerations" with a population equivalent (PE) of over 2000, and more advanced treatment in agglomerations with a PE greater than 10,000 in sensitive areas. Agglomeration are defined as an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point.

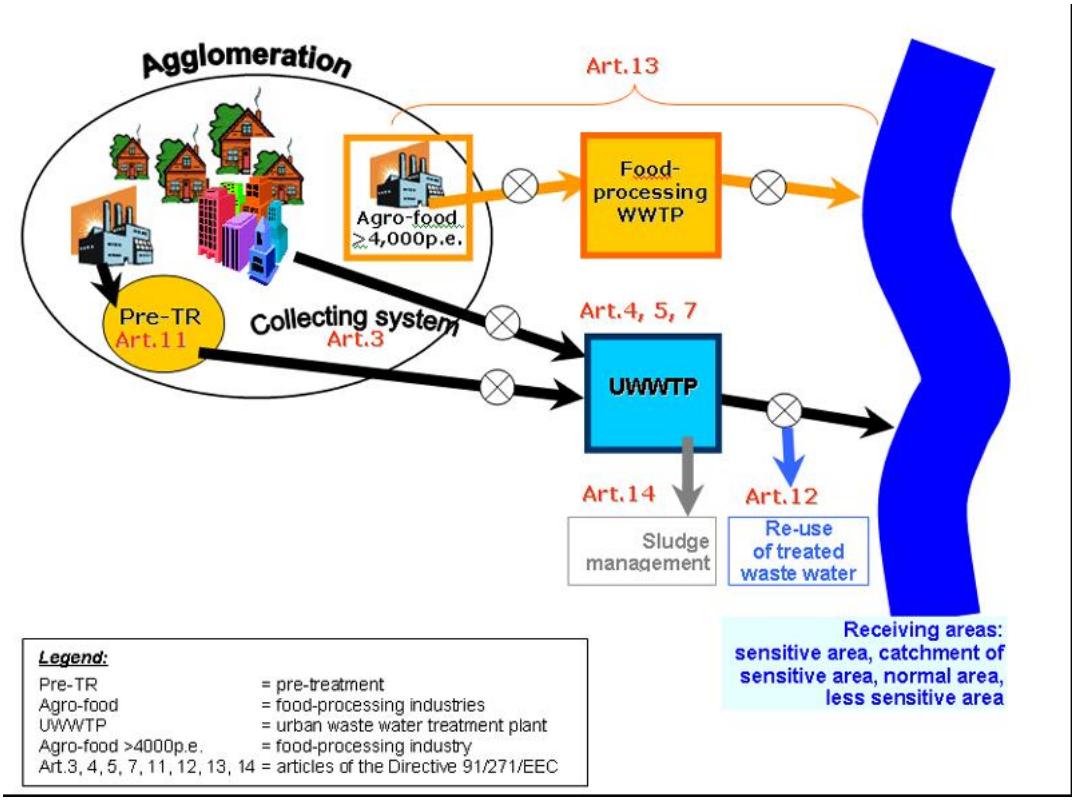

Figure 2: Treatment Requirements under the Urban Wastewater Directive (Source European Commission Environment Website)

The directive covers the four main principles in managing the wastewater system: planning (pre-authorisation required for all discharges), regulation (limits on discharge standards), monitoring (treatment plant and receiving environment), information and reporting.

The treatment level required is based on the population equivalent that is connected to the wastewater treatment plant. For a load less than the equivalent of 2,000 people only secondary treatment is required. The directive defines secondary treatment as the removal of the dissolved and suspended biological matter including organic matter. For load greater than 10,000 and/or designated sensitive areas and their catchments tertiary treatment is required. Tertiary treatment is defined as nutrient (nitrogen and phosphorus) removal and might involve both biological and chemical processes. This could also include a separation process to remove the microorganisms from the treated water prior to discharge or additional treatment.

Standards for treatment are outlined in the directive and therefore as consistent over all countries. The minimum treatment standards are <125 mg/L for COD, <25 mg/L for BOD, <35mg/L for suspended solids, <15 mg/L for Total nitrogen (sensitive areas) and <2 mg/L for Total phosphorus (sensitive areas).

The Urban Wastewater Directive has been implemented for over 20 years, however within most countries with in the European Union there are still some areas which are defined as non-compliant.

2.2 NITRATES DIRECTIVE

The Nitrates Directive was established to limit the use of nitrogen-containing fertilizers and manures is necessary for intensive livestock production, as excessive use of fertilizers constitutes an environmental risk

(leaching) for which environmental policy was required. The Nitrates Directive was established in 1991. The overall aims of this Directive is to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices.

The first part of this Directive requires each Country to identify waters (both surface and groundwater) which are polluted or are at risk of pollution. Pollution is defined as a concentration of more than 50mg/L and/or the potential to become eutrophic.

The second part of the Directive requires countries to designate "Nitrate Vulnerable Zones"(NVZs). These could be a whole catchment, portions of waterways and/or areas of land which drain into polluted or at risk waterways.

The third part of the Directive requires the establishment of Codes of Good Agricultural Practice. These can be implemented by farmers on a voluntary basis. These codes could cover measures such as limiting the periods when nitrogen fertilizers can be applied on land in order to target application to periods when crops require nitrogen and prevent nutrient losses to waters.

In addition to the Codes of Good Agricultural Practice, the Directive requires the establishment of action programmes which must be implemented by farmers within NVZs. These programmes include limiting the maximum amount of livestock manure to 170kg/ha/yr.

National monitoring and reporting is required every four years, and must include: nitrates concentrations in groundwaters and surface waters; eutrophication of surface waters; assessment of the impact of action programme(s) on water quality and agricultural practices; revision of NVZs and action programme(s) and estimation of future trends in water quality.

2.3 THE WATER FRAMEWORK DIRECTIVE

The Water Framework Directive was established on the 23rd October 2000 to provide a legal framework to protect and restore clean water across Europe and ensure its long-term, sustainable use. The Directive looks to manage fresh water resources based on river basins. The directive includes setting quality levels, public participation and economic requirements including cost recovery of water services. As approximately 60% of the surface area lies in river basins that cross borders within European Union, the Water Framework Directive also requires coordination by a number of different countries within each river basins.

By 2003 countries had to identify all the river basins lying within their national territory and assign them to individual river basin districts, and designate a competent authority for each of the river basin districts. In addition, countries had to analyse the characteristics of each river basin and have to carry out an economic analysis of water use.

Under this Directive, by 2009 all river basins districts were to have a management plan, with pricing policies introduced in 2010. The River Basin Management Plans, which should provide a clear indication of the way the objectives set for the river basin are to be reached within the required timescale. The measures provided for in the river basin management plan seek to: prevent further deterioration in water quality, protect and enhance water quality and preserve protected areas.

By 2010, Member States must ensure that water pricing policies provide adequate incentives for users to use water resources efficiently and that the various economic sectors contribute to the recovery of the costs of water services including those relating to the environment and resources. This cost recovery rule is expected to impact particularly irrigated agriculture, where users have not paid the full costs of water supply.

By 2015 each River Basin was targeted with meeting the set environmental objectives, revising the management plan and developing a flood risk management plan. The Water Framework Directive stipulates that groundwater must achieve “good quantitative status” and “good chemical status” (i.e. not polluted) by 2015. Groundwater bodies are classified as either "good" or "poor".

Following the 2015 review, there are two further review periods programmed taking the timeframe out till 2027.

2.4 RESULTS TO DATE

In March 2007 the EU commission published its first progress report on the implementation of the EU Framework Directive. The report found mixed results, noting that most member countries have transferred the directive into national law. But the report concludes that "the legal transposition of the Directive in national law is poor and in many cases inadequate", with only three countries in conformity with the Directive. In 2012 a further report was undertaken, reviewing the progress of Countries to date. Figure 3 below presents the development of the River Basin Management plans, with those areas shown in red not compliant, and those shown in green compliant.

Figure 3: State of Adoption of the River Basin Management Plans (Source –EU 2012)

In the 2012 report this stated that the information provided in the River Basin Management Plans on chemical status for surface waters was not sufficiently clear to establish a baseline in 2009. While the chemical quality of water bodies in Europe has improved over the last 30 years, the quality standards is still below that introduced by the Water Framework Directive objectives. As it may take time to get a good data set and then gain improvement the Directive allows for an extension of the water quality goals to 2027.

	Number of Water Bodies	% Water Bodies in a good status/potential 2009	% Water bodies in a good status of potential 2015
Ecological Status of Surface Waters	82,684	43	53
Chemical Status of Surface Waters	Not able to be assessed due to lack of data		
Quantitative Status of Groundwater	5,197	85	92
Chemical Status of Groundwater	5,197	68	77

Table 1: Improvement in Water Quality Expected in 2015 (Source - European Commission 2012)

Overall it is difficult in 2015 to gauge whether the Water Framework Directive will have the required impact till the performance reports are collated, which are due at the end of the 2015. As presented in Table 1 above, it

appears that there will be improvement in 2015, but that it will not be the full uptake originally targeted by the Directive. Those opposed to the Water Framework Directive have referred to it as a toothless tiger, which as the EU legislation is ratified by each countries legislation appears not to be the case.

The European Union situation with a number of rivers, with a number Countries of contributing pollution to each makes it a difficult to manage without taking an overall cohesive approach. And as they say, the only way to eat an elephant is with one bite at a time.

3 NATIONAL OBJECTIVE FRAMEWORK

The National Objective was introduced 2014, to provide national bottom lines which will guide objective and limit setting around the country. The objective of the National Objectives Framework is to provide an approach to establish freshwater objectives for national values that is nationally consistent and recognises regional and local circumstances.

Water Quality Guidelines i.e. bottom lines have been set for Freshwater covering: Phytoplankton, Total Nitrogen, Total Phosphorus, Periphyton, Nitrate, Ammonia, Dissolved Oxygen, E.coli, Cyanobacteria. Using these bottom lines as a minimum, Regional Council's are required to further develop and assess the current state of their waterways, how communities value these waterways and what goals should be set for the future, based on economic, social, cultural and environmental factors.

There are situations where a value can be set lower than the National Bottom line, if the existing freshwater quality is below the national bottom line and: this is caused by naturally occurring processes; or infrastructure listed in Appendix 3 to the National Objective Framework contributes to the existing freshwater quality; or the freshwater management unit is specified in Appendix 4. To date there are no infrastructure or freshwater management units specified in Appendices 3 or 4 respectively.

4 IMPLICATIONS FOR NEW ZEALAND

The National Objective Framework provides consistency nationwide by the provision of minimum standards, i.e. bottom lines. However the assessment of the waterway and implementation of the "teeth" to the National Objective Framework still lies within the Regional Plans. There is no requirement for cooperation and collaboration between the Regional Council's and therefore there is the potential for differences in terms of implementation.

4.1 WAIKATO RIVER

The focus from the National Objective is still strongly on water quality in the waterways, and provides no consistency between levels of treatment required for each point source discharge. Within Europe, there is consistency with the Urban Wastewater Directive, and clear quality guidelines based on population size.

In New Zealand, discharges to waterways from point sources tend to be heavily monitored, however these typically make up a small portion of the nutrient load to the waterway, with the bulk of the load coming from background and/or landuse activities. This is illustrated in the Table 2 below, which outlines the Nitrogen and Phosphorus Loads to the Waikato River.

Mass Loads in Waikato	Nitrogen Load	Phosphorus Load
Lake Taupo Outflow	3%	2%
Point Sources	7%	18%
Background	29%	35%
Landuse	61%	45%

Table 2: Waikato River Nutrient Loads – (Source –Waikato Regional Council Technical Report 2014/56 – Sources of nitrogen and phosphorus in the Waikato and Waipa Rivers, 2003 -12)

Confounding the problem is that while the river catchment is typically within on Regional Council boundary, discharges (point source and diffuse) tend to cross District Council boundaries. While on District Council can focus on environmental improvements, this isn't always consistently applied.

While the current National Objective Framework provides minimum standards for the Rivers, it does not outline how Regional Council should focus on and enhance the water quality. Historically the easiest way to improve water quality was to focus on the point sources, requiring at least incremental improvement each consent renewal period. However as the easy and economical gains in treatment levels are used up, it becomes difficult to justify the significant financial expenditure required to achieve an incremental improvement, which in some cases may have no perceivable impact on the receiving environment.

4.2 LAKE TAUPO

In the Taupō catchment, nitrate contamination of groundwater is a major problem. In 2003 there were blue-green algal blooms in several North Island lakes. Health warnings about swimming were issued at Lake Taupō for the first time, and this lower quality impacted the downstream Waikato River. While it was not well understood why the blooms occurred and were widespread that summer. However it is generally agreed that if nutrient concentrations in the river had been lower, the blooms would have been less severe.

To address these issues a different catchment based model has been implemented to reduce the nutrient loading on the lake. This has been undertaken with funding from Central Government, through a Lake Taupo Protection Trust formed by collaboration between Regional Council, Taupo District Council and local Iwi. This catchment based model aims to reduce nutrient inputs to the lake by 20% by changing land use and improving farming practices

The Lake Taupo Protection Trust has set up contracts with land owners to change the way land is used have been signed which will in time reduce nitrogen leaching by 20 percent or 170 tonnes a year. This has been done through converting dairy farms to forestry and reducing stock numbers. The 20% reduction will be achieved by 2018.

5 CONCLUSIONS

The National Objectives are a step in the right direction, but alone will not form the "silver bullet" to solve New Zealand's water quality pressures. These provide some of the "teeth" that were missing from the initial National Policy Statement (2011), including a framework for making decisions about the value of a waterway.

However lessons learned from the European model are that targeting point sources alone, is not a long term achievable goal given the large proportion that landuse activities contribute to water quality values. Applying a catchment wide approach in terms of assessing impact from land use activities has shown to be effective in New Zealand when looking at the Lake Taupo experience, and further opportunities for collaboration between stakeholders should be investigated for each water catchment.

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