The Economics of the Ruataniwha Dam – Is it the son of Clyde?

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ABSTRACT

This paper examines the economics of proposed Ruataniwha Dam. The paper finds:

1. For private investors to get a commercial return implies a water price that is uneconomic to farmers. If this is the case, the dam requires a substantial subsidy.
2. If the intention is to facilitate high intensity dairy units, then simply subsidising maize silage or palm kernel exfoliator (PKE) is a simpler and more flexible option.
3. If the Dam was to proceed, it should do so as a farmer-owned and underwritten venture – as this would align commercial risk and reward underpinned by a tangible bottom-line.

KEY WORDS

Cumec (cubic metre), Hawkes Bay Regional Council (HBRC), Hawkes Bay Regional Investment Company (HBRIC), Intensive Dairy, Irrigation, Lucerne, Makaroro River, Public Sector Discount Rate (PSDR), Public Sector Risk Free Rate (PSRFR), Ruataniwha Water Storage Scheme (RWSS) 'Take or pay' contacts, Tukituki Catchment, Water storage

DEDICATION

This paper is dedicated to the memory of Dr Paul van Moeseke (1933 – 2014), Professor Emeritus, Economics Departments, Otago University.

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INTRODUCTION

At the risk of commencing a paper on water storage with a somewhat ironic turn-of-phase, the decision to proceed with the Clyde High Dam was a watershed in New Zealand's political and economic history – with history now judging the entire episode as an unmitigated disaster. Over thirty years later, this paper examines the proposal to build a dam for irrigation purposes in the Hawkes Bay – the Ruataniwha Water Storage Scheme (RWSS). This paper seeks to ascertain whether lessons from the former have application to the latter; and if so, what are they and have they been heeded?

This paper is organised into four parts. Firstly, some of the salient lessons of the Clyde Dam saga are laid bare to provide a historical context and caution to contemporary decision making. Secondly, the economics of the RWSS are investigated and, in particular, various financing options for the Ruataniwha Dam are outlined. This analysis shows that not only are there are unlikely to be sufficient cash flows to attract private sector investment; but there is no economic rationale for public sector investment either. Thirdly, the concept of farmer ownership and underwriting of the Ruataniwha Dam is examined. Despite showing a number of merits compared to public financing and/or underwriting, the major challenge that emerges is reconciling the need for take and pay contracts (from a project underwriting perspective) with farm profitability (given climatic realities and lower cost feed alternatives). Finally, the paper briefly examines an alternative based on enhanced dry stock farming – particularly the use of deep rooting and drought resistant feeds such as lucerne. Critically, a crop like lucerne may be a significantly more attractive option.

PART 1: LESSONS FROM CLYDE

The RWSS is, at first glance, a straightforward and compelling proposal. As outlined by the Hawkes Bay Regional Council (HBRC):

The scheme consists of a 96 million m³ storage reservoir located in the upper Makaroro River, storing water during periods of high flow and over winter. Water from the scheme can then be released improving river flows in the Tukituki Catchment through summer for aquatic life and other river users, while at the same time providing secure water to irrigators. The scheme will be funded by both the public and private sector.[4]

In practice, building dams and developing irrigation schemes have often been 'easier said than done' – with commentators such as Farley[5] outlining a litany of

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[4] *Source*: http://www.hbrc.govt.nz/Hawkes-Bay/regional_development/hbric/Pages/rws.aspx

[5] Farley, P (2013) *Irrigation Scheming: A History of Government Irrigation in New Zealand*.

challenges (and downright failures) associated with irrigation schemes. Critically, Farley's analysis shows that in a New Zealand context, 'gold plating', cost over-runs, poor economic analysis, and local boosterism were the norm rather than the exception with government sponsored schemes. However, it is the comparison with controversial Clyde High Dam that provides potentially the most instructive lessons.

The starting point for the Clyde High Dam was a series of highly distorted price signals regarding water resource values, capital costs, electricity costs, and project risk that made any robust economic analysis of the proposal highly challenging. However, the major problem was the unwavering and blinkered pursuit of dubious political imperatives masquerading as regional and national development. These arguments can be summarised as follows:

1. Without development, the hydro potential of in the Clutha was essentially being 'wasted';
2. Water could be used to produce hydro power, which could then be used to produce aluminium;
3. Aluminium could then be exported, adding to export earnings; and
4. In the process, the City of Dunedin could be re-vitalised via a major industrial development and thereby avoid inevitable economic decline.

In an interesting parallel with the RWSS, the Clyde High Dam was not only heavily criticised on environmental grounds (both in terms of the impact on the Clutha but also the impact of the proposed smelter at Aromoana) but also on economic grounds. In particular, two lines of argument were especially relevant, namely:

1. the questionable economic viability of aluminium production in New Zealand unless the electricity price was artificially low;[6] and
2. the need for the power generated by the dam at all (as electricity forecasting had been widely inaccurate leading to an oversupply of generation capacity).

As originally envisaged, the Clyde High Dam was a co-dependent project as it was intended to supply electricity to the proposed Aromoana smelter (which was never built). Indeed, in essence, New Zealand was exporting electricity – albeit in a storable form: aluminium.

In comparison, while the RWSS also faces a zero price for water from a resource rental perspective (which implies the opportunity cost of the water is also zero),

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[6] Van Moeseke, P. (1980) *Aluminium Smelting in New Zealand: An Economic Appraisal*, Economic Discussion Papers, Otago University

one significant difference is the proposal for a mixture of public and private funding – with the latter likely to demand a risk-adjusted return on equity (combined with strong commercial and contractual incentives to ensure the project is delivered on time, on specification, and on budget). The fact that two major private sector investors have withdrawn is therefore a much more serious concern than merely securing sufficient project finance.

The arguments presented in support of the RWSS also appear eerily familiar, and can be summarised as follows:

1. Water that is currently flowing into the sea is 'wasted' as it could be used for the irrigation of farmland;
2. Irrigation will increase production as it can facilitate a switch from drystock farming to intensive dairy;
3. The resulting milk can be turned into commodity ingredients such as milk powders for export – thereby assisting to achieve political objectives regarding export growth; and
4. In the process, the RWSS also satisfies regional development goals by arresting the economic malaise that has settled across the Southern Hawkes Bay.

In this case, rather than the export of electricity via aluminium ingots; the essence of the RWSS is the export of milk in the form of 25kg bags of powder.

In retrospect, and legal issues notwithstanding, there were a number of 'off-ramps' available whereby the Clyde High Dam could have been abandoned but were ignored, namely:

1. The decision by Alusuisse to abandon investment in the Aromoana Smelter (c/f. the decision by Trustpower and Ngai Tahu to reject investment in the Ruataniwha Dam);
2. The discovery of the 'River Chanel Fault' fault, which ultimately led to significant delays and cost over runs as dam construction had to be significantly modified (c/f. the discovery of the Mohaka fault);
3. Continuing to build the dam in the knowledge that its major customer, the Aromoana Smelter, was no longer proceeding, and in the context of weak alternative uses for the electricity (c/f. weak farmer uptake of the proposed 30 year 'take or pay' irrigation contracts and static demand for irrigation in the absence of large scale dairy conversion); and
4. Economic analysis that showed the project was not viable (c/f. HBRIC's own analysis that shows the entire project has a net present value of -$27m when discounted over 35 years at the public sector discount rate [PBSR]).

It is therefore worrying to note that HBRC and its subsidiary, the HBRIC appear intent on proceeding with the construction of the Ruataniwha dam ('off-ramps' notwithstanding) and may even challenge the environmental bottom lines imposed through the Board of Inquiry process.[7]

In summary, there appears to be sufficient historical similarities between the Clyde High Dam and the RWSS for significant caution to be exercised on the part of its promoters. Unfortunately, none of the lessons appear to have been acknowledged – let alone addressed.

PART 2: THE ECONOMICS OF THE RUATANIWHA DAM

As noted above, economic evaluations commissioned by HBRIC show that the entire project has a net present value (NPV) of -$27m when discounted at the public sector discount rate (PSDR) of 8% per annum over 35 years.[8]

The notion that the RWSS is a regional, let alone a national, 'game changer' is therefore illusionary.

Central to the RWSS is the $300m Ruataniwha Dam, as it is the dam that provides the storage capacity for the irrigated water. Securing private sector investment the Ruataniwha Dam has proved challenging[9] – and the reason is not difficult to ascertain: for investors to receive a commercial return (private sector assumed 16% on equity, public sector at 8%)[10] implies a water price that is uneconomic for farmers (**37.5 cents** per cumec – see appendix 2, scenario 1).

As a result, without some form of subsidy, the dam is neither attractive to investors nor viable for farmers – even with the starting point of the water being zero priced from a resource rental perspective (and as previously noted, implying the opportunity cost of the water is also zero).

Maybe in recognition of the challenges faced by farmers, HBRIC has fixed the water price at **27 cents** per cumec – but also requires farmers to enter into 30 year 'take or pay' contracts. The immediate result of setting a fixed price is that there are insufficient cash flows generated to service private sector equity

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7 *Source*: http://www.nzherald.co.nz/hawkes-bay-today/news/article.cfm?c_id=1503462&objectid=11255185

8 *Source*: Butchers Partners Ltd, March 14 - An updated summary of values tables, (incl. present values, regional economic impacts & cost ratios)

9 *Source*: http://www.nbr.co.nz/article/ngai-tahu-follows-trustpower-quitting-ruataniwha-scheme-bd-156392

10 *See*: Appendix 1 for a full summary of assumptions.

participation unless the public sector partner accepts a nil return (which implies a **$243.75m** lump-sum subsidy – see appendix 2, scenario 2);

Given the water price is fixed, the key question becomes the volume of water available; as this will determine the free cash flows generated and, as a consequence, the degree of financing the project can sustain. While 96m cumecs are claimed, the question remains whether:

1. 96m cumecs is an achievable volume or a theoretical maximum reservoir capacity; and
2. There is sufficient water to provide farmers their contracted flows whilst also guaranteeing minimum summer river flows (including environmental flows for flushing purposes).

These questions are critical as the **entire** 96 million cumecs would need to be fully contracted and generating a minimum of 25 cents per cumec of distributable earnings to achieve the PSDR of 8% per annum (which only allows 2 cents per cumec [$1.92m] as total annual operating costs).

In short, unless the claimed volume of 96m cumecs can be stored **and** sold then the storage part of the project is not viable from a public perspective either; as it fails to meet the PSDR.

Construction of the dam is possible if less than 96m cumecs are sold *if*:

1. Total cost is no more than $300m;
2. Project finance can be secured at the public sector risk free rate (PBRFR – assumed at 5%);
3. 25 cents/cumec are available for distributions; and
4. 83m cumecs (86% maximum storage capacity) is subject to 30 year take or pay contracts (this generates a 6.9% gross return).

Under these assumptions, the capital costs will be repaid over 26 years, albeit with an implicit lump sum public subsidy of **$41.25m** (see appendix 2, scenario 3). While public sector investment at less than the PSDR can be justified if there are broader societal benefits, HBRIC's own analysis shows that no such benefits exist.

Clearly, if the Ruataniwha Dam was subject to time delays and/or cost escalation and/or lower levels of irrigation uptake by farmers then the economic case for the dam deteriorates even further.

In short, even assuming a project that comes in on time, on scope, and on budget there is still no economic rationale for public sector investment in, or the underwriting of, the RWSS – indeed, given the marginal grass produced through irrigation is costed at approximately **70 cents**[11] kgDM, and supplements such as PKE cost approximately **40 cents**[12] a kgDM, it is easier and potentially less risky for rate/tax payers to simply subsidise the cost of supplements rather than investing in a dam.

PART 3: FARMER OWNERSHIP AND UNDERWRITING OF DAM CONSTRUCTION

Given the critical role played by the take or pay contracts (which effectively underwrite the construction cost of the Ruataniwha Dam by making it 'bankable'), if the RWSS was to proceed it would make significant sense that it be via a farmer owned entity – potentially a cooperative. This is because such an entity aligns commercial risk with commercial reward and is underpinned by a tangible bottom-line: something that a public sector entity is likely to lack – as ultimately, it can socialise losses to rate and/or tax payers.

Farmer ownership, however, is not without its own set of challenges. For example, it is questionable whether a farmer-owned entity can access long term debt at the PSRFR without some form of public sector involvement (e.g. a guarantee or underwrite). Unless the guarantee was premised on a sufficient volume of take or pay contracts to fund the debt servicing costs of the dam, such an arrangement would effectively remove the symmetry between commercial risk and reward – and thereby exposing rate and/or tax payers to financial losses.

The cost and ability to finance debt funding has the affect of focusing attention squarely on the on-farm viability of irrigated water at 27 cents/cumec – as this will drive whether farmers have any commercial incentive to participate in the scheme. A key factor is the regional climate: and in particular, an October-March window for grass growth – as this will determine when irrigated water can be utilised. To illustrate this issue, two different on-farm scenarios are considered – both assuming intensive dairying, namely:

1. **On-farm option 1: 'Irrigation as drought insurance'**, which implies stocking levels are kept the same, but the need to address drought risk (e.g. drying off early/employing supplements/destocking/sending cows out-of-district for grazing) is mitigated as one can simply 'turn on a tap'; and

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[11] Data generated by GSL Diagnostic

[12] *Ibid*.

2. **On-farm option 2: 'Irrigation as a means to boost production'**, which implies the application of water during the October-March window to grow additional grass and thereby increase milk production.

Clearly there are also permutations where both options could be used simultaneously – however, as outlined below, this does not change the findings.

In both cases, the same constraint bites: it is cheaper to simply purchase supplements as and when additional feed is required; rather than grow irrigated grass (~40 cents kgDM v ~70 cents kgDM). Two additional points are also worthy of note:

1. In terms of option 1, the frequency that irrigated water is needed becomes critical. For example, whilst the Tukituki catchment can get very dry, it is by no means drought-like every year. This is a critical issue as a take or pay contract means that the farmer will be paying for water **every** year regardless of whether it is used or not. For example, if on average a farmer only used 100% of contracted water every second year then that increases the effective cost of water to **54 cents**/cumec (and potentially more if the likelihood of severe drought is less frequent).

   This will drive the cost of producing a kilogram of dry matter of irrigated grass even higher relative to supplements.

2. In terms of option 2, while the 'down year' issue is eliminated (as it is assumed water is taken and used every year to grow additional grass) there remains the 'off season' issue regarding feed options from April-September. In this instance, the critical issue becomes whether milk production has increased on a *per cow* basis or *per hectare* basis (i.e. higher stocking numbers). The more production increases are driven by higher stocking rates then the bigger the 'feed gap' that will appear from April- September.

   Given it is pointless to apply additional water to grass at this time (as it simply will not grow) then the consequence is the need to buy supplementary feed for the additional cows to get the additional milk that was promised through the use of irrigation.

The implications for farmers are as follows:

1. There exist cheaper alternatives to irrigated grass if the objective is 'drought-proofing' a farm; and

2. If the desire is to increase production through increasing stock numbers, then simply operating a year-round feed pad is more cost effective than growing irrigated grass for part of the year.

In this situation it is difficult to see how even a farmer owned entity could reconcile the need for take and pay contracts (in order to under write construction costs of the dam) whilst also making the same work in terms of farm finances. Indeed, the most likely result is that the farmer entity would not attract sufficient farmer support to make the construction of the dam possible.

PART 4: ALTERNATIVE DEVELOPMENT OPTIONS

It is estimated that it takes approximately 1000 litres of water (or one cumec) to produce one litre of raw milk.[13] In the absence of large scale land change use to intensive dairying, it is difficult to envisage a land use option that would require 96 cumecs of irrigated water annually in the Tukituki catchment – especially as climatic conditions do not favour a switch to horticulture.

The implication is that in the absence of dairy expansion the Ruataniwha Dam represents a sunk investment and a stranded asset; whereas in the presence of dairy implies a very low implicit return on water: a litre of raw milk is currently worth **50 cents** at the farm gate and even a shadow price of **10 cents** per cumec (or 1/100 cent per litre) would represent 20% of the farm gate value of the marginal milk produced.

An alternative to intensive dairy is enhanced dryland farming. For example, the Ministry of Agriculture and Forestry (MAF, now the Ministry for Primary Industries [MPI]) report considerable success from the use of lucerne in drought-prone Marlborough. As outlined by MAF:

Farming through a prolonged drought, Doug Avery realised that his family's South Marlborough farm was no longer financially, environmentally or socially sustainable. Since then, the Averys have embarked on a journey that's seen the farm's profitability and production curve trend ever upwards.[14]

Avery explains:

The key to change has been drought-proofing the property, not with an expensive irrigation system, but a plant called lucerne.

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13 Zonderland-Thomassen, MA and SF Ledgard, (2012) *Water footprinting – A comparison of methods using New Zealand dairy farming as a case study*

14 *Source*: http://www.beeflambnz.com/Documents/Farm/Dryland%20farming%20-%20a%20Marlborough%20family's%20journey.pdf

In 1998, feeling burned out and bitter from years of drought, Doug went to a seminar about lucerne presented by Lincoln University Professor Derrick Moot.

"That one hour offered me light at the end of the tunnel. It was probably the most valuable hour of my life."

These days, around a third of Doug's 1500 hectare property is planted in lucerne which, he says, is the key to sustainability for dry-land farmers.

"The plant shows you don't have to drain a river to run a profitable farm."[15]

In other words, options regarding enhanced drystock farming are worth considering before undertaking large scale engineering solutions. However, they are a significantly less exciting.

CONCLUSION

The conclusion this paper reaches is simple and clear: there is no economic or commercial rationale to proceed with the RWSS – indeed, HBRIC's own analysis confirms the former and the withdrawal of two major private sector investors (including one with significant hydro experience), the apparent difficultly in securing alternative investors, and the tardy response from farmers to sign up for water contracts provide a telling commentary regarding the latter.

It also suggests that arguments about 'economically viable consent conditions' and threats to appeal the Board of Inquiry's findings regarding nitrogen levels within the waterway are not only misguided but miss the fundamental point that the Dam is neither economically or commercially viable at any nitrogen level.

In addition to being wary of the sort of local (and potentially national) boosterism associated with large scale regional development initiatives, this paper also finds claims that failing to progress the RWSS will doom Hawkes Bay to third world status[16] are overblown and unconvincing. The example of lucerne use in Marlborough shows that there are viable development alternatives in the agricultural space – it is just that not all of them happen to go 'moo'.

15 *Source*: http://www.stuff.co.nz/marlborough-express/news/8742619/Drought-breaker-on-Country-Calendar

16 See: http://www.stuff.co.nz/business/farming/agribusiness/10220813/English-pushes-case-for-Ruataniwha-dam

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APPENDIX 1: ASSUMPTIONS

1. Water is zero priced in terms of a resource rental (price therefore simply reflects cost of provision so opportunity cost is nil).
2. Dam cost is fixed at $300m ($275M estimate and ~10% contingency).
3. Private sector rate for equity participation is 16%.
4. 'Public' is assumed to either central or local government – or a combination of both.
5. Public sector discount rate (PSDR) is 8% per annum (as per Tsy guidelines and assumed by Butcher).
6. Public sector borrowing rate (the 'risk-free rate' or PSRFR) is 5% per annum.
7. Dam has a maximum theoretical capacity of 96m cumecs but only 83M cumecs is available for annual allocation (as more than this has the potential to risk minimum flows – especially in dry years).
8. Water price is fixed at a flat rate of 27 cents per cumec:

    a. **Sub-assumption 1**: Annual Operating costs are no more than $1.67m per annum (2 cents per cumec based on 83m cumecs)
    b. **Sub-assumption 2**: 25 cents per cumec is available for distributions (so maximum distributions are $20.75 per annum).

9. 30 year 'take or pay' agreements (or their equivalent) exist for the entire 83m cumecs.
10. For simplicity, company tax and gst are assumed away (as are inflation and the need for inflation indexing).

APPENDIX 2: SCENARIOS

Scenario 1*: 50/50 Public-private partnership on commercial terms*

1. Dam cost of $300m is split equally between private and public investment
2. Private sector provides $150m equity at 16% and public sector provides $150m debt at 8%
3. Average cost of capital is therefore 12%, so annual financing costs are $36m
4. Given 96m cumecs of water, that implies a minimum water price of **37.5 cents per cumec** (96m cumecs x $0.375 = $36m).

Scenario 2*: 50/50 Public private partnership*

1. Dam cost of $300m is split equally between private and public investment
2. Total annual distributions are $24m (96m cumecs at $0.25 per cumec)
3. Private sector investor provides equity at 16% per annum.

Under scenario 2, while the PBDR is met in terms of average cost of capital ($300m at 8% per annum is $24m), given the private sector requires a 16% rate of return then the entire $24m is required to service the private sector. As a result, there is no return for the public sector partner.

The implicit public sector construction subsidy is **$243.75m**, which is 81.25% of the construction cost of the dam. This is represented by:

1. -$150m initial investment, as it is effectively written off; and
2. -93.75m being the net present cost of servicing the $150m assuming capital cost is the PCRFR discounted at the PSDR in perpetuity ([$150m x 5%]/8%)

Scenario 3*: Dam financed at the PSRFR*

1. Dam cost of $300m is 100% debt financed at 5% per annum (over the life of the project)
2. 83m cumecs of water annual is subject to 30 year take or pay contracts for 30 years with at least 25 cents cumec available for debt servicing
3. Total annual distributions are $20.75m (83m cumecs at 0.25 per cumec), which implies a gross return of 6.9% ($20.75m/$300m).

Under scenario 3, the 1.9% spread between the revenue received and the debt financing costs are sufficient to repay the initial capital costs in 26 years, which leaves some headroom for issues such as financing costs during construction.