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Evaluating the Mana of the Manawatu: Estimating the Recreational Ecosystem Service of the Manawatu Catchment, New Zealand

Introduction

The understanding that the earth is a finite system is one that is widely overlooked in economics. Traditional economic theory posits that growth can continue unabated with continued growth being the ultimate goal. While some acknowledgment is afforded to the fact that natural resources can be depleted, the assumption exists that these resources can be reasonably substituted with man-made resources and technological advances. This substitution may enable growth to continue for a time but does not address the issue that the natural resource may no longer be available and the future cost of this to future human generations (Daly, 2005).

As a counter to this, Ecological Economics seeks to recognise and quantify the value that ecosystem functions and products provide to ensure that their importance is known and in turn to highlight potential costs should these resources be irreversibly depleted (Costanza, 1989).

Working within the framework of the Ecological Economics paradigm, this report seeks to provide an assessment of the value of recreational ecosystem services in the Manawatu catchment as they exist at present with a view to considering how improvements to the catchment could increase the potential recreational value of ecosystem services that the Manawatu River can provide.

Ecosystem Services

Ecosystem services are defined as the benefits that humans derive from ecosystem functions where ecosystem services "contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet" (Costanza et al., 1997). The objective of valuing the free services provided by nature is to ensure such services are not considered to have a zero value and by extension not given any weight in the decision-making process.

To quantify this and other contributions to the global economy that must be maintained Costanza (2008) defines four important types of assets that need to be considered. These are social, human, built and natural capital. Social capital is made up of networks between people whereas human capital consists of the attributes of individuals and how they contribute to society as a whole. Built capital relates to infrastructure and tangible products and is the main focus of the traditional economy to the point that man-made capital is often considered an equivalent substitute for natural resources (Daly, 2005). Natural capital is the ecosystem services that provide invaluable benefits that are often overlooked and consequently compromised by traditional market mechanisms. Examples of natural capital include such varied services as flood protection and soil formation through to recreational assets and aesthetic services of natural landscapes (Costanza, 2008).

In terms of benefits that can be derived from freshwater ecosystems Wilson and Carpenter identify seven different benefit categories that can be used for economic valuation purposes (Table 1). Of importance in this study are the in-stream, aesthetic and ecosystem benefits of freshwater ecosystems.

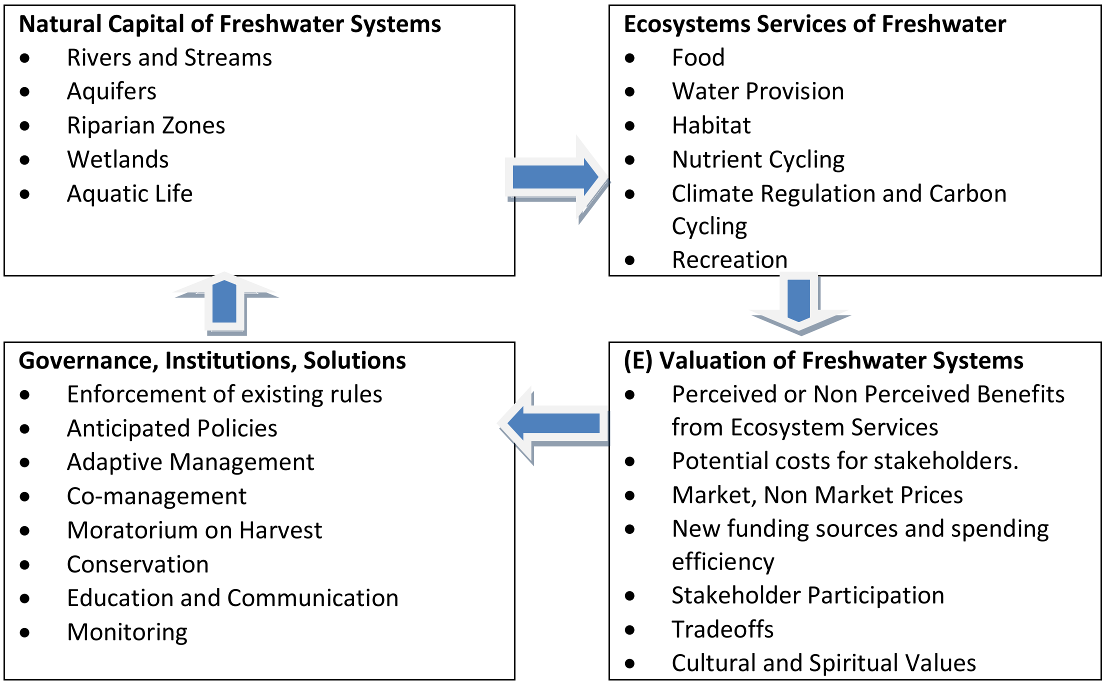
Table 1: Benefits derived from freshwater ecosystems for valuation purposes.

Benefit class	Benefit category	Benefit subcategory
Use	In-stream	Recreational (fishing, swimming, boating)
		Commercial (transportation)
	Withdrawal	Municipal (drinking water)
		Agriculture (irrigation)
		Commercial (electricity)
	Aesthetic	Enhanced near-water recreation (hiking, picnicking, photography)
	Ecosystem	Enhanced recreation support (wildlife viewing, hunting)
		Other ecosystem services
Nonuse	Vicarious consumption	Significant others (family)
		Diffuse others (American public)
	Stewardship	Inherent (remote wetlands)
		Bequest (future generations)
	Option	Individual risk-aversion

Source: Wilson and Carpenter (1999, pg. 774)

The following diagram (Figure 1) provides a framework that demonstrates a need for a collaborative and integrated approach to the management of ecosystem services if a positive, reinforcing cycle between the capacity of ecosystem services and management strategies are to be created (van den Belt, 2012). The framework consists of the natural capital of freshwater ecosystems and the services that are derived from these. In turn evaluation of these services will hopefully lead to policies and management which reinforce the importance of the natural capital assets (van den Belt, 2012).

Figure 1: Dynamic ecosystem service framework.



Source: Adapted from van den Belt, (2012 in press)

Recreational Value

The ecosystem service "recreation" is one of 17 ecosystem services provided identified by Costanza et al. (1997) and covers the free services provided by natural capital for recreational activity. It covers activities such as eco-tourism, sport fishing, and other outdoor recreational pursuits like tramping or swimming that take place because the natural environment provides the "infrastructure" for the activity to occur in.

Affordability and access to leisure activities is an indicator of the level of well-being in a society. Reduced work allows people to pursue leisure which can increase both physical and mental health. Leisure activities also build community thereby growing social capital.

It is recognised by many that recreation in general is both physically and spiritually uplifting. Recreation in areas surrounded by beautiful, serene natural capital can heighten the sense of spirituality, which increases the recreational service value. Walking and biking popularity in such areas supports the view that people are placing increasing importance on this recreation service.

In valuing non-market recreational ecosystem services we can begin to understand the scale of benefits that are derived from them (Wilson and Carpenter, 1999). These recreational values can be defined as being a consumptive or non-consumptive use. Consumptive values include activities such as recreational fishing and hunting where the resource is typically consumed and it not available for another person's use as opposed to non-consumptive values where use of the resource does not deprive others of the benefit of that resource. Examples of the latter are activities such as swimming, boating, walking, cycling and wildlife watching (Vaske et al., 1982).

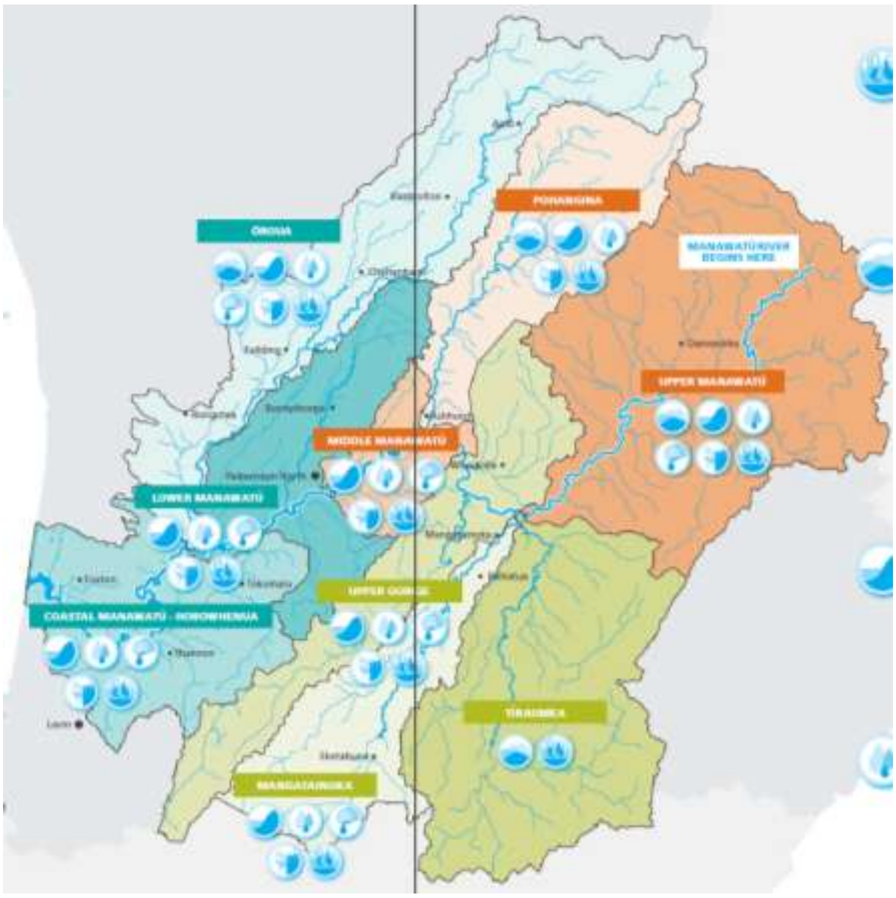
The Manawatu Catchment

The Manawatu River and its tributaries are located in the lower North Island within the Wanganui/Manawatu region. The catchment covers an area of 5,898km^2 with a total stream length in the catchment of 9,648km. Besides the Manawatu River itself, at a length of 235km, other large tributaries in the catchment include the Oroua (131km), Mangatainoka (71km), Mangahao (86 km), Pohangina (71 km) and Tiraumea (69 km) Rivers (Land and Water New Zealand, 2012). The main city in the region, Palmerston North with a population of approximately 80,000, is situated on the Manawatu River itself.

The Manawatu catchment lies within the jurisdiction of Horizons Regional Council and lies within the boundaries of the following Local Authorities: Manawatu District Council, Horowhenua District Council, Tararua District Council and Palmerston North City Council. The estimated total population of these four districts at 2011 is 160,500 (Statistics New Zealand, 2012).

The state of the river has come to prominence in recent years Record of river and Manawatu River Leaders Accord comprised of representatives from Local Authorities, Horizons Regional Council, Iwi/Hapu, environmental interest groups and farming and industry (Horizons Regional Council, 2012a). An action plan was formed as part of the Accord which divides the Manawatu catchment up into nine sub-catchments (see Figure 2) and identifies specific issues and actions required for each. The Action Plan highlights the widespread modification of land cover in the region for the purposes of urban development and farming and the consequences of these changes for the River in terms of increased sediment and nutrient loads and a substantial decrease in riparian vegetation.

Figure 2: Schematic of the Manawatu catchment showing the nine sub-catchments.



Source: Manawatu River Leaders Accord – Action Plan

Natural Capital of Freshwater Systems

Natural Capital of Riparian Zones required for recreational fishing

The natural environment provides the following ecosystem services that support trout spawning and fisheries (Table 2) and thereby allow humans to participate in, and enjoy recreational fishing.

Table 2: Trout Spawning and Fisheries Ecosystem Requirements.

Trout spawning	**Trout fisheries**
Accessible spawning habitat	Overhanging shade
Cool water temperature.	High quality terrestrial and aquatic macroinvertebrate food sources
High dissolved oxygen	Instream cover
Stable cobble/gravel substrate	Low suspended sediment for sight feeding
Natural flow variation	High dissolved oxygen
Low suspended and deposited sediment	Low to moderate water temperature
High degree of habitat heterogeneity(pool/riffle complex)	Good water quality

Source: McArthur and Lambie (2007)

The following table (Table 3) lists the ecosystem services that support recreational fishing in the Manawatu Catchment that are under pressure and the causes of those pressures.

Table 3: Ecosystem Services Under Pressure in Manawatu Catchment and Causes.

Ecosystem Service Loss	**Main Cause**
Loss of habitat heterogeneity (pool/riffle complex)	River channelling and floods protection works
Loss of instream and riparian cover	Conversion of land to urban/pastoral use
Loss of high quality aquatic and terrestrial invertebrates	Habit loss and water quality loss
Water quality degradation	loss of natural filtration such as wetlands, vegetation cover for soil stabilisation, nutrient and pathogen loading
High water temperature	Loss of shade, wastewater disposal
Low dissolved oxygen	Increased nutrients in waterways
High suspended and deposited sediment	Erosion from hill country and river/ stream banks
Loss of wetlands	Refugia, water filtration

Adapted from: Source: McArthur and Lambie (2007)

Fish species in the Manawatu Catchment

Both brown and rainbow trout are present in the river, averaging around 1.5kg, with many fish going much larger. There are also perch in the lower reaches (www.nzfishing.com). The Manawatu River is a gravel bed river in its higher reaches "Trout mainly inhabit gravel streams, rivers and lakes and are not often found in mudstone or siltstone catchments." (McArthur and Lambie, 2007, p.9). The fisheries are sustained by natural reproduction. "Trout typically spawn in low-gradient streams with cold well-oxygenated water, clean unsilted gravels and stable flows" (Hicks et al., 2010, p.213). Clear water is required as turbidity reduces visual feeding. Abundant instream and riparian cover is needed to keep water temperatures below 20^{o}C. The optimum water temperature for trout is around 13^{o}C. (McArthur and Lambie, 2007).

Spawning occurs in late autumn or early winter and takes place over the length of the river and its tributaries. The female trout builds a redd (nest) in the stream bed usually in a pond and lays eggs which are fertilized then covered with gravel. Fertilisation takes approximately a month later – the actual time depends on water temperature. For successful fertilization water must circulate through the redd to supply the embryo with oxygen and remove wastes. Tributary streams with high sediment loads are not suited to spawning as the silt can smother the redd. Flooding also can dislodge and reduce spawning success. Trout fry need to live in areas with low water velocity and protective cover for the first few months. This type of habitat can be found on the margins of streams.

Rainbow trout feed on invertebrates and small fish while brown trout generally feed more on small fish. The native koura (freshwater crayfish) can be an important food source for both species (Hicks et al., 2010). When water quality declines as a result of nutrient loading periphyton growth can change the aquatic invertebrate communities from good quality insect larvae to lower energy small midge larvae and snails. Trout do not thrive where food sources are lacking so this reduces the quality and quantity of trout available for anglers.

Natural Capital of Riparian Zones required for biking

The natural environment provides an ecosystem service that provides for biking recreation. The following attributes are valued by biking participants:

- Natural shade
- Aesthetics / beauty / serenity
- Shelter from wind and rain
- Safe from traffic
- Purpose built tracks to provide a fun challenge
- Wildlife variety
- Connection with nature

Recreational walking is often pursued in riparian and bush areas for the above attractions. In this sense, recreational walking includes tramping, which is a hobby for many New Zealanders and tourists. Biking on the other hand, has historically been associated with built infrastructure such as paved surfaces. However mountain biking, which became popular in the early 1990's, is a newer recreational ecosystem service that requires natural capital and very little built infrastructure. The numbers involved in the sport have increased rapidly over the past 20 years, and now most New Zealand centres have an active club. In 2011, the Department of Conservation opened the Heaphy Track in the South Island to mountain bikers in winter months as part of a 3 year trial. This illustrates the connection of mountain biking with the natural environment.

Natural Capital of Riparian Zones required for swimming

Alongside recreational fishing, swimming as a recreation activity requires perhaps the highest level of water quality when envisaging an ideal scenario. Direct contact with the water means that nutrient and bacterial levels in the water will have a direct influence on the suitability of a site for swimming. High sediment loads may also impact upon the value of a site as poor water clarity is often construed as being unhealthy for swimming purposes and also decreases the aesthetic value that may be derived from swimming in a specific location. Similarly riparian vegetation may increase the overall aesthetic value of a site that causes individuals to favour that site over any other. Riparian vegetation is also linked to many other aspects of general river health. Water flow levels will also affect swimming to an extent although it is accepted that seasonal variations in flow levels do occur naturally.

Natural Capital of Riparian Zones required for boating

Water flow levels are likely to have the greatest impact on recreational boating, however, pressures on water flow are far lower in the Manawatu catchment compared to other catchments in New Zealand where water demand for irrigation purposes and extraction for large hydroelectric power schemes can have a large impact on river flow levels for boating purposes. Water quality in terms of both nutrient/bacterial levels and water clarity are both also of importance to boating. Improved water clarity would equate to an increased ability to safely navigate boats. Nutrient/bacterial levels would be important to non-motorised forms of recreational boating such as whitewater rafting, kayaking and canoeing where contact with the water is far more likely. Again, riparian vegetation is important for aesthetic reasons and general river wellbeing.

Valuation Methods

The value of ecosystem services includes both the market and non-market price values. Market price value includes costs such as petrol, food and accommodation that a participant might incur to enjoy the ecosystem service. They can be used to estimate the increase in value of commercial activities, tourism revenue and the value of related contracts signed (Ghermandi et al., 2009). Non-market price value includes the net benefit over what the participant may have paid. For example a nature walk may not have included an entry fee, however there is a benefit for the participant. Eco-system valuation attempts to calculate this benefit so that the importance of providing such areas is appreciated. A forest is not only worth the amount of timber that can be harvested, but also the recreational benefit of users of the forest, as well as other potential benefits. There are many methods of estimating the non-market price values, and they traditionally fall into two categories; revealed preference methods and stated preference methods. Recent developments in valuation research have also combined the methods to draw on the best elements of both proposals (Christie, Hanley & Hynes, 2007). Values of other studies can also be transferred in a practice known as benefit transfer. These methods are further defined below.

Revealed Preference Methods

Revealed preference (RP) methods elicit preferences from actual observed market place information that indirectly link to the ecosystem service in question (Ghermandi et al., 2009). The advantage of these methods is that the values are grounded on actual behaviour, however the approach is unable to value for anticipated future levels (Christie et al., 2007). Included in this group are techniques such as Travel Cost Method (TCM), Hedonic Pricing (HP), Averting Costs Method, Replacement Cost Method, Wage Techniques, and Averting Behaviour. The more relevant of these methods are discussed briefly below, along with the applicability of using each technique in relation to recreation eco-system valuing. In particular, the literature study by Ghermandi et al. (2009) counted 758 observations related to recreation, aesthetic and cultural ecosystem services from 320 different studies. We highlight the percentage of observations utilised by each method.

Travel Cost Method estimates the travel cost to visit the site. It typically includes a unit rate for the number of kilometres driven to visit the site plus the opportunity cost of the time taken. The cost of kilometres travelled can be estimated relatively easily; however the opportunity cost is less scientific. Some studies (such as Chakraborty & Keith, 2010) use the calculation that a person's leisure time is worth a third of their professional rate. For example a person who earns $30/hr in their professional life would have their opportunity cost calculated at $10/hr. This method accounted for over 30% of the 758 observations included in the Ghermandi et al. (2009) review.

Hedonic Pricing method uses real estate data to estimate the value of an environmental commodity, such as an improved view or air pollution (Palmquist, 1991, as cited in Ghermandi et al., 2009). This method helps us to determine WTP, when the characteristics of the attribute change. This method is not conducive for calculating recreational benefits, and was not used by any of the studies included in the Ghermandi et al. (2009) review. A good example of its use was by Tyrväinen (1996) to determine the value of small urban forests of a town in Finland.

Replacement Cost Method has been used to estimate the loss of ecosystem functions, for example the economic damage of soil erosion by using market prices for soil and fertilizers to estimate the replacement cost of the lost soil (Navrud, 2000). This method would be relevant to use in the Manawatu River system, however it is not relevant for estimating the recreational ecosystem service.

Stated Preference Method

Stated preference (SP) methods invoke a simulation of the market through a questionnaire administered to a sample of the affected population (Ghermandi et al., 2009). Effectively it creates a supply demand scenario whereby the interviewer offers the ecosystem service at a given price, and the respondent can accept / reject the offer. This method has an advantage over the revealed preference methods in that it can extend valuation beyond the current observed state. Included in this group are techniques such as Contingent Valuation Methods and Choice Experiments. These are explained below, again with the percentage of observations used in the literature study by Ghermandi et al. (2009).

Contingent Valuation Method (CVM) uses survey methods to discover what people would be willing to pay, in dollar amounts, for specified improvements to existing public goods or their willingness to be paid for something that is taken away (Mitchell & Carson, 1989). This method accounted for over 55% of the 758 observations included in the Ghermandi et al. (2009) review, which indicates its usability in valuing recreational benefits. Criticisms with the technique are that the values are hypothetical and can be subject to biases, however much research has been conducted to aid the removal of most biases (Ghermandi et al., 2009).

The Conjoint Choice or Choice Experiments (CE) objective is to elicit individual preferences, in monetary terms (WTP), for individual attributes. It involves a survey whereby the respondents choose their preferred option from a number of different choice sets. Each choice set has a number of different attributes, including price, at differing levels across the options. Trade-offs between various characteristics can then be derived and a value placed upon each attribute. CE can accommodate a wide range of outcomes, and give a full profile of target valuation whereas results from a CVM study can only fit the specific outcome described in the study (Nielsen et al., 2007; Mourato et al., 2003). Due to the complexity of the questionnaire, CE is best applied when a project or policy affects only certain aspects of a resource (Mourato et al., 2003). This method accounted for just over 5% of the 758 observations included in the Ghermandi et al. (2009) review.

Combination of RP and SP Methods

The combination approach was intended to draw on the best elements of both methods, specifically the advantage of grounding values on actual behaviour as per RP; and extending the valuations beyond existing levels of provision as per SP (Christie et al., 2007). An example of a combined RP-SP method is the Contingent Behaviour model (Englin & Cameron, 1996; Hanley, Shaw & Wright, 2003).

The Contingent Behaviour Method was utilised by Christie et al. (2007) to assess: "(i) the extent to which the number of trips made to a forest changes when the forest facilities change and (ii) the consumers' surplus value associated with that change" (p.77).

Only 5% of the 758 observations included in the Ghermandi et al. (2009) review used this method, however that is possibly because many of the observations were made before this method had been first used.

Benefit Transfer

Gathering primary data for ecosystem valuation can be costly or impractical in many situations. Therefore a popular method to value ecosystem services is to use the results of another study, and then make adjustments to the values to reflect the differences between the sites. Brookshire and Neill (1992) state that: "A benefit transfer is the application of monetary values obtained from a particular nonmarket goods analysis to an alternative or secondary policy decision setting" (p. 652). Plummer (2009) warns of many possible errors with benefit transfer, the biggest of which is choosing a site which is a poor match for the ecosystem under consideration. Plummer (2009) suggests the error can be limited by closely following established guidelines for the use of this method.

According to Plummer (2009) there are a number of factors that need to be considered when using benefit transfer. These include:

- How closely the biological and physical characteristics of the sites match
- The similarity in how humans expect to use the sites
- Its connection with non-use values (i.e. is there an iconic species that needs to be protected at one site?)
- Adequate data, sound economic method and correct empirical technique.

Valuation of Recreational Ecosystem Services for the Manawatu catchment

In an attempt to quantify the potential value of recreational ecosystem services within the Manawatu catchment, four specific areas of recreation have been considered. These are recreational fishing, swimming, non-motorised boating and cycling.

Recreational fishing

This part of the report aims to value to put a value on the recreational activity “angling” in the Manawatu catchment. The ability to fish in a waterway for recreation is a free ecosystem service provided by the freshwater systems of the Manawatu catchment.

It should be noted that commercial fishing is part of the ecosystem service “food production”. Studies carried out indicate that the values placed on catching a fish for recreation are higher than you would find for catching a fish for food (Wheeler and Damania, 2001). This is because when the activity is classed as recreation people enjoy the experience of being in a natural environment as well as the rewards associated with catching fish.

Brown and rainbow trout were intentionally introduced from Europe to New Zealand waters in the 1870s for the purpose of establishing recreational sports fishing similar to that found in northern hemisphere countries. Native species were considered not suited for this purpose (Hicks et al., 2010). Brown trout ova of English stock from Tasmania were hatched by the Auckland Acclimatisation Society over a 15 year period and the progeny sold for liberation in various parts of NZ. Rainbow trout were similarly introduced from San Francisco (Hicks et al., 2010). Both species have successfully established themselves in the Manawatu catchment.

A number of different methodologies can be used to estimate the recreational value for angling. These include:Perceived or Non Perceived Benefits from Ecosystem Services, Potential costs for stakeholders, Market, Non Market Prices, New funding sources and spending efficiency, Stakeholder Participation, Tradeoffs, Cultural and Spiritual Values (for a detailed discussion see van den Belt et, al. 2012). This section briefly discusses three non-market pricing mechanisms that were considered for recreational fishing in the Manawatu Catchment.

Dichotomous Contingent valuation method (CVM)

A nominated single value (or bid) is offered to respondents in a binary take-it-or-leave-it choice about whether they are willing to pay this amount for a fishing trip. Estimates for how much a trip cost are calculated and then fishers are asked; If you had to pay an additional $X would you still have gone fishing?

According to Wheeler and Damania (2001) expenditure on consumables has been used as a payment vehicle in a large number of studies on recreational fishing as fish-related consumables are familiar and recurring items of expenditure.

The take-it-or-leave-it approach is a way to overcome biased results from multiple bids and issues associated with the distribution of bid amounts (Wheeler and Damania, 2001).

Willingness to Pay (WTP)

Willingness to pay surveys attempt to captures consumer surplus by asking individuals how much they would be willing to pay to go fishing. This amount is then extended across the entire population to construct a demand curve of marginal benefits. For marine fishing Wheeler and Damania (2001) found that WTP was greater where the main motivation was enjoying the outdoors and fishing was an important recreational activity for the respondent. WTP was also positively associated with income.

Travel Cost

This method takes into account the cost of visiting a site and can be comprised of factors such as vehicle costs, accommodation costs and the opportunity cost of the time a person spends fishing (generally being a function of their wage).

Calculating the Value of Recreational Fishing in the Manawatu Catchment

This study calculates for 2009/2010 an estimate of the value of recreational fishing in the Manawatu Catchment based on expenditure by recreational anglers. This amount will be an underestimate of the real cost as it does not take into account the consumer surplus associated with the activity. Total economic value could well be greater than price times quantity estimates as many people would be willing to pay more than the cost of their annual expenditure on fishing to undertake this activity. In addition this valuation only covers the direct or "use" value in terms of angling recreation. There may well also be a indirect or "non-use" aspect associated with individuals been willing to put a value on recreational fishing for its option value (willingness to pay for the ability to undertake angling in the future), existence value (willingness to pay for other to have the pleasure of angling despite never wanting to do it themselves) and/or bequest value (the willingness to preserve for future use by anglers).

The value of fisheries recreation in the Manawatu catchment for the year 2009/2010 has been estimated as $663,047. This is made up of the following three components.

- Expenditure on fishing licences for the Manawatu Catchment ($173,812)
- Expenditure on fishing equipment (depreciated over 10 years) ($272,200)
- An estimate of travel costs ($217,035)

Converting this to a quarter 4 $2011 value yields a total of $702,829.

Expenditure on fishing licences for the Manawatu Catchment

The value of fishing licences sales for the Wellington Region Fish and Game area was calculated for the year 2009/2010 by multiplying the number of licences sold by the price per licence type (Table 4, data from Fish and Game). To estimate the portion of licence holders angling in the Manawatu catchment the angler days for 2007/2008 spent in the Manawatu catchment as a percentage of the total angler days for the Wellington region was calculated (46%). This data was sourced from Unwin

(2009). It was then assumed that 46% of the total spend on fishing licences in the Wellington Region was for fishing in the Manawatu catchment.

Table 4: Cost of Fishing Licences for the Manawatu Catchment.

	No of licences	$ per licence	Total $	Portion MC $
Whole season				46%
Family	585	147	85995	39557.7
Adult	2252	113	254476	117058.96
Junior	196	22.5	4410	2028.6
				0
Winter				0
Adult	253	68	17204	7913.84
Junior	21	13.5	283.5	130.41
				0
24 hour				0
Adult	662	22.5	14895	6851.7
Junior	84	7	588	270.48
	4053		377851.5	173,812

Source: Fish and Game data

Expenditure on fishing equipment

To get an estimate of the annual amount spent on fishing equipment in a year the following costs were sourced from www.flyshop.co.nz. It was assumed that all gear purchased other than flies would last 10 years. Flies would be consumed at a rate of 20 per year. As shown in Table 5 the total annual estimate of the cost of fishing equipment is $146 per year.

Table 5: Annual Expenditure on Fishing Equipment per Licence Holder.

Fishing Equipment					**$NZ**
Neoprene waders for cold water				3mm	320
Vest					130
Flybox					30
Fly lines $60-$150					105
Fly rod and reel $150-$600 (Beginner to intermediate)					375
Total					960
			10% per yr depreciation		96
Flies	$2.50	each	Est 20 per year		$50.00
					$146.00

Source: www.flyshop.co.nz

Assuming that 46% of the 4053 licence holders (1864) are in the Manawatu Catchment the annual spend on fishing equipment would therefore be 146*1864 or $272,200. There is also a multiplier effect associated with retail sales – for example the flow on effect from people being employed selling fishing equipment. Due to the difficulty associated with determining the extent that this takes place within the Manawatu catchment this has not been included.

An estimate of travel costs

The Manawatu River, is 170 kilometres in length, and has many tributaries with a variety of different waters available to the angler. According to the surveys undertaken by Unwin

"New Zealand resident anglers affiliated with one of the twelve FGNZ Regions expended 78.1% of their effort within their home Region, with most of the remainder (16.4%) expended in a geographically adjacent Region" (Unwin, 2009, p.19).

To estimate travel costs the total angler days for 2007/2008 was taken to be the same for 2009/2010. This may be slightly high as the trend in angler days between 1994/95 and 2007/2008 was downwards. Angler usage of sport fisheries is monitored. In the Wellington Fish and Game Council area there has been a 20% decline in fishing licences in the 10 years between 1999/2000 and 2009/2010 (5040 down to 4053; source Wellington Fish and Game data). It was assumed that 50% of the 20670 angler days involved no transport due to close proximity or travelling with friends or family to the fishing location. As most resident anglers tend to fish within their home region (Urwin, 2009) travel costs were estimated on the basis of a 30 kilometer round trip at a cost 70cents per kilometre (Massey University, 2012). To get a more accurate estimate it would be necessary to carry out a survey of anglers. As angling is a recreational activity travelling time was taken to be part of the recreation and not costed.

The total cost of travelling to fishing sites is therefore (10335*30kms*$.70) or $217,035

Comparisons with other studies done for Recreational Angling using the Travel Cost Method

Kerr et al., (2004) estimated the recreational values for angling on the Rakaia river using the preferred exponential weighted least squares model method benefits to be in the range of $4 - $9 per angler per trip [June 1983$]. This equates with $2010 of $12.18.to $27.39. Taking the average of this range for the number of angler days in the Manawatu Catchment gives a value for recreation of $408,955.

In another study using an individual, single site travel cost approach Kerr and Greer (2004) cited in (Kerr et al., 2004, p.28) estimated the recreational angling benefits from fishing in the Rangitata River to be "in the range $18 - $45 [June 1983$], with the smallest lower bound 95% confidence interval from all of their models being $10 per angler per trip [June 1983$]". This equates with quarter 4 $2011 of $58.08 to $145.19. Taking the average of this range for the estimated number of angler days in the Manawatu Catchment gives a value for recreation of $2,080,931.

These studies can be considered suited to benefit transfer to estimate the valuation of angler recreation in the Manawatu catchment as they are both New Zealand freshwater recreational fishing studies. The sites are similar – gravel rivers, though the fish species is different (salmon instead of trout). At the same time extrapolating findings to the Manawatu Catchment is fraught for a number of reasons. These include:

i. The age of the studies (1982/83)
ii. Angling activity is responsive to fish abundance, so travel cost models applied in different years can yield substantially different value estimates. "Kerr and Greer's (2004) Rangitata River travel cost study estimated benefits based on trips made in an "average" year, whereas the Rakaia River study used information on trips in the *1982/83* season, which was regarded as poor." (Kerr et al, 2004, p.28)

iii. Travel cost models require assumptions and modelling choices to be made by the analyst.

Swimming

Three approaches that could be taken to assist in valuing recreational ecosystem service benefits derived from swimming for the Manawatu catchment are outlined below. The first two suggest building on previous reports and collecting primary data, the third recommends benefit transfer.

Approach One

The approach could be adopted from a Horizons Regional Council report published by Booth et al (2010), which identified a number of attributes that contribute to the overall prosperity of swimming. These were; social attributes (behaviour, use and perceptions); amenity attributes (maintenance activities, facilities, services, regulations); aesthetic attributes (natural make-up of the river); river attributes (physical structure of the shore and river bed); and water quality attributes (health, clarity and quality of river). These identified attributes could be explored further in order to derive primary data. In terms of social attributes, a survey could be facilitated to gauge the perception of people from within the catchment- how people perceive river quality now and if they would use the river more for recreational activity if the water quality were to improve. A review of amenity attributes could follow. This would explore if people are currently deterred by a lack of services and facilities associated with the river, for example toilets. Aesthetic and physical attributes could also be evaluated – has recreation decreased or increased as a result of change to the river? Lastly, water quality ought to be measured and compared with other rivers in New Zealand. An analysis of these results would reveal those aspects that are deserving of more attention and how strongly people feel towards river clean up. Perhaps the role of governance and institutions would need to be addressed in order to improve recreational ecosystem services for the catchment. This approach would create a sense of urgency among stakeholders as primary data would likely show that improvements would greatly improve the value of recreational ecosystem services.

Approach Two

Approach two could focus on developing an assessment completed by Lindis Consulting for Horizons Regional Council. Through this assessment several main factors were found to contribute to the desirability of swimming. Public access, space to recreate and parking are significant factors that could be research further in order to provide an estimate of recreational value. Research could firstly be undertaken to find swimming spots that are publicly accessible- as adequate vehicle access and parking was found to be a swimmer expectation. It was also found that swimming was expected to be at no (monetary) cost – this opinion could be further explored. The next stage of this approach could be an analysis on the area provided for people to recreate in - people are more likely to enjoy swimming where there are places to sit, in turn encouraging other recreational ecosystem services such as fishing, walking and picnicking (Booth et al, 2009). As these factors are thought to be significant, they could be researched and an analysis made on the significance of the results in terms of recreational value. It is evident that more catchment specific data collection is needed in order to provide a more accurate estimate of recreational ecosystem service value.

Approach Three

By now it is evident that although various methodologies could be used there are few values that already exist in order to ascertain the value on recreation in the Manawatu catchment. The most accurate approach would be through primary data collection to inform value estimates. Due to a limited timeframe, benefit transfer is the suggested methodology here to inform recreational ecosystem service value for the Manawatu catchment.

Below is the suggested benefit transfer approach:

Step one: Use a case study from another catchment to compare figures. Numbers such as catchment population, length of streams in the catchment, and the percentage of people that participate in swimming will be researched and compared with known numbers in the Manawatu catchment.

Step two: Research on the maximum number of swimmers expected to use the Manawatu catchment will be sourced. In order to estimate how many people are thought to swim currently a rough estimate on the difference in water quality compared to the Manawatu catchment will be used. Water quality is assumed to be the main difference between the two compared catchments.

Step three: The number of swimming days per person will be estimated according to participation per year taken from the corresponding catchment.

Step four: The economic benefit of swimming from a chosen case study will be used as a default number to find the overall value of recreational ecosystem services in the Manawatu catchment and adjusted for the high amount of rural isolation in the Manawatu catchment.

Step five: The value of swimming in the whole catchment will be estimated.

Application to the Manawatu catchment

After extensive research, Shapiro and Krol's 2003 study of the New Hampshire catchment in the United States will be used as a case for benefit transfer to provide a rough estimate on the value of recreation ecosystem services in the Manawatu catchment.

It was found that although the population within the catchment was bigger in New Hampshire – the area of the catchment was relative in terms of population density and the total length of streams in the catchments. As a rough estimate this catchment will be used for benefit transfer. It should be noted that the method of valuing the recreational benefit was derived from direct market values only via the amount of money spent at retail outlets by individuals visiting sites to swim. Due to this the resulting benefit value is likely to greatly underestimate the total benefit value that is derived from swimming that also includes a consideration of social wellbeing. The following Table 6 provides a summary of values used in deriving the recreational value of swimming.

Table 6: Numbers used to estimate the value of swimming.

	New Hampshire (NH)	Manawatu Catchment (MC)	Observations and Assumptions
a. Population total	1,318,194 [1]	160,500 [4]	
b. Total Length of Streams in Catchment	10,000 miles [2] = 16,093km	9,648 km [3]	MC approx 1/3 smaller than the NH
c. % of people who participate in swimming at least once per year who live I the region	71% [5]	34.7% [6]	NH has a higher participation percentages than MC and the reason for this is assumed to be water quality. Therefore the number of swimming participants will be taken as 10%
d. Max number of swimming participants	a x c= 935,917 est. actual	a x c = 55,694 est. max	This is the max number for the MC as we know this is the max number of people that can swim
e. Number of Swimming days per person	6 million [2] / e = 6.4	Est from NH = 6.4	Straight number transfer
f. Estimated economic benefit per person per day (not incl tourism)	US$10.55	Est from NH = $10.55 /2 = 5.27	Reduced by 50% to account for a large rural area and one main centre
g. Conversion to $NZ for 2011 Q4	NZ$24.21	NZ$12.11	Conversion rate of US$1 = NZ$1.81 & 1.268 inflation[7]

1. Estimated population numbers in 2011. Reference: U.S. Census Bureau. (2012). *New State and country quick facts. Retrieved* on February 6, 2012 from http://quickfacts.census.gov/qfd/states/33000.html
2. Shapiro,. L. & Krol,. H. (2003). *Estimates of Select Economic Values of New Hampshire Lakes, Rivers, Streams and Ponds: Phase II Report.* New Hampshire Lakes Association: New Hampshire.
3. Land and Water New Zealand. (2012). *History of the river.* Retrieved February 6, 2012 from http://landandwater.co.nz/councils-involved/horizons-regional-council/manawatu/history-of-the-river-3/
4. Statistics New Zealand (2012). *Subnational Population Estimates: At 30 June 2011*. Retrieved 6 February 2012 from http://statistics.govt.nz/~/media/Statistics/Browse%20for%20stats/SubnationalPopulationEstimates/HOTPJun11/snpe-at30jun11-all-tables-prov.xls.
5. This is the percentage of people that participated in river and lake swimming at least once in the last year. It is assumed for the purposes of this exercise that 71% did participate in river swimming as the numbers have not been extrapolated further. Reference: Shapiro,. L. & Krol,. H. (2003). *Estimates of Select Economic Values of New Hampshire Lakes, Rivers, Streams and Ponds: Phase II Report.* New Hampshire Lakes Association: New Hampshire.
6. This number was taken from an Active New Zealand Survey for the 2007-2008 period. As an overall nationwide number 34.7% of people surveyed were found to have participated in swimming the last year. Reference: Active New Zealand Survey. (2012). *Swimming.* Retrieved February 3, 2012 from http://www.activenzsurvey.org.nz/Documents/sport-profiles/Swimming.pdf
7. Currency conversion http://www.xe.com/ict/?basecur=USD&historical=true&month=2&day=17&year=2003&sort_by=name&image.x=7&image.y=13&image=Submit and inflation value http://www.rbnz.govt.nz/statistics/0135595.html

The maximum number of swimming participants was calculated for each catchment – this was taken from the percentage of people that participate in swimming. New Hampshire has a higher participation percentage (d) and this is assumed to be due to a higher water quality. In order to estimate the amount of swimming that takes place in the Manawatu catchment (considering the water quality) the number of people expected to swim will be assumed as 10%.

Therefore 160,500 x 10% = 16,050 people that are estimated to swim annually in the Manawatu catchment.

From the New Hampshire example, the number of swimming days per year is known to total 6 million which when divided by the proportion of the population who participate in swimming, gives a value of 6.4 swimming days per person per year (i.e. number of visits).

This number is transferred directly to the Manawatu catchment in order to estimate the total number of trips: 6.4 * 16,050 = 102,720 swimming trips per year in the Manawatu catchment

Table 7: Current recreational value of swimming.

Total Current Recreational Value of Manawatu				
Number of participants	Swimming days per year	Total No. trips	Value per trip per day	Total Value
16,050	6.4	102,720	$12.11	$1,243,939.20

Calculating the Potential Value of swimming in the Manawatu Catchment

If restoration measures were undertaken that provided an increase in water quality to a level where participants no longer held concerns about their health from swimming in the river we assume that the percentage of the population that participates in river swimming could be taken as being the 34.7% that identified as participating in swimming as a recreational activity in the Active New Zealand Survey 2007/8. Table 8 shows the potential value associated with this increase:

Table 8: Potential recreational value of swimming.

Potential Recreational Value of Manawatu				
Number of participants	Swimming days per year	Total No. trips	Value per trip per day	Total Value
55,694	6.4	356,438	$12.11	$4,316,464.18

Non-motorised Boating

For the purpose of this study non-motorised boating includes: whitewater rafting, kayaking, and canoeing. Non-motorised boating was chosen due to motorised forms being able to be undertaken regardless of state of river (Vesterinen et al., 2010) and therefore it is presumed that the ecological state of a waterway will have a far lesser influence on whether people choose to undertake motorised boating or not. With non-motorised boating activities there is a much higher likelihood of water contact and hence the water quality would be of greater importance.

Of greatest importance to canoeing, kayaking and whitewater rafting is the level of instream flows as indicated by the number of studies found in relation to this factor. In the Manawatu catchment instream flows are not hampered by large-scale water extraction or hydroelectric power schemes so while studies for benefit transfer were sought it is accepted that the basis of most studies were the effects of varying flows it is considered that some aspects of the value of these studies might still be transferable to be able to provide a estimate for the recreational value of non-motorised boating in the Manawatu catchment.

The study that was chosen to potentially provide the most reliable value for benefit transfer was by Cocklin et al. (1994) which considers the value of canoeing and kayaking in the Upper Whanganui and Whakapa Rivers in the central North Island. The study targeted regular visitors to the Whanganui and Whakapapa Rivers who undertook canoeing and kayaking on the upper parts of the river system in an attempt to quantify the current value of these recreational activities and then project the effects that changing instream flow related to water extraction for hydroelectric power generation might have on the recreation value. While the study is relatively old (utilising data from 1988/9), the study is conducted in the North Island of New Zealand also and the data gathered is divided into regions so that a value can be transferred that represents the value of trips made by those living in proximity to the subject sites.

The values in the Cocklin et al. study (1994) were derived using the travel-cost method which consisted of three components: (i) direct transport costs, (ii) the opportunity cost of time (taken to be a third of the national average hourly wage) and (iii) variable expenditures (e.g. accommodation). Values were then calculated for visitors by region.

For the purposes of transferring a value to the Manawatu, the average of the Tongariro ($29) and Wanganui/Taranaki ($75) region travel cost estimates were used as these two regions are those that the Whakapapa and Upper Whanganui rivers lie in. The population of these regions combined was 219,300 which is slightly higher than the population value for the approximate Manawatu catchment of 160,500 which was derived from 2011 estimates of the population in the four local authority areas that cover the Manawatu catchment, being Palmerston North City, Tararua District, Manawatu District and Horowhenua District (Statistics New Zealand, 2012).

The average of the two regions in the study provides a 1994 New Zealand dollar value of $52. Converting this to the last quarter of 2011 yields a travel cost value of $79.40 per person per visit (Reserve Bank of New Zealand, 2012). The averaging of this value takes into account that travel distances for recreational trips in the Manawatu catchment may be shorter and that the central North Island environment in which the study was undertaken arguably demonstrates a far higher aesthetic value.

In terms of the potential number of people undertaking these recreational pursuits within the Manawatu catchment a figure of 6.4% of the total population undertaking a single visit has been employed. This value has been directly transferred from the Active NZ Survey conducted in 2007/2008 and represents the percentage of adults who participated in canoeing or kayaking at least once in a 12-month period (Sport and Recreation New Zealand, 2009). While this value represents only adult participation it is considered that this can reasonably be extending to the whole population as this value does not count a total number of trips, only a percentage of the population who participated in these activities once during the year. Therefore it will obviously underestimate any regular participants' numbers of visits. The 6.4% participation rate from the survey does not include whitewater rafting of which there are some whitewater rafting operators present in the Manawatu catchment. While this may underestimate the number of trips further this is balanced out by the potentially increased travel cost value in the study by Cocklin et al. (1994), with the inclusion of people undertaking whitewater rafting. Table 9 shows the estimated current value of non-motorised boating in the Manawatu catchment.

Table 9: Current recreational value of non-motorised boating.

Total Current Recreational Value of Manawatu				
Population	Pop taking a single visit	Total No. trips	Value per trip per day	Total Value
160,500	6.40%	10,272	$79.40	$815,596.80

Calculating the Potential Value of non-motorised boating in the Manawatu Catchment

To quantify the potential value of non-motorised boating it is assumed that sufficient restoration of the riparian corridor could enable the value of these activities to come into line with those demonstrated in the study by Cocklin et al. (1994) where the vegetation is considered largely pristine although access to sites is consequently more difficult. This figure also represents visitors that may have made a slightly longer journey to access sites than may be the situation for the Manawatu catchment, hence an increase in ecological value may also entice users from outside of the Manawatu region to travel specifically to visit these recreation sites.

Using this increased value yields the following potential recreational value for the catchment:

Table 10: Potential recreational value of non-motorised boating.

Potential Recreational Value of Manawatu Catchment		
Potential value per person per trip	Potential number of trips	Potential value
$158.80	10,272	$1,631,193.60

Biking

Due to lack of previous research, and a lack of resource to undertake the research ourselves, there is little option but to attempt a benefit transfer from another study. We are aware of a number of potential errors with this work, mainly through broad and little founded assumptions. We will attempt to highlight these limitations as we go.

The base research from which we will transfer the benefit is from Christie et al. (2007). As mentioned in the Valuation Methods section, this study utilised the Contingent Behaviour Method which valued the existing recreational eco-system via CE, as well as Contingent Behaviour Model to value a range of enhancements to the forest resource. 1568 interviews were conducted on-site at seven forests throughout Great Britain: Glentress, Dyfnant, Cwm Carn, Thetford, New Forest, Rothiemurchus, and Whinlatter. Three aspects of recreational ecosystem service were studied: biking, nature watchers and general forest visitors. For the purpose of this exercise, it is only the CE value that is of relevance.

Through the Choice Experiment method, various attributes were analysed, including putting the bikers into specific groups (ie leisure riders, downhill specialists etc) to ascertain what elements might be worth amending to increase their value / willingness to pay. However for the exercise of this benefit transfer, we have listed below in Table 11 the values for the entire riding population as opposed to various categories of riders.

Table 11: Recreational values for biking derived from the choice experiment method.

Choice Experiments Method		
	Per person per trip	
	UK£ (2006)	NZ$ (2011)
Dedicated downhill trails	£9.74	$31.53
Dedicated single track trails	£8.40	$27.19
Obstacles	£7.56	$24.47
Dedicated cross country trails	£5.81	$18.81
Bike wash facilities	£4.27	$13.82
Shower facilities	£1.58	$5.11
Total	£37.36	$120.94

Conversion Rates:

Conversion rates were calculated as follows:

UK£(2006) → NZ$ (2006) = 2.815 multiplier via the following webpage: http://www.xe.com/ict/?basecur=GBP&historical=true&month=10&day=17&year=2006&sort_by=name&image.x=29&image.y=13

NZ$ (2006) → NZ$ (2011) = 1.15 multiplier via the following webpage: http://www.rbnz.govt.nz/statistics/0135595.html

Comparison of study to others

The value of the study appears to be lower than we would expect. The median average for biking from Rosenberger & Loomis (2001) is NZ $108.37 (2011 value). The value of the chosen study compares well.

Brief summary of study area characteristics from Google searches:

Glentress : Supposed best mountain biking in Britain http://thehubintheforest.co.uk/trails

Dyfnant: Remote forest situated on high ground, home to the 'Rainbow Trails'. http://www.forestry.gov.uk/website/recreation.nsf/LUWebDocsByKey/WalesPowysDyfnant

Cwm Carn: Purpose built mountain bike tracks with plenty of challenging single track and steep slopes http://mbwales.com/en/content/cms/centres/cwmcarn/cwmcarn.aspx

Thetford: Literally hundreds of miles of fast-flowing singletrack. http://www.forestry.gov.uk/england-cycling#thetford

New Forest: No specific bike tracks, but quieter country roads are the main attraction in nice countryside setting. http://www.thenewforest.co.uk/activities/cycle-map.aspx

Rothiemurchus: Variety of mountain biking, rushing rivers, native pine forests. http://www.edinburghbicycle.com/comms/site_info/route-guides-north-scotland/route-rothiemurchus.htm?f_Cardinal=10

Whinlatter: A 7km and 19km mountain biking track. http://whinlatter.com/

Adjustments for the Manawatu catchment:

The above-mentioned Great Britain tracks appear to be well established, popular tracks with the possible exception of the New Forest. Whilst the Manawatu catchment has the potential to reach the level of these tracks, it is currently well enough developed. It currently has pleasant tracks alongside the river, however only has a single track of easy ability that stretches approximately 30km in total between Ashurst and Palmerston North. These limitations with the Manawatu catchment is that the willingness to pay would be reduced, as well as the number of activity days per year. At this stage we focus on the value per activity day. The value for the Manawatu is adjusted accordingly:

Given the Manawatu does not have any dedicated downhill trails, bike wash facilities or shower facilities, the value for these elements can be removed. The reduces the Manawatu biking value to NZ$70.47 (2011 value).

Obstacles are also limited in the Manawatu, so this value can be halved, which reduces the value further to NZ$58.24 (2011 value).

Character of the site is also reduced in the Manawatu with its current lack of vegetation and unattractive river quality, however the cliffs and general country is scenic. We have applied a further 75% reduction for this factor to give a final figure of NZ$43.68. This is summarised in the following Table 12:

Table 12: Recreational values for biking derived from the choice experiment method.

Benefit Tranfer for Manawatu Catchment		
	Per person per trip	
	UK£ (2006)	NZ$ (2011)
Dedicated single track trails	£8.40	$27.19
Obstacles	£3.78	$12.24
Dedicated cross country trails	£5.81	$18.81
SubTotal	£17.99	$58.24
75% multiplier	£13.49	$43.68

Participation Rates:

In terms of the potential number of people undertaking these recreational pursuits within the Manawatu catchment a figure of 6.1% of the total population undertaking a single visit has been employed. This value has been directly transferred from the Active New Zealand Survey conducted in 2007/2008 and represents the percentage of adults who participated in mountain biking at least once in a 12-month period. While this value represents only adult participation it is considered that this can reasonably be extending to the whole population as this value does not count a total number of trips, only a percentage of the population who participated in these activities once during the year. Therefore it will obviously underestimate any regular participants' numbers of visits.

Value of biking as a recreational eco-system service for the Manawatu

Table 13: Current recreational value of biking.

Total Current Recreational Value of Manawatu				
Population	Pop taking a single visit	Total No. trips	Value per trip per day	Total Value
160,500	6.10%	9,790.5	$43.68	$427,635

Calculating the Potential Value of biking in the Manawatu Catchment

We assume here that the park could reach the same standard as the tracks in England. In terms of natural beauty, New Zealand should be able to easily compete. We also assume that as well as increasing the value per trip to match that of UK, the number of trips would also double due to the greater attraction.

Table 14: Potential recreational value of biking.

Potential Recreational Value of Manawatu Catchment		
Potential value per person per trip	Potential number of trips	Potential value
$120.94	19,581	$2,368,197.81

Valuation Summary

The below table 15 gives the values as calculated above.

Table 15: Summary of estimated recreational values.

Summary of existing value					
	$ Activity day	Pop.	% pop engaged in activity	Activity days / person / year	Total Value
Fishing					$702,829
Swimming	$12.11	160,500	10.0%	6.4	$1,243,939
NM Boating	$79.40	160,500	6.4%	1.0	$815,597
Biking	$43.68	160,500	6.1%	1.0	$427,649

We now compare these to the median averages found by Rosenberger & Loomis (2001) in their literature study of 163 studies that incorporated 760 value estimates. We appreciate that we are not familiar with the particulars of any of the studies, however given the share number of value estimates, it is useful to use the median averages for comparison. In the study, median averages for each type of recreation were shown in a table. To see how our catchment compared for the three benefit transfers completed, it is worthwhile to compare our estimates to the median average of the study as can be seen below in Table 16 (all $ are NZ 2011 4th quarter).

Table 16: Comparison of recreational value estimates to existing studies.

Proportion related to Rosenberger & Loomis (2001) study			
	Activity day / person	R & L study	Proportion
Swimming	$12.11	$35.91	34%
NM Boating	$79.40	$71.89	110%
Biking	43.68	108.37	40%

Swimming and biking can be seen to be well under the median average of the Rosenberger and Loomis (2001) study (R & L), and non-motorized boating slightly ahead. We interpret this result to indicate swimming and biking are well short of their potential due to the present state of the catchment. For swimming, the water quality is poor, and for biking the track quality is poor and unchallenging. With significant improvement, we would expect the potential to at least equal that of the R & L study. Non-motorised boating however already exceeds the R & L average, and we put this down to the fact that the river is suitable enough for this activity, and improvement of the catchment would not dramatically increase the willingness to pay. Further research would be necessary to confirm this hypothesis. However from the data we have, we are confident that the values transferred to the Manawatu catchment are within the expectations in regards to the values calculated from other studies.

Potential Valuation

It is worthwhile to now attempt the potential value of the recreation ecosystem service for the catchment. This includes the additions of picnicking, walking / hiking, motorised boating and ildlife viewing. We appreciate there may also be others, and indeed over the passage of time expect more recreational ecosystem services to be found. For example, the mountain biking phenomenon would not have been predicted 50 years ago. We have described above our methods for determining the potential value of fishing, swimming, non-motorised boating and biking. Our method for determining the remaining recreational ecosystem services that we have not studied, we recognise that the catchment is in a much worse state than most areas that would no doubt be subject to value estimates. Therefore if the catchment was brought up to the median standard of other sites that were the subject of the R & L study, that this might be an appropriate potential value. We realise of course that this reasoning might be selling the catchment a little cheaply, and much higher values could feasibly be achieved. However it is our opinion that to aim for the median average of other studies would be a massive improvement for the manawatu region, and would go a long way to restoring the mana of the Manawatu. The potential value calculated is just over NZ$60m, as detailed in the below Table 17.

Table 17: Estimate of the total potential recreational value for the Manawatu catchment.

Potential Value for entire recreational ecosystem service of Manawatu Catchment						
	Current ad/p	Pot. ad/p	Pop.	% pop engaged	Act days/p/yr	Total Value
Fishing						$1,981,839
Swimming	$12.11	35.91	160,500	10.0%	6.4	$3,688,675
NM Boating	$79.40	79.4	160,500	6.4%	1.0	$815,597
Biking	43.68	108.37	160,500	6.1%	1.0	$1,060,996
Picnicking		47.79	160,500	3.0%	1.0	$230,109
Walking / hiking		45.82	160,500	64.1%	11.0	$51,853,830
Motorised boating		35.83	160,500	6.4%	1.0	$368,046
Wildlife viewing		55.79	160,500	1.0%	1.0	$89,543
Total						**$60,088,635**

It is assumed that the non-motorised boating would not increase in value as a result of the improving catchment, however this is also possibly a conservative estimate. The remaining previously un-transferred estimates have used the median average from the R & L study for current activity days / person, and the activity days / person / year were taken from the Active New Zealand Survey for the 2007-2008 period. As mentioned above we expect this potential could be exceeded with the right investment, and this number arrived at is decidedly conservative. However it is important to note that it is also achievable, but not without a lot of community commitment.

Governance and Institutions Involved with the Manawatu Catchment

Governance and institutions are highly influential to the improvement of recreational ecosystem services in the Manawatu catchment. It is worth acknowledging that all stakeholders are vital and each has a supporting role – a spectrum of stakeholder contributions is paramount to ensure a holistic approach is taken; from policy adoption through to proactive education. Here, we explore some of the significant contributions that stakeholders are making to the Manawatu catchment and suggest how the available tools could be further applied to enhance the current state if the Manawatu River.

The Resource Management Act (1991), is an overarching document that delegates responsibility to local and regional authorities over the management of natural and physical resources (Leberman & Mason, 2002). At a higher level the Department of Conservation works in collaboration with Tourism New Zealand to plan the use of Crown land (Leberman & Mason, 2002). A key adjustment to the direction of the RMA 1991 from previous legislation is the emphasis that land use has on people and the environment. Previous approaches determined land use without taking the greater impacts into consideration (Leberman & Mason, 2002). Difficulties arise as local planners are required to take directives from central government (Leberman & Mason, 2002). Local government planners are somewhat caught in the middle as they acknowledge national policies whilst satisfying their own local stakeholders (Leberman & Mason, 2002).

An example of intervention at a regional level, is the introduction of a Horizons Regional Council policy to regulate the fencing of waterways wider than a stride in the Manawatu catchment.

Although there are definitely costs and benefits associated with increased regulation – long term advantages will lead to increased water quality and recreational activity. Although there has been criticism that all streams should be fenced, it is encouraging that definitive action is underway (Horizons defends water work, 2011).

In 2010, through the collaboration of stakeholders in the region, 'the Manawatu River Leaders' Accord was adopted (Horizons Regional Council, 2012a). A significant part of this Accord takes into account the direct role of recreational ecosystem services as it aims to improve the catchment to an appropriate level for contact recreation and the ability to sustain fish species (Horizons Regional Council, 2012a). The Accord contains six major action points, of which, the likes of New Zealand Fish and Game, the Department of Conservation, and various Councils including the Palmerston North City Council are all signatories (Horizons Regional Council, 2012c).

Indicator and monitoring frameworks represent a significant section of the Accord. Greater emphasis could be given to public perception as a form of monitoring progress. The employment of a survey to gain information on public understandings of the river catchment could provide a benchmark from which the Accord could monitor perception progress. Further exploration of recreational indicators could also be of value, as there are currently limited figures available on the value that recreational ecosystem services provide – specifically with regard to the Manawatu catchment. It is important that progress towards the envisioned goals is measured so the importance of these collective actions is realised (Integrated Freshwater Solutions, 2012b).

Educational programmes are currently conducted through Horizons in order to ensure that subsequent generations are aware of good environmental practice (Horizons Regional Council, 2012b). The Green RIG is one tool that is used by the Regional Council to support the environmental education of schools and communities (Horizons Regional Council, 2012b). An emphasis on education and communication are integral to a proactive community. The development of clubs, societies and interest groups stems from education and the ability people have to interact with their environment – where recreation occurs, a greater community responsibility will be adopted and in turn lead to a growing concern over management of the environment.

The Environment Network Manawatu (ENM), provides a hub for local interest groups to work as a collective in order to promote community action to enhance the Manawatu environment – there are currently over nineteen interests groups that work together under this umbrella in the Manawatu area (ENM, 2012a). Green Corridors is a member of ENM who has actively been involved in the replanting of native bush to improve biodiversity (ENM, 2012a). This project to plant eco-sourced natives commenced in early 2000 and was labelled the 'Turitea Stream Green Corridor'. Linking the Tararua Ranges with the Manawatu River, this project was about creating public access and improving recreational objectives such as an environment excellent for walking (ENM, 2012b).

The Manawatu Gorge site is an example of the Department of Conservation (DoC) working with the Horizons Regional Council to improve the Gorge as part of a recreation providing area of the Manawatu River (DoC, 2012). A central goal of this collaboration is to "preserve, sustain and enhance the biodiversity, scenic and recreational values of this unique site" (DoC, 2012, p.2). Through collaboration, stakeholders are aiming to improve walking, kayaking and bird watching which will in turn lead to an increased value in ecosystems services as more people come to enjoy and appreciate the recreational activities supported by the Manawatu River catchment (DoC, 2012).

An advantage such as the Gorge being the only place in New Zealand where a river channels through a range and finishes on the opposite side to join the sea is a recreational asset (DoC, 2012).

The Integrated Freshwater Solutions (IFS) project is a stakeholder collaboration to develop effective tools that can assist in addressing freshwater management needs – its case study is the Manawatu River Catchment (Integrated Freshwater Solutions, 2012a). Co-management is one practice that could be adopted and is currently under investigation by Tanenuirangi Manawatu Inc (Integrated Freshwater Solutions, 2012c). This approach would see a balance between statutory obligations of the Regional Council and Maori values whilst balancing wider community needs (Integrated Freshwater Solutions, 2012c). In addition, another approach could include mediated modeling in order to explore co-management scenarios (Integrated Freshwater Solutions, 2012c). Furthermore, bayesion belief modelling could be used to monitor progress as it would show likely effects of land use changes in relation to water quality and the capacity for fish species to endure changes caused to rivers and streams (Integrated Freshwater Solutions, 2012d).

These stakeholders and the contributions they make to improve the rivers natural capital and recreational ecosystem services are invaluable. The development of walkways and facilities to support recreation could be a great way to further enhance the natural system. The process of envisioning should continue to be employed in order to provide stakeholders with a focus on the overall picture (Integrated Freshwater Solutions, 2012c). The likes of an environment network to provide collaboration and the sharing of resources is an excellent way of making the greatest possible impact on river health and effectively utilising time and resources.

In a statement released by Environment Minister Nick Smith and Agriculture Minister David Carter (2011), there is anticipation that a forum to focus on appropriate water quality levels, ideal quantity and allocation will assist in policy formation. New funding has been established to assist in the cleanup of lakes and rivers through sustainable irrigation projects (New Zealand Parliament, 2011). To date, this national collaboration has assisted to drive community initiatives to improve water management in the Manawatu (New Zealand Parliament, 2011).

There are a number of different institutions that impact on recreational fishing in the Manawatu catchment. Important ones include: Territorial local authorities, iwi Horizons Regional councils and the Wellington branch of Fish and Game New Zealand.

Territorial Local Authorities under the RMA (1991) are responsible for land use in the catchment. From the authorized land use activities there are wastewater outflows and stormwater run-off that flow into the river and impact on water quality. Iwi as tangata whenua have a right to protect their toanga water and be consulted on management decisions. Horizons Regional Council puts in place the rules and regulations that need to be met to maintain water quality and quantity in the Manawatu River catchment.

Fish and Game New Zealand manage sports fish and gamebirds and have a statutory responsibility “to manage, maintain and enhance the sports fish and game bird resource in the recreational interests of anglers and hunters” (Conservation Act 1987). While responsible to the Minister of Conservation the organisation does not receive funding from central government. Funding comes from the sale of hunting and fishing licences. Much of Fish and Game New Zealand management activities are focused on advocacy, at both national and regional levels to prevent water quality deterioration.

Potential tools that can be used by the institutions involved with fisheries recreation in the Manawatu Catchment include:

- Enforcement of existing rules
- Anticipated Policies
- Adaptive Management
- Co-management
- Moratorium on Harvest
- Conservation
- Education and Communication
- Monitoring

Conclusion

Working within the framework of the Ecological Economics paradigm, this report has sought to provide an assessment of the value of recreational ecosystem services in the Manawatu catchment for the recreational aspects studied. Economic valuation is far from an exact science, however there are now rules and frameworks in place to make the process as robust as possible. Primary valuation involving first-hand research is typically the most robust procedure; however benefit transfer is more commonly used, often due to a lack of resources / time on the behalf of the author. Benefit transfer has been criticised as being too inexact, due to the number of flaws that exist because of a lack of similar characteristics between any two sites.

We have assumed that the Manawatu catchment can be brought up to the median standard of other areas that have been previously subjected to valuations. The potential of the Manawatu catchment was estimated to be $60m, and we consider this estimate to be conservative. Mana can be restored to the Manawatu, and a range of valuable ecosystem service benefits, including recreation, can be achieved. However it will require commitment and collaboration from the full range of stakeholders for this potential to be realised.

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