# SUMMARY

When setting a value on water, there are two possible relevant values:

The economic value of water supply (a “provisioning” service) is an estimate of the value of Alberta’s fresh water supply. This value is useful when quantifying either the benefits of measures to save water or the costs of increased development and water usage. I recommend using a value of $2800 per thousand cubic meters increasing at between 5-10% per year as the most accurate estimate of the cost of water now and going forward. The extreme case moving forward is water costing about $6000 per thousand cubic meters and increasing at 10% per year.

Water regulation relates to the variability of a given water supply. By increasing or decreasing the frequency of extreme events, and by increasing or decreasing the water stored in groundwater reservoirs or wetlands, landuse change can have economic consequences. The easiest way to quantify this change is to take per hectare values from existing studies from comparable landscapes, but this method cannot be forecast into the future. A more interesting method would be to quantify the ecosystem services based on the variance of stream flow or the frequency of extreme events. I have not yet found a good way to quantify this for the Upper Bow Basin, but I have pointed to some examples of studies below.

The values given above are most effective for quantifying costs and benefits of given policies. They make it possible to quantify in dollar terms the economic benefits or costs of a change in landuse practices or the use of best practices. Given current data limitations, my suggestion is to use the values given for water quantity only. While this method is both incomplete and still faces a number of issues, it is likely the best current solution available.

# INTRODUCTION

Water can be a difficult ecosystem service to classify, because it plays so many roles. The Millennium Ecosystem Assessment (2005), which gives one of the most cited typologies of ecosystem services, normally classifies these as provisioning, regulating, cultural, or supporting services. Fresh water, however, can be easily classified in all these categories: It is a provisioning service because it is a core necessity which we consume; water-based ecosystems then act as key regulating mechanisms either by storing water or by protecting against storms and floods; fresh water is a supporting service because it is necessary for the life processes that sustain other ecosystems and ecosystem services; finally, water can be used for many types of recreation and is central to many cultural traditions.

As a consequence, how to quantify the service provided by water can be difficult. In practice, most studies limit their analysis to a small number of the above aspects which are relevant to the study area. For example, in the case of Ontario’s greenbelt, Sara Wilson considered only the regulating services provided by the greenbelt by quantifying the avoided costs of extra storm sewer infrastructure. [[1]](#footnote-1) Conversely, in the credit valley watershed (which is located inside the greenbelt), Mike Kennedy and Jeff Wilson analyzed only the effect of groundwater recharge. Since some towns in the watershed were completely dependent on groundwater, Kennedy and Wilson estimated the value of groundwater recharge to be equal to the avoided cost of getting water from the next available alternative (in their case, Lake Ontario).[[2]](#footnote-2) As evidenced by these examples, there seems to be no systematic method for measuring the total service provided by water quantity and water regulation services in a given area and most of the time researchers choose their values based on the specific characteristics and available data for a given region. While there has been efforts to create such an approach, these have been highly complex and involving multiple variables, and cannot be easily transferred to current studies.[[3]](#footnote-3)

What follows is a preliminary attempt to get preliminary estimates on the value of water services in Alberta. For the reasons stated above, these are by no means exhaustive, and are unfortunately still quite limited. For simplicity sake, I have arbitrarily divided water services into regulating services and water supply services (where water supply is comparable to the “provisioning” category in the Millenium Ecosystem Assessment report).

# WATER REGULATION

The value of water regulation refers to the ability of certain ecosystems to either store water or regulate stream flow. Water regulation has been estimated both on a per hectare and per resource basis.

**Method 1** – TEEB Study[[4]](#footnote-4)

The Economics of Ecosystems and Biodiversity study is a global study with estimates for each landscape type. While it is difficult to find out where in the following ranges a specific landscape type falls, these nevertheless give a basic idea of what each ecosystem is worth.

|  |  |  |  |
| --- | --- | --- | --- |
| Landscape Type | Number of Studies Sampled | Minimum Water Flow Regulation Value (2007 Int $/ha/yr)[[5]](#footnote-5) | Maximum Water Flow Regulation Value (2007 $/ha/yr) |
| Temperate and Boreal Forests | 2 | 0 | 3 |
| Grasslands | 0 | NA | NA |
| Inland Wetlands | 4 | 14 | 9369 |
| Rivers and Lakes | 0 | NA | NA |
| Polar and High Mountain Systems | 0 | NA | NA |

I have also copied values for water supply here. However, I believe it is much more useful to use the values cited in the next section.

|  |  |  |  |
| --- | --- | --- | --- |
| Landscape Type | Number of Studies Sampled | Minimum Fresh Water Supply Value (2007 Int $/ha/yr)[[6]](#footnote-6) | Maximum Fresh Water Supply Value (2007 $/ha/yr) |
| Temperate and Boreal Forests | 3 | 0 | 455 |
| Grasslands | 4 | 219 | 602 |
| Inland Wetlands | 6 | 1 | 5189 |
| Rivers and Lakes | 2 | 1141 | 5580 |
| Polar and High Mountain Systems | 0 | NA | NA |

#### Costanza et. all Nature Paper

This paper, which appeared in Nature Magazine in 1997, gave estimates of the various Ecological Goods and Services values of certain landscape types. A summary of water regulation values follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Landscape Type | Location of Studies | Average Water Regulation Value (1994 US $/ha/yr) | Minimum Water Regulation Value (1994 US $/ha/yr) | Maximum Water Regulation Value (1994 US $/ha/yr) |
| Temperate /Boreal Forest | Mexico (1 Study) | **.14** | .14 | .14 |
| Grassland /Rangeland | Southern High Plains (1 study) | **2.54** | 2.54 | 2.54 |
| Inland Wetlands (Swamps and Floodplains) – WATER REGULATION | Malaysia (1 study) | **30** | 30 | 30 |
| Inland Wetlands (Swamps and Floodplains) – FLOOD PREVENTION | USA (2 studies) | **7240** | 3341 | 11138 |
| Lakes and Rivers | USA (4 studies) | **5445** | 3070 | 7820 |

#### Summary

Unfortunately, in my limited time studying the issue of water regulation, the above numbers are the best I could find for the study area (other than the already existing values estimated previously by Mark Anielski for a previous project).

The ideal solution in this case would be to find an example of a local, concrete cost to increased water variability tied to a specific value for water variability. Examples include:

* The cost of increasing the capacity of Calgary’s storm sewers for extreme weather events.
* The estimated damage costs due to flooding for a specific river flow or height.
* The costs to farmers of not being able to water their fields due to water rationing programs instituted in extreme dry events.

Since I was not able to find any specific examples of these or other measures of value (such as contingent valuation surveys), my recommendation at this point is to ignore the costs of water regulation and focus on only the quantity as detailed in the next section.

# WATER SUPPLY

Alberta’s water is becoming scarcer compared to the demand for water. In some places, the demand for water has outstripped the total supply of water in an area. When this happens, water becomes a rival good, because one person’s use of water prevents another person from using it. In order to regulate the use of this scarce good, the Government of Alberta provides a limited number of allocations to individual users of water (irrigation, industrial, municipal, etc.). By analyzing the price that users are willing to pay to acquire a water allocation, we can get an idea of how scarce water is, and what the potential benefits of water conservation.

The utility of measuring the price of water is in doing cost-benefit analysis. For example, when considering whether to install drip irrigation systems, it is useful to compare the cost of the systems compared to the economic value of the water saved using these systems. Some best practices which save a significant amount of water may be both ecologically and economically sound choices, because users could sell the unused water permits to fully recoup the additional costs of these best practices.

**PRICE SUMMARY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Method** | **Low Estimate** | **High Estimate** | **Average Estimate** | **Trend** |
| **$/1000 cubic meters** |
| Transfer of irrigation permits | 1600 | 6000 | 2800 | Increasing |
| Municipal Cost of Water (Calgary) |  |  | 1306.7 (2010) | Increasing (approx 5% per year) |
| Industrial Price of Water (Canada) |  |  | 790 (2006 US dollars) | Increasing (Approx 9.6% a year) |

**Method 1** – What are Albertans willing to pay for water in the upper Bow?

*NUMBER*: Since the number of water allocations from the South Saskatchewan river basin is now fixed, there has been a limited trading of permit allocations between users. The value of these permits normally ranges from $2000-$5000 per acre-foot[[7]](#footnote-7) (approximately $1600-$4000 per thousand cubic meters) of water per year. Prices are rising, as evidenced by the recent transfer of 2000 acre-feet of water from the Western Irrigation District to the Municipal District of Rockeyview for $15 million dollars ($7500 per acre-foot, or approximately $6000 per thousand cubic meters), primarily for the construction of the new Crossiron Mills mall. The proceeding example is currently an outlier, not falling in the normal range of water sale prices, but at current rates of increase it will not be long before prices of $7500 per acre-foot become the norm.

*TREND*: Increasing.[[8]](#footnote-8) I don’t have a specific figure for rate of increase at this point.

CAVEATS: The market for water in Alberta is not perfectly competitive, as the government must approve every transaction, and has been reluctant in the past to approve projects. For example, in the recent agreement between the Western Irrigation District and the Municipal District of Rockeyview, the province clawed back 10% of the water permit allocations in order for the transaction to go through. As a result, there are still relatively few transactions, transaction costs can be very high, and there remains large differences in the price paid for each individual water contract.[[9]](#footnote-9).

WHAT IT MEASURES: Because irrigation districts find it difficult to sell water that their farmers need, this number gives a reasonably good indication of the total cost for water efficiency improvements. For example, the money given to the Western Irrigation District was used to install much more efficient equipment, which allowed them to sell a portion of their water without reducing the total number of acres irrigated.[[10]](#footnote-10)

When using estimates, I recommend using this value over the following two because it is relevant locally (unlike method #3 which considers Canada as a whole) and does not have as many caveats as method #2.

**Method 2** – What does it cost for water to Calgarians?

*NUMBER*: The municipal usage rate per cubic meter in Calgary is $1.3067 per cubic meter ($1306.70 per dam) in 2010 rising to $1.3825 per cubic meter (1382.50 per dam) in 2011. It was $1.2540 per cubic metre in 2009.[[11]](#footnote-11)

*TREND*: Water rates increased in Calgary by 4.2% between 2009 and 2010, and are announced to rise by 5.8% between 2010 and 2011.

*CAVEATS*: As a regulated utility, this price does not give an accurate measurement of the true value of water, because the price is not directly set by market forces, and can often reflect the political goals of the regulator. In actual fact, a simple calculation on the most recent City of Calgary budget shows that roughly 40% of the operational costs of water and wastewater treatment are financed through taxes.[[12]](#footnote-12) In addition, the pricing structure of the Calgary utility includes a number of other monthly or yearly costs which are not factored into this total.[[13]](#footnote-13) Finally, the price people pay for water embodies both the basic cost of the water as well as a “value added premium” for the services of the city in cleaning the water, and so does not directly translate into the cost for water quantity alone.

Nevertheless, this number does give us a baseline of total willingness to pay for water. Calgarian residents are willing to pay at least $1.35 per cubic meter of water at current usage rates, showing that the value of this water at the quality provided by the city must be at least that or greater.

**Method 3** – Industrial Price of Water

Number: In 2006, the average cost of water for an organization with an annual usage of 10000 cubic meters of water in Canada was 0.79 US dollars per cubic meter (790$ US dollars per dam). [[14]](#footnote-14) However, this number is likely much higher in 2010, and the price of water in Alberta is expected to be higher because of its increased scarcity.

TREND: Canada’s average rate for water for large users rose 58% between 2001 and 2006 (approximately 9.6% a year).[[15]](#footnote-15) In 2006, water in Canada cost less than in any other jurisdiction except the United States, but also had the highest rate of increase for the five year period from 2001 to 2006.[[16]](#footnote-16)

1. Wilson, S. (2008). Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services. Vancouver: David Suzuki Foundation. <http://www.davidsuzuki.org/publications/downloads/2008/DSF-Greenbelt-web.pdf> (accessed August 11, 2010). [↑](#footnote-ref-1)
2. Kennedy, M. & Wilson, J. (2009). Natural Credit: Estimating the Value of Natural Capital in the Credit River Watershed. <http://pubs.pembina.org/reports/natural-credit-report.pdf> (accessed August 11, 2010). [↑](#footnote-ref-2)
3. See for example Gardner Pinfold Consulting Economists Limited, Renzetti, S., Cairns, R., Grafton, Q. (2002). Monitoring the Value of Natural Capital: Water. Report Prepared for Environment Canada and Statistics Canada (contract K0821-1-0023). <http://www.aipa.org/Adobe_Files/Value_of_Water/2002_09_Monitoring_the_Value_of_Natural_Capital_Water.pdf> (accessed August 11, 2010). [↑](#footnote-ref-3)
4. The Economics of Ecosystems and Biodiversity. (2010). Appendix C: Estimates of Monetary Values of Ecosystem Services. *Ecological and Economic Foundation*. Retrieved from: <http://www.teebweb.org/EcologicalandEconomicFoundation/tabid/1018/language/en-US/Default.aspx> (accessed July 30, 2010). [↑](#footnote-ref-4)
5. An international dollar is a unit of currency that has the same purchasing power as an American dollar in 2007. [↑](#footnote-ref-5)
6. An international dollar is a unit of currency that has the same purchasing power as an American dollar in 2007. [↑](#footnote-ref-6)
7. Jim Webber (Western Irrigation District), Personal Communication, July 29 2010. Nicol (2005) found a similar range of values ($133-$600) in a small number of official water transfers in Southern Alberta. See: Nicol, L. (2005). Irrigation Water Markets in Southern Alberta (MA Thesis). University of Lethbridge, Lethbridge AB. http://www.aipa.org/Adobe\_Files/Value\_of\_Water/2005\_04\_Lorrain\_Nichol\_Thesis\_Final.pdf (accessed August 11, 2010). [↑](#footnote-ref-7)
8. Jim Webber (Western Irrigation District), Personal Communication, July 29 2010. [↑](#footnote-ref-8)
9. Nicol, L. (2005). Irrigation Water Markets in Southern Alberta (MA Thesis). University of Lethbridge, Lethbridge AB. http://www.aipa.org/Adobe\_Files/Value\_of\_Water/2005\_04\_Lorrain\_Nichol\_Thesis\_Final.pdf (accessed August 11, 2010). [↑](#footnote-ref-9)
10. Jim Webber (Western Irrigation District), Personal Communication, July 29 2010. [↑](#footnote-ref-10)
11. City of Calgary (no date). Water and Wastewater Rates. Last updated December 21, 2009. [http://content.calgary.ca/CCA/City+Hall/Business+Units/Water+Services/Customer+Service/Water+and+Wastewater+Rates/Water+and+Wastewater+Rates.htm](http://content.calgary.ca/CCA/City%2BHall/Business%2BUnits/Water%2BServices/Customer%2BService/Water%2Band%2BWastewater%2BRates/Water%2Band%2BWastewater%2BRates.htm) (accessed July 29, 2010). [↑](#footnote-ref-11)
12. The budget document is currently available at <http://www.calgary.ca/docgallery/bu/finance/budget/2009_2011/pdf/05_uep_business_plan_and_budget.pdf> [↑](#footnote-ref-12)
13. Ibid. As an example, the monthly base fee for a residential consumer was $11.98 in 2010). [↑](#footnote-ref-13)
14. NUS Consulting (2006). 2005-2006 International Water Report & Cost Survey. <http://www.vewin.nl/SiteCollectionDocuments/Nieuws%202007/2006WaterSurvey-NUS.pdf> (accessed July 29, 2010). [↑](#footnote-ref-14)
15. Ibid. Note: 9.6% a year is less than 58%/5 because it takes into account compounded growth. [↑](#footnote-ref-15)
16. Ibid. [↑](#footnote-ref-16)