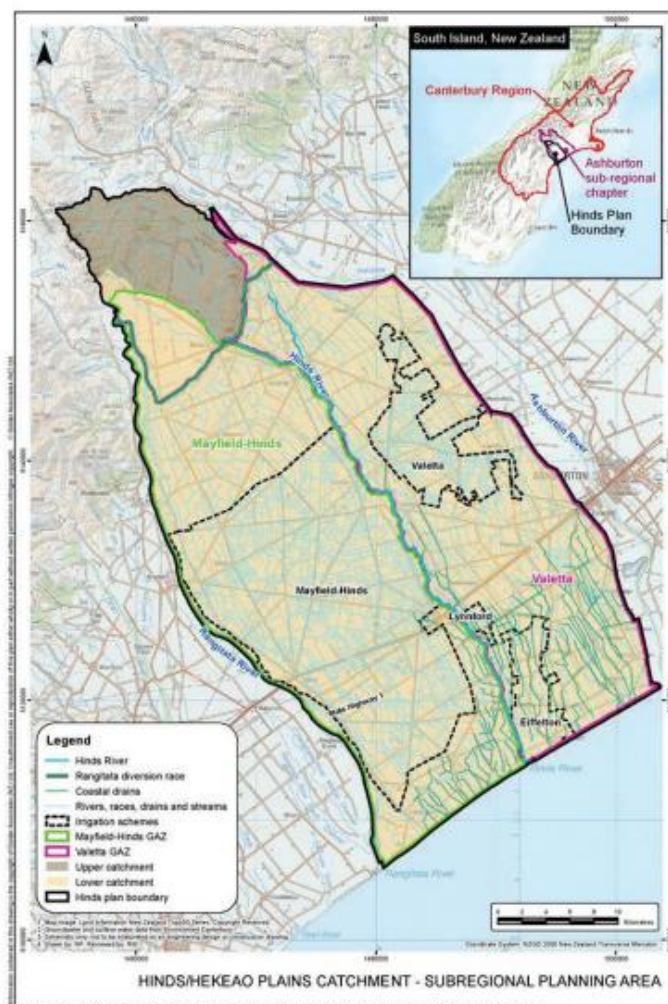


# Impact of DIN Bottom Line in Hinds/Hekeao Plains – October 2019

## Hinds Plains Case Study

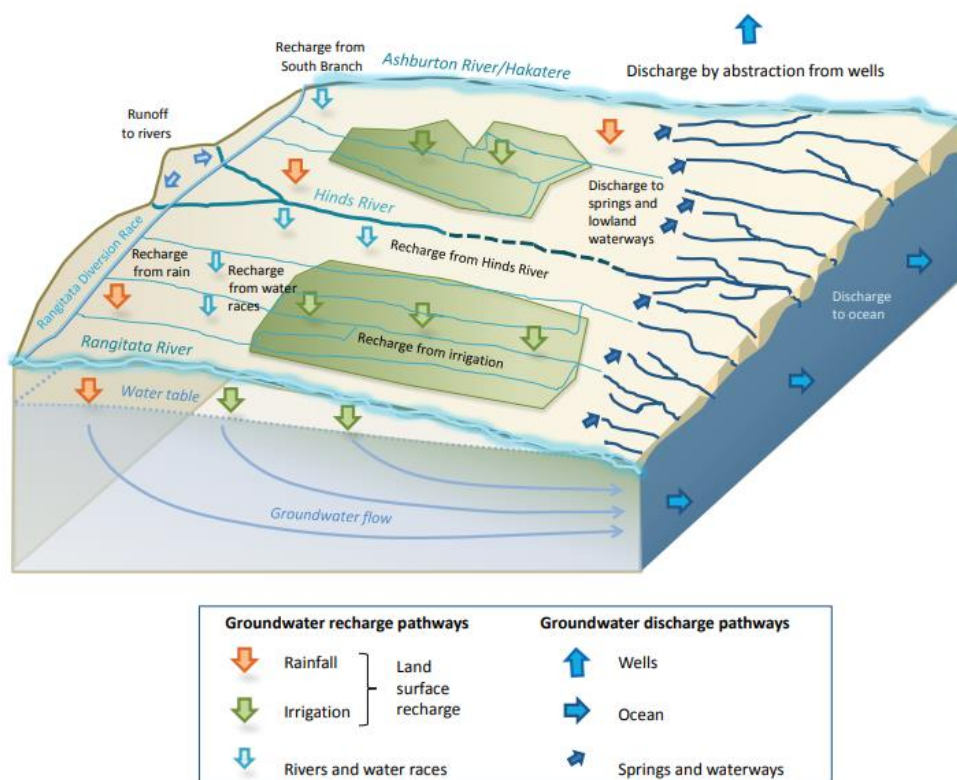
The Hinds/Hekeao Plains is an area covering approximately 1,375 km<sup>2</sup>(<sup>1</sup>) and is located between the Ashburton and Rangitata Rivers in Mid-Canterbury (Figure 1). The hydrology is characterised by high rainfall and stony, free draining soils near the foothills, and low rainfall and heavy soils in the historic swamp land near the sea. Rainfall in the foothills and plains and recharge from the Ashburton/Hakaterere and Rangitata Rivers feed into groundwater system, which in turn can be seen as springs further down the plains (Figure 2).

Figure 1: Boundary of the Hinds/Hekeao Plains



<sup>1</sup> Durney, P. et.al. *Integrated Catchment Modelling of the Hinds Plains Environment Canterbury* Technical Report No. R14/64 (2014)

Figure 2: Conceptual block diagram of the groundwater system in the Hinds/Hekeao Plains (not to scale)



Historically, the land between State Highway 1 and the sea was a swampy wetlands fed by springs and the Hinds River and was an important source of mahinga kai for Te Rungaga o Arowhenua. In the 1800s, European settlers saw the potential for using this land for production and drained the wetlands, creating what is now known as the Hinds/Hekeao Drains. Early settlers also channelized the Hinds River to create an outlet to the sea<sup>2</sup>.

Due to the stony nature of the soils on the plains and the abundance of water in the major rivers meant the benefits of irrigation could be identified as early as the 1880s and the Rangitata Diversion Race (RDR) was established in the 1930s<sup>3</sup>. Irrigation in the area has therefore been in place for over 75 years, with the majority of the catchment irrigated by either irrigation schemes, groundwater or surface water.

Land use has changed considerably in the area, with low intensity sheep, deer and beef systems dominating until the 1980s, moving to irrigated dairy and dairy support after the economic reforms of the 1980s and improvements in irrigation technology became available (Figure 3). Due to the connectivity between the groundwater and low land springs feeding the Hinds/Hekeao Plains, nitrate levels in the groundwater will drive nitrate levels in the lowland drains<sup>4</sup>. Under the historic borderdyke-irrigation, low-intensity livestock farming systems common pre-1980s, nitrate levels in the groundwater averaged ~3.3 ppm (Figure 4) and have increased significantly over the past 20 years (Figure 5).

<sup>2</sup> Bower, R. *Hinds/Hekeao Technical Overview – Subregional Plan Development Process*, Environment Canterbury Technical Report R14/79 (2014)

<sup>3</sup> Body, A and Cushnie, C. *Water, Farming and Families – the Mayfield Hinds Irrigation Scheme*, Mayfield Hinds Irrigation (2015)

<sup>4</sup> Note Nitrate levels will be a good approximation for Dissolved Inorganic Nitrogen (DIN) as sources of ammonia and nitrite are limited.

Figure 3: Land Use in the Hinds Hekeao Plains<sup>5</sup>

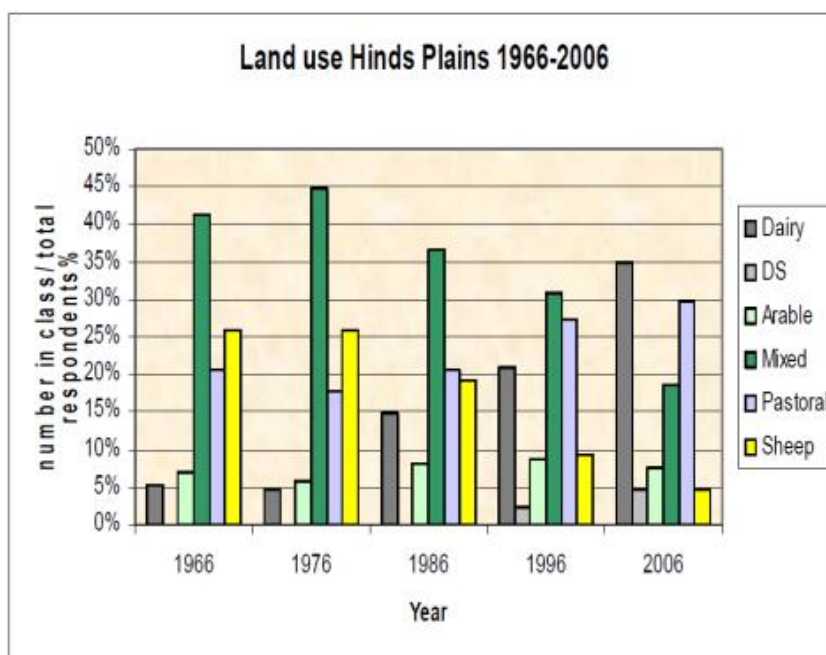


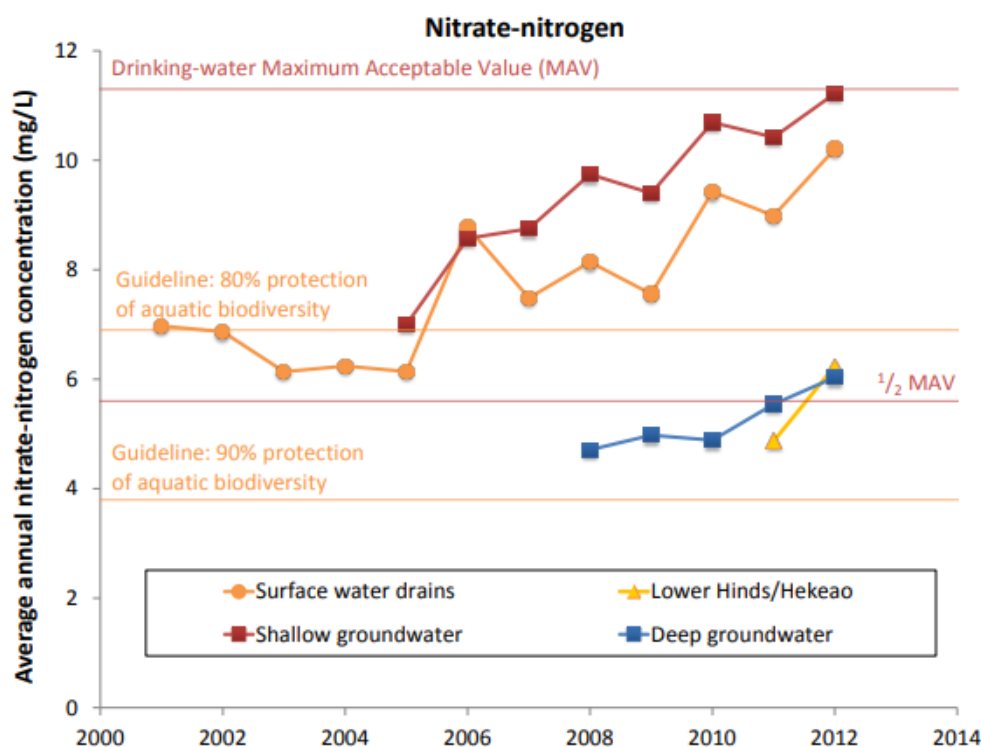
Figure 4: Nitrate nitrogen concentrations measured in groundwater samples collected on the Ashburton-Hinds prior to 2004<sup>6</sup>

Well No	Well depth (m)	Samples collected			Nitrate nitrogen (mg/L)
		Count	First	Last	
K36/0118	11.3	12	1992	2003	2.2 - 8.1
K37/0028	5.1	1	1994	1994	1.9
K37/0087	16	1	1995	1995	3.5
K37/0088	10.1	1	1995	1995	11
K37/0114	9.3	7	1991	1997	5 - 8.5
K37/0147	9.8	10	1995	2003	0.6 - 13
K37/0216	9.5	12	1992	2003	4.5 - 10.3
K37/0222	18.7	5	1988	1993	1.6 - 3.9
K37/0358	15.6	9	1995	2003	11 - 12.8
K37/0466	6	13	1991	2003	1.3 - 6.3
K37/0467	8.2	7	1991	1997	1.1 - 4.3
K37/0468	9.1	13	1991	2003	1.6 - 6.5
K37/0516	46.9	1	1995	1995	0.6
K37/0563	0	2	1994	1995	0.9 - 1.9
K37/0619	55	7	1997	2003	2.6 - 3.3
K37/0833	10	6	1998	2003	4.3 - 8

<sup>5</sup> Durney, P. et.al. *Integrated Catchment Modelling of the Hinds Plains Environment Canterbury* Technical Report No. R14/64 (2014)

<sup>6</sup> Hanson, C., Abraham, P. *Nitrate contamination and groundwater chemistry – Ashburton-Hinds Plain, Environment Canterbury* Technical Report R10/143 (2010)

Figure 5: Annual Average Concentrations of Nitrate in Monitoring Wells and Spring-Fed Waterways in the Hinds/Hekeao Plains<sup>7</sup>



In response to the impact of land use change on groundwater quality and ecosystem health of the Hinds/Hekeao Drains, Canterbury Regional Council initiated a subregional process to set nitrogen loss reduction targets to achieve an average nitrate concentration of 6.9 ppm in the lowland streams. This Subregional process involved extension community engagement, including with Te Runanga o Arowhenua, Fish and Game and community representatives. Through this process, new rules were introduced to reduce nitrogen losses on the plains by 36%, with implementation of Managed Aquifer Recharge (MAR) to further reduce nitrate levels.

As part of the Subregional process, numerous scenarios were proposed to understand the reduction required and the impact these reductions would have on the community and what benefit these changes would have to water quality. The on-farm nitrogen loss scenarios were assessed by Mark Everest of Macfarlane Rural Business in the document titled *Hinds Catchment Nutrient and On-Farm Economic Modelling (2013)* and included:

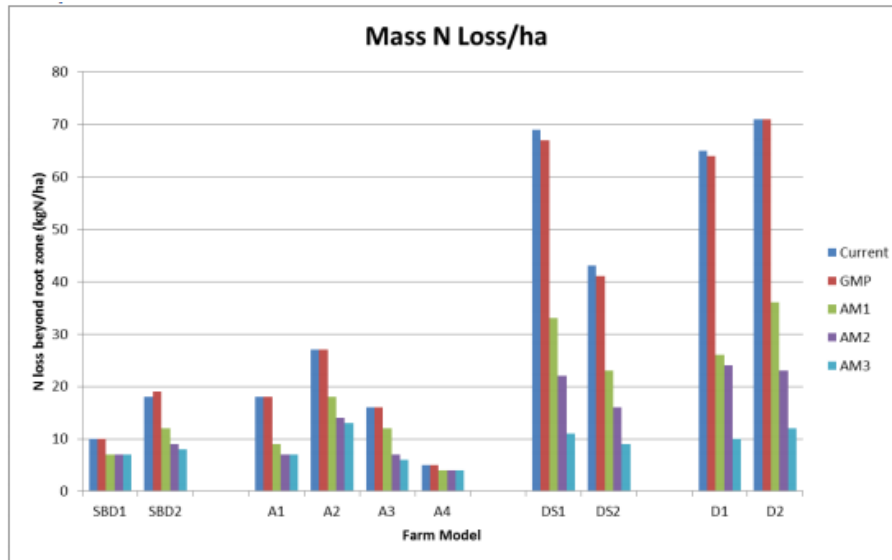
1. Baseline (no change in land use)
2. Good Management Practice (GMP)
3. Advanced Mitigation 1 (AM1)
4. Advanced Mitigation 2 (AM2)
5. Advanced Mitigation 3 (AM3)

Advanced Mitigation 3 (AM3) was considered the “*beyond optimism*” scenario that deliberately modelled extreme nitrogen loss reductions to understand the economic impact these sorts of land use changes.

<sup>7</sup> Scott, Lisa *Hinds Plains Water Quality Modelling for the Limit Setting Process*, Environment Canterbury Technical Report No. R13/93 (2013)

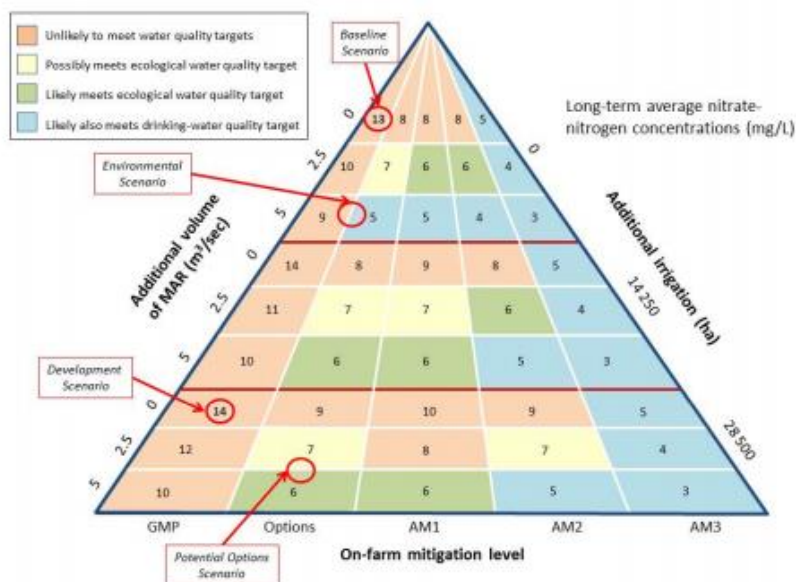
Nitrogen loss reductions modelled varied from between a 20% reduction for dryland arable properties to up to 85% reductions for intensive dairy systems (Figure 6).

Figure 6: Modelled Nitrogen Loss by Farm System Type and Mitigation Level<sup>8</sup>



When the estimated catchment loads were modelled assuming AM3 practices and MAR were implemented, nitrate levels in the Hinds/Hekeao Drains could still only achieve 3ppm (Figure 7), three times the proposed 1 ppm national bottom line limit.

Figure 7: Summary of estimated average nitrate concentration from various permutations of intensification, on-farm mitigation and augmentation<sup>9</sup>



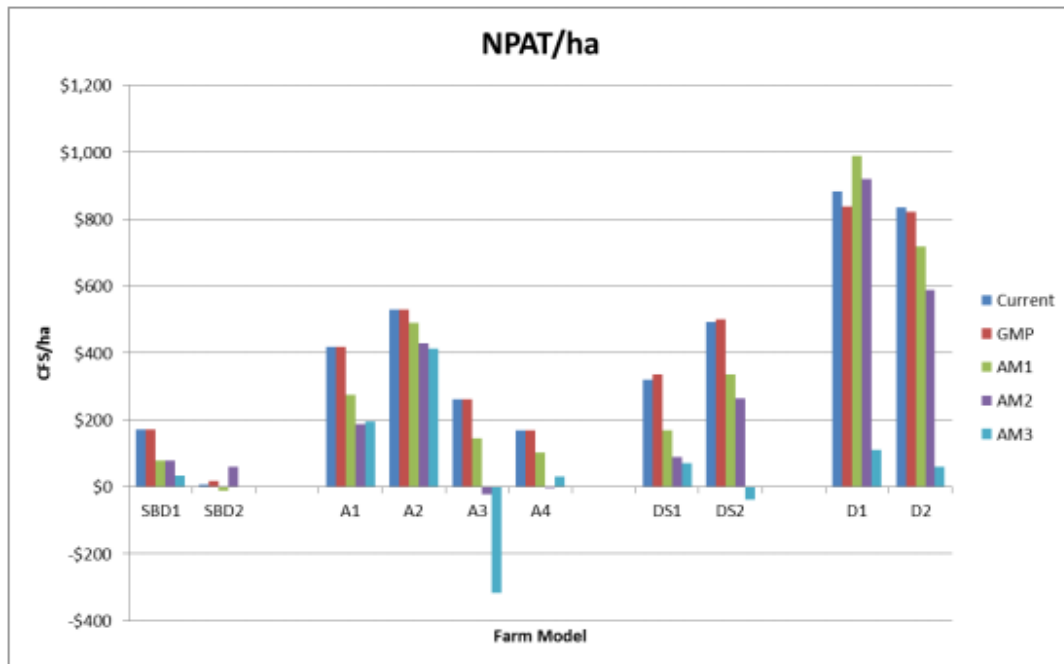
<sup>8</sup> Everest, M. *Hinds Catchment nutrient and on-farm economic modelling*, Environment Canterbury Technical Report R13/109 (2013)

<sup>9</sup> Bower, R. *Hinds/Hekeao Technical Overview – Subregional Plan Development Process*, Environment Canterbury Technical Report R14/79 (2014)



To understand the economic implications of these changes, Everest (2013) modelled the impact on Net Profit After Tax (NPAT) for each of the modelled farm systems at the different mitigation levels. Overall, implementation of AM3 farm systems would result in reductions of NPAT of between 22% and 221% (Figure 8).

Figure 8: Modelled results for whole farm nitrate concentrations in soil drainage and net profit after tax for ten farm systems under five different levels of management<sup>10</sup>



For MHV Water shareholders, who account for approximately 42% of the Hinds/Hekeao zone, the modelled reduction to Nitrate leaching to achieve 3 ppm resulted in a reduction of NPAT of 90% from current levels, removing approximately \$36.7M per year out of the Ashburton economy. This significantly reduces funds available for debt repayment and environmental mitigations to an unsustainable level.

The result of the above analysis was used for the Hinds/Hekeao Subregional process and the community agreed the impacts of achieving the 3ppm at the AM3 mitigation standards were too significant and therefore set the expectation to achieve 6.9 ppm instead.

#### Impact on Community of 1 ppm DIN

The analysis completed by Everest for the Hinds/Hekeao Subregional process demonstrates the potential economic impact of on-farm reductions needed to achieve a 3ppm DIN limit in our catchment. We also note historic extensive livestock operations under borderdyke also resulted in average nitrate levels of 3.3 ppm.

If a 1 ppm DIN bottom line limit was implemented under the NPS for Freshwater, there will need to be a wholesale change in land use on the Hinds/Hekeao plains, potentially to forestry, as we are not aware of

<sup>10</sup> Everest, M. *Hinds Catchment nutrient and on-farm economic modelling*, Environment Canterbury Technical Report R13/109 (2013)

any other land use capable of nitrogen loss reductions sufficient to meet the standard. Effectively, the National Bottom Line Standard of 1ppm for DIN in the Hinds Hekeao Drains is unachievable, and there is evidence to suggest the macroinvertebrate health of the waterway will not materially improve with a lower DIN to the current toxicity limit of 6.9 ppm<sup>11</sup>.

Our farmers are actively engaged and on board with meeting the targets set in Plan Change 2. Overriding the limits set through the planning process to implement an unachievable DIN bottom line undermines farmer engagement across the Hinds Hekeao Plains.

The impact on the communities within our catchment will also be detrimental. Conversions of productive land to, say, forestry consistently results in a reduction of employment opportunities, population size, fewer schools, teachers, and support services. Furthermore, as income reduces farmers will be under pressure to reduce their staff numbers and take on more work themselves. By spending more time on the farm, there is less capacity to engage with the wider community, volunteer and provide support to others, creating isolation and reducing the strength of rural support networks.

Ultimately, a reduction in income of this scale removes the dignity of self-sufficiency and being able to provide for yourself, your children and your community. Farmers are intimately connected with their land and the pride of being able to pass on a sustainable business to their children is an integral part of their self-identity. Removing all potential for livestock grazing of any sort on the plains will mean passing on the family farm is no longer an option.

Stress, isolation and a loss of connection will result in a deterioration of mental health and wellbeing of the 4,500 people<sup>12</sup> who live in our catchment. Many thousands more are dependent on the success of this area for their livelihoods and acceptance of DIN bottom lines which can have these impacts seems be at odds with the values of our government who *“have put the wellbeing of New Zealanders at the heart of everything we do”*<sup>13</sup>.

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<sup>11</sup> See Waikakahi Stream Case Study from IrrigationNZ NPS Submission.

<sup>12</sup> [http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request\\_value=14916&parent\\_id=14909&tabname=#14916](http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=14916&parent_id=14909&tabname=#14916)

<sup>13</sup> <https://www.labour.org.nz/wellbeingbudget2019-ataglance>