Waimea Community Dam
Economic Impact Analysis

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For the Nelson Regional EDA

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Contents

1.0 Executive Summary

1.1 Introduction

The Nelson Regional Economic Development Agency (EDA) commissioned this economic impact analysis of the proposed water augmentation scheme for 1800 hectares in Waimea Plains/Wairoa/Wai-iti on completion of the Waimea Community Dam. The analysis is being undertaken so that stakeholders at regional and national level fully appreciate the economic contribution the facility can potentially make to the region, as well as the cost and disruption to the region's economy of not proceeding with the investment. The potential cost of not proceeding becomes more acute as increasing demand exacerbates the region's recurrent water shortages.

Two main analytical methods have been applied.

1. **Gross Domestic Product (GDP):** In the GDP analysis, benefits are analysed in terms of the impacts on the wider regional economy, including the flow-on effects of increased revenue in the impacted sectors. This methodology identifies a continuing stream of spending (revenues) and the downstream impact of those revenues within the region stimulating further activity and sales.
2. **Cost Benefit Analysis (CBA):** In the CBA, quantifiable benefits and costs are assessed and are then adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) are expressed on a common basis in terms of their current Net Present Value, or NPV. The technique considers the stream of revenues generated into the future to have a lower purchasing power (reduced by the annual discount rate) than revenue available for spending today.

Four areas are analysed:

1. **Production and Processing:** Production and processing includes the improved yields on existing land, and the additional land that will be available for cultivation of apples, kiwifruit, grapes, berries, pastoral land. It also includes the associated processing of those items, such as winemaking or nutraceutical and food preparation extracts.
2. **Non-Augmentation:** We have assessed the cost of doing nothing, or non-augmentation, as a separate component. This is assessed as an averaged NPV figure and also as a revenue stream figure.
3. **Hydro Generation:** The costs and benefits of the proposed hydro generation bonus are considered both as a GDP and an NPV figure.
4. **Additional Land Usage:** The project will have revenues from the additional land which will be converted to more intensive cultivation, and also in terms of additional yield on existing cultivated land. The value and rateable value of this land will also increase as its potential revenues are realised.

The findings in each of these areas are outlined in this executive summary, in terms of both GDP and NPV (where relevant).

1.2 Production and Processing Findings

Production and Processing, from all horticultural areas, form the basis of the study, and are the most important element of the analysis.

An estimate of the GDP generated from increased production has been analysed. The estimate for the annual contribution to GDP is based on production at full maturity. The analysis also considers the multiplier effect of increased production activity on the region's GDP and positive impact on employment and investment opportunities. The production mix on existing irrigated areas (3800ha) will inevitably change over the 25-year timeframe with security of the water supply. The value of this increased production on existing irrigated land will be additional to the revenues generated from newly irrigated areas.

Table 1a: Estimates of GDP Generated from Increased Horticultural Production and Processing on Newly Irrigated Land

Production and Processing	Annual GDP	25 Year GDP
Total Production Value Added	$58.0m	$1,154m
Total Processing Value Added	$8.5m	$132m
Total Increased GDP	**$66.5m**	**$1,187m**

The Regional Economic Development Strategy Review (REDS) undertaken for the Nelson Tasman region during 2010 identified the GDP contribution of the horticultural sector in the 2009 Year at $351m out of a regional GDP of $3.7b. The primary sector in its broad definition (which includes processing of primary production) represented 28% of the region's GDP.

The Cost Benefit Analysis (CBA) methodology applied to the Production and Processing of additional production includes the cost of development for conversion to other productive use, the lead time for reaching commercial production quantities and the revenue stream anticipated to be generated over the 25-year timeframe for the analysis. The additional production potentially generated from the increased irrigated land area represents in the vicinity of $770,000 in regional GDP per hectare over the 25-year timeframe.

Table 1b: Newly Irrigated Yield Scenario – Development with Improved Cultivars

Benefit of Augmentation	NPV
Increased production on currently irrigated land	$127.6m
Increased production on newly irrigated land	$89.0m
Total increased production	$216.6m
Increased value of processing	$60.2m
Total Increased Net Benefit	**$276.8m**

1.3 Impact of Non Augmentation

The cost of not proceeding with the storage dam and providing irrigation to potentially 1800ha of current dryland pasture is significant. Even more significant is the impact on currently irrigated land where water allocations would be significantly scaled back (by an estimated 70%) in the event of 1 in 10 year and 1in 25 year droughts.

Security of irrigation water (and water for industrial, commercial and residential properties) is central to the concerns on the Waimea district. Existing production from currently irrigated areas and the foregone production from potentially irrigated dryland pasture are at severe risk from drought events. In a 'worst case' scenario GNS science has estimated a cut in present allocations for irrigation of approximately 70% which based on total water allocation would represent a reduction from the present irrigated 3800ha to a manageable 705ha. Intensive land uses would no longer be viable under this scenario and production on much of the existing irrigated area would, of necessity, have to revert to dryland pasture production.

The cost to the region is substantial. On a strictly revenue stream basis (ie, ignoring analysis of such downstream effects as volumes flowing to processing, loss of production and potential unemployment)) the GDP impact of non augmentation would be as follows:

Table 1c: Cost of Non Augmentation in GDP

Cost of Non-Augmentation	Annualised GDP Loss	25-Year GDP Loss
Total lost GDP	**$17.5m**	**$440m**

The NPV over the 25-year timeframe is also considerable:

Table 1d: Cost of Non Augmentation in NVP

Cost of Non-Augmentation	NPV
Loss to production	$60m
Loss from power generation	$3m
Total cost of Non-Augmentation	**$63m**

1.4 Hydro Generation Bonus

The potential for additional revenues from hydro generation were also analysed through the model.

Table 1e: Hydro Generation GDP

Category	Annual GDP	25 Year GDP
Power supply	$5.6m	$140.0m
Dam construction	$24.6m	$24.6m
Lines Upgrade	$0.8m	$0.8m
Total GDP estimate	**$31.0m**	**$165.4m**

The hydro unit generates ongoing power revenues over the life of the project. During construction and any upgrade to the transmission lines employment of contractors, material supplies and plant generate revenues within the local economy. The regional GDP impacts from such activity are evaluated as a one-off impact occurring during the construction period. These are significant at more than $25m in addition to the continuing vague-added impacts from power generation itself.

In assessing the NPV from the hydro power generation add-on the revenue streams over the period have been offset by the cost of construction and the annualised discount on future (post tax) earnings.

Table 1f: Hydro Power Generation NPV

Summary Outcome	NPV
Additional Revenue Generation	$2.7m

There are also long term issues to consider. The security for water availability and distribution from the proposed facility is important within the region. Should an event like an occurrence of an earthquake of the intensity of the Christchurch quakes, Nelson's water supply would be under severe stress. A rupture in the pipeline feeding Nelson city could have disastrous consequences for Nelson industry and residences. The potential of alternative backup supply would mitigate the impacts from such an event.

1.5 Tax Benefits

Income tax benefits have been estimated from the revenue streams generated over the 25-year timeframe for each of the main horticultural crops and the hydro power add-on. These have been assessed on the basis of per hectare revenue streams adjusted for the area of land that would be converted to each crop type. Development costs have been amortised over the 25-year period and operational costs have been set against annual revenue estimates. The level of income tax benefit to potentially accrue over the 25-year period is estimated at $33.5m in the conservative benchmark case and significantly higher for average prices realised in the "High" and "Best Case" scenarios outlined in the Technical Appendix.

The potential income tax benefits potentially derived from hydro power generation are estimated at $2.4m.

Table 1g: Potential Tax Benefit Estimate

Tax Category	Tax Benefit
Income Tax – Increased Production	$33.5m
Income Tax - Processing	$8.6m
Wine Excise Tax	$36.3m
Hydro Generation Income Tax	$2.4m
Total Tax Benefit estimate	**$80.8m**

1.6 Land Productivity Findings

In addition to improving the productivity of existing cultivated land, and therefore raising the potential of improved yields, the project assesses the additional land which would become available for cultivation through irrigation. The estimated land value premium for land with water permits is in the range of $15,000 to $20,000 per hectare (ha).

Table 1h: Hectares available for cultivation

Crop Production	2008 ha	Additional ha
Pasture	1,450	300
Apples	1,650	860
Kiwifruit	80	90
Grapes	550	400
Berries	70	150
Total	**3,800**	**1,800**

Source: Agfirst Land Use Profile, Northington Partners Report, January 2010

1.7 Comparison with Opuha Irrigation Scheme

The Opuha Irrigation scheme completed in 1999 is a larger facility than the proposed Waimea Community Dam, but provides a useful comparison of the relative contribution that the proposed dam could potentially deliver.

The Waimea Plains has the advantage of a climate that is conducive to intensive horticultural development, an option that cannot be replicated in South Canterbury where conversion to pastoral conversion, forage crops and vegetable growing for processing have been the options for newly irrigated areas. As outlined in Appendix 1 the increased revenues (output) on the Waimea Plains is potentially more than 10-fold that achieved in the Opuha district. The impacts from increased horticultural production to downstream processing revenues is equally dramatic with potential revenues per hectare close to 15-fold those achievable from pastoral operations (due to increased production for processing).

1.8 Additional Considerations Not Analysed

As part of the feasibility studies for the Waimea Community Dam, environmental flow requirement assessment for the Waimea River was carried out. The Waimea Water Augmentation Committee (WWAC) decided on a provision of a minimum flow of 1100 l/s in the lower Waimea River. This flow (“environmental flow”) provides habitat protection for the aquatic ecosystem reduces the prospect of saltwater incursions and provides for amenity, community recreation, and aesthetic impact of the river. The increase in water availability over summer months also protects the demand for water from expanding industry and residential activity and ensures that drastic reductions in water allocations for all users (and associated reductions in revenues and incomes within the region) will not be required in drier years. These considerations (amenity, recreation, and aesthetics), while relevant, are subjective and have therefore not been included in the economic analysis.

1.9 Conclusion

The economic analysis findings can be summarised as follows:

Table 1i: Summary of Total Economic Analysis Findings

<table>
<tr><th>Area of calculation</th><th>Annual GDP</th><th>25-Year GDP</th><th>NPV</th><th>IRR</th></tr>
<tr><td>Increased Production and Processing</td><td>$66.5m</td><td>$1,187m</td><td>$276.8m</td><td rowspan="2">25%</td></tr>
<tr><td>Cost of Non-Augmentation</td><td>$17.5m</td><td>$440m</td><td>$63.0m</td></tr>
<tr><td>Hydro Generation Bonus</td><td>$5.6m</td><td>$140m</td><td>$2.7m</td><td>10%</td></tr>
<tr><td>Total findings</td><td>S89.6m</td><td>$1,767m</td><td>$342.5m</td><td></td></tr>
</table>

An essential component of the Cost Benefit Analysis of the project was the evaluation of Sensitivity Analysis and calculation of Internal Rate of Return (IRR) factors. These two measures are detailed in the Technical Appendix along with CBA factors and multiplier analysis profiled by worst and best case scenarios in addition to the Benchmark scenario summarised above.

The IRR measure Benchmark scenario reflects the strong productivity potential that could be achieved from the irrigation of dryland pasture for intensive horticultural crops in the Waimea Plains. These are significantly higher than those recorded from the establishment of the Opuha Dam.

The study indicates a very positive outcome from proceeding with the storage dam project which would provide significant economic benefits to the region, given the cost of dam construction and associated infrastructure costs.

2.0 Background and Findings of this report

2.1 Background

The cost of the proposed 13 million m^3 capacity water storage dam has been assessed at $41.6m. These costs cover the design and construction of the dam structure itself, an allowance for land purchase, an environmental mitigation package and obtaining the appropriate consents. The capital investment so evaluated excludes any costs associated with the piped delivery from the dam or other water distribution infrastructure. The elapsed timeframe from commissioning contractors (anticipated early 2013), the commencement of construction and completion of the dam structure is planned to be two years. A further 12 months has been allowed for in the dam to fill sufficiently which could begin in the winter of 2015 but has been scheduled in the analysis as winter 2016 (to make allowance for any delays in final commissioning) in time for spring irrigation in the critical October/November growing season.

The hydro generation component is a stand-alone investment option with revenues and costs treated separately from the main analysis of potentially newly irrigated land.

The TDC has commissioned a parallel study to evaluate and advice on the governance and ownership options for the Waimea Community Dam. Options being considered are:

- Council owned and operated (CCTO)
- Community owned (WWAC proposal)
- Partnering arrangements between the public and private sector. Examples include design build and maintain (DBM) and Build and Ownership Transfer (BOT).

2.2 Potential Increase in Regional GDP

Cost Benefit Analysis is a method of comparing several development options as to their contribution to net investment benefits. The methodology assesses all capital costs, operating costs and potential revenue streams over a particular timeframe. Annual benefits are brought to a common present year base through the technique of Discounted Cash Flow (DCF).

Another measure of the benefits likely to accrue to a region or area from the development of more intensive activity is the measure of GDP and downstream multiplier impacts. This methodology is more familiar in identifying a continuing stream of spending (revenues) identifying the downstream impact on a region from stimulating activity and the sales of products and services in achieving those revenues.

The analysis in this project also considers the multiplier effect of increased production activity on the region's GDP and positive impact on employment and investment opportunities.

An estimate of the GDP (direct and indirect downstream Type I impacts) generated from increased production has been analysed. The estimate for the annual contribution to GDP is based on production at full maturity. The 25-year GDP takes into account lower yields in early years.

Table 2a: Estimates of GDP Generated from Increased Horticultural Production (Type I Impacts)

Production Area	Annual $m	25 Year Period $m
Apples	40.4	731
Kiwifruit	9.5	159
Grapes	4.1	91
Berries (boysenberries)	3.8	69
Pastoral	0.2	4
Total from Newly Irrigated Land	58.0	1,054
Processing		
Winemaking	6.1	82
Berries	2.0	41
Extracts	0.4	9
Total Processing Value-Added	8.5	132
Total Increased GDP from Production + Processing	$66.5m	$1,187m

Table 2b: Hydro Generation: GDP Value Added from Hydro Power Sale After Tax (Type I Impacts*)

Category	Annual $m	25 Year Period $m
Power supply	5.6	140.0
Dam construction	24.6	24.6
Lines Upgrade	0.8	0.8
Total GDP estimate	31.0	165.4

* The definitions of value-added GDP, Type I and Type II impacts are outlined in the Technical Appendix.

Note regarding calculation of Indirect Benefits:
An evaluation of the indirect benefits to the region's productive activities and the community has been assessed as an integral component of the project. Where the benefits, such as processing of horticultural production, power generation and associated employment, could be quantified they have been incorporated into the analysis. In those situations where it was not possible to quantify such benefits (such as enhancement of recreational options, environmental improvement etc) qualitative assessments of downstream benefits have been indicated to guide decision makers in the overall implications of the project benefits.

2.3 Cost Benefit Analysis (NPV)

In 2008, Northington Partners was commissioned by the Waimea Water Augmentation Committee (WWAC) to prepare a financial analysis for the dam construction and evaluated several scenarios for the cost amortisation of the facility. Their analysis was entirely focussed on payment for the capital costs of the dam and did not consider the revenue streams for increased production generated from irrigation.

The Capital Financial model prepared by Northington Partners for evaluation has, in collaboration with John Cook & Associates, been expanded to a full CBA evaluation model.

The timeframe for the CBA model is similar to that set for the funding period for the initial consent period for the dam, assumed to be 25 years. Because the maximum permissible consent period under the RMA is 35 years a more conservative period of 25 years for repayment was adopted for the original Northington analysis and replicated here. The 25-year timeframe for the CBA commences once the storage dam has reached a fill capacity where irrigation water can be distributed. It is assumed that the dam would be sufficiently full for irrigation drawdown one year after completion of the dam structure. This is taken as Year 0 in the analysis.

The output from the modelling process provides NPV revenue streams for each of the scenarios for the amortised life of the project. The revenue streams have been analysed as to:

- Regional GDP and additions to national GDP
- Assessment of employment potentially generated by increased activity on newly irrigated pasture land
- Increased value of primary production at farm gate prices
- Increased volume of product for processing – value-added GDP + employment
- Increased export receipts
- Regional impact from hydro-electricity generation.

A review of the potential direct benefits of hydro generation was undertaken. The indirect benefits from reducing reliance on the Islington transmission link was also addressed. Analysis of these factors was undertaken in collaboration with Network Tasman executive.

The full CBA considers two active scenarios and a “do nothing” non-augmentation scenario.

Each scenario includes the cost of development for conversion to other productive use, the lead time for reaching commercial production quantities and the revenue stream anticipated to be generated over the 25-year timeframe for the analysis

2.3.1 Scenario One: Original Base Scenario

The original base analysis contained in the January 2010 Northington Partners report.
The benefits of augmentation/irrigation are analysed from the additional production and the gross yields that would be conferred valued at $45.9m over the first 25-year operational life of the project expressed in current value (NPV). The costs of not going forward with the proposed storage dam have been estimated at $46.7m over that same period of the project. The overall economic benefit of proceeding with the storage dam is estimated as the absolute difference (+/-) between the two outcomes at $92.6m.

Table 2c: Base (Original) Scenario – Northington Partners (2009 Year Prices)

Summary Outcome	**Economic Value (NPV)**
Benefit of Augmentation	$45.9m
Estimated cost of Non-Augmentation	$46.7m
Overall Economic Value of Augmentation	$92.6m

2.3.2 Scenario Two: Improved Yield Scenario

The second, and most important, scenario analysed was that from the implementation of land conversion for intensive cultivation from a base of 2011 prices projected out to 2015, the year that production increases are assumed would start to impact. The production yields are significantly enhanced from conversion with new cultivars, production and security of water.

The value of additional production is analysed from the model at $127.6m improvement on currently irrigated land, $89.0m on newly irrigated land and additional value from processing production of $60.2m. The potential cost from not proceeding with the dam is estimated at $58.9m. Thus the overall economic benefit of proceeding with the storage dam is estimated as the difference between the two outcomes at $335.7m.

Table 2d: Improved Yield Scenario – Development with Improved Cultivars (Est 2015 prices)

Summary Outcome	**NPV**
Benefit of Augmentation	
Increased production on currently irrigated land	$127.6m
Increased production on newly irrigated land (West Waimea + Wai-iti)	$89.0m
Total increased production	$216.6m
Increased value of processing	$60.2m
Total Increased Net Benefit	**$276.8m**
Estimate cost of Non-Augmentation	$58.9m
Overall Economic Value of Augmentation	**$335.7m**

The estimate of net contribution from augmentation as outlined above considers only the increase in horticultural and agricultural development at the farm gate level. In the case of potentially increased apple and kiwifruit export sales (FAS) returns to growers includes packing, packaging, cool storage and freight to port.

In other industries further processing of products is the norm; in meat and wine production and berry crops and other natural products processed into supermarket stocked products and high value nutraceuticals. In the case of wine-making increased grape volumes could translate into net additional NPV revenues in the vicinity of $40m. The increase in stock numbers that could be run of newly irrigated pasture land would increase the volume of stock sent for meat processing. However, this is anticipated to be offset by the loss of stock production from former dryland pasture converted to other end production uses with irrigation.

The processing of other high value natural products grown in the Waimea Plains on newly irrigated land would add further NPV revenues to those already identified in intensive horticultural development scenarios. The NPV value of processing increased production from newly irrigated land is estimated to total $60.2m over the 25-year period.

2.3.3 Scenario Three: Hydro Generation Bonus

Analysis of the potential for additional revenues from hydro generation were also analysed through the model. The basic analysis considered selling power at the current wholesale price of 8c/KwH which would generate a positive NPV of $2.7m.

The other options for sale of power exploring different structure and discount rates indicated an enhanced return over the 25-year timeframe. Details contained in the Technical Appendix.

Table 2e: Hydro Power Generation Option

Summary Outcome	Economic Value (NPV)
Additional Revenue Generation	$2.7m
Estimate cost of Non-Augmentation	-
Overall Economic Value of Augmentation	$2.7m

2.3.4 Scenario Four: Non Augmentation

The cost of not proceeding with the storage dam and providing irrigation to potentially 1800ha of current dryland pasture is significant. Even more significant is the impact on currently irrigated land where water allocations would be significantly scaled back (by an estimated 70%) in the event of 1 in 10 year and 1in 25 year droughts.

The cost to the region is substantial. The NPV value of not proceeding has been calculated at $60m for the impacts on production. A further $3m NPV would be foregone in power generation.

Northington Partners reported that from their calculations on a strictly revenue stream basis, it is estimated that the total annualised loss under this non-augmentation scenario would be in the vicinity of $17.5m per year. Over a 25 year period the aggregate loss would amount to some $440m (once account had been taken of extreme dry year impacts).

The recommended requirement to raise the minimum flows in the Lee/Wairoa/Waimea River system to maintain water flow security and effect the potential of the Waimea Plains district are at the core of the proposed Waimea Community storage dam/augmentation. The potential revenues generated from increased production and product processing from an expanded area under irrigation (1800ha) significantly increases the potential negative impacts of non augmentation.

2.3.5 Sensitivity and Internal Rate of Return Analysis

An essential component of the Cost Benefit Analysis of the project has been Sensitivity Analysis and the calculation of Internal Rate of Return (IRR) factors. These two measures are detailed in the Technical Appendix along with CBA factors and multiplier analysis.

The IRR measure profiles Best case, Benchmark and Worst case scenarios. The outcomes of this analysis, profiled in the following table, reflect the strong productivity that can be achieved from the irrigation of dryland pasture for intensive horticultural crops in the Waimea Plains.

Table 2f: Nominal Pre Tax IRR Sensitivity Analysis

Scenario	IRR (Nominal Pre-Tax)
Augmentation Outcomes	
Worst case scenario	10.3%
Low scenario	16.8%
Benchmark case	24.9%
High scenario	27.3%
Best case scenario	32.2%
Hydro Dam	
MED price path	9.8%*

Fixed price path ($80/MWh)	7.8%**

* 7.3% Real + 2.5% Long Term Inflation

** 5.3% Real + 2.5% Long Term Inflation

2.4 Taxation Implications

The potential increase in tax revenues at local authority and national level were evaluated on the basis of profits generated from the potential increased production resulting from irrigation of formerly dryland pasture.

At the local government level the increase in the productive capacity and revenues potentially generated from newly irrigated areas will flow into enhanced valuations for those land parcels. The rating contributions from newly irrigated areas will be higher than previously and reduce the contribution required from lower rated areas within the revenue pool of the local catchment. Rates are determined on the revenue requirements of local government to meet their expenditures on behalf of the community and rating obligations distributed by land valuation.

At the national level the potential tax benefits accruing from the project include:

- Increase in income tax obligations from increased production on newly irrigated land.
- Additional GST tax on the sale of products into the domestic market
- The increase in excise tax from the manufacture of additional volumes of wine produced from increased grape production.

2.4.1 Taxation Benefits at Local Government Level

The potential benefits accruing to local government from increased rates stream will occur once a revaluation of land converted to horticultural crops from dryland pasture takes place allowing a reassignment of rating obligations within the community pool.

There will be no increase in the overall rating revenue generated from the community in any one year but rather a redistribution of the contributions made by each segment of the community.

2.4.2 Taxation Benefits at Central Government Level

Income tax benefits have been estimated from the revenue streams generated over the 25-year timeframe for each of the main horticultural crops and the hydro power add-on. These have been assessed on the basis of per hectare revenue streams adjusted for the area of land that would be converted to each crop type. Development costs have been amortised over the 25-year period and operational costs have been set against annual revenue estimates. The level of income tax benefit to potentially accrue over the 25-year period is estimated at $33m in the conservative benchmark case and significantly higher for average prices realised in the “High” and “Best Case” scenarios. Estimates of the income tax contribution from increased production are detailed in the Technical Appendix in addition to the summary outline below.

Table 2g: Income Tax Generation

Crop Type $m	Worst Case Scenario	Low Scenario	***Benchmark Case***	High Scenario	Best Case Scenario
Apples	0	0	6.6	39.5	74.0
Kiwifruit	10.8	14.8	24.3	34.0	50.7
Grapes	0	0	0	0	0.7
Berries	0	1.1	2.6	7.1	11.9
Total Tax Generated	**10.8**	**15.9**	**33.5**	**80.6**	**137.3**

An estimate of the potential income tax generated at the processing stage for additional production has been made. The income tax contribution from processing (for the Benchmark Case) is estimated to be in the region of $9m over the 25-year period. Current wholesale prices for wine varietals are at the low end of the spectrum having been battered by the global recession and the recent rise in the cross rate of the NZ$. Over the coming two decades it could be reasonably anticipated that the wholesale price achieved for wine exports would rise.

Excise Tax

Excise is payable on wine once it leaves bond. The excise is a set rate per litre of wine currently (since 1/4/11) at the standard rate of $260/litre. Since 1989 the levy on wine (under 15% alcohol) has been indexed to the Consumer Price Index though for a period the rate was increased in addition to the rise in the CPI.

The wine produced per ha of mature grapevines (at the Benchmark 8.5 tonnes per ha) is assumed at 5,530 litres before “shrinkage” during the maturing, testing and bottling process. The total excise revenues based on a constant 2011 year rate are outlined in the following table.

Table 2h: Wine Excise Revenues

Production Yield Outcomes	Av Tonnes per hectare	Annual $m	25 Year Period $m
Worst case scenario	8.0	4.3	34.2
Benchmark scenario	**8.5**	**4.6**	**36.3**
Medium case scenario	9.0	4.9	38.4
High case scenario	9.5	5.1	40.6
Best case scenario	10.0	5.4	42.7

The Benchmark scenario of 8.5 tonnes produced per hectare would generate revenues of $4.6m per year once the vines are in full production and $36.3m over the 25-year analysis timeframe.

GST Tax Generated

The bulk of potential increased production from newly irrigated areas in the Waimea Plains would be destined for export markets. This applies to apples, kiwifruit, wine, berries and extracts. Over 85% of apples and kiwifruit is exported direct and the bulk of reject fruit is processed into apple pulp exported for baby food preparations and filling in pies and other processed foods. Some of the remainder is juiced as concentrate for manufacture. A substantial portion of the berry crop is exported directly as frozen product or processed for flavouring ice cream and yoghurts in export markets.

Accordingly the GST generated from sale within New Zealand is minimal and has been ignored for the purposes of this analysis. Moreover, any processed product entering the domestic market would have a value-added GST component at point of sale.

Table 2i: Summary of Tax Benefits

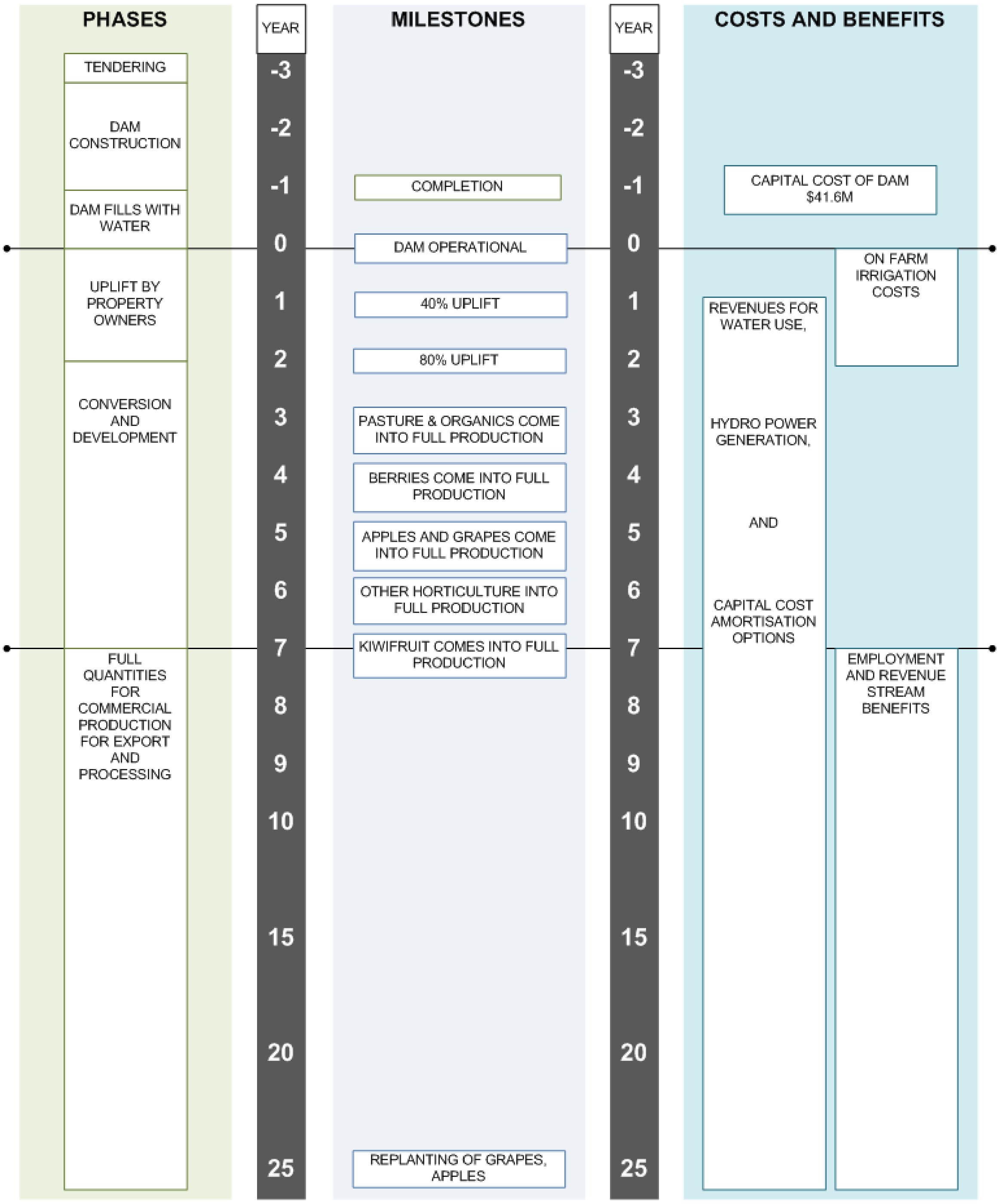
Tax Category	Tax Benefit
Income Tax – Increased Production	$33.5m
Income Tax - Processing	$8.6m
Wine Excise Tax	$36.3m
Hydro Generation Income Tax	$2.4m
Total Tax Benefit estimate	**$80.8m**

3.0 Methodology and Underlying Assumptions

3.1 An overview of the model

The diagram below shows the timing assumptions and the major elements that have been included in this economic modelling process.

Figure 1: Model Phases, Milestones and Outputs



3.2 Existing Production profile (ha) on Soil Type

3.2.1 Production Mix

The mix of production by soil type currently taking place on the irrigated area of the Waimea Plains is indicated in the following tables prepared by Agfirst for the January 2010 report.

Table 3a: Production on Plains as at 2008

Crop Production	**Soil Moisture Type**			
Hectares (2008)	Low	Medium	High	Total Ha
Pasture	500	100	850	1,450
Apples	720	170	760	1,650
Kiwifruit	30	10	40	80
Grapes	300	20	230	550
Berries	10	10	50	70
Total	1,560	310	1930	3,800

Note: Area under production for apples, kiwifruit, berries is assumed.

Additional area of the Waimea Plains proposed for irrigation in the Northington Partners analysis is as follows.

Table 3b: Additional Irrigation Potential Area on Waimea Plains

Crop Production	**Soil Moisture Type**			
Hectares (2008)	Low	Medium	High	Total Ha
Pasture	40 (20%)	20 (10%)	140 (70%)	200
Apples	324 (40%)	81 (10%)	405 (50%)	810
Kiwifruit	36 (40%)	9 (10%)	45 (50%)	90
Grapes	180 (60%)	15 (5%)	105 (35%)	300
Berries	20 (20%)	10 (10%)	70 (70%)	100
Total	600	135	765	1,500

Additional Crop profile based on current pattern of plantings.

Additional area of the Wai-iti district proposed for irrigation in the Northington Partners analysis is as follows:

Table 3c: Additional Irrigation Potential Area in Wai-iti Area

Crop Production	**Soil Moisture Type**			
Hectares (2008)	Low	Medium	High	Total Ha
Pasture	20 (20%)	10 (10%)	70 (70%)	100
Apples	20 (40%)	5 (10%)	25 (50%)	50
Kiwifruit	0	0	0	0
Grapes	50 (50%)	10 (10%)	40 (40%)	100
Berries	10 (20%)	5 (10%)	35 (70%)	70
Total	100	30	170	300

The combined additional area proposed for irrigation in the Waimea Community Dam feasibility analysis is as follows.

Table 3d: Combined Additional Irrigation Area Production

Crop Production	Soil Moisture Type			
Hectares (2008)	Low	Medium	High	Total Ha
Pasture	60	30	210	300
Apples	344	86	430	860
Kiwifruit	36	9	45	90
Grapes	230	25	145	400
Berries	30	15	105	150
Total	700	165	1930	1,800

3.2.2 Demand for Water Resource

The underlying demand for Waimea district water resources was profiled in the Northington Partners 2010 report. Water demand and the required storage volume was estimated on the basis of "hectare equivalents" with the benchmark based on demand of an assumed irrigation requirement of 30mm/wk (300m^3/ha/wk). This standard was considered to take account of the differing water volumes required for different land uses, as well as allowing the demand for future urban and industrial uses.

The assumed overall demand for water, prepared in consultation with the WWAC Committee, taking a "future-proofing" perspective of 50-100 years was as follows:

Table 3e: Demand for Water Resource

Water Demand Component	Area Equivalent (hectares)
Existing irrigation area – Waimea Plains	3,800
Potential new irrigation area – Waimea Plains	1,500
Potential new irrigation area – Wai-iti	300
Potential new irrigation area – Rabbit Island	250
Existing TDC urban and industrial use	620
Allowance for future TDC urban and industrial use (100 yr horizon)	780
Allowance for future regional supply	515
Total	7.765

Source: Northington Partners, January 2010

The approach taken in this report is to analyse the increase in economic activity as a result of expanding the area of land potentially under irrigation while ensuring demand for industrial, commercial and residential use is maintained into the future.

The analysis in this report is thus focussed on the potential increase in production from newly irrigated land and processing of the resultant products, the potential for more intensive land use on existing irrigated areas and increased industrial production and the contribution this could make to the regional economy.

The total area of newly irrigated land assumed in this analysis is a total of 1800 hectares including the Waimea Plains and designated areas in Wai-iti. Rabbit Island, as detailed below, has been omitted from the analysis.

3.2.3 Rabbit Island

A total of 250 ha out of the more than 1000ha area of the island has been designated as suitable for additional irrigation. The mix of production likely to take place on the proposed irrigated area is not known at this stage. The most likely outcome is for pasture for grazing/leasing. Some of the designated irrigated area is likely to be used for recreational purposes. As a result of the uncertainty as to development for commercial cropping the designated 250 hectares on Rabbit Island has been omitted from the analysis.

3.2.4 Irrigation Takeup

The CBA model has assumed that a total of 80% of potentially irrigable land in West Waimea and Wai-iti would be irrigated by property owners taking up the option. For calculation purposes 40% of land in Year 1 and a further 40% of land in Year 2 would be signed up for irrigation.

3.3 Land Costs

The cost per hectare of land on the Waimea Plains is circa $70,000 per hectare, in the range $60 to $80/85K for (small parcels of 6/8 hectares) irrigated land depending on the area and soil type. The important feature is that the price of Waimea Plains land already has the capital cost of irrigation/water rights factored in.

The land parcels on the Plains are relatively small and fragmented which mitigates against such options as dairy conversions. The level of sales of productive land on the Plains in the past two years has been low. Land parcels are tightly held.

Leasing blocks for the intensive cultivation of dwarf variety of apples, for new kiwifruit cultivars and the extension of the boysenberry and black currant crops under cultivation will take place as currently un-irrigated areas can be irrigated.

The relative *productive land prices per hectare* (with house site costs stripped out) in the Waimea Plains are:

- Waimea East with water allocation and in proximity to other productive land is in the range of $65,000 per hectare.

- In Waimea West (other side of river) near Brightwater but with limited water allocation land values are in the range $50/55,000 per hectare.

- West Waimea (which includes Eves Valley) marginal dry land is in the range $30/35,000. Flat land in this area is potentially very productive for intensive horticulture once irrigation is available.

- Redwoods Valley, with no water allocation and no prospect of one without the WWAC irrigation proposal proceeding, the going price per hectare is $30,000.

- Wai-iti area: good pasture land with the prospect for converting to viticulture the going price is $30,000. Dry land in proximity to other productive land – say as dairy support - would be in the range $20/25,000.

- The premium for land with water rights in Wai-iti is considered (by Telfer Young) to be in the range $15/20K per hectare.

- On the main part of the Waimea Plains the premium for land with water permits is considered to be in the region of $25/30,000 for larger parcels in excess of 10ha.

Over the past decade the main drivers of land purchases has been horticultural development:

- Pipfruit
- Kiwifruit
- Grapes
- Berries
- Market gardeners

In the period 2008 and 2009 the price of dry pasture land was driven by grapes. With that crop off the boil prices have eased back. They are anticipated to increase again once the economy comes right. The prospect for pipfruit, kiwifruit and berries (particularly boysenberries) is considered to be bright as new cultivars are developed and come to mature production. The viability of intensive horticultural production on newly irrigated land and the redevelopment from lower yielding varieties in other areas on the Waimea Plains is considered excellent as market expansion occurs in the coming two decades with the opening of the Australian market and more particularly the North Asia/China markets.

The recently signed Free Trade Agreement (FTA) with China calls for the eventual elimination of tariffs on all goods exported to and originating from China with up to a 9 year phase out period on some goods. The tariffs on vegetables and some fruits exported to (and imported from) China have already been eliminated. Export of NZ apples comes into this category. The current tariff of 50% on pipfruit renders accessing the Indian market non competitive. Negotiation of a FTA with India that incorporated agricultural and horticultural products would provide an emergent market in a high growth economy.

Source of land purchase funding has been fraught during the recession. Traditional sources of finance, such as retail banks, rural lending organisations and private equity firms have significantly scaled back their lending to the rural sector and tightened the criteria for properties they will lend on. Several of the country's major investment vehicles have been reported as seeking domestic investment opportunities such as:

- Kiwisaver
- NZ Super Fund
- ACC
- Pension funds

These funds require confirmation that the sector, industry is robust – has a potentially increasing supply, that market access is expanded and integrated distribution systems are in place for selling a global competitive and quality product – are maturing as the horticulture sector enters a possible new cycle of investment and production.

The opening up of the Australian market to pipfruit imports from NZ and the recently signed FTA with China alluded to above all potentially meet the investment criteria these corporate entities are seeking.

3.4 Development Costs for Crops

The cost of development for the various crop options are indicated in the following. These have been included in the economic model as one-off costs. Ongoing improvements to pasture, replanting plans etc are included in the operational costs section.

Table 3f: Development Conversion Cost from Dry Pasture Land

Conversion To	Development Cost per hectare	Development Factors
Pasture	$3,000	Regrassing and laying irrigation pipes
Apples	$62,500 + $30,000 frost	Dwarf varieties on wires = 3000 plants/ha at $12/plant + wires. Frost cloth
Kiwifruit – grafted onto existing green rootstock	$20,000 + $20,000 frost	Most of this redevelopment will take place on existing Waimea Plains orchards
Gold + hybrids from bare land	$55,000 + $20,000 frost	Cost of development on bare land: plants, support structure, irrigation pipes etc
Grapes	$70,000	Posts, wires + irrigation
Berries (Boysenberries)	$37,500	Support structures + irrigation
Cane Berries (black currants)	$3,350	Irrigation

The anticipated capital cost for irrigation take-up based on amortisation of the dam is in the vicinity of $5,000 per hectare. This capital cost is included in the development cost for the main conversion options; apples, kiwifruit, grapes and boysenberries. Annual operating charges are anticipated in the range of $50/60 per hectare.

The cost of development for grapes per hectare has been verified by Grapegrowers Association chair. A further factor is the current grape supply situation which many industry players consider will delay any serious planting intentions for probably five years. However, the wine surplus overhang that has impacted the industry for the past four years (since the 2008 season) has apparently cleared. The 2010 vintage juice in storage is reported to have effectively all been sold.

The cost of planting bare land in black currants or other cane varieties is significantly below the cost of development for boysenberries. The cost of the putting in irrigation drip lines down berry rows is in the vicinity of $3000 to $4000/ha dependent on the size of area to be irrigated. The pumping equipment would be $8/10,000 (cost spread over the irrigated area) and the lines upwards of $3000 per hectare.

Conversion of previously dry pasture land for dairy or intensive market gardening would require K- lines or hydrants down the rows controlled by an irrigator which at current prices is in the vicinity of $40,000.

Overall the equipment cost of irrigating previously un-irrigated land is relatively low per hectare. The bulk of the development cost in apple/ kiwifruit or grape conversions is in the posts, wires and other support structures.

3.5 Lead Times for Full Production from Planting

Table 3g: Lead times for each sector

Sector	Lead time
Pasture	1 season = 12 months
Apples	3 years for dwarf varieties, 6 years for maximum production
Kiwi - grafted onto green rootstock	18 months
Gold + hybrids from bare land	5 years
Grapes	3 years on plains irrigated land to produce commercial Quantities, and 4/5 years on clay hill country.
Berries (Blackcurrants)	2 years for cane berries to reach an adequate height for machine picking..
Berries (Boysenberries)	2 years after planting for commercial quantities

3.6 Production Levels for Irrigated Crop Land

The following assumptions on animal stocking rates and horticultural production per hectare are based on new varieties and best husbandry practices. These production rates are above those being achieved in the region on average and for horticultural production reflect the planting of more intensively cultivated cultivars, higher yielding varieties, club varieties which command a premium export price etc.

3.6.1 Existing Un-irrigated Pasture Base

The base case for analysis is that of 6.5 stock units on dry bare land – the national average mix for pasture. This has been used in the model for evaluating the additional production to be obtained from irrigation of dry land areas.

Irrigated land will have a higher stocking component as grass growth can be maintained for longer during the year.

Yield rates assumed for various production options on the newly irrigated areas are profiled in the following table. In addition to the conversion of pasture to more intensive cultivation, there will also be a degree of replanting and improved productivity from existing irrigated areas over time – this is already happening with the introduction of new gold kiwifruit cultivars (developed for Tasman region) being grafted onto existing green kiwifruit rootstock. The lead time between grafting and full production is 18 months compared to 5 years if starting from bare land.

Table 3h: Benchmark Production Rate on Irrigated Land (per ha)

Production/Crop	Production units	Production per irrigated ha	Farm Gate Export Price 2010 $	Farm Gate Domestic Price 2010 $
Pasture	Stock units	12.0*	100.00	90.00
Apples/Pears	TCEs	3,500	23.00	2.80
Kiwifruit - gold	Trays	12,000	13.06	6.00
Kiwifruit - green	Trays	8,200	6.95	2.00
Grapes	Tonnes/ha	8.5	1,790	1,790
Berries (Boysenberries)	Tonnes/ha	18.0	2,000	2,000

3.6.2 Pasture Conversions and Dairy Conversions

The Pasture stocking rate relates to sheep and cattle. Dairy has significantly higher stock units per irrigated hectare (up to 24 stock units/ha), however, it is anticipated (for the purpose of this model) that there will be a negligible level of dairy conversion on newly irrigated land due to availability of large land parcels and the relatively high cost of land in Waimea compared to other areas in the South Island. A more likely scenario is the redevelopment of support/runoff land for existing dairy operations and/or growing winter forage crops which would up the overall carrying capacity.

3.6.3 Lamb Prices

Note that high lamb prices in key overseas markets are meeting consumer resistance at this year's level of $92 to $125.This is $30 per lamb higher than in the previous season. This year's (2011) supply onto export markets would be down as the kill is estimated at 18.5m lambs down from 25m before the droughts and dairy conversions. The numbers of breeding stock are on the rise again which is also impacting the annual kill in this season.

Note that additional domestic sales of apples will be for juicing and processing. Retail markets are already tied up.

3.7 Production Costs per Hectare

Production costs for various products have been sourced from MAF data (typically their farm/orchard models) per planted hectare. The annualised development charge that appears in the MAF data has been omitted in the operating cost structure as the full development costs of conversion from dryland pasture are assumed to cover the 25-year timeframe. 0

For the purposes of analysis the farm/orchard working expenses are taken as the cost of operations per hectare. Annual charges for irrigation at $50/60 per hectare are included in "other working expenses". Interest, lease, tax are all dependent on the ownership structure of the property and are not taken as part of the operating cost structure.

The operating cost per hectare is taken per producing hectare, typically less than the size of the entire property which would have dwelling, sheds, access roads, windbreaks etc/

Table 3i: Orchard Gate Cost Structure 2010/11 – Pipfruit (Nelson)

Cost Component	Cost per planted hectare $2010
Annualised development	2,407*
Husbandry	10,865
On Orchard Harvesting	12,706
Packing, cool storage, freight	20,449
Other working expenses	2,914
Total Orchard working expenses	**46,934**
Interest	2,807
Rent/leases	1,111
Tax	0
Total Interest, tax, leases costs	3,918
Total expenses	**50,850**

Source: MAF Horticulture and Arable Monitoring Report, 2010
* Omitted from Orchard Working Expenses

Table 3j: Vineyard Gate Cost Structure 2010/11 – Vineyard (Nelson)

Cost Component	Cost per Planted hectare $2010
Annualised development	600*
Husbandry	6,684
Harvesting	693
Other working expenses	996
Management salaries (MAF est)	2,500
Total Vineyard working expenses	**10,873**
Interest	1,630
Rent/leases	233
Tax	333
Total Interest, tax, leases costs	1,863
Total expenses	12,736

Source: MAF Horticulture and Arable Monitoring Report, 2010
* Omitted from Vineyard Working Expenses

Table 3k: Orchard Gate Cost Structure – Kiwifruit (Bay of Plenty)

Cost Component	Cost per Planted hectare $2010
Annualised development	0
Working expenses	10,000
Harvesting	15,100
Packing, cool storage, freight	43,400
Other overhead expenses	3,260
Total Orchard working expenses	**71,800**
Interest	3,990
Rent/leases	0
Tax	880
Total Interest, tax, leases costs	4,875
Total expenses	76,670

Source: MAF Horticulture and Arable Monitoring Report, 2010

Table 3l: Farm Gate Cost Structure – Sheep & Beef (National)

Cost Component	Cost per Planted hectare $2010
Annualised development	n.a.
Labour expenses	33
Farm working expenses	210
Other overhead expenses	46
Total Farm working expenses	**289**
Interest	69
Rent/leases	7
Tax	19
Total Interest, tax, leases costs	95
Total expenses	384

Source: MAF Horticulture and Arable Monitoring Report, 2010

Table 3m: Farm Gate Cost Structure –Boysenberry (Nelson)

Cost Component	Cost per Planted hectare $2010
Annualised development	n.a.
Husbandry	3,640
Harvesting	16,830
Other working expenses	2,730
Total Orchard working expenses	23,200
EBIT (Interest, tax, leases) costs	n.a.
Total expenses	23,200

Source: Nelson based operations, FY2011

The boysenberry crop is effectively exclusive to Nelson region for global supply. Consumer demand and price were markedly affected by the global recession with a significant overhang of fruit in storage. Prices fell by close to 20% in 2008/09. Prices and demand are anticipated to return as the world economy picks up. Demand from emerging countries is also anticipated to add to global consumption.

The comment has been made that another 100ha of boysenberry production is warranted.

Other berry crops for which Nelson region is the prime producer are black currants which has demand from the food sector and also pharmaceuticals + nutraceutical industry.

3.8 Prices – Export and Domestic

Price levels in the original Northington base model are those of 2009. They reflect price levels during the global recession which were for some commodities/products significantly below those achieved at the end of the 2006 season.

The prices used in the Improved Yield Scenario reflect current 2011 prices being realised in NZ$ terms and reflect the impacts of the current global commodities price boom that is anticipated to continue for some time through its supply cycle adjusting to increased market demand from existing and emerging markets.

Farm and orchard gate prices also reflect the relative strength of the NZ$ and its cross rate with metropolitan currencies. The NZ$ is volatile and the country is a price taker not price maker.

Future realised prices levels have been projected at current price levels as have the operating costs of production. Full details of the sensitivity analysis on these projected price levels, yields and packout rates outcomes are contained in the Technical Appendix. The following charts indicate the range of price and yield impacts on returns to growers.

3.8.1 Apple Growing

Nelson Tasman is the second most important to Hawke's Bay in terms of pipfruit production. The region exported 4.6m Tray Carton Equivalents (TCEs: typically 18kg net weight of fruit) in the 2010 season, a level of production that had been static for four seasons. The 2010 season export price averaged in the $22.20 range per TCE.

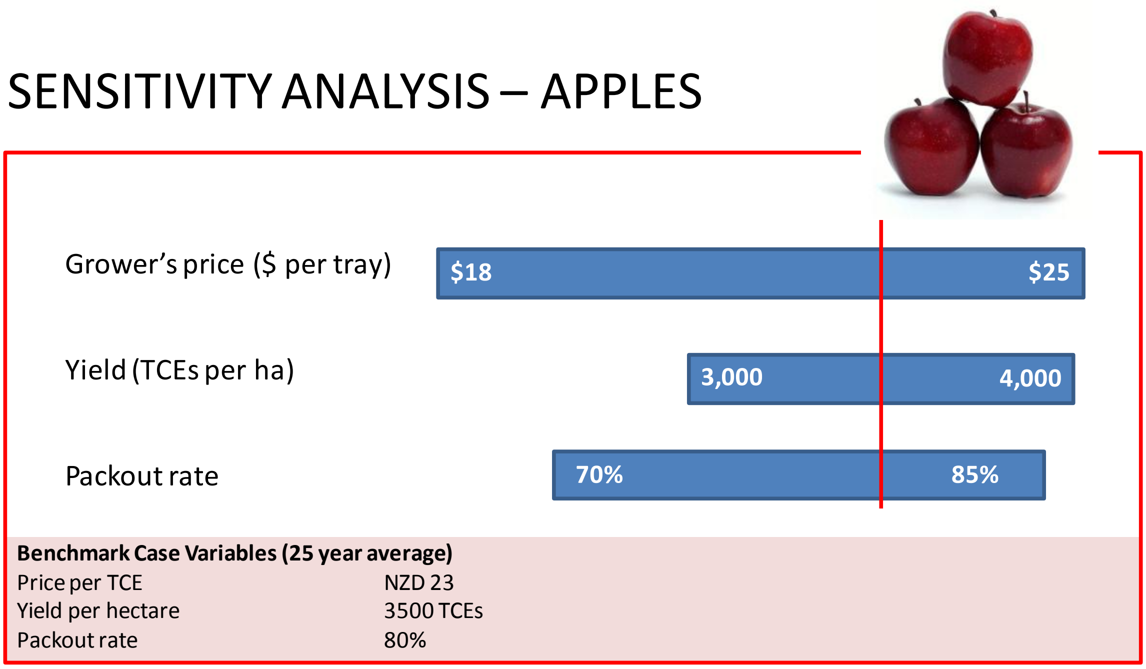
The Braeburn varietal has been the mainstay of Tasman export production. Growers have been culling their Braeburn trees along with older plantings of Royal Gala and replanting with the club varieties of Jazz and Pink Lady which have been achieving higher returns.

The move to intensive growing of dwarf varieties on irrigated land has boosted the yield per hectare markedly in the past three to four years. Upwards of 4000 TCEs per hectare is being achieved by the better growers.

The analysis assumes that newly irrigated flat land will be planted in higher yielding dwarf varieties when irrigation comes on stream. Irrigation is required in the early growing years and the critical ripening period in October and November.

The analysis assumes a total of 860 ha of additional pipfruit planting on irrigated land could take place. The price achieved is assumed at $22/23 per export TCE (including $9.80 for packing, storage and transport costs) and the average yield per hectare is 3,750 TCEs. Export packout rates have in the past averaged 70% of fruit produced though club varieties have achieved higher packout rates. Packout rates have improved in recent seasons with the introduction of dwarf varieties and tree protection.

Figure 2: Sensitivity Analysis for Apples



To achieve the quality and packout rates (80%) assumed in the "improved yield" scenarios a level of risk mitigation is required. With the current high costs of development for intensive cultivation lenders are also insisting on reducing impacts from adverse weather events such as hail and frosts – frost cost cover is becoming a necessity to protect the investment. Moreover, availability of water is also necessary for frost control.

Fruit not up to export grade goes for juicing and for processed contracts into sliced and diced for further processing. The price for such fruit realises somewhere in the range 6c-16c/kg (currently 16c/kg) but does not incur packing and storage costs.

Cherries are a crop that is witnessing a resurgence with expanding demand from emerging Asian markets. The costs of development for cherry production are similar to those for apples and revenue yields in a similar range. The development of cherry orchards (typically small scale) is assumed to occur within the land use mix allocation of 860ha for apples. Development of pear production is assumed within the same land use mix allocation

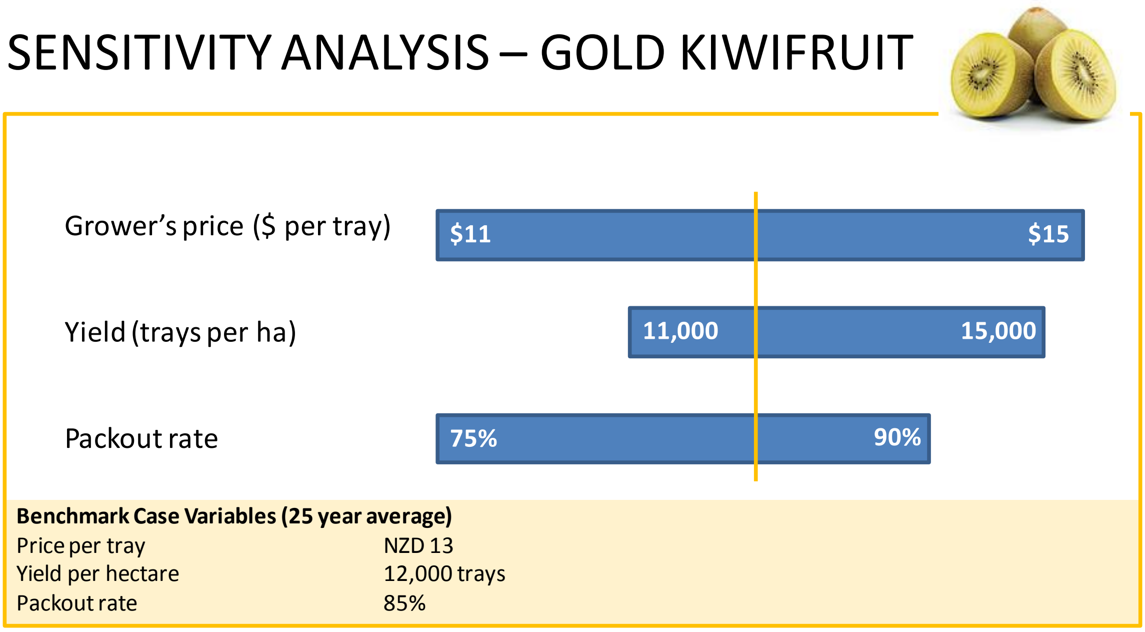
3.8.2 Kiwifruit

Many growers had quit their kiwifruit orchards in the Waimea region. The green Haywards variety which has been the region's mainstay has been achieving poor returns.

Recently introduced new cultivars that can be grafted onto existing green kiwi rootstock produce a gold variety that is achieving high returns. Prices in the range of $8-8.80 a tray equivalent before packing charges (currently $4.26/tray of gold) are being achieved. FAS returns are in the $13.10/tray range. Yield per hectare has been markedly improved with the new cultivars achieving yields of 11/12,000 trays per hectare.

The analysis assumes an additional 90 ha of kiwifruit would be planted on newly irrigated land and yields improved from the average 8,200 trays/ha (green Haywards) achieved currently to 12,000 trays of new gold cultivars. Bay of Plenty top growers are achieving yields of 15,000 trays per hectare and premium prices of $10/tray (excluding packing costs). While these are at the top of the line, several of Tasman's growers are confident they can achieve similar yields.

Figure 3: Sensitivity Analysis for Kiwifruit



3.8.3 Viticulture/Grape growing

The boom in grape growing across the top of the south increased the size of the annual harvest as new plantings came on stream. Two good seasons in 2008 and 2009 with significantly increased crops increased the grape tonnage markedly.

This coincided with the onset of the global recession impacting on consumption rates and inevitably on prices. Grape prices (based on Marlborough analysis) weighted by the harvest mix ($/tonne) realised:

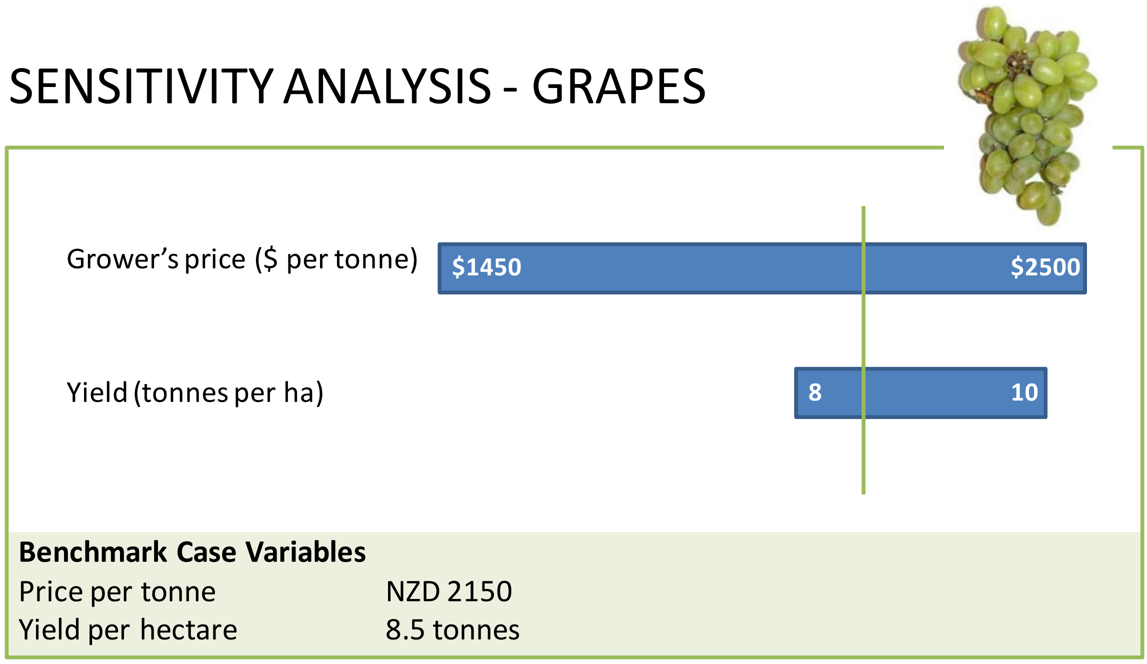
- 2006/07 season $2,311
- 2007/08 season $2,445
- 2008/09 season $1,797
- 2009/10 season $1,465
- 2010/11 budget $1,545

The original base case assumed a return of $9,530 per tonne. Returns since 2008 have collapsed. The Nelson region price realised in the 2010 season was an average $1290 per tonne.

Tasman grape yields are lower than those achieved in Marlborough and have been assumed at 8.5 tonnes per hectare. Also the mix of grape varieties differs with aromatics and pinot noir providing a greater share of the mix than the ubiquitous Sauvignon Blanc (though as the iconic NZ white has a significant portion of the export market mix so wineries must still be able to offer Sauvignon Blanc in order to sell their other varietals).

The grape yields realised on irrigated land on the Waimea Plains is above the average for the region (which includes hill country) and is closer to 10 tonnes/hectare.

Figure 4: Sensitivity Analysis for Grapes



For analysis purposes the mix of new plantings on the 400 additional irrigated hectares is assumed to be:

- 200 ha of pinot noir
- 100 ha of pinot gris
- 100 ha of Riesling (and other aromatics)

The weighted average return per hectare of this mix (based on 2010/11 Nelson price per tonne) would be $1790/tonne. On a mix including Sauvignon Blanc for export sales the weighted average revenue per hectare could be closer to $1450.

The enhanced price anticipated to be achieved when new plantings come on productive stream in 2015/16 is assumed for analysis purposes as 20% above current levels at $2,150 per tonne. All grapes whether destined for export or domestic wine sales will attract a similar price.

3.8.4 Berries

The Tasman region is the prime area within NZ for the growing of blackcurrants and boysenberries with the latter being the main growing area in the world.

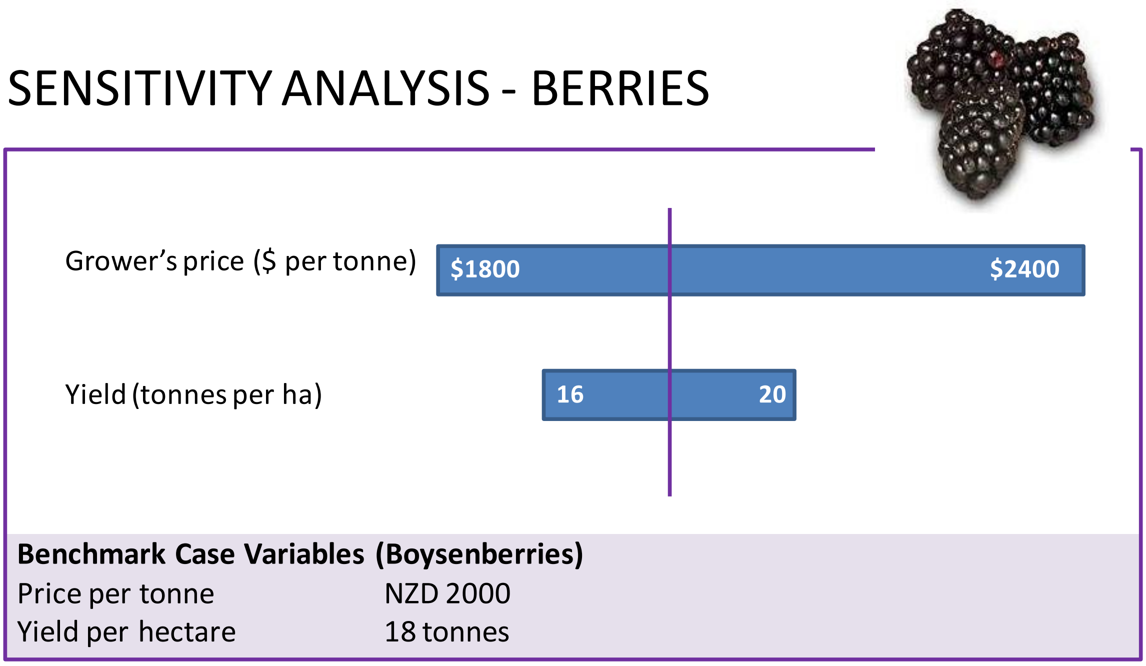
The boysenberry crop is effectively exclusive to Nelson Tasman region for global supply. Consumer demand and price were markedly affected by the global recession with a significant overhang of fruit in storage. Prices fell by close to 20% in 2008/09.

Prices and demand are anticipated to return as the world economy picks up. Demand from emerging countries is also anticipated to add to global consumption.

The comment has been made that another 100ha of boysenberry production is warranted. The model assumes an additional planting of 150ha in berries with boysenberries and black currants the additional crops at 75ha each. Yields of 20 tonnes/ha have been assumed for boysenberries with a farm selling price for export quality fruit in the region of $2000/tonne. Additional cropping is assumed to be exported as frozen product by processors.

Blackcurrants, for which the Tasman region is the prime producer in NZ, have a lower yield of 7 tonnes per hectare. Processed black currants have a growing market as a source of antioxidants in the food sector and also the pharmaceutical and nutraceutical industries. Industry operators are of the opinion that the higher return, processed/extract portion of the blackcurrant market will grow at the expense of the commodity segment.

Figure 5: Sensitivity Analysis for Berries



3.8.5 Sheep + Beef

Food prices globally started to rise mid 2007 but took a pause as the global recession kicked in. However, by end 2010 food prices were on the rise globally again. The assumed price of meat/wool used as input into the CBA model is lagging behind the rise but the extent to which this can be anticipated to be sustained is an unknown. For the purposes of analysis the original base farm gate stock unit price is taken as $76.00. A lower domestic return of $70.00 per stock unit has been assumed for the CBA analysis.

The prices quoted are based on MAF's national sheep and beef price monitoring. Stock unit price levels in the period prior to 2011 were:

- 2090/10 year $76.88
- 2010/11 budget $75.98
- 2011 actual $90 - $125 are being offered for lambs in prime condition by Alliance. While there is evidence of consumer resistance at these levels the global shortage is expected to keep lamb prices above the long run average for some time.

Annual returns will fluctuate depending on weather, grass growth and lambing/calving rates. Export price for prime stock has been taken as $76.00 per stock unit and the domestic price at $70/stock unit.

Irrigated pasture land is assumed to support 12 stock units per hectare in the Nelson Tasman context. Nationally dry land pasture averages 6.5 stock units per hectare the base case used in the base CBA analysis.

The yield per hectare of $3000 assumed in the original Northington Partners analysis was based on the then yield achievable on conversion of dry grazing land to dairy. It is not expected that dairy conversions will be a major feature of any redevelopment in the Waimea Plains district. There are few land parcels available on current dry land in the designated areas of a size to allow an efficient modern dairy operation. A number of smaller scale operations existed a decade or so ago in the Brightwater, West Waimea area, but these have since been converted to other uses as the economies of scale required could not be achieved. See Appendix on farm type units in Waimea area.

3.8.6 Overall Revenue + Cost Structure – Horticulture Development

The yields resulting from the two basic scenarios:

- Original Northington Partners/Agfirst report "Base Yield"
- Improved Yield where future prices take into account productivity improvements and opening of export markets.

Table 3n: Crop Returns/hectare

Production Hectares (2008)	Base Yield (Original) $	Improved Scenario Revenues/ha $	Farm Costs $	Improved Yield
Pasture	3,000	1,165	365	800
Apples	11,630	74,900	46,930	28,000
Kiwifruit Green	9,980		54,560	
Kiwifruit Gold		144,000	71,800	72,200
Grapes	9,530	18,270	10,870	7,400
Berries (Black Currants)	3,700	8,700	4,990	3,690
Berries (Boysenberry)	3,700	40,000	23,000	17,000

Note: Blackcurrants are predominantly machine harvested with some hand-picked for premium niche markets. Boysenberries destined for the commodity export trade are machine harvested with premium fresh sales hand-picked. Self picked fruit is a feature in larger growing operations near population centres.

Table 3o: Processing Returns/ha equivalent

Production Hectares (2008)	Base Yield (Original) $	Improved Scenario Revenues/ha $*	Processing Costs $	Improved Yield **
Wine/Grapes	n.a.	40,800	21,600	19,200
Berry (Black Currants)	n.a.	42,000	31,500	10,500
Berries (Boysenberry)	n.a.	36,000	18,000	18,000
Carnosic Acid	n.a.	15,100	2,800	12,300
Ginkgo powder	n.a.	16,900	1,700	15,200

* Processing costs include purchase cost of fruit and manufacturing

** These are the Benchmark projections used in both CBA and multiplier analysis

3.9 Downstream Processing Factors

The additional processing of produce within the region provides an added contribution to the region's GDP and employment. The GDP generated beyond the farm gate is significant.

This report evaluates the potential level of additional GDP generated from processing the increased output from bringing more land into intensive horticultural production. The original Northington Partners report didn't attempt to evaluate this additional contribution from processing to the regional economy as it was not part of their brief.

3.9.1 Wine making

The value-added GDP contribution from processing grape juice into wine is a major contributor from the sector. The following tracks the relative coefficients and costs involved.

Table 3p: Wine Making Coefficients and Costs

Activity	Reds Pinot Noir, Merlot	Whites SB, Chardonnay
Litres of juice/tonne	650	720
Shrinkage, samples 5%	615	680
Cases per tonne = 9l per case	65	75
Wholesale price excl Excise, GST	$70	$60
Revenue per tonne W/sale	$4,550	$4,500
Costs		
Contract winemaking/litre	$2.50	$2.00
Cost per tonne, winemaking	$1,540	$1,360
Packaging, bottles $1.50/bottle	$18/case	$18/case
Total wine, packaging cost = $36/case: cost per tonne	$2,340	$2,340
Margin per tonne	$2,210	$2,160

3.9.2 Apple Processing

The additional value-added to orchard gate prices at the packing and packaging stage is typically in the $0.50/0.60c per kg ($9.80 per TCE). The number of packhouses has reduced significantly since the early 2000s after deregulation.

The main packhouses packing and distributing the Waimea Plains pipfruit crop have invested in improved equipment and systems. The potential to significantly increase the value added and profitability of their operation is there as apple volumes increase as the cycle turns.

Overheads of packhouse operation are high but marginal costs are extremely low providing the opportunity for improved profits with high throughputs.

3.9.3 Sheep and Beef Processing

The incidence of property owners opting to irrigate currently dry pasture land for stock grazing is considered to be low. Some will take the opportunity to irrigate paddocks for wintering over stock, stock fattening or dairy support pasture.

The increase in potential output in stock numbers is anticipated to be offset by the conversion of existing pasture land to more intensive cultivation.

On balance the increase in stock coming forward for slaughter will probably be neutral.

It is worth noting that the value-added component of meat processing is substantial. The downstream economic contribution from meat processing (mainly lambs and ewes) makes a high relative contribution to the regional economy.

3.9.4 Berry Processing

The boysenberry crop is effectively exclusive to the Nelson Tasman region for global supply. Consumer demand and price were markedly affected by the global recession with a significant overhang of fruit in storage. Prices fell by close to 20% in 2008/09 season. Prices are coming back but industry commentators are not anticipating major increases in global demand. However, the increase of a couple of percent in market demand for the product can significantly increase demand for the Nelson product.

The quality of Nelson region grown black currants is very high due to the cultivars that have been selectively grafted to increase the important health components and the high UV content in Nelson which enhances the quality DNA features. Protecting the properties and image of the Nelson/NZ product is particularly important into the future.

Most of the berryfruit (boysenberries and black currant) are snap frozen and sold to manufacturers of jams, beverages and yoghurt/ice cream makers overseas. This is a commodity market.

The major processor considers that black currants are the fruit of the future. They are a high quality product, have anti-oxidant and anti-aging properties that OECD countries are increasingly looking for. Processing of the product into powders and extracts for neutraceuticals and cosmetics is considered to have major potential and exact a premium price. Marketing activity to build this market is under way.

3.9.5 Other Products and Extracts

A number of other products are being experimented with in the Tasman region to assess viability. Several of these already have a global demand as extracts in the areas of cosmetics, anti-aging supplements, and natural anti-rancidisation agents in prepared food manufacturing.

The production of Carnosic Acid is already being undertaken in Nelson with imported ingredients. The potential to achieve high yields on irrigated land for the base product are considered excellent. Cultivation of rosemary also lends itself to small lot growers and life-style properties.

3.9.6 Industrial Water Users

The major industrial users of water in the Waimea reticulation area are Nelson Pine Industries, The Alliance meat plant and ENZA. These three major industries have over the past couple of decades significantly reduced their water usage while maintaining or increasing the level of manufacturing/processing they undertake.

Nelson Pine Industries

Nelson Pine Industries (NPI) has moved to mechanical bark stripping and away from using water. Their water consumption has declined to 30% of its former usage level as a result of this switch. There is little likelihood of an increased requirement for water allocation for NPI. Any increase from increased production would be marginal and has been built into TDC planning forecasts.

Alliance Group

Alliance phased out its old-style abattoir plant and recently introduced a new modern plant in the process improving efficiency significantly. In the old plant the water use rate was 0.8m^3 for each lamb equivalent, a total 1.8m m^3 of water per year. With the introduction of the new plant water use per lamb equivalent was reduced to 0.5m^3 per lamb and with additional efficiencies has been further reduced to 0.33m^3 per lamb.

Over half a million lamb equivalent stock units are slaughtered at the plant each year. Throughput is determined by availability, drought, feed levels, lamb prices and other factors. About a third of lambs come from the region – Tapawera, Motueka Valley, etc –they get very few lambs off the Waimea Plains as land is too valuable, expensive for sheep rearing. The rest of the supply for slaughter comes from outside the region: mainly Marlborough and increasingly North Canterbury with rationalisation in the number of meat works.

The Alliance Nelson plant is the only sheep plant in the Top of the South Island above Ashburton. The Belfast and Islington chains have gone as has that of Blenheim, a reflection of the drop in the lamb kill over the years. Sheep numbers which used to be 60m+ nationally in the 1980s have reduced to 35m. NZ will be lucky if the sheep meat kill is up to 19m this season.

The combined influence of reducing stock numbers in major global sheep meat producers; NZ, Australia, Argentina, US etc over the past couple of decades resulting from poor prices has been exacerbated by global recession, droughts and floods. A global under supply situation is confronting an increasing demand as new consumers are entering the market; demand is rising from recession lows in traditional sheep meat importing countries. This under supply situation could persist for a number of years until the overall supply of domestically produced and imported/exported sheep meats regains some sort of balance world wide.

Overall the prospect for maintaining stock units through the Nelson plant is thus pretty secure given the supply, plant capacity in the Top of the South and increasing demand for chilled lamb at the supermarket counter.

ENZA

ENZA has improved its water usage through operating efficiencies and economies of scale. The size and capacity of packhouses in the district has increased even as the throughput of export apples in a season has reduced from 6.5m TCEs in the 2004 season to a lower 4.6m TCEs in 2010. This lower level is being maintained and could well increase as new markets in Asia and Australia come on stream.

Fishing Sector

Sealord's demand for water for fish processing is governed by their catch quotas and the portion of their catch that is processed in the Nelson area. Sealord in their Nelson area operations are looking to reduce their water cost structure in a number of ways which include:

- Cutting back on fresh water use and use more salt water in their processing.
- Currently use a lot of water in thawing frozen fish for factory processing – anticipate making greater use of radio frequency technology in thawing product.
- Their use of fresh water in refrigeration will remain high.
- Aquaculture processing will make greater use of automation and microwave technology for opening mussels and other molluscs.

Sealord is anticipating cutting water usage by a third by these measures.

The Christchurch earthquake has raised concerns as to the vulnerability of Nelson's water supply from the Maitai dam. If Nelson was to suffer an earthquake of the severity of the Christchurch quake then Sealord indicated they could possibly have no water for six months in such an event. In this context the importance of the Waimea Community Dam takes on added significance in securing the region's overall water supply and allocation.

Into the Future

While there are no new major industries (with the exception of increased aquaculture production) on the immediate horizon that would boost demand for large volumes of industrial water such an eventuality could occur in the future. The most likely scenario envisaged by planners is a gradual expansion of the industrial base in the Richmond catchment area adding to water demand over time. In such a scenario together with the emergence of a major new industry occurring, the Waimea Community Dam becomes a critical component in securing the region's industrial future.

3.10 Hydro Electric Add-on Option

The capacity and generating potential of the proposed storage dam on the Lee River has been assessed by Tonkin and Taylor. The feasibility analysis covered geotech investigation, land purchase, construction costs, and environment implications. The key features of the dam design and capacity are indicated below.

Network Tasman provided details of generating potential and revenue estimates based on 2009 operating factors.

Capacity	
Dam Capacity	**13m^3**
Optimised Storage Buffer	50.000 m^3
Dam Irrigation Potential	7,765 ha equivalents
Capital Costs	
Dam cost total	\$41.6m (2010 \$)
Hydro Plant Add-on	
Generation Plant/Equipment	\$2.65m (2010 \$)
Distribution System Upgrade	\$1.85m (2010 \$) Upgrade to dam lines
Total Additional Cost	\$4.5m
Cost components of Lines Upgrade	Labour contract 1000/man hours = 40% total
	Equipment (cables, poles etc) = 60%
Output	
Output-Capacity Total	1200 kW
Of which Residual	200 kW (this is the natural spill during high rainfall
Main	1000 kW (designed flow over 7/8 months)
Output Energy	6.4 GkW/pa
Revenues	
Wholesale rate	\$0.08 per kW.
Revenue Estimate	\$493k/pa (2010 \$) revenue estimate to be finalised
Operating Costs	
Additional Staffing	Nil (Claim it can be done with existing staff + systems)
Operational overheads	\$129,000/pa (2010 \$) – includes contribution to dam M&O

Outcomes

The CBA analysis applied to the operating costs and potential revenues produced a net revenue stream (NPV) over the 25 year timeframe adopted for the analysis.

On the basis of a wholesale price of $0.08c per KwH, the 2010 wholesale price for power distributed by Network Tasman, the hydro generating option appears to be marginal. For the installation of generating capacity to be profitable for the distribution company a higher wholesale price would be required.

The Ministry of Economic Development forecasts for wholesale power prices indicates that in the coming 5years they would be at the 12c/Kwh level, 50% above those used in the Network Tasman profile. At this higher price level, which would kick in by the time the dam became operational, the hydro capability is likely to be profitable. In both scenarios the corporate tax impost (at 28%) has been deducted to assess the NPV component.

The relative contribution that the proposed hydro add-on component could make will depend on the structuring of the final output. If the sale of power is structured to include the lines distribution charges in addition to the wholesale price component to an end user, the NPV revenue stream would be significantly enhanced.

Were the residual option for hydro development to go ahead, the NPV revenue stream would be positive (at a NPV of $2.6m outcome over the period) and a useful addition to revenues with low capital costs and minimal operating expenses. Details of NPV outcomes with different wholesale prices and real discount rates are contained in the Technical Appendix.

GDP Estimate

The estimate of GDP value-added over the 25-year timeframe indicates a different picture. Over that 25-year period, once the storage dam has filled to provide generating capacity, the revenue stream created in terms of employment and regional turnover is an important adjunct to the district. The revenue streams generated over the 25-year timeframe for the base ($80/MwH) option are substantial at $430m and after allowing for corporate tax and total revenue impact of $310m into the regional economy is estimated.

The regional GDP component of that activity is estimated at $140m in direct and indirect value-added impacts to the region’s businesses and production and a total of $149m in total value-added impacts when induced impacts from the spending of wages/salaries, fees etc are included. The region’s businesses, construction industry and labour employment also benefit during the 2-year construction period and the upgrade to the lines distribution network. These are estimated to increase regional GDP by:

- $25m in direct and indirect value-added impacts flowing from the construction of the storage dam and a total of $30m to the regional economy when the induced downstream spending from wages and salaries earned is included.
- The upgrade to the lines distribution network would add a further $1m to regional GDP.

Details of revenue streams, multipliers and GDP impacts potentially flowing from the construction of the storage dame and possible hydro plant option are contained in the Technical Appendix.

Income Tax Contribution

The potential income tax contribution from the power generation benchmark scenario is estimated to contribute $2.4m in income tax.

3.11 Non Augmentation

The cost of not proceeding with the proposed Waimea Community Dam would incur significant costs as a result of there being no conversion of currently dryland pasture land to more intensive production and, in addition, a general reduction of output from the Waimea Plains area in dry years.

In the report prepared by Northington Partners and Agfirst on the impacts from irrigation on the Waimea Plains, assessments of the likely impact on the 3,800 hectares currently irrigated from not proceeding with a storage dam and lost production were examined in detail. Their January 2010 report stated:

"Current minimum flow allowance is 600l/sec and the GNS Science investigators strongly recommended that the maintenance of minimum flows in the river system should be raised to 1,100 l/sec." (Refer p5 Northington Partners Report, January 2010)

In the 'worst case' scenario, (refer p15 Northington Partners Report, January 2010), it is assumed that maintenance of the increased minimum flow of 1,100 l/sec would be implemented by TDC through cancellation of sufficient current water allocations to maintain the current security of supply – a 35% cut in allocations during a 10 year drought. Based on work undertaken by GNS Science, this is estimated to require a cut in present allocations of approximately 70%.It is assumed such cuts would apply only to irrigation consents, because allocations for urban and industrial use would have a higher priority for continuation.

Intensive land uses will clearly no longer be viable under this scenario for land owners who lose access to their water allocations, resulting in the prospect of considerable losses in capital values (*and in potential production foregone).* In order to establish the potential magnitude of the aggregate value loss across all current irrigators, the following simplifying assumptions are made;

- The affected area that is currently used for apples, kiwifruit, and grapes is by necessity converted to dryland pastoral uses. Based on a 70% reduction in total water allocations, the irrigable area is reduced from the current 3,800 hectares to 705 hectares and it is assumed that the reduction is applied to all land uses on a pro-rata basis.

- The estimate of aggregate capital value loss for existing irrigators without augmentation is approximately $165m (under these assumptions)."

Agfirst Consultants used the water restriction data to estimate the likely reduction in net farm surplus (measured on Earnings before Interest &Tax [EBIT] basis) for the predominant land uses within the irrigable area.

Estimates of drought events are based on historical water flow records. A relatively crude approximation of the aggregate financial cost of non-augmentation over a 25 year period was made on the basis of available data. For this analysis it is assumed that the financial/economic impact of water restrictions is negligible for anything less severe than a 1 in 5 year drought and that the costs of a lower frequency drought (1 in 10 year and 1 in 25 year) can be interpolated."

The cost of non-augmentation on existing irrigated production is estimated in this CBA model at $59m (NPV) over the 25-year period.

Table 3q: Non Augmentation Scenario: Impact on Current Irrigated Land

Crops Produced	Crop Area hectares	Base (Original)$	Base (Revised) $
Pasture	1,450	3,000	3,000
Apples	1,620	11,630	16,500
Kiwifruit	180	9,980	15,000
Grapes	550	9,530	6,120
Berries	-	3,700	10,300

The revised base returns per hectare have assumed to incorporate positive changes in the yields from improved cultivars and more intensive plantings.

- Pasture: reflects the returns per hectare for dairying assumed by Agfirst.
- Apples: assumes 30% of the area devoted to apples has been converted to higher yielding dwarf varieties by 2016 season.
- Kiwifruit: assumes that 40% of existing green Haywards vines have been grafted with higher yielding (and premium priced) gold cultivars.
- Grapes: takes account of improved returns (average $1450/tonne) by 2016 season.
- Berries: original base used black currants as the benchmark, revised base averages returns/ha of boysenberries and black currants.

The report also expresses the cost of non-augmentation in terms of foregone profitability, stating: "Another way to express the potential loss of regional income under the above scenario considers the annual reduction in on-farm profitability that would result from a 70% reduction in the water allocation. Their estimate of the annual loss is based on several broad assumptions.

- The land use on the remaining 705 hectares will be similar to that for the existing 3,800 hectares of irrigated land, and that the newly unirrigated land (3,095 ha) will be forced into dryland pastoral use.
- The consultants assumed profitability from dryland farming is based on 75% of the current profitability for irrigated dairying which Agfirst estimated at an average of $3000 per hectare.

On this basis, it is estimated that the total annual loss under this non-augmentation scenario would be in the vicinity of $17.5m. Over a 25 year period the aggregate loss would amount to some $440m."

This estimate of reduced profitability and potential losses is possibly optimistic as returns to dryland pastoral farming with sheep and cattle (from recent analysis) would appear to be significantly below the $2250 (75% 0f $3000) assumed in the original Northington Partners analysis.

This potential loss is very significant as specific types of intensive horticulture; in particular market gardening, (with a South Island wide demand catchment), berryfruit, apples, kiwifruit and grape growing would all be effected. Some would become uneconomic; particularly those that require daily water application and are labour intensive (like market gardening) in getting their product to market. In addition to the physical production on the Plains, the volume of product moving through the pipeline to downstream processing and distribution would also be affected. No attempt at this juncture has been made to quantify that impact.

4.0 Peer Review

A selection of industry operators have been canvassed on their views as to the likelihood and accuracy of outputs from the modelling process. These include those in the horticulture sector and pastoral industries together with major processors of horticultural products in the region. MAF senior analysts have also been approached for their inputs at the production stage and to comment on outputs.

Recreation and tourism operators with an interest in the outcomes have been approached.

Essential parts of the analysis that has been established for this project study has been peer reviewed to ensure that the inputs into the analysis are accurate and robust and that the methodology used is appropriate along with the conclusions drawn from the findings.

The areas of peer review undertaken in this study include:

Horticultural Development

The potential yields and export and domestic prices for the various development options on newly irrigated pasture land converted to other land use. The soil type and moisture retention factors through the 1800 hectares potentially to be irrigated have an assessed and based on Agfirst's soil analysis of the Waimea region.

The over-riding assumption used in establishing potential land mix and horticultural development has been the adaption of best practice and the introduction of new cultivars that would be planted when the project proceeds. These have also been reviewed by Agfirst experts.

Projections of yields and potential price levels into the future have been peer reviewed by the Chair of Berryfruit NZ and middle level benchmark yields and prices have been adopted as a result. Sensitivity analysis on price and yield factors has been incorporated into the economic impact/CBA model and the text.

Cost Benefit Analysis

The methodology, inputs and output analysis derived from the Cost Benefit Analysis (CBA) has been peer reviewed by Northington Partners as various milestones in the analysis process have been reached.

The CBA analysis covers both the potentially increased production from horticultural development and the product volumes and outputs potentially generated from downstream processing of the increased product volumes.

Multiplier Analysis

The outputs by sector in terms of increased regional GDP and employment factors has been reviewed at an early stage.

Hydro Generation Option

The outcomes from analysis of the hydro generation options associated with the dam development have been reviewed by Network Tasman who also supplied the base operating data on which CBA and Multiplier Analysis was undertaken.

5.0 Interview Contact List

Nick Dalgety	Senior Policy Analyst, MAF
Julian Raine	Executive Director, Wai-West Horticulture
Neil McCliskie	MD, Alandale Orchards
Richard Inglis	Manager, Latitude 41 Packhouse (Turners & Growers)
Peter O'Sullivan	Operations Manager, Freshco Nelson
David Binns	Quality Manager, ENZA International
Trevor Bolitho	MD, Waimea Estates
Philip Woollaston	CEO, Woollaston Estates
Richard Daniell	MD, Nutrizeal
Andrew Simpson	Manager, Berryfruit New Zealand
Julian Raine	Chair, Berryfruit New Zealand
John Gibb	MD, Sujon
Philip Field	Director, Berryfields
Phil Hyatt	Former President, Blackcurrant NZ
Tim King	Deputy Mayor, TDC
John Ewers	MD, Ewers Fresh
Mark O'Connor	MD, Appleby Fresh
Rob Conning	Conning Market Garden
Jamie Russ	Marketing Manager, MG Marketing
Terry Kreft	Plant Manager, Alliance Group
Paul Dalzell	Marketing Manager, Nelson Pine Industries
Dorje Strang	Commercial Development Manager, Sealord
Steven Spark	Horticultural Consultant, Agfirst
John Bealing	Land Use Consultant, Agfirst
Wayne Mackey	CEO, Network Tasman
Colin Starnes	Commercial Manager, Network Tasman
Joseph Thomas	Water Resource Scientist, TDC
Murray Staite	Corporate Services Manager, TDC
Murray Harrington	Partner, PricewaterhouseCoopers
Matthew Yates	Director, PricewaterhouseCoopers
Greg Anderson	MD, Northington Partners
Will Parkyn	Associate, Northington Partners
Rod Baxendine	Rural Sector Valuer, Telfer Young
Dick Bennison	Rural Sector Valuer, Duke & Cooke

6.0 APPENDICES

6.1 Appendix 1: Case Study: the Opuha Dam irrigation scheme

The Opuha Dam was commissioned in 1999 after a protracted development stage. While the Opuha scheme is a larger facility many of the features of the Opuha dam are similar to that proposed for the Waimea Community Dam facility. A comparison of size and capacity is profiled in the following table.

Table 6a: Comparison of Irrigation Dam Parameters

Storage Dam Feature	Opuha Dam	Waimea Community Dam
Height of dam structure (m)	47m	52m
Crest length (m)	100m	220m
Dam storage capacity (m^3)	91 million	13 million
Lake formed (ha)	700ha	65ha
Water demand component (ha)	16,000ha *	7,760ha
Head of water (m)	n.a.	147m
Hydro power generation capacity (MW)	7.6MW	1.2MW
Cost of dam structure ($m)	$32m (1996)	$38.1m
Cost of land, consents, environmental mitigation etc	n.a.	$3.5m
Proportion of storage allocated to environment %	50%	30%

* Estimated irrigated catchment area representing half (50%) of the potential area coverage for irrigation/dryland pasture

An ex post study of the Opuha Dam dynamics was completed in 2006 based on FY2003 and FY2004 farm operation financial data in the catchment area to evaluate the economic impact of the scheme.

The project funding mechanism was through a private/public sector partnership that financed the construction and sold shares in the enterprise providing the right of access to irrigation.

- Share uptake was initially low
- The scheme after 10 years was fully subscribed
- Shares (in 2006) were selling at a premium of over 10 times their original cost.

Despite the relatively modest level of irrigation usage on member farms, which averaged half (49%) of the effective farm area of shareholding members, the scheme is considered successful and providing significant economic growth momentum in the district.
The extent of conversion to more intensive farming that has occurred (less than anticipated for the Waimea Plains) has significantly raised the yields and return per hectare on participating farm operators. The options available to farmers in the Opuha catchment were restricted compared to those available to Waimea Plains operators. The major options were for dairy conversions and the cultivation of forage crops and particularly vegetables for processing. The following indicates the

increases in yield and revenues generated on newly irrigated land compared to dryland pasture in the Opuha catchment.

Operating costs are increased on irrigated farmland through the costs of irrigation water itself but also the increased costs of plantings, additional labour for harvesting etc, interest charges and infrastructure R+M would also be higher.

The study indicates that in the 2004 FY the average revenues generated gross revenues of $2073 per irrigated hectare and $862 per dryland hectare. Though on farm working expenses at $1500 per irrigated hectares were higher than the $655 on dryland hectares the net revenues per ha were more than double. The conclusion is inescapable that irrigation has the potential to significantly increase the gross revenues generated per hectare.

Table 6b: Financial Performance Comparison Opuha Catchment

Farm Operating Factors	Dryland		Irrigated	
	% of Revenue	**$/ha Effective**	**% of Revenue**	**$/ha Effective**
Total Revenue		**862**		**2073**
Farm Working Expenses	**76%**	**655**	**73%**	**1503**
Farm Cash Surplus	**24%**	**208**	**27%**	**570**
Total overheads		**213**		**484**
Net profit after tax	**-1%**	**-5**	**4%**	**86**
Disposable Surplus		**(142)**		**(153)**

Note: Financial data was sourced from sample farm property tax records which inevitably would include allowances to ensure the stated net incomes were tax efficient.

Electricity generation contributed a further $1.03m to direct output.

The most significant differences in productivity between dryland and irrigated properties were in the area of crop yields. The yield/ha for all crops was significantly higher on irrigated land than dryland cultivation. Increased stock numbers were also a feature of irrigated land area. Comparison of dryland and irrigated land yields are detailed in Table A3 following.

Table 6c: Productivity Yields on Sampled Farms

Crop/Stock	Dryland	Irrigated
Lambing %	136%	144%
Beef calving %	94%	94%
Milksolids/cow		384
Fawning %	89%	84%
Velvet kg/ha		44
Feed crop (T/ha)	3.1	12
Grain (T/ha)	6.5	8
Process vegetables (T/ha)	5.6	24
Small seed (T/ha)	1.7	1.9

Source: Ex Post Study, Aoraki Development Trust, 2006

6.1.1 Comparison of Economic Impacts

The relative impacts from irrigation are outlined in the following table. The impact data for the Waimea Plains relates specifically to the additional level of output generated from the proposed newly irrigated area (1800ha). In the case of the Opuha Dam catchment in South Canterbury the impact of on farm irrigation was analysed from a structured sample of farm financial records . Prior to the Opuha Scheme the area effectively had no irrigation capability and were all dryland farming operations.

The difference between the potential revenue generation and flow-on impacts from irrigation on the Waimea Plans compared to that of the Opuha Scheme is dramatic and reflects the superior potential from intensive horticultural production that is possible in the Waimea district. The increased revenues (output) on the Waimea Plains is potentially more than 10-fold that achieved in the Opuha district. The impacts from increased horticultural production to downstream processing revenues is equally dramatic with potential revenues per hectare close to 15-fold those achievable from pastoral operations (due to increased production for processing).

The economic impacts have been assessed per hectare of irrigated land based on conversion and changed land use mix as a result of irrigation availability.

Table 6d: Comparison of Economic Impacts per hectare

Economic Impact Factor	Opuha Irrigated land $/ha	Waimea Plains newly irrigated land $/ha*
Output ($/year)		
Direct on farm	2,070	27,840
Direct in processing	2,040	32,600
Indirect and induced	1,940	14,600
Total	6,050	75,000
Value Added GDP ($/yr)		
Direct on farm	750	14,100
Direct in processing	380	13,200
Indirect and induced	830	7,860
Total	1,960	35,160
Household Income ($/year)		
Direct on farm	300	11,200
Direct in processing	200	4,900
Indirect and induced	490	4,160
Total	1,000	20,260
Employment (FTEs/$m)	FTEs/$m	FTEs/$m
Direct on farm	9.6	11.3
Direct in processing	4.8	4.4
Indirect and induced	12.6	3.4
Total	26.9	19.1

Source: Opuha Dam Ex Post Study, Aoraki Development Trust, August 2006
John Cook & Associates, May 2011

The employment figures generated for the Opuha Scheme as recorded in the ex post study are somewhat ambiguous as the direct employment factor has been adapted from FTEs per 1000ha. The FTEs estimates derived from the Waimea Community Dam analysis are based directly on FTE employment generated per $m weighted for each of the potential conversion options considered in the model analysis. The potential increase in on farm employment as a result of conversions from dryland pasture to irrigated production while substantial, due to a significant increase in revenues generated/ha, is less than that indicated in the above table – the weighted increase of 11.3 FTEs with irrigation compares to 8.9 FTEs for dryland employment per $m revenue generated.

The improvements in productivity effected through intensive planting of apple crops, the significantly increased yield potential and economies of scale achieved in orchard and packing operations in the Waimea district have reduced the employment requirement below that indicated in the above table for horticultural production.

6.2 Appendix 2: Technical Appendix

Two main analytical methods that have been applied in the analysis of project outcomes are:

1 **Gross Domestic Product (GDP):** In the GDP analysis, benefits are analysed in terms of the impacts on the wider regional economy, including the flow-on effects of increased revenue in the impacted sectors. This methodology identifies a continuing stream of spending (revenues) and the downstream impact of those revenues within the region stimulating further activity and sales.

2 **Cost Benefit Analysis (CBA):** In the CBA, quantifiable benefits and costs are assessed and are then adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) are expressed on a common basis in terms of their currant Net Present Value, or NPV. The technique considers the stream of revenues generated into the future to have a lower purchasing power (reduced by the annual discount rate) than revenue available for spending today.

Four areas are analysed:

3 **Production and Processing:** Production and processing includes the improved yields on existing land, and the additional land that will be available for cultivation of apples, kiwifruit, grapes, berries, pastoral land. It also includes the associated processing of those items, such as winemaking or nutraceutical and food preparation extracts

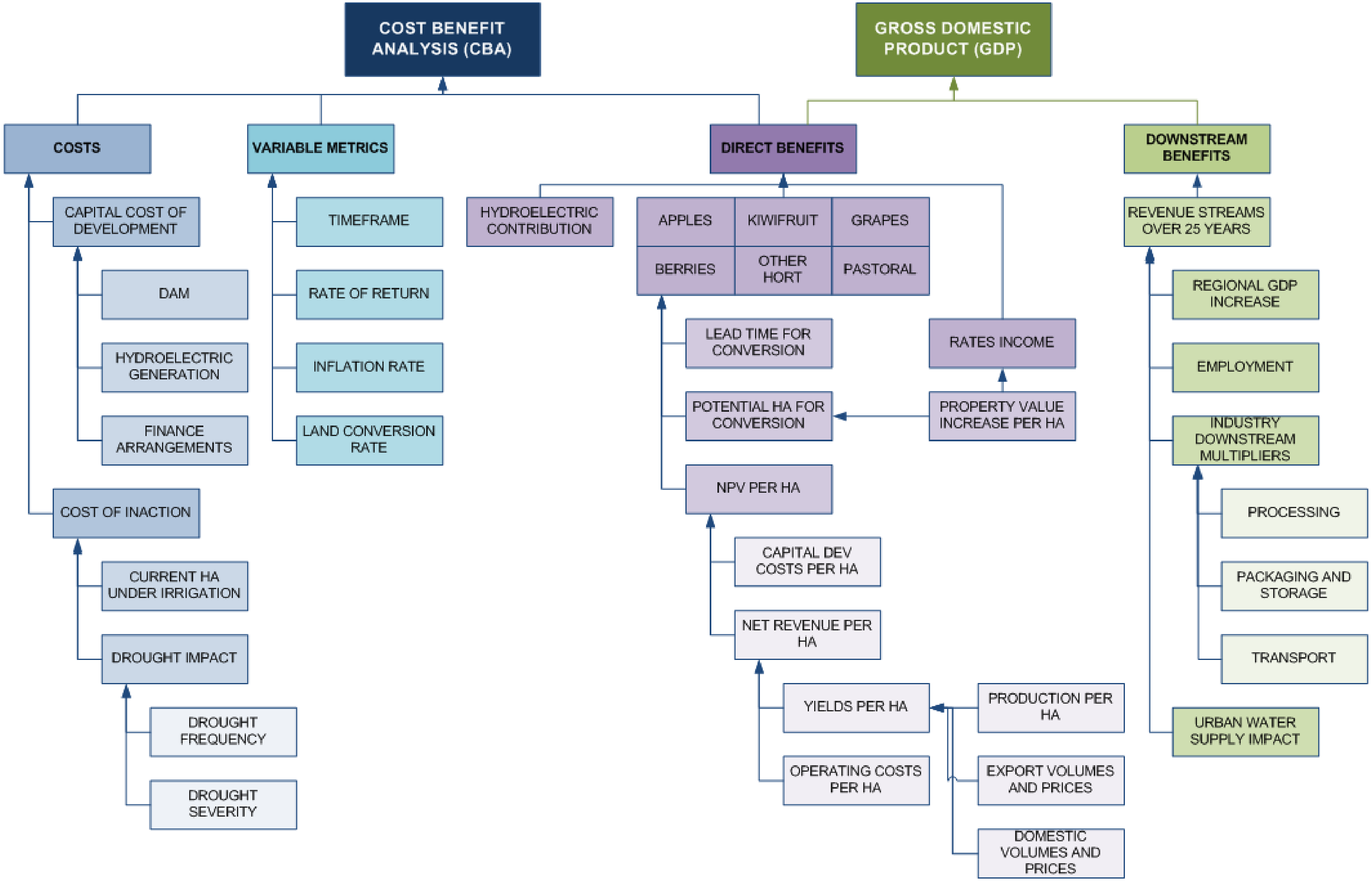
4 **Non-Augmentation:** We have assessed the cost of doing nothing, or non-augmentation, as a separate component. This is assessed as an averaged NPV figure and also as a revenue stream figure.

5. **Hydro Generation:** The costs and benefits of the proposed hydro generation bonus are considered both as a GDP and an NPV figure.

6. **Additional Land Usage:** The project will have revenues from the additional land which will be converted to more intensive cultivation, and also in terms of additional yield on existing cultivated land. The value and rateable value of this land will also increase as its potential revenues are realised.

6.2.1 Structure of the Economic Model

Figure 6: Diagrammatic Representation of the Components of the Economic Model



6.2.2 Gross Domestic Product

The regional multiplier factors (prepared by Butcher Partners) were applied to the revenue streams estimated for each of the crop options on newly irrigated land. The resulting added value GDP measure derived in the analysis is profiled in Table TA1 following.

An estimate of the GDP (direct and indirect downstream Type I impacts) generated from increased production has been analysed. The estimate for the annual contribution to GDP is based on production at full maturity. The 25-year GDP takes into account lower yields in early years.

Table 6e: Estimates of GDP Generated from Increased Horticultural Production (Type I Impacts)

Production Area	**Annual $m**	**25 Year Period $m**
Apples	43.4	731
Kiwifruit	9.5	159
Grapes	4.1	91
Berries (boysenberries)	3.8	69
Pastoral	0.2	4
Total from Newly Irrigated Land	58.0	1,054
Processing		
Winemaking	6.1	82
Berries	2.0	41
Extracts	0.4	9
Total Processing Value-Added	8.5	132
Total Increased GDP from Production + Processing	$66.5m	$1,187m

Table 6f: Hydro Generation: GDP Value Added from Hydro Power Sale After Tax (Type I Impacts)

Category	**Annual $m**	**25 Year Period $m**
Power supply	5.6	140.0
Dam construction	24.6	24.6
Lines Upgrade	0.8	0.8
Total GDP estimate	31.0	165.4

Type I Impacts: The direct and indirect activity generated from regional suppliers and product services used in the production of crop types.

Type II Impacts: Includes the induced impacts from spending of recipients of revenue streams from crop production in addition to the purchase of regional goods and services.

6.2.3 Cost Benefit Analysis

The Cost Benefit Analysis (CBA) for the area potentially irrigated is based on the Net Present Value of the revenue streams over the 25-year timeframe. The relative contributions by crop type are profiled in Table TA1 following.

Table 6g:Improved Yield Scenario – Development on Newly Irrigated Land (Est 2011 prices)

Summary Outcome	NPV
Benefit of Augmentation	
Increased production on currently irrigated land	$127.6m
Increased production on newly irrigated land (West Waimea + Wai-iti)	$89.0m
Total increased production	$216.6m
Increased value of processing	$60.2m
Total Increased Net Benefit	**$276.8m**
Estimate cost of Non-Augmentation	$58.9m
Overall Economic Value of Augmentation	**$335.7m**

6.2.4 Hydro Generation Option

Table 6h: Hydro Generation Option Outcomes

Option	Power Price/MwH $	Real Discount Rate	NPV $m
W/sale only (base)	80.00	5.5%	2.6m
W/sale only (3rd party	120.00	5.5%	3.7m
W/sale+ lines charge	140.00	7.2%	3.1m
W/sale+ lines charge	140.00	5.5%	5.3m

The analysis of hydro power revenue streams has been made in two ways. The benchmark case evaluates the revenues and IRR based on a constant $ wholesale price (of $80/MWh) and the alternative scenario on an increasing price based on Ministry of Economic Development (MED) power price projections. The NPV value of revenues at the $80/MWh scenario is a positive $2.6m over the 25-year timeframe. The IRR factor for the benchmark case is estimates at 7.8% and at 9.8% using MED price projections.

The potential income tax contribution from the power generation benchmark scenario is estimated to contribute $2.4m in income tax.

6.2.5 Sensitivity Analysis and Internal Rate of Return

An essential component of the Cost Benefit Analysis of the project has been Sensitivity Analysis and the calculation of Internal Rate of Return (IRR) factors. Table TA2 following profiles the worst and best case projections together with the Benchmark case used as the standard for net revenue analysis per hectare. Two intermediate projections were also included in the analysis. These scenarios reference an average yield, market return to growers in NZ$ and packout rates over a 25-year timeframe (with the completion of dam and filling to sufficient capacity for irrigation draw off =Year 0). Revenues and operating costs are in constant 2010/11 NZ$.

Table 6i: Best and Worst Case Scenarios

Crop Type	Worst Case Scenario	Low Scenario	***Benchmark Case***	High Scenario	Best Case Scenario
Apples (80% Packout)					
Yield (TCEs/ha)	3000	3250	3500	3750	4000
Price (NZ$ FAS)	$18.00	$20.00	$23.00	$24.00	$25.00
Net Revenue/ha NZ$	$2,100	$6,900	$19,400	$23,200	35,300
Kiwifruit (85% Packout)					
Yield (Trays/ha)	11,000	11,000	12,000	13,000	15,000
Price (NZ$ FAS)	$11.00	$12.00	$13.00	$14.00	$15.00
Net Revenue/ha NZ$	$44,600	$53,900	$72,000	$90,900	$122,000
Boysenberries					
Yield (tonnes/ha)	16	17	18	19	20
Price (export processing)	$1800	$2000	$2000	$2200	$2400
Net Revenue/ha NZ$	$5,800	$11,000	$13,000	$18,800	$25,000
Grapes					
Yield (tonnes/ha)	8.0	8.5	8.5	9.5	10.0
Price (export processing)	$1450	$1790	$2,150	$2150	$2500
Net Revenue/ha NZ$	$730	$4,300	$7,400	9,600	$14,100

6.2.6 Internal Rate of Return (IRR) and GDP

The IRR measure profiles Best case, Benchmark and Worst case scenarios. The outcomes of this analysis, profiled in the following table, reflect the strong productivity that can be achieved from the irrigation of dryland pasture for intensive horticultural crops in the Waimea Plains.

Table 6j: Internal Rate of Return Analysis

Scenario	**IRR Analysis (Nominal Pre-Tax)**
Augmentation Outcomes	
Worst case scenario	10.3%
Low scenario	16.8%
Benchmark case	24.9%
High scenario	27.3%
Best case scenario	32.2%
Hydro Dam	
MED price path	9.8%*
Fixed price path ($80/MWh)	7.8%**

* 7.3% Real + 2.5% Long Term Inflation

** 5.3% Real + 2.5% Long Term Inflation

The model calculates three components of net present value created by the augmentation scheme, namely;

1. Cost of non-augmentation: this represents the cost of drought that is expected to be avoided by implementing the augmentation scheme.

2. Benefit of augmentation: agricultural production is expected increase with better water availability (eg, pastures will be converted in higher yielding crops and improved cultivars will be planted).

3. Secondary economic value: increased agricultural production will result in greater demand for processing, particularly of high value crops such as berries and grapes. This increased requirement for processing adds value to the region.

The cost of the scheme is $41.6m and for simplicity we have assumed that half of this cost is outlaid in December 2012 with the balance paid one year later. The real cost of the project has been calculated using a simple NPV (at a 10% discount rate the real value is $39.7m).

The sum of the three value components equates to the total economic value created by the augmentation scheme. In order to calculate the overall IRR of the project the net value of the project has been determined as the economic value less the NPV of the project costs. The discount rate accordingly equates to the "internal rate of return: that gave a net project value of zero.

6.2.7 Tax Contribution from Increased Production

Estimates of potential income tax generation have been made for each of the scenarios evaluated in the "Sensitivity Analysis". The outcomes of this analysis is profiled in Table TA4 following.

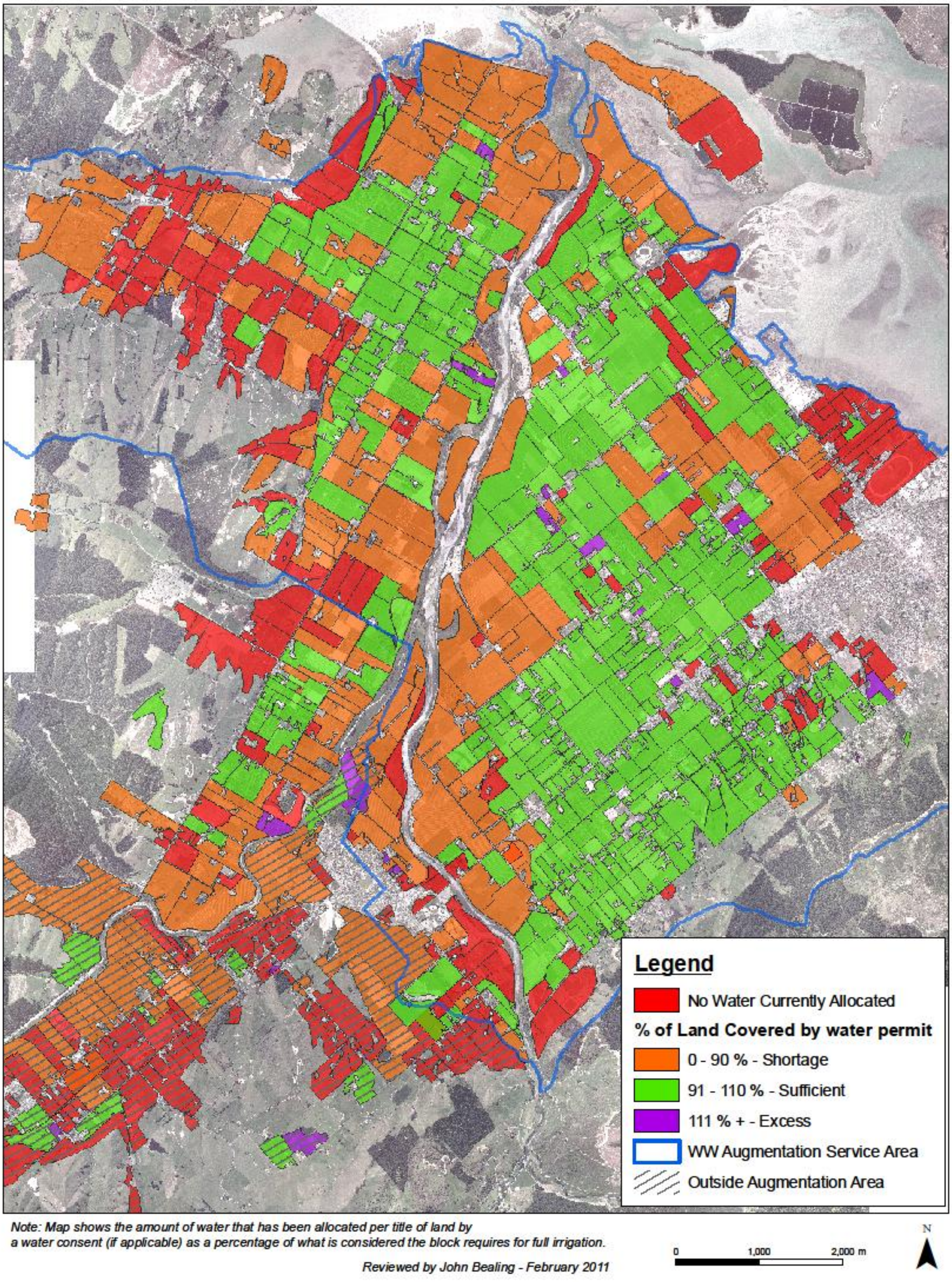
Table 6k: Income Tax Generation

Crop Type	Worst Case Scenario $m	Low Scenario $m	**Benchmark Case $m**	High Scenario $m	Best Case Scenario $m
Apples	0	0	**6.6**	39.5	74.0
Kiwifruit	10.8	14.8	**24.3**	34.0	50.7
Grapes	0	0	**0**	0	0.7
Berries	0	1.1	**2.6**	7.1	11.9
Total Tax Generated $m	10.8	15.9	**33.5**	80.6	137.3

6.3 Appendix 3: Map of the Affected Area

The satellite map which follows shows the area of the Waimea Water Augmentation Zone and the degree to which properties are affected.

Properties requiring additional water within the Waimea Water Augmentation Zone



Note: Map shows the amount of water that has been allocated per title of land by a water consent (if applicable) as a percentage of what is considered the block requires for full irrigation.

Reviewed by John Bealing - February 2011

6.4 Appendix 4: Tables and Figures

6.4.1 Tables

6.4.2 Figures