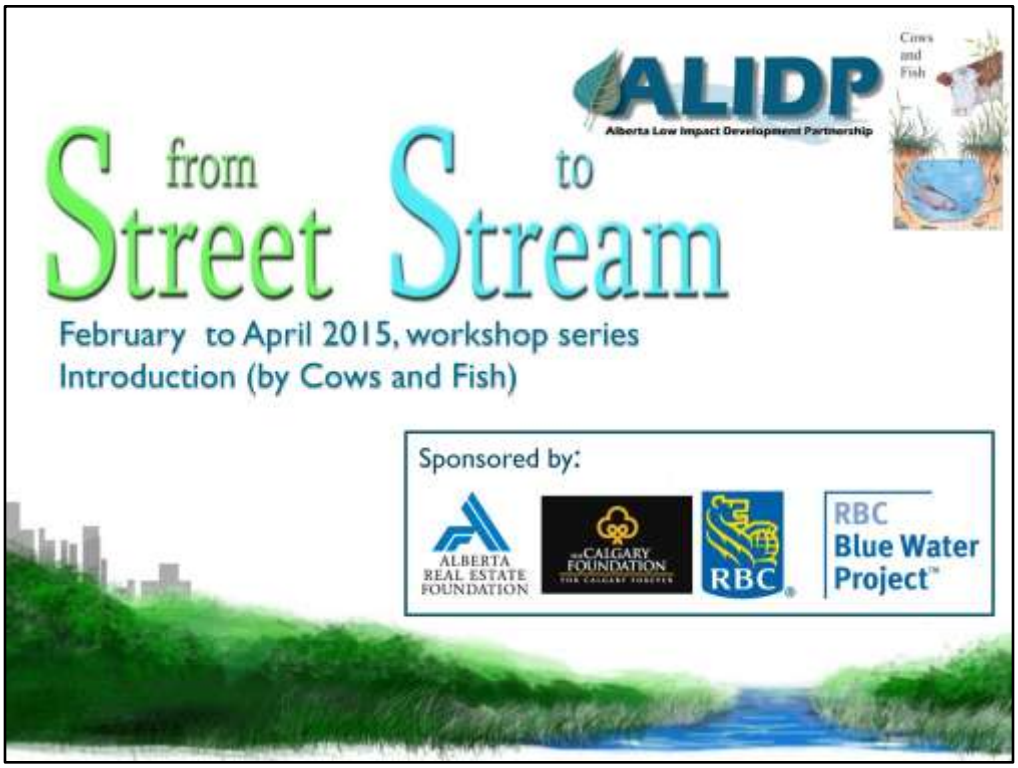
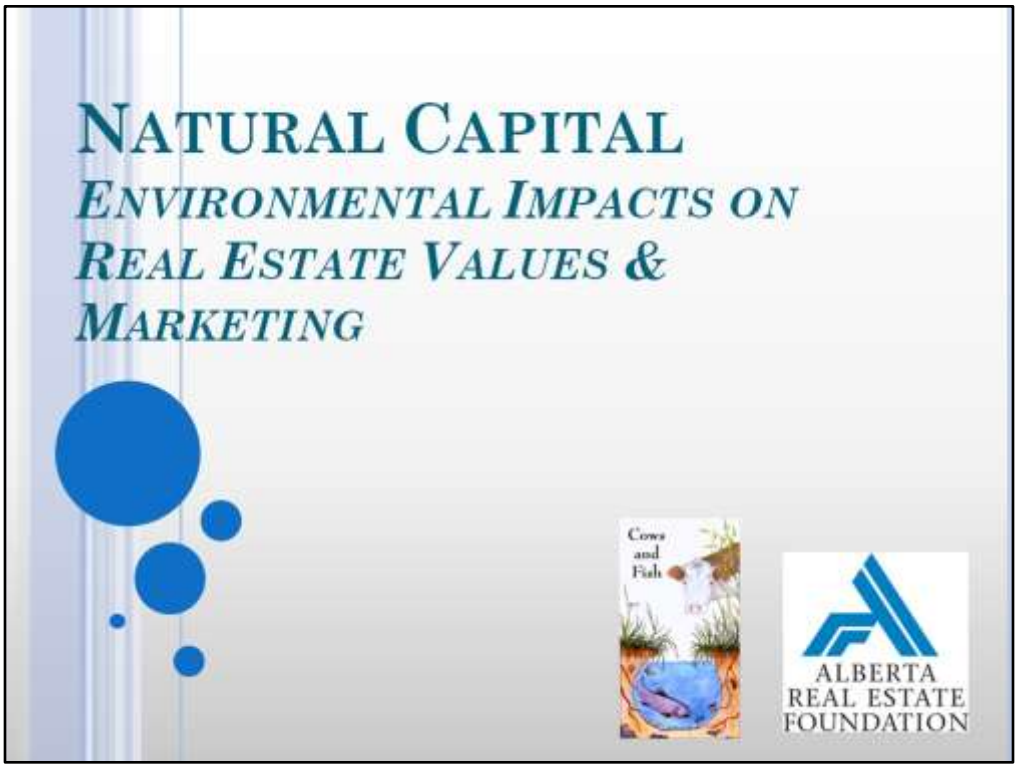


From Street to Stream - this collaborative workshop by Cows & Fish and the Alberta Low Impact Development Partnership (ALIDP) explores how water quality, stormwater runoff, natural water storage and resiliency can be improved in developed areas. In this workshop series we look at low impact development, sound riparian restoration and management, and the importance of considering both upland and riparian areas as part of a whole system management approach.

This workshop series is geared for the public, realtors, decision makers (planners, municipalities), green builders, and others interested in sustainability related to stormwater, greening, housing, and landscapes.



This workshop series builds on a Natural Capital workshop offered in 2010 by Cows and Fish for the Alberta Real Estate Foundation where we explored the Environmental Impacts on Real Estate Values & Marketing.

The primary sponsors for our current Street to Stream workshop include the Alberta Real Estate Foundation, The Calgary Foundation and The RBC Blue Water Project.

Thank you also to our local sponsors and co-hosts for our six Street to Stream workshops conducted in Calgary, Red Deer, Edmonton, Wetaskiwin and Lethbridge from February to April, 2015.

Alberta Riparian Habitat Management Society (Cows and Fish) Members and Supporters

Alberta Beef Producers
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Producers, Landowners and Community Groups

www.cowsandfish.org

Cows and Fish

I am here today representing the Alberta Riparian Habitat Management Society or more commonly known as Cows and Fish. Cows and Fish is a charitable, non-profit society based in Alberta. For over 20 years, with the help of our members and supporters listed on this slide, we have been working with landowners and community groups across the province to promote and foster riparian stewardship. As our name suggests, we have our roots in tackling agricultural issues, but more and more we are also working with urban and lakeshore riparian stewardship groups.

Before we begin, when we contemplate why we love Alberta, what images come to your mind?

Perhaps the rolling native fescue landscapes of the Cowboy trail along the foothills of the snow capped Rocky Mountains. Perhaps a sun-kissed tranquil lake shoreline or a clear fast flowing mountain stream.

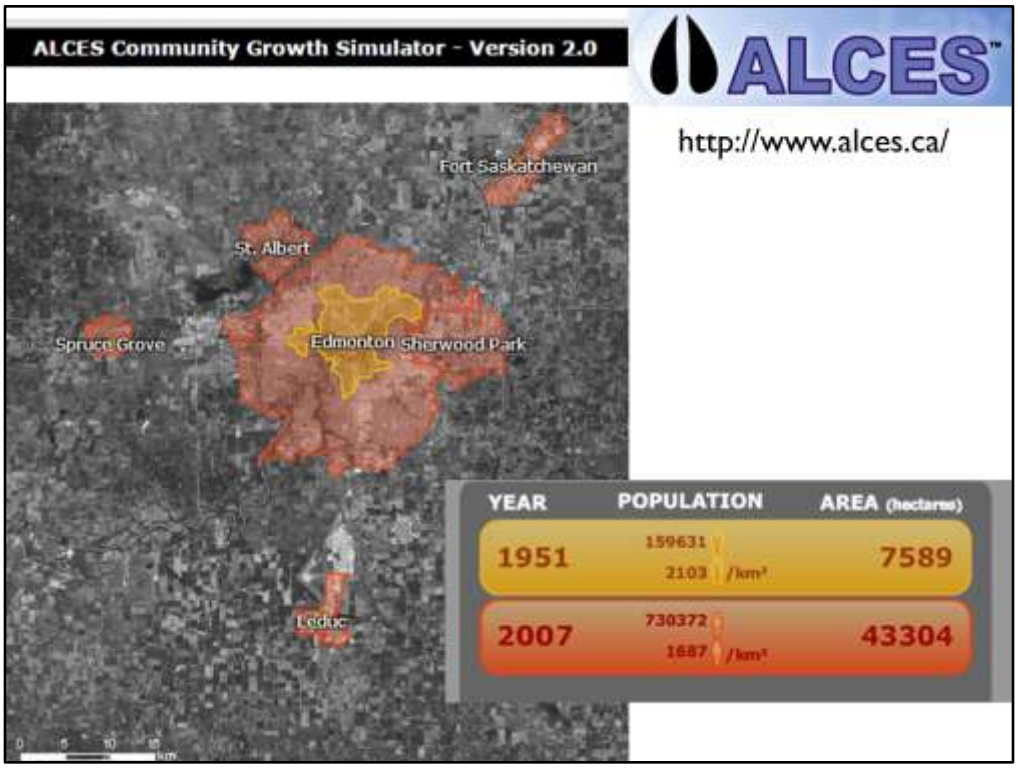
These are the images that stick with us and what we pride ourselves on.

Yet at the same time we all know Alberta is becoming an increasingly busy place with many activities happening across our watersheds. All of which are putting a strain on the system in terms of water quality, biodiversity, and ecosystem health.

In particular we know our urban landscapes are rapidly expanding.

As of 2007, for the first time in human history, globally the number of people living in urban centers out-numbered rural populations.
According to statistics Canada, by 2001, Canada's population was already 80% urban.

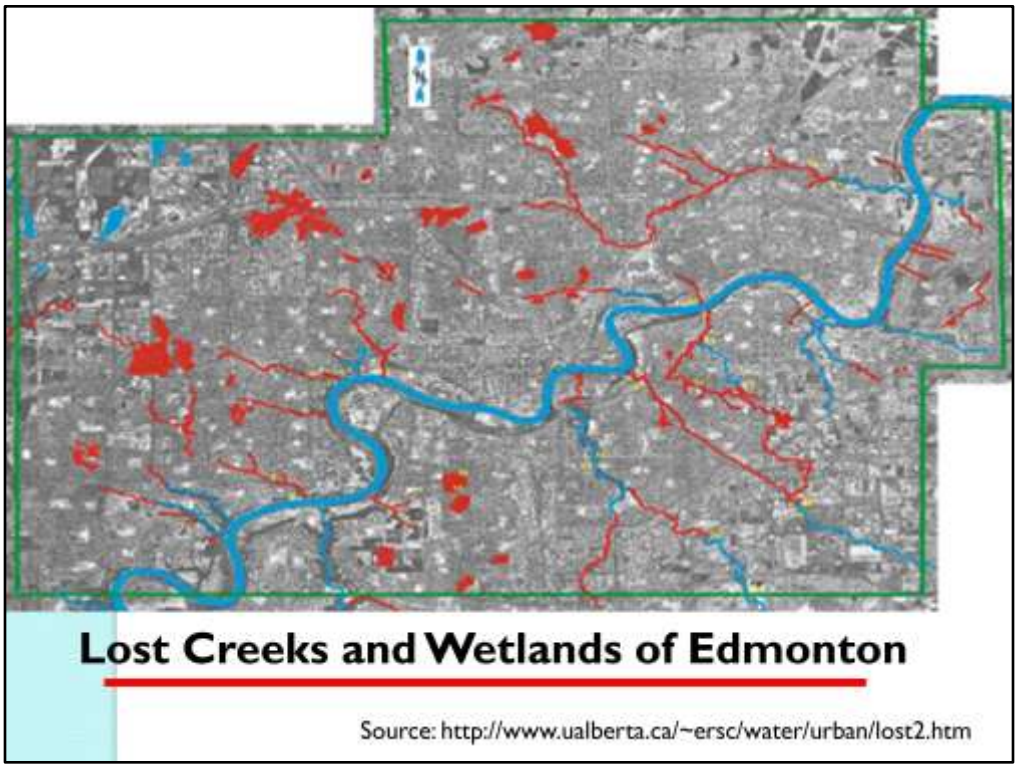
References:
Source - http://www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html
http://www.sciencedaily.com/releases/2007/05/070525000642.htm



If we take Edmonton as an example, in little over 50 years Edmonton's footprint has expanded dramatically as you can see here.

References:

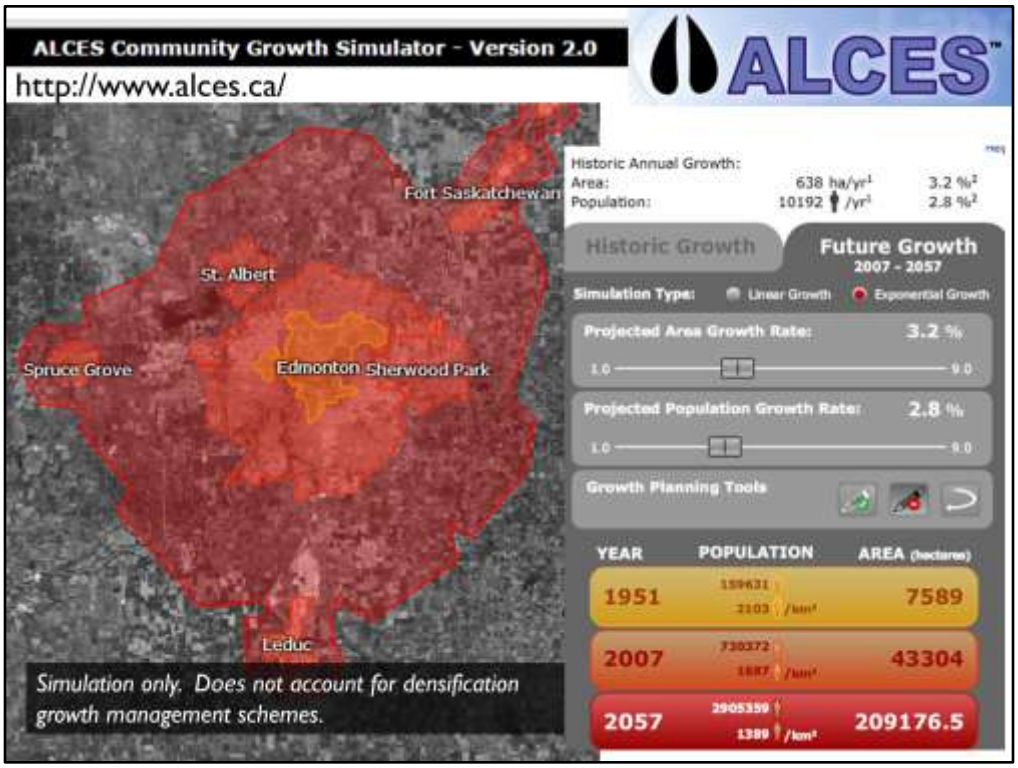
Source - http://www.alces.ca/



With this urban expansion we have seen the disappearance of many small streams and wetlands within Edmonton's city limits.

References:

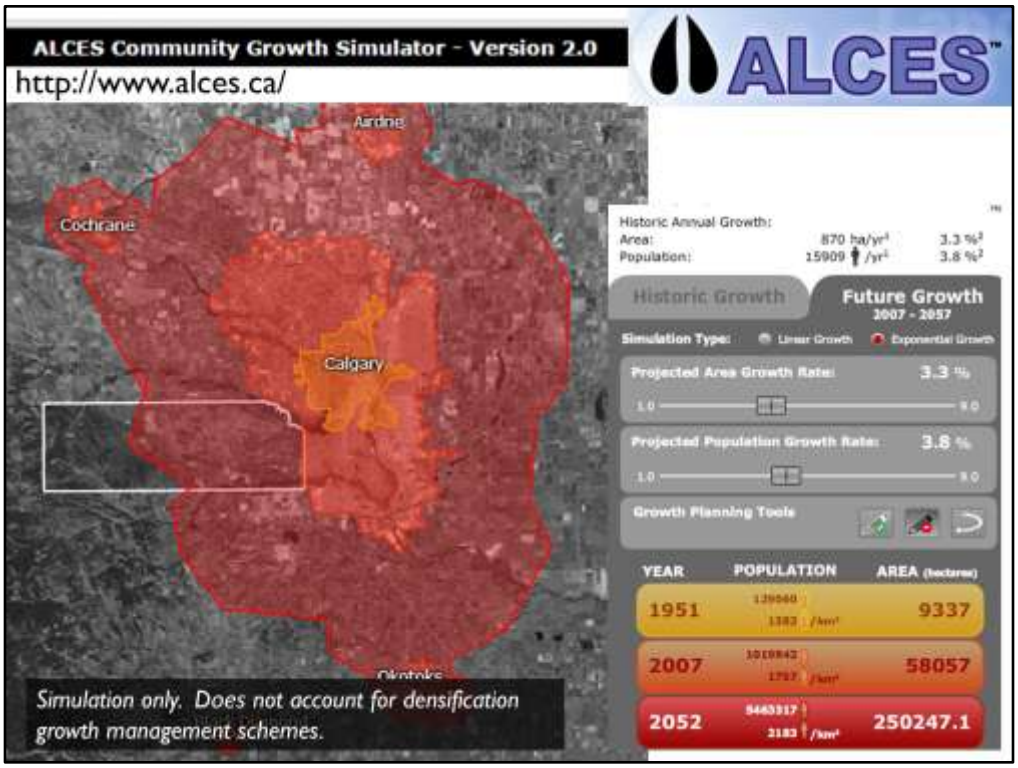
http://www.ualberta.ca/~ersc/water/urban/lost2.htm



If we project this type of exponential growth rate forward using a very coarse cumulative effects simulator – Edmonton could like this by 2057. Of course this is a simulation only and it does not account for densification growth management schemes, but still it makes the point clearly that our urban footprint has the potential for rapid and large scale expansion going forward.

References:

Source - http://www.alces.ca/



Calgary's projected possible future footprint looks equally large under this type of simulation.

References:

Source - http://www.alces.ca/

And just as our cities and towns grow, so too are we seeing intensified growth in lakeshore communities where people are rushing to, perhaps to escape the busyness of our urban centers.

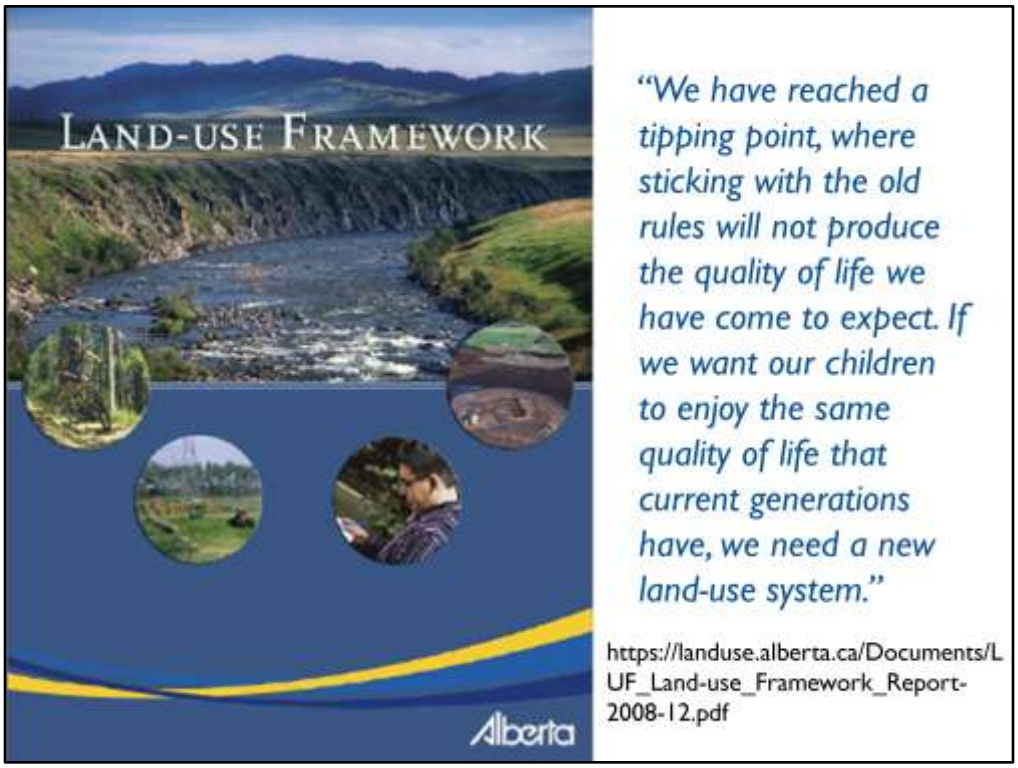
So the question becomes, and it is one that we will explore in this workshop, can we continue with a business as usual approach to development both in our cities and towns or along our lakeshores....

... and still meet our goals set out at the provincial level, of protecting watershed health?

We now have not only a Water For Life Strategy supported by regional Watershed Planning and Advisory Councils, a newly released Wetland Policy, and also a Provincial Land Use Framework under which we are starting to see Regional Plans come out for our major watersheds such as the recently approved South Saskatchewan Regional Plan.

Under the Water for Life strategy it is recognized that *"Water is not only a resource, it is a life source. We all share the responsibility to ensure a healthy, secure and sustainable water supply for our communities, environment, and economy – our quality of life depends on it."*

Source:
http://www.waterforlife.alberta.ca/



Similarly in the Alberta Land Use Framework we acknowledge that
"We have reached a tipping point, where sticking with the old rules will not produce the quality of life we have come to expect. If we want our children to enjoy the same quality of life that current generations have, we need a new land-use system."
(https://landuse.alberta.ca/Documents/LUF_Land-use_Framework_Report-2008-12.pdf)

Going forward Municipalities are expected to amend municipal development plans and other planning documents to align with provincial directions stated in regional plans and watershed management plans.

In our workshop today we hope to build a better understanding of the impacts of our land management choices and the outcomes on our water bodies and other natural capital values. A focus for today though will not be to dwell on the problems but rather to hone in on ways that we can improve our management practices and make better choices.

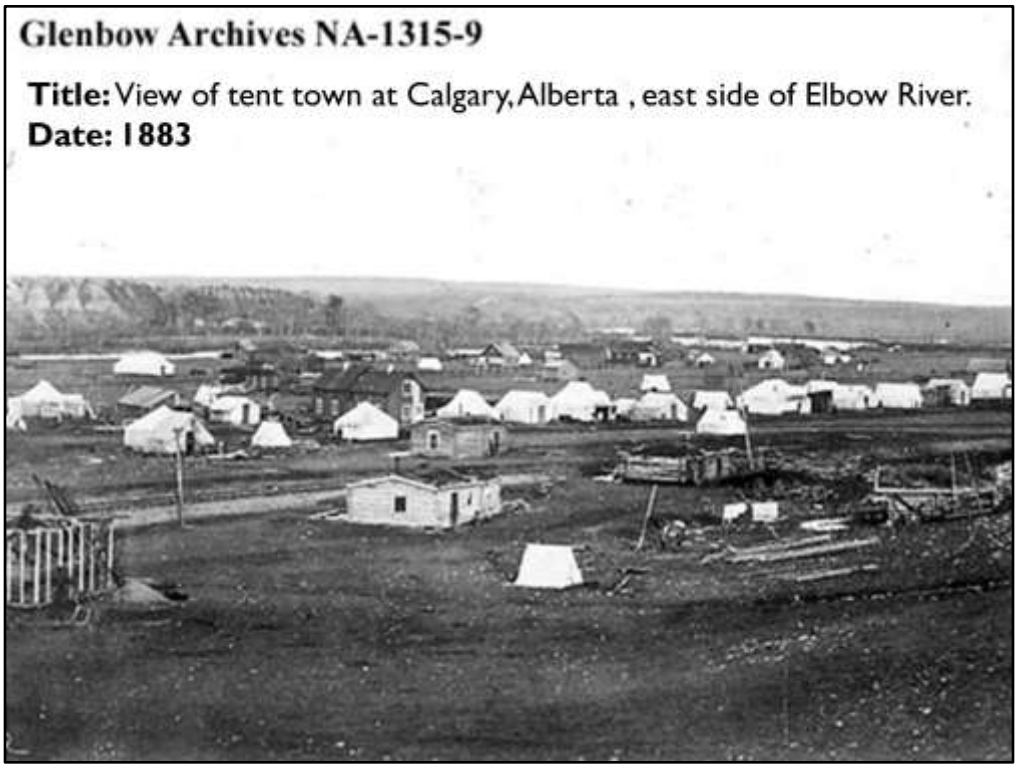
To begin, I will focus on riparian areas and discuss what is being done in Alberta to understand the natural capital value of riparian areas and to find ways to better manage, protect and restore functional riparian systems within our built landscapes.

A key part of improving and maintaining riparian health is recognizing that everything we do on our landscapes is interconnected – meaning that solutions to keeping our wetlands, lakes, streams, rivers and their riparian habitats healthy really starts in the uplands with how we manage stormwater runoff as an example. This will be the theme of Leta Van Duin's presentation today. Leta, the Executive Director of the ALIDP, will give us a chance to see what is in the realm of the possible for Alberta and showcase local examples of innovative low impact development case studies.

We will then for the last half hour of the workshop turn it over to you. We have prepared a couple of examples that we want you to work through in groups so that you can have the chance to apply some of the principles we will be talking about today.

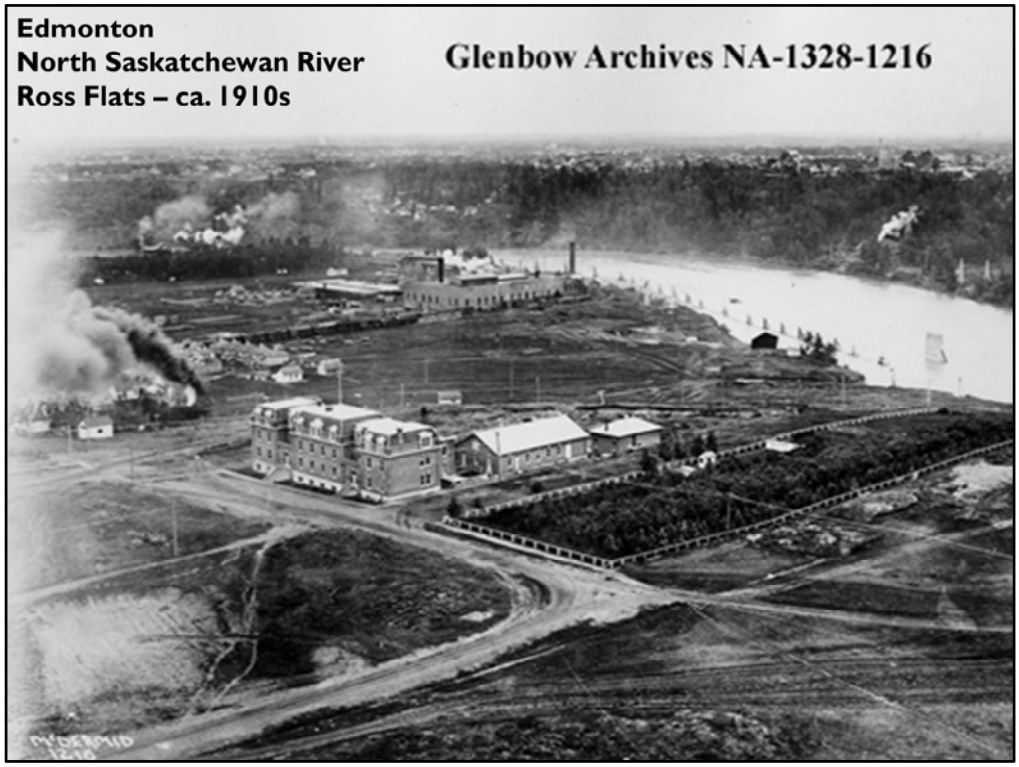
Part 1 – A new way forward, Riparian

Before I jump into it, first let us briefly look back in time to consider how we have come to be where we are today.



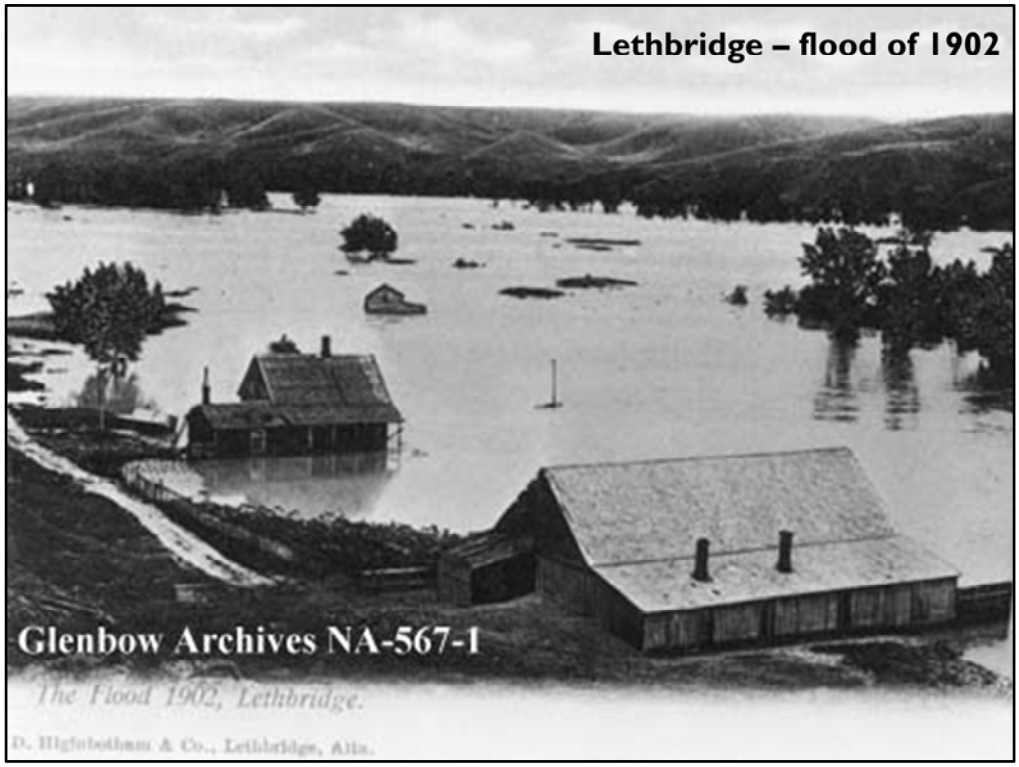
If we consider how this province was settled, it is clear that we Europeans have always been drawn to living near water. This is a photograph from the Glenbow archives showing an 1883 tent town on the east side of the Elbow River in Calgary – perhaps the last time we could find free parking downtown.

Glenbow Archives
File number: NA-1315-9
Title: View of tent town at Calgary, Alberta , east side of Elbow River.
Date: 1883



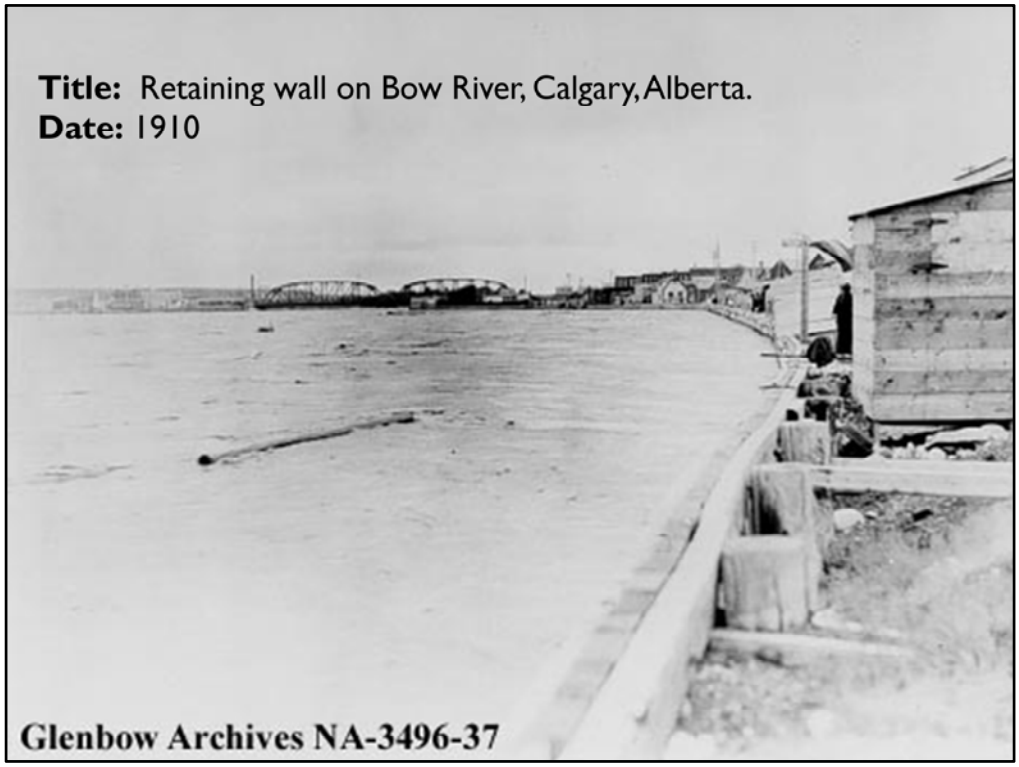
Here we see the early days of Edmonton. Our river valleys provided us with shelter and easy access to water and they functioned as essential transportation corridors.

Glenbow Archives
File number: NA-1328-1216
Title: Bird's eye view of Ross flats from Legislature building, Edmonton, Alberta.
Date: [ca. 1910s]



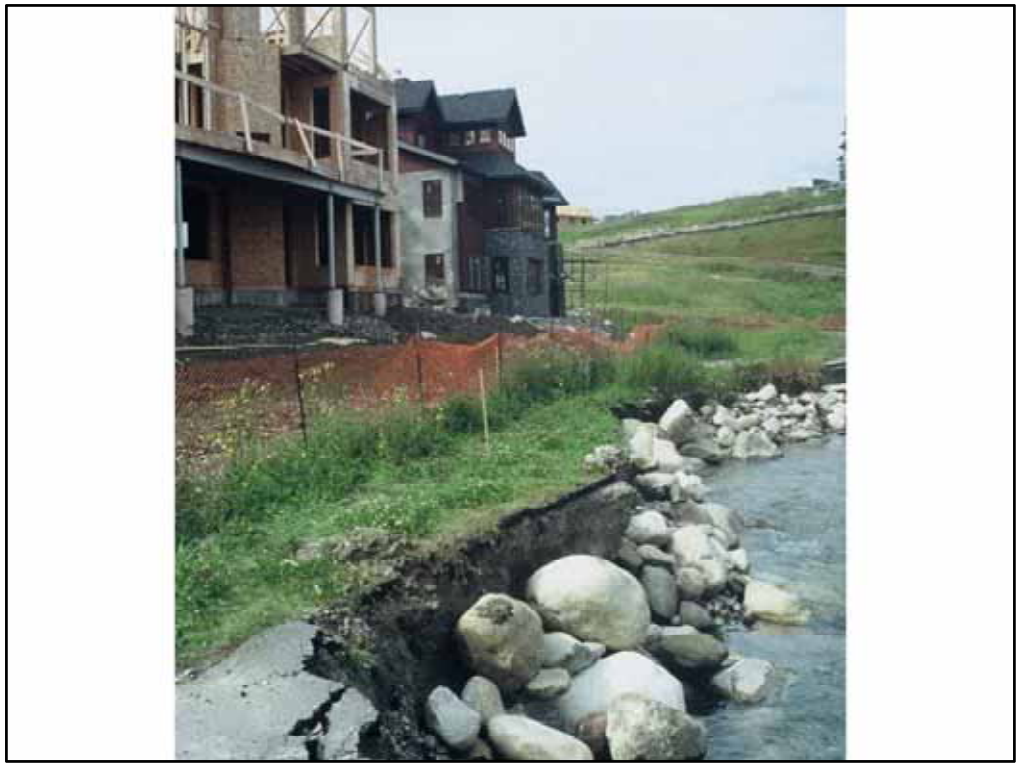
But as we know all to well, the allure of building on flat inviting floodplains has certainly gotten us into trouble over the years. This is a photograph of the Oldman River in flood in Lethbridge in 1902.

Glenbow Archives
Image No: NA-567-1
Title: Lethbridge, Alberta, during the **flood** of 1902.
Date: 1902
Photographer/Illustrator: Higinbotham, J. D. and Company, **Lethbridge**, Alberta.



And so, all things considered, we did not perhaps make the wisest of choices back in the day.

Glenbow Archives
File number: NA-3496-37
Title: Retaining wall on Bow River, Calgary, Alberta.
Date: 1910



But what is concerning, is that it seems even recently we continue to repeat these choices.

What costs and consequences do we now face as a result of choices like this to essentially build the riparian zone out of existence?

Or from choices like this to convert once thriving trout streams like Nose Creek essentially into a channelized stormwater conduit?

Similarly, what costs and consequences do we face by incrementally stripping away natural vegetation around our lakeshores and intensifying our adjacent developments?

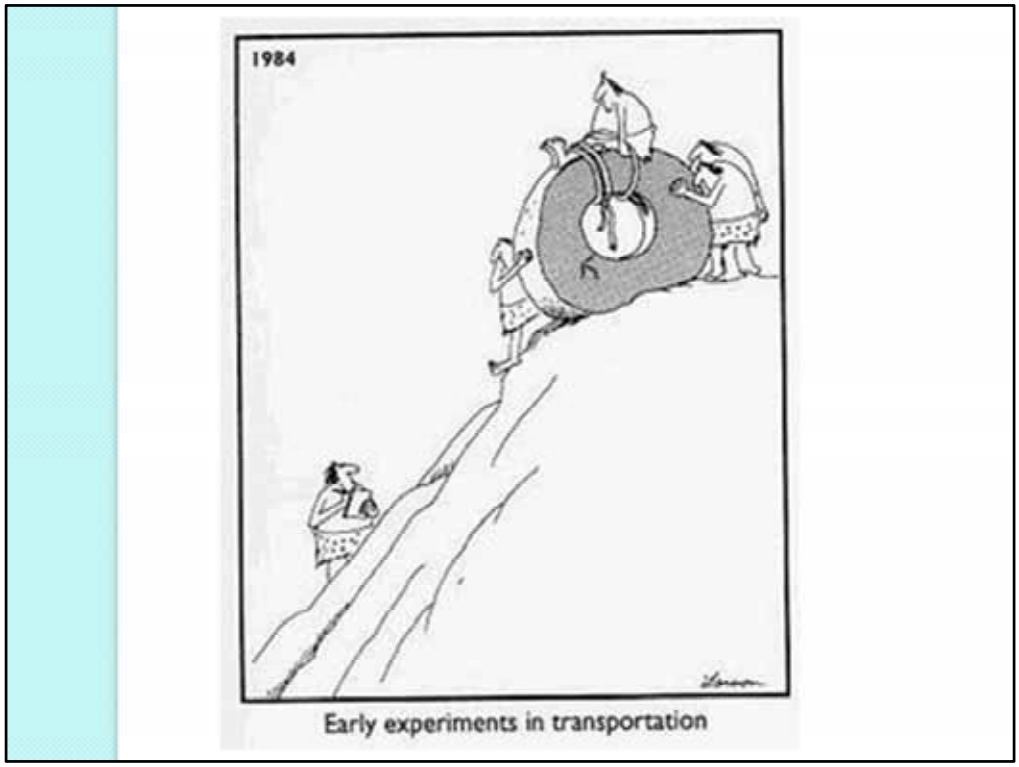
As we see increasing signs of stress to indicators like water quality, it is important to contemplate if our development choices are putting at risk the very values that attract us to these places in the first place.

Bluegreen algae blooms can pose a serious health threat to humans and other animals as some common cyanobacteria produce potent liver or nerve toxins. Due to these serious risks to health, Alberta Health Services monitors and issues warnings for Alberta water bodies, particularly those popular recreation lakes and reservoirs. People are cautioned against swimming or wading in water with concentrated cyanobacteria and are advised to closely supervise children and pets to avoid water contact. Excessive bluegreen algae blooms can also create anoxic conditions due to bacterial decomposition processes that consume dissolved oxygen. This in turn contributes to fish kills.

In 2013, Alberta Health Services issued bluegreen algae health advisories for 33 lakes in Alberta, mostly in the Edmonton and Red Deer region of central AB and further north. Included on this list is Isle Lake where we recently witnessed a massive fish kill event. Isle Lake is located approximately 80 km west of Edmonton. Abnormally high algae blooms linked with this fish kill event are associated with increased amounts of nutrient rich runoff coming off the adjacent modified landscapes.

References:

http://blog.abmi.ca/2014/03/19/winter-fish-kill-in-isle-lake-the-problem-is-land-use-the-solution-is-land-use/#.VP9vfvzF-FM
http://www.edmontonjournal.com/news/Video+Alberta+fish+kill+worst+ever/10680095/story.html (video by Bruce Edwards, Edmonton Journal)



With these types of consequences in mind, with our choices over time, have we set ourselves on a downward trajectory?

Or, can we learn from nature to find new and more sustainable ways of doing things.

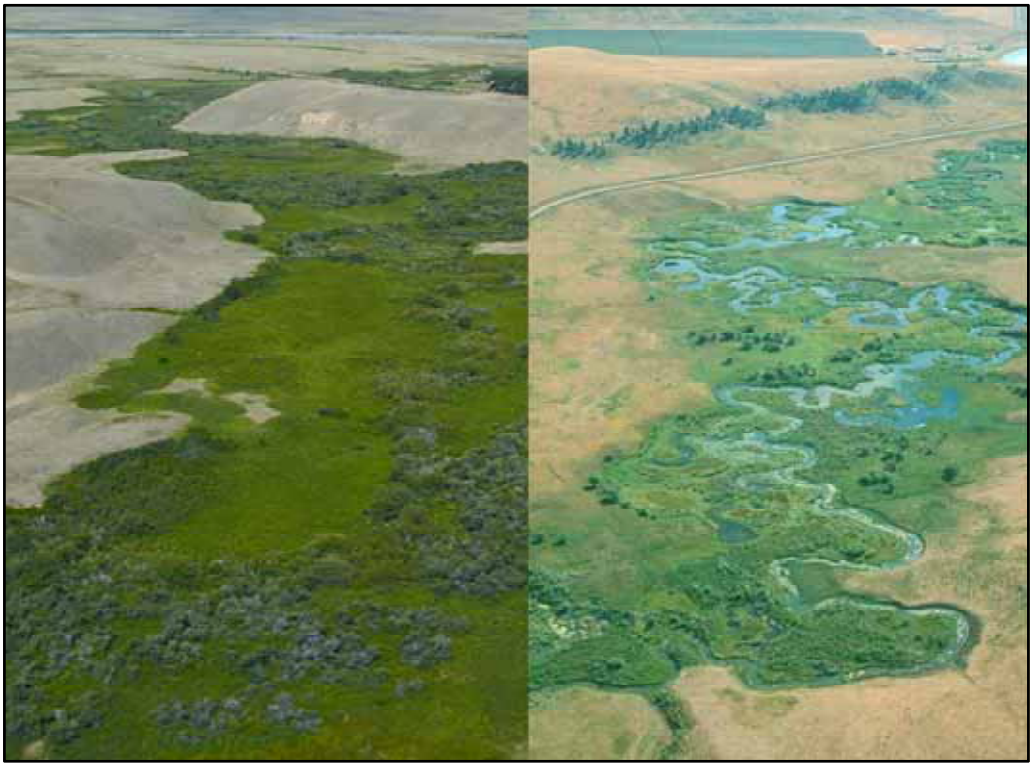
Natural Capital

Natural Capital	Societal Benefit
	Water supply, water filtration, flood regulation, habitat, recreation
	Pollination, CO_2 storage, food production, soil formation
	Food production, habitat, scenic
	Water supply, water filtration, habitat, food production, recreation
	Air quality, raw materials, habitat, CO_2 storage, soil formation
	Scenic, CO_2 storage, tourism, human health

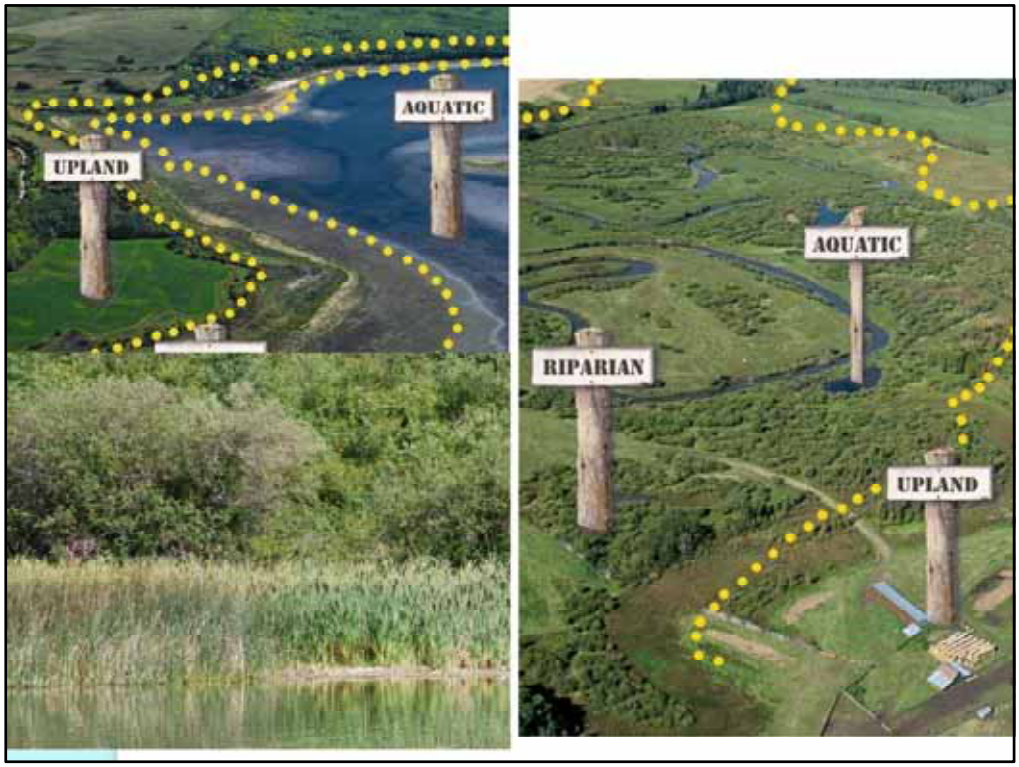
As a society, we tend to better protect and manage what we value – what we understand to be important to our well being.

Many of us see capital as man-made goods.

Natural Capital includes things like: wetlands, streams, rivers, and forests. The values society gains, free of charge, for maintaining these lands are called ecological goods and services.

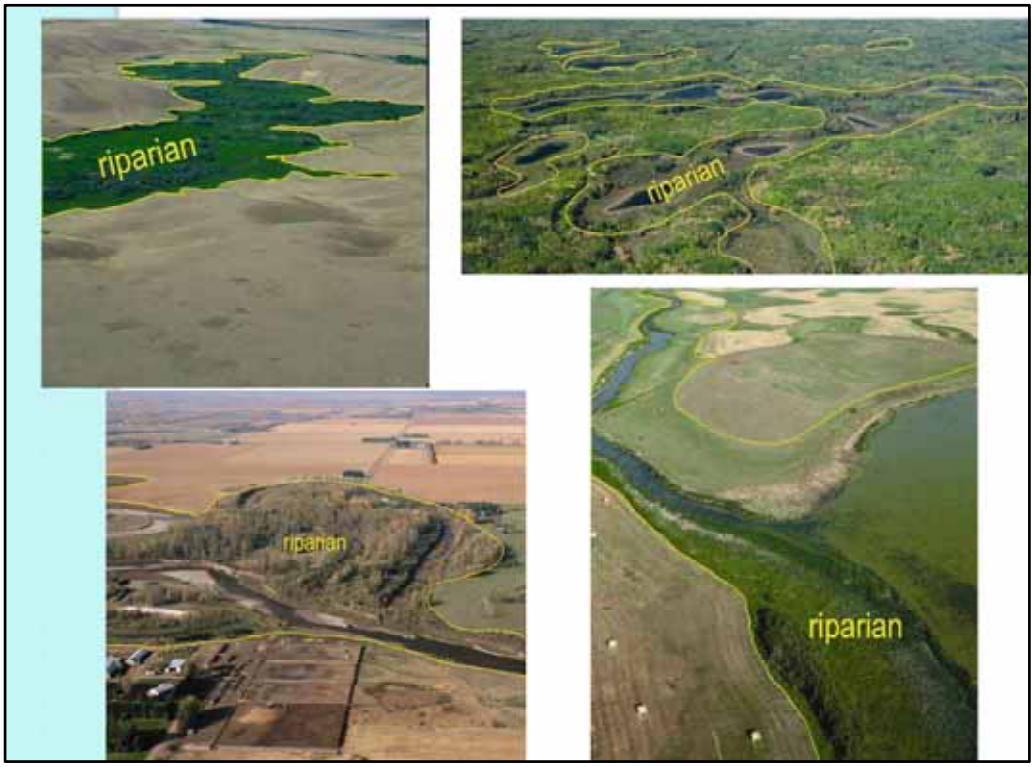


Riparian Areas are one form of natural capital. Riparian areas are those green zones of lush and productive vegetation along our streams and rivers, lakes and wetlands.

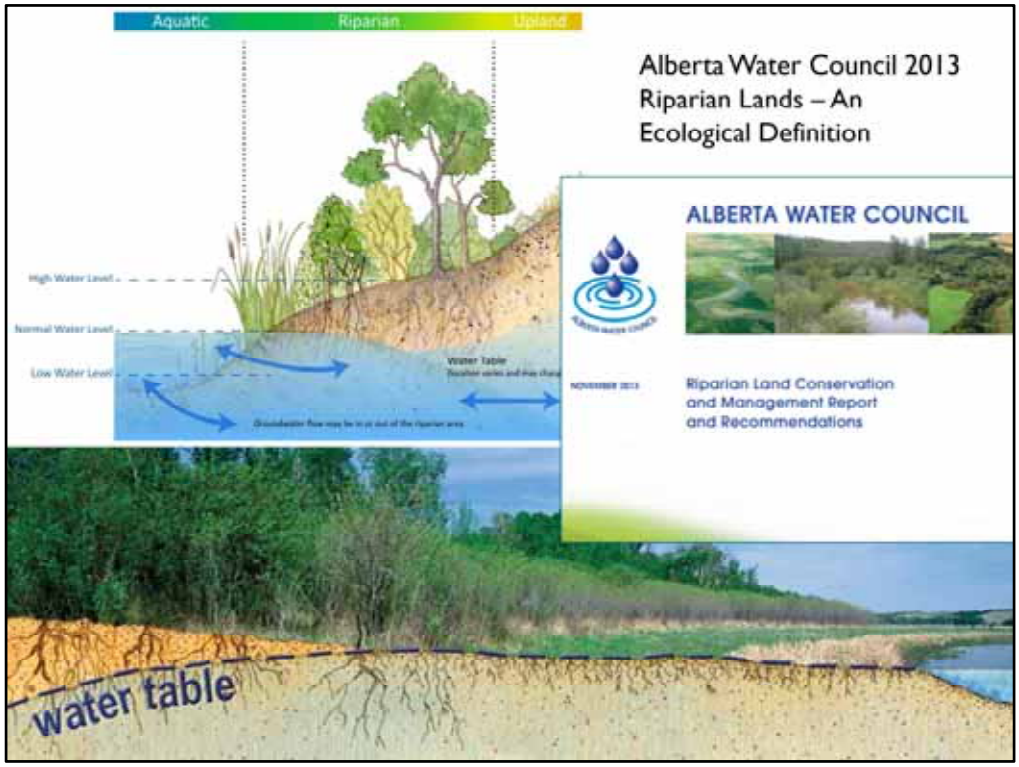


These areas form the transition zone between our upland and aquatic environments – they encompass the emergent zone of cattails, bullrushes or sedges along our lakes and wetlands and extend out to include the lush band of willows or poplars growing along the moist outer fringe of these water bodies.

Along our streams and rivers they encompass moist floodplains within our valley bottoms.



Riparian areas are unique and dynamic areas that can vary from several meters to several hundred meters away from the waters edge. You can use topography, soil and vegetation indicators to help determine the extent of riparian areas.



Where you have water modified soils, and plants that are adapted to temporary or permanently saturated soil conditions either from a high water table or from frequent flooding, you know you are in a riparian area.

A big step forward for Alberta is that we finally have a provincial definition for “riparian lands” that was put out in the report shown here by the Alberta Water Council in 2013 . Part of the definition acknowledges that riparian areas perform various functions.

----------*Full definition (for reference only):*
Riparian Lands — An Ecological Definition: Riparian lands are transitional areas between upland[1] *and aquatic ecosystems. They have variable width and extent above and below ground and perform various functions. These lands are influenced by and exert an influence on associated water bodies*[2]*, including alluvial aquifers*[3] *and floodplains. Riparian lands usually have soil, biological, and other physical characteristics that reflect the influence of water and hydrological processes.*

[1] For the purpose of this definition, “upland” is considered to be the land that is at a higher elevation than the alluvial plain, stream terrace(s), or similar area associated with a water body.

[2] A water body is any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands and aquifers (generally excludes irrigation works). Source: *Alberta Water Act.*

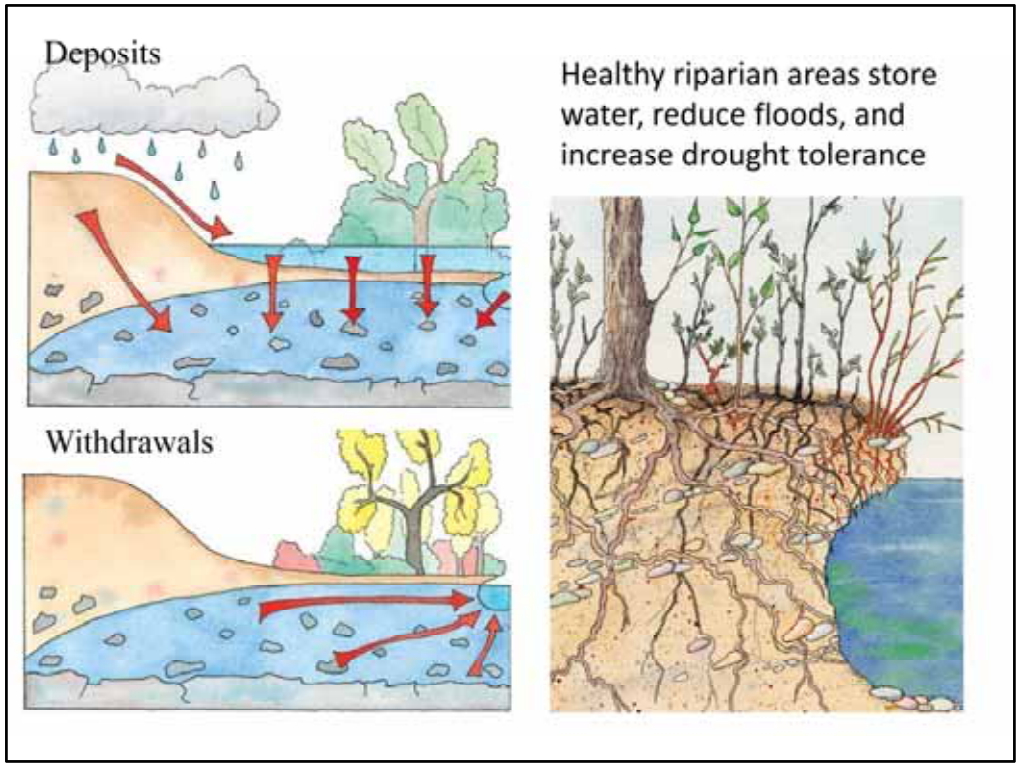
[3]For the purpose of this definition, alluvial aquifers are defined as areas where groundwater is under the direct influence of surface water.

Full report available from:
http://www.albertawatercouncil.ca/Publications/tabid/59/Default.aspx#Research_reports

But what is important to understand is that the ability of riparian areas to perform ecological functions depends on how healthy and intact these areas are and land use impacts to the surrounding landscape.

In natural environments, where we have healthy riparian areas with an abundance of native riparian plants like willows, sedges and cattails these areas can be highly efficient at filtering runoff and absorbing nutrients like phosphorus and nitrogen and incorporating these nutrients into their biomass.

Healthy, well vegetated riparian areas also help to resist and slow down erosion and loss of land by way of hundreds of kilometers of deeply rooted plants.



Another key function of healthy riparian areas is their sponge like ability to soak up and store water. Water that soaks into our groundwater aquifers after snowmelt or during early spring and summer rainstorms is available to be released back into our waterbodies later in the season. This helps to maintain flow in streams that may otherwise run dry by late August.

Riparian areas with deeply rooted plants like balsam poplars are particularly good at soaking up water- roots open up water infiltration pores that penetrate deep into the soil.

By comparison water infiltration and also erosion resistance is compromised where we clear away native riparian trees, shrubs, cattails and sedges and replace these with shallow rooted, but beautifully manicured mowed lawns. A study done recently by a University of Calgary Masters student found that poplar stands have more than 10X the hydraulic conductivity or infiltration capacity than adjacent areas of lawn (Skorobogatov 2014).

Infiltration is even less where we have frequently mowed compacted lawns. Repeated mowing can compress the riparian sponge and create higher amounts of runoff.

Reference: Anton Skorobogatov. 2014. Hydrological Functionality of Plants and Its Application to Stormwater Management. University of Calgary Master's of Environmental Design Thesis.

When it comes to flooding, riparian floodplains are nature's safety valve - these areas are specially adapted for absorbing and storing excess water that spills out over the channel once in a while. For our riparian areas, floods are a natural process of renewal not destruction. In fact we know that plants like balsam poplars and cottonwood trees depend on floods as a natural part of their regeneration cycle. Balsam poplar and cottonwood trees are critical components of healthy river ecosystems throughout much of Alberta. These trees time the release of their fluffy white cotton seeds to coincide with spring peaks in river flows. Poplar seedlings germinate in moistened flood deposited or flood scoured soils clear of other vegetation.

Because cottonwoods and poplars have adapted to natural river flow patterns over thousands of years they are sensitive to changes in streamflow. In river systems across North America where we have severely altered natural flow regimes by damming or diversion projects this has contributed to declines in cottonwood and poplar forests (Rood and Mahoney 1990).

References:

Rood SB and Mahoney JM. 1990. Collapse of riparian poplar forests downstream from dams in western prairies: probable causes and prospects for mitigation. Environ Manage 14: 451-64.

Rood SB, Braatne JH, and Hughes FMR. 2003a. Ecophysiology of riparian cottonwoods: stream flow dependency, water relations and restoration. Tree Physiol 23:1113-24.

Rood SB, Gourley C, Ammon EM, et al. 2003b. Flows for floodplain forests: successful riparian restoration. BioScience 53: 647-56.

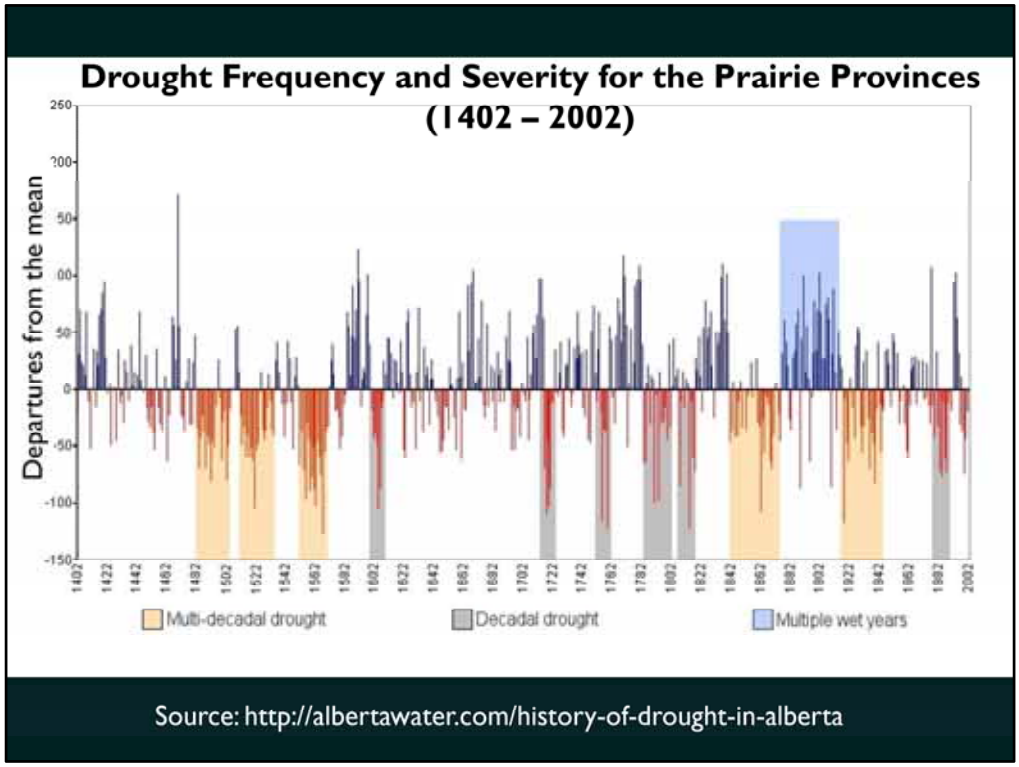
The nutrient rich soils left behind after a flood stimulates new growth and a boost in productivity in riparian plants.

This cycle of renewal and fertility associated with flooding was once embraced and revered by ancient Egyptian and Roman civilizations. Fertile moist soils deposited by the annual flooding of the Nile enriched crops and was seen as a gift from the gods. The roman statue in the lower right of the Nile River God holds in his right hand a horn of cornucopia alluding to the bounty brought by the Nile's annual flood.

References

Wilkinson, Richard H. (2003). The Complete Gods and Goddesses of Ancient Egypt. Thames & Hudson. ISBN 0-500-05120-8.

Francis Haskell and Nicholas Penny, 1981. *Taste and the Antique: the Lure of Classical Sculpture 1500-1900.* (Yale University Press) cat. no. 58.



But as much as we have been preoccupied with floods lately, it is important to also realize, that the water storage functions of healthy riparian floodplains and wetlands benefit us equally well during periods of drought.

We know from tree ring analysis that since 1402 the prairie provinces have experienced periods of decadal and multi-decadal droughts. We know that this trend is likely to continue into the future as well. Due to water quantity concerns the Province of Alberta stopped accepting applications for new allocations of water in the Oldman, Bow, and South Saskatchewan sub-basins in southern Alberta as of 2006 reminding us of water shortage concerns.

Sustaining flows through periods of drought becomes critical to sustaining aquatic life such as by maintaining flows in small spawning tributaries for trout.

Shade, cover and woody debris are just a few other reasons why fish like trout are dependent on healthy riparian edge habitat.

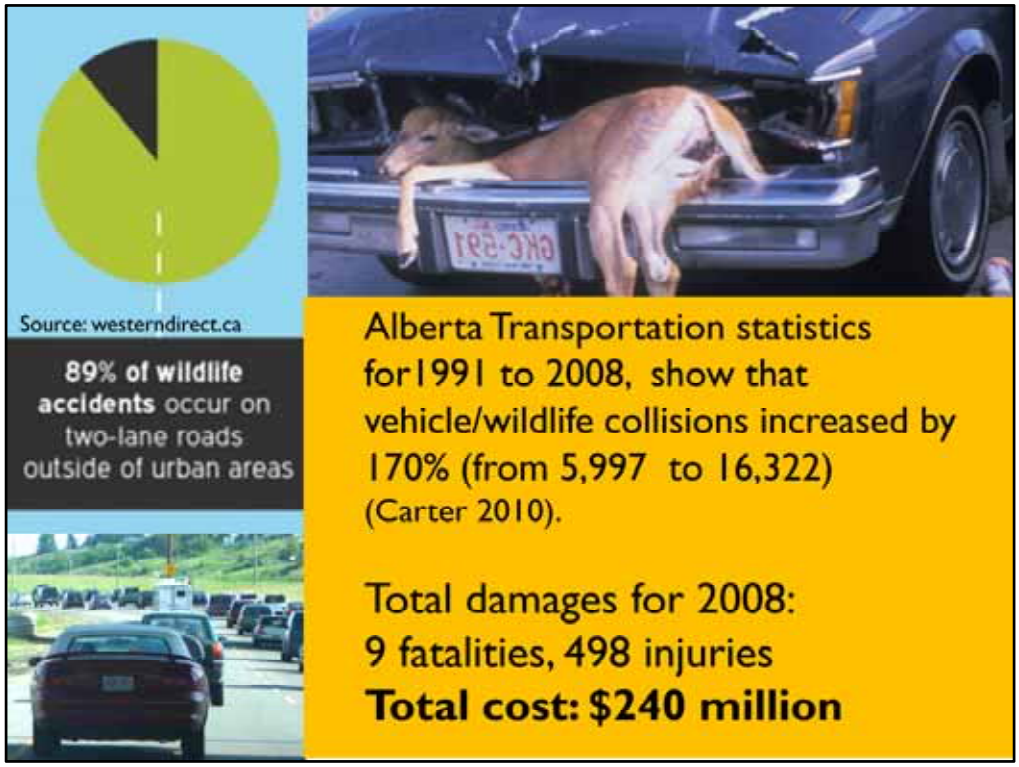
But it is not just fish that depend on these habitats, the majority of our wildlife species in Alberta rely on riparian habitats for all or part of their life cycle.

For more information: http://cowsandfish.org/pdfs/biodiversity.pdf

References:

Palliser Environmental Services Ltd. 2007a. Managing Riparian Areas for Biodiversity – A Summary of Research and Annotated Bibliography from Alberta and Other Relevant Areas. Unpublished report prepared for Alberta Riparian Habitat Management Society (Cows and Fish). 21 pp. + Appendices

Palliser Environmental Services Ltd. 2007b. Biodiversity (Bird) and Riparian Area Literature Review and Summary. Unpublished report prepared for Alberta Riparian Habitat Management Society (Cows and Fish). 9 pp. + Appendices

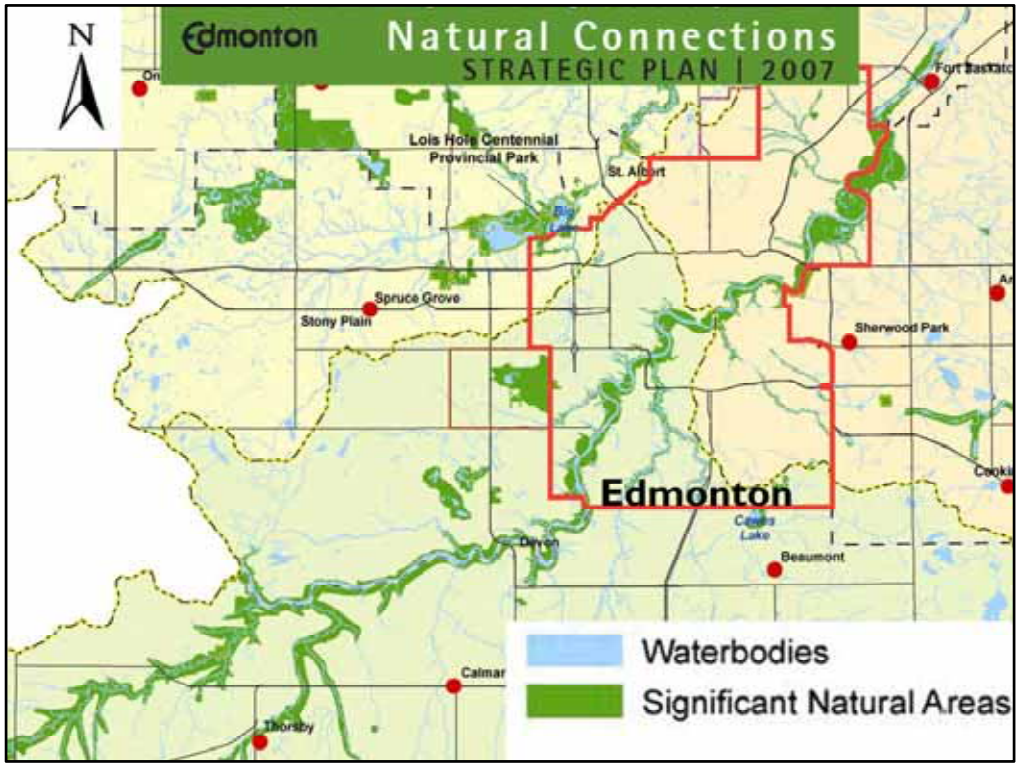


From an urban perspective, we generally don't accommodate wildlife movement patterns very well in the planning of our cities and associated roadways. This is reflected in rising vehicle/wildlife collisions with many of them occurring outside of urban areas as wildlife seek to navigate their way around our cities and towns. In 2008 wildlife/vehicle collisions cost as much as $240 million dollars. This cost has likely risen a lot since then.

References:

https://www.westerndirect.ca/learning-centre/insurance-news-and-advice/view/428-car-accidents-caused-by-wildlife-in-alberta-and-bc

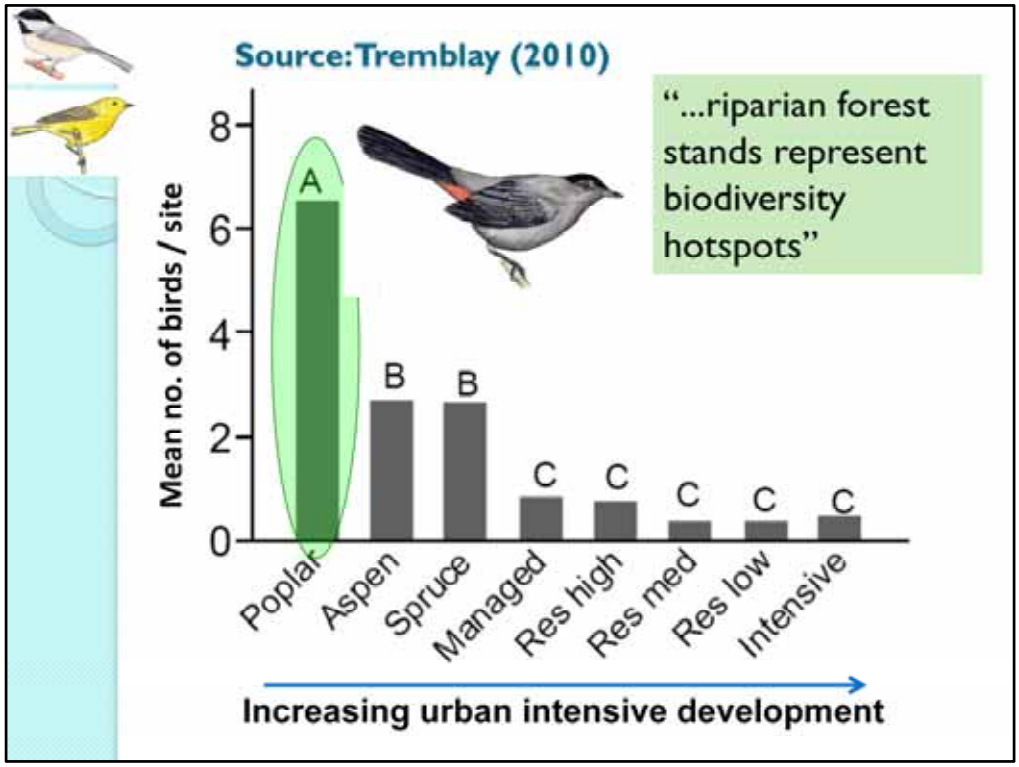
Carter, A. 2010. Vehicle and Wildlife Collisions (Available from: http://www.alces.ca/references) (sources used - Alberta Collisions Involving Animals 1991-2008 Alberta Transportation, Office of Traffic Safety, May 2009. Alberta — Animal Vehicle Collisions 2008 Alberta Transportation, Office of Traffic Safety, May 2009)



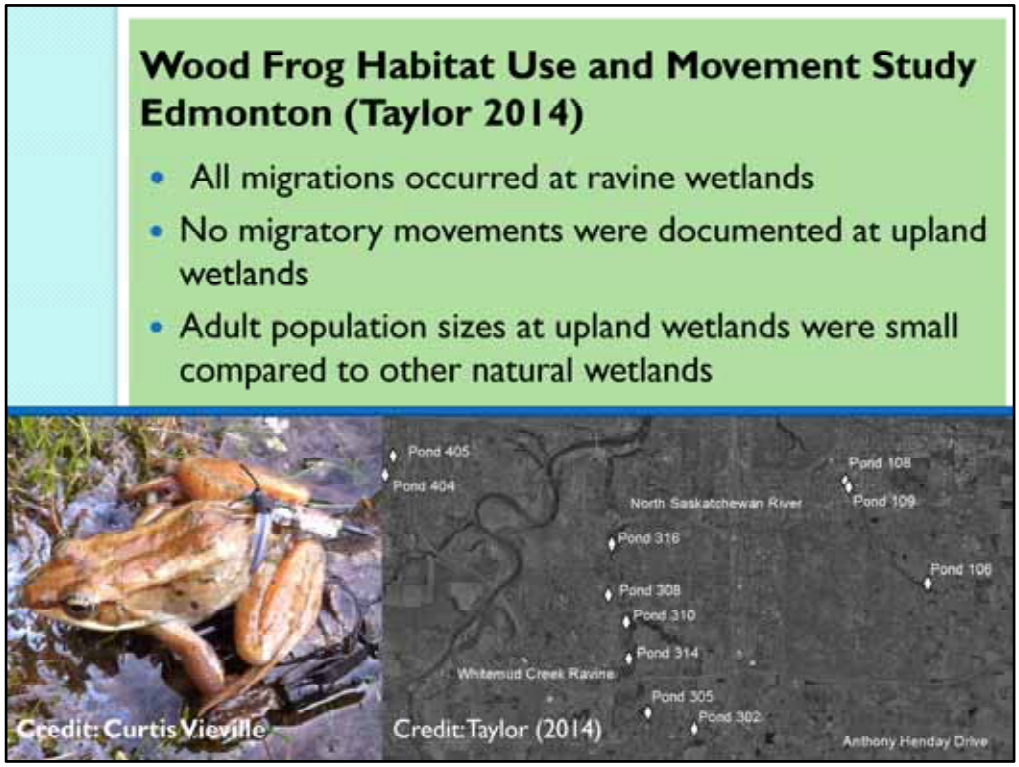
In this respect, our river and stream riparian corridors often offer the only safe movement passage through a large urban center. As an example, consider the importance of the North Saskatchewan river valley corridor for wildlife movement in the busy Edmonton region.

Reference:

http://www.edmonton.ca/city_government/documents/Natural_Connections_-_Strategic_Plan_JUNE_09.pdf#search=natural connections

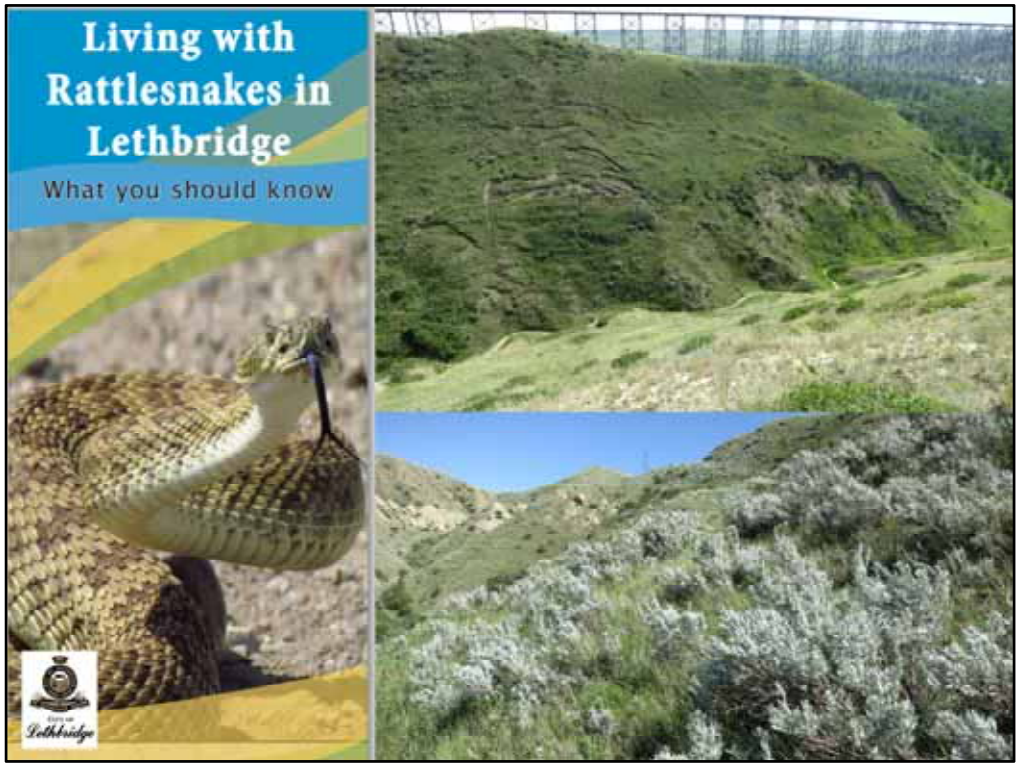


This is not only true for large mammals like deer, but also for birds. In a recent study of forest songbirds in Calgary, Marie Tremblay found that Calgary's poplar riparian forests are biodiversity hotspots for numerous bird species including for species such grey catbirds that are usually considered urban avoiders.



The same applies to amphibians like wood frogs. In order to maintain healthy genetically diverse populations, frogs need to be able to disperse over the landscape and interact with other frog populations. In a recent study by a University of Alberta Masters student (Murdoch Taylor) Murdoch looked at frogs in 11 wetlands in Edmonton. He found that the only frogs that made meaningful migratory movements were those frogs in wetlands that are associated with connected corridors of riparian ravine habitats such as along Whitemud Creek ravine. By comparison, frogs in ponds in the upland areas of Edmonton surrounded by inhospitable buildings and roads and mowed grass, mostly just stayed within 25 m of their pond. The populations of frogs in these urban isolated wetlands also seemed to be lower than populations in adjacent natural wetlands in undeveloped areas. What this means is that frogs in wetlands that are not part of a connected network of green space will likely eventually die out.

Reference: Taylor, M.E. 2014. Post-breeding movement patterns and multiscale habitat use of adult wood frogs (*Lithobates sylvaticus*) at urban wetlands of Edmonton, Alberta. Master of Science in Ecology, University of Alberta.



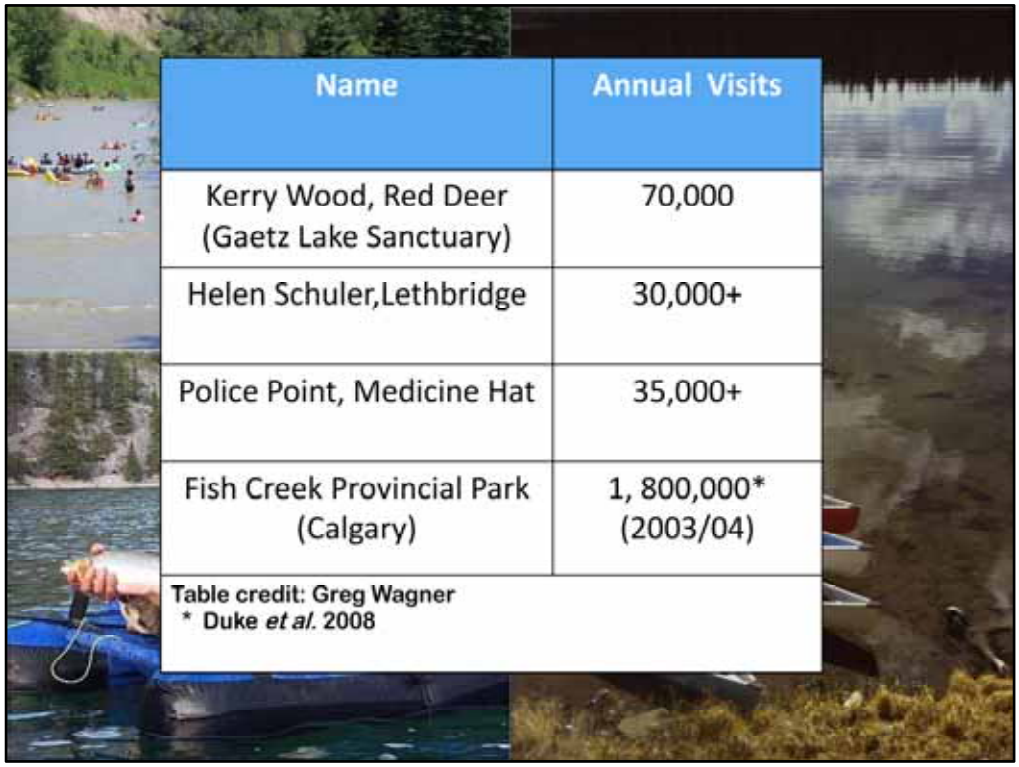
River valley slopes and riparian corridors in Lethbridge provide a safe travel corridor and overwintering hibernacula to a unique, but increasingly threatened animal, the Prairie Rattlesnake.

Formerly widespread and abundant, there are now fewer than 50 adult rattlesnakes in Lethbridge. It is estimated that about 75% of secure rattlesnake habitat in southwest Lethbridge has been lost to urban development in the past 15 years (Ernst 2011). The core population of resident rattlesnakes in Lethbridge are in Popson Park and Cottonwood Park in the southwest part of the city. Again, careful urban planning and maintenance of connected, ecologically functional, riparian corridors and adjacent native upland bench habitat, will be important for rattlesnake conservation here.

References:

Ernst, R. 2002. Management and recovery strategies for the Lethbridge population of the prairie rattlesnake. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 40. Edmonton, AB. Ernst, R. 2011.

Ernst, R. 2011. Lethbridge Rattlesnake Conservation Activities: 2011 Summary. Unpublished report prepared for the City of Lethbridge.



Name	Annual Visits
Kerry Wood, Red Deer (Gaetz Lake Sanctuary)	70,000
Helen Schuler,Lethbridge	30,000+
Police Point, Medicine Hat	35,000+
Fish Creek Provincial Park (Calgary)	1, 800,000* (2003/04)

Table credit: Greg Wagner
* Duke *et al.* 2008

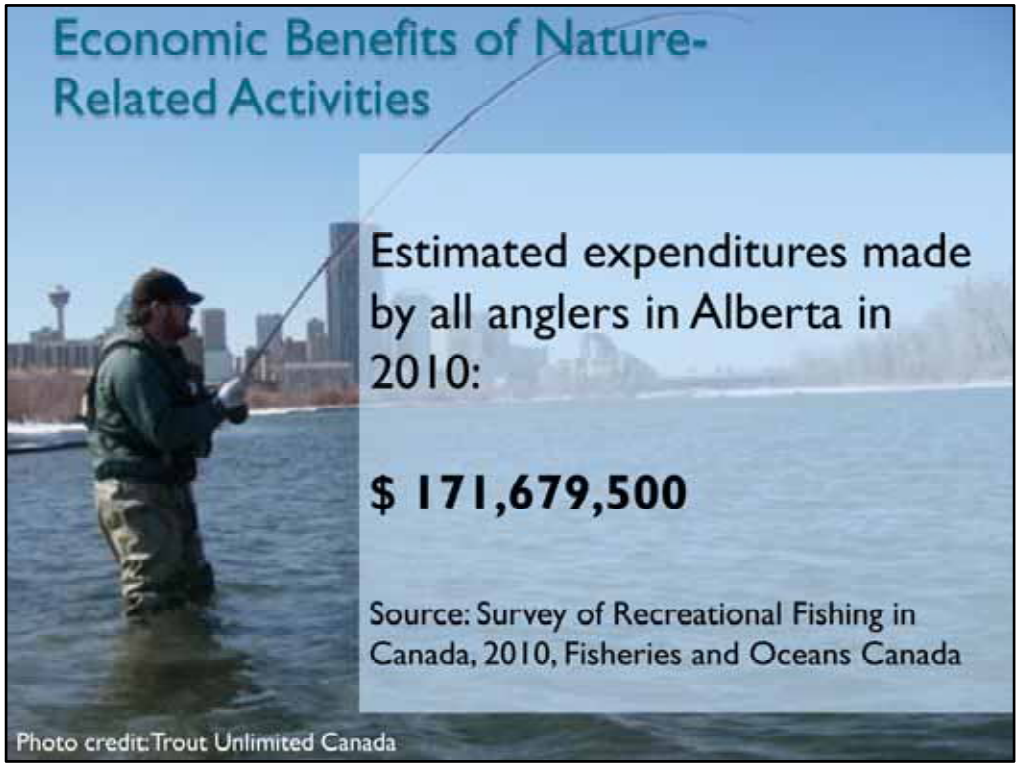
And of course wild creatures of the human variety are also drawn to riparian areas. In urban areas riparian parks receive use by many thousands of people each year.

These numbers suggest just how important urban riparian parks are to our quality of life.

References:

Duke, D., Lee, T. and Sanderson, K. 2008. Fish Creek Provincial Park: Visitor Monitoring Program. Prepared for Alberta Tourism Parks and Recreation, Parks Division. http://www.rockies.ca/files/reports/Visitor%20Monitoring%20Program_fish%20Creek%20Provincial%20Park.pdf

Greg Wagner, Telephone survey. Athene Environmental Limited

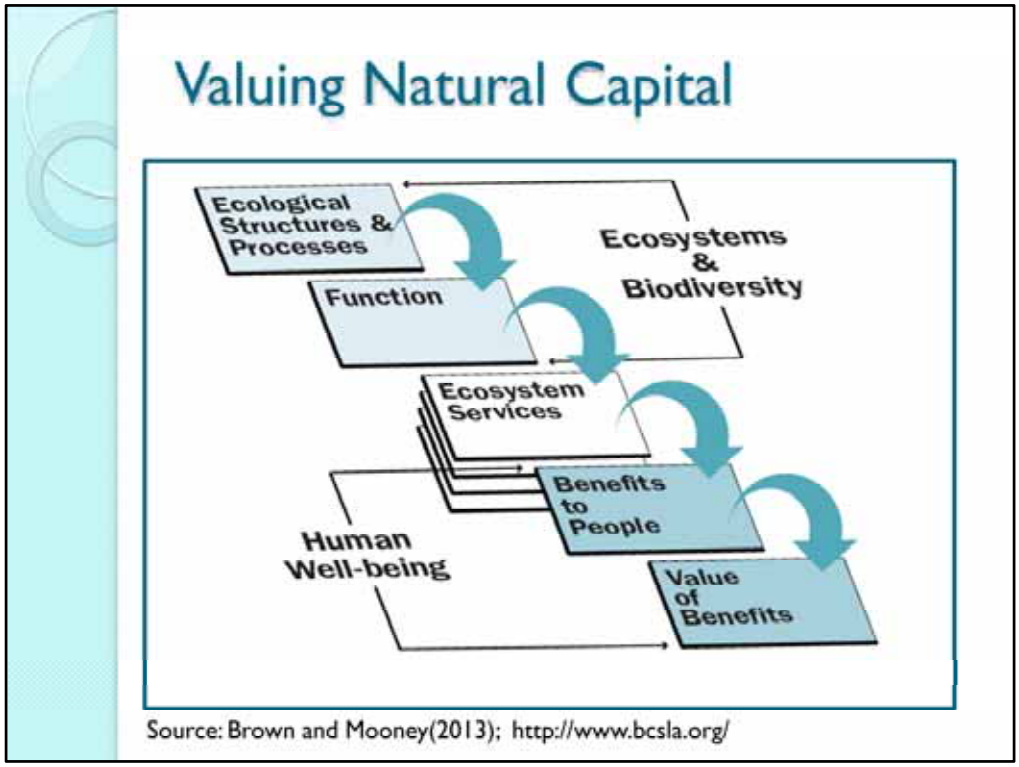


Quality of life benefits from riparian areas translate into an economic benefit as well. If we look at revenue generated from Recreational fishing alone, a recent survey estimated that anglers in Alberta spent over $170 million in 2010 on expenses such as angling package deals, food and lodging, transportation costs, fishing services, fishing supplies and other angling related expenses.

Source: Survey of Recreational Fishing in Canada, 2010, Fisheries and Oceans Canada http://www.dfo-mpo.gc.ca/stats/rec/can/2010/RECFISH2010_ENG.pdf

In addition, more than $290 million dollars was spent on major purchases related to recreational fishing activities such as fishing, boating and camping equipment and other such purchases.

Source: Survey of Recreational Fishing in Canada, 2010, Fisheries and Oceans Canada http://www.dfo-mpo.gc.ca/stats/rec/can/2010/RECFISH2010_ENG.pdf



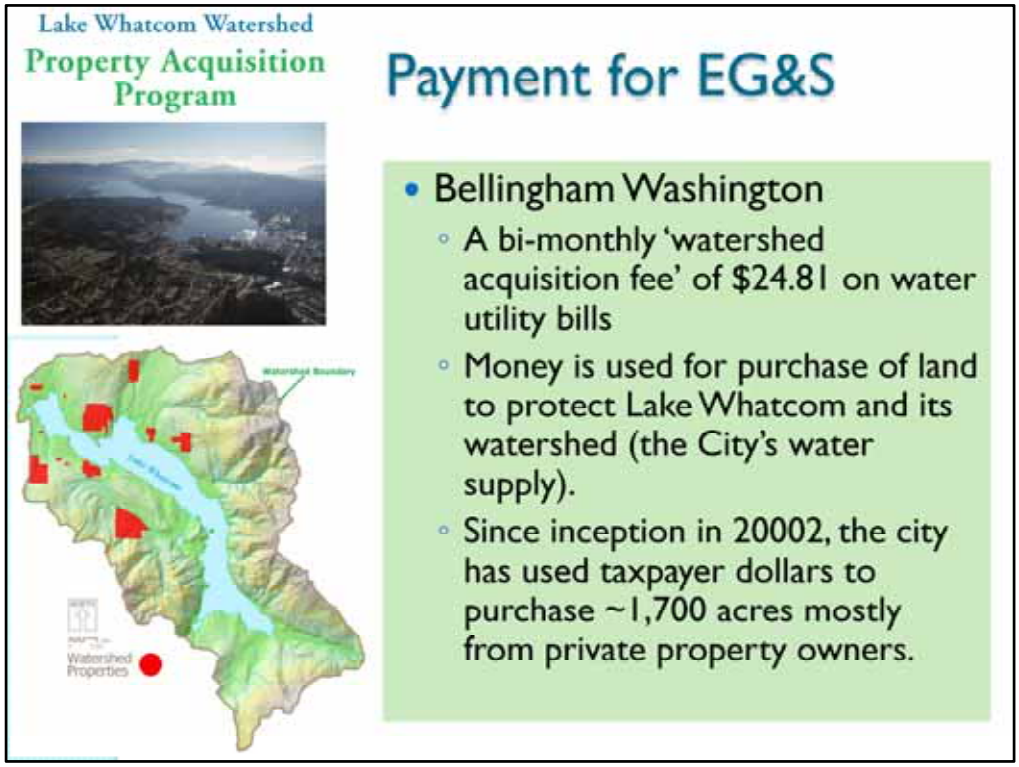
These types of economic benefits from healthy ecosystems are an example of how natural capital can be valued in monetary terms. There have been many other studies done recently to look at how to quantify other ecosystem goods and services in Alberta and across the world.

Source: Brown, G. and Mooney, P. 2013 Ecosystem Services, Natural Capital & Nature's Benefits in the Urban Region: Information for professionals and citizens. Vancouver, BC: School of Architecture and Landscape Architecture, University of British Columbia.

Watershed ecological goods and services example:

In the 1990's faced with the prospect of spending upwards of 8 billion dollars on new water treatment infrastructure and annual infrastructure maintenance costs upward of $200 million per year, officials in New York City opted instead for the comparatively much cheaper option to invest $100 million each year in watershed stewardship and protection programs in the Catskill/Delaware watershed. This watershed supplies 90% of the city's drinking water supply. Since 1997, New York City has acquired or contracted easements for more than 70,000 acres of land in the Catskill watershed to ensure the protection of key natural features such as streams and wetlands. They also invest money each year in supporting agricultural pollution prevention programs, watershed forestry programs and others in addition to capital investments in projects such as septic system maintenance, inspection and replacement and stormwater retrofit programs. In the wake of events like Hurricane Sandy which could easily have crippled their water treatment infrastructure, natural ecosystem services were unaffected by power outages.

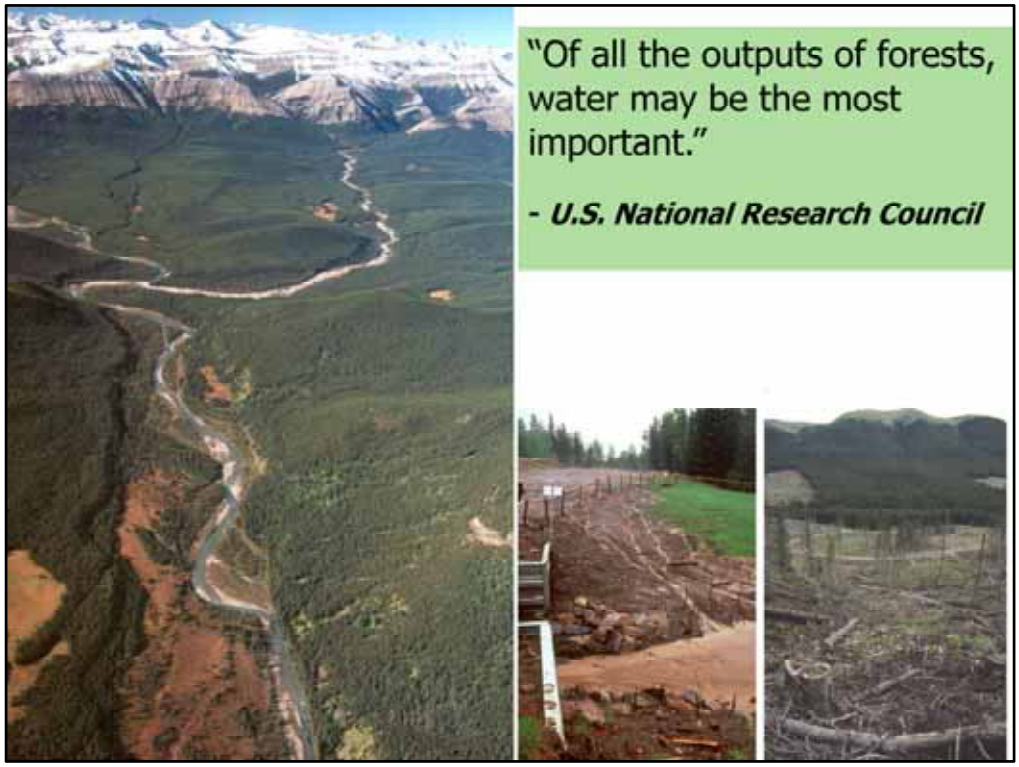
http://www.pwconserve.org/issues/watersheds/newyorkcity/
http://www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9542&section=news_articles&eod=1
http://www.forbes.com/sites/stevezwick/2013/01/17/the-8-billion-bargain-how-watershed-payments-save-cities-support-farms-and-combat-climate-change/



Watershed ecological goods and services example 2:

In Bellingham Washington, a bi-monthly 'watershed acquisition fee' of $24.81 on water utility bills is applied to allow for purchase of land to protect Lake Whatcom and its watershed (the City's water supply). Since inception in 2002, the city has used taxpayer dollars to purchase ~1,700 acres mostly from private property owners.

http://www.obwb.ca/fileadmin/docs/Lake_Whatcom_Property_Acquisition_Program.pdf

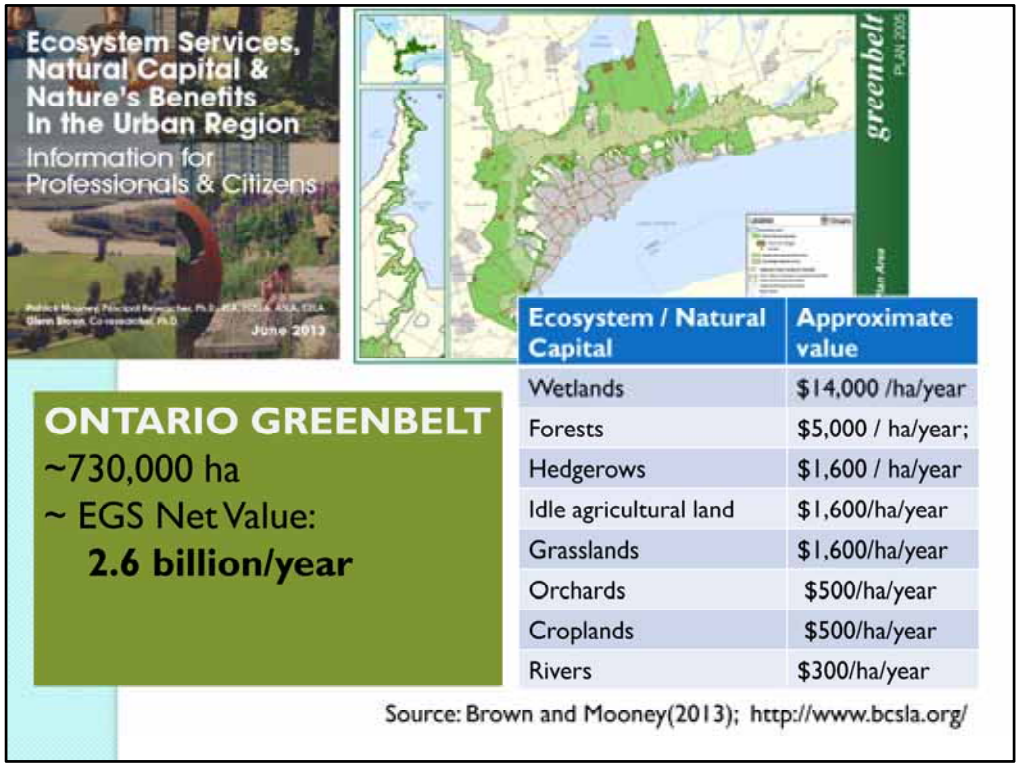


The New York and Bellingham Washington payment for ecological goods and services programs are supported by studies that strongly correlate intact headwater landscapes with decreased water treatment costs.

For example, a study of 27 water suppliers in the United States found that "*for every 10% loss in forest cover, there is a 20% increase in water treatment costs, and approximately 50% of the variation in treatment costs can be explained by the amount of forest cover in the source water area*."

Reference: Dudley, N. and S. Stolton. 2003. Running Pure: The Importance of Forest Protected Areas to Drinking Water. World Bank/WWF Alliance for Forest Conservation and Sustainable Use. United Kingdom. Wilson, Sara. 2008. Ontario's wealth, Canada's future: Appreciating the Value of the Greenbelt's Eco-Services. David Suzuki Foundation and Friends of the Greenbelt Foundation, page 23

Cited in: Meghan Beveridge and Danielle Droitsch. 2010. Making the Connection: Water and Land in Alberta. Prepared by Water Matters Society of Alberta - http://aref.ab.ca/wp-content/uploads/2012/08/making-the-connection-v2.pdf.



Canadian example: The Ontario Greenbelt is currently the world's largest greenbelt, at 1.8 million acres (~730, 000 ha). It surrounds the Greater Toronto and Hamilton Metropolitan Area in southern Ont. It was created by Provincial legislation in 2004 to "act as an urban containment boundary to protect farmland and natural resources from urban sprawl". A study of ecosystem services of this greenbelt estimated the total value of EGS to be over $2.6 billion / year (not including value for wildlife habitat and biodiversity)
Wetlands - $14,000 / ha / year;
forests - $5,000 / ha/year;
Hedgerows - $1,600 / ha/year
Idle agricultural land - $1,600/ha/year
Grasslands - $1,600 /ha/year
Orchards - $500/ha/year
Croplands - $500/ha/year
Rivers $300/ ha/year

Source: Brown and Mooney(2013); http://www.bcsla.org/

Valuing Natural Capital – In Alberta
City of Edmonton River Valley

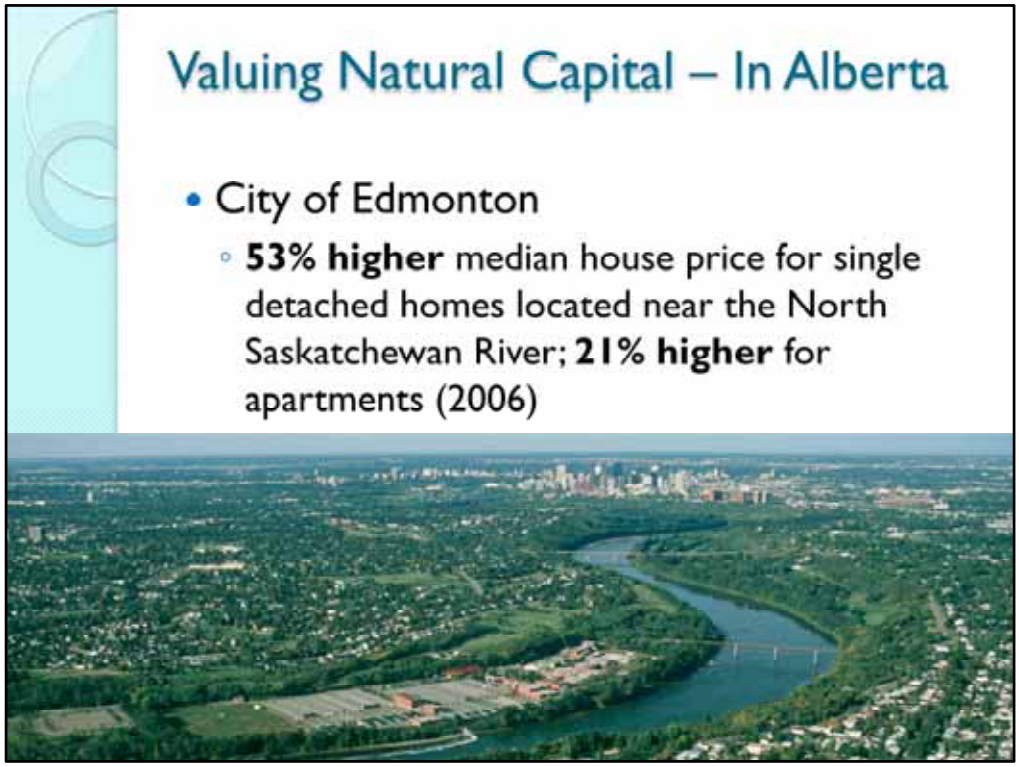
Service	Ecosystem	Low Estimate	High Estimate
		Millions	
Air quality / filtration:	Forest	$4.2	$156.0
Water quality / purification	Wetlands / riparian areas	$0.1	$0.4
Stormwater management	Forest	$66.9	$66.9
Erosion control	Forest	$4.9	$4.9
Carbon sequestration	Forest, shrubland, grassland	$7.1	$35.5
Pest control	Valley	$0.8	$0.8
Total		**$84.0**	**$264.5**

Alberta example:

For the North Saskatchewan River valley between Devon and Fort Saskatchewan, an AMEC study from 2006 suggests that the 36,372 hectares of natural vegetation and riparian areas annual contributes between $84 and $265 million per year based on six types of ecosystem services for which estimates could be calculated: air quality filtration, water purification, stormwater management, erosion control, carbon sequestration and pest control.

Despite the large range in estimated benefits, it is believed that the total value of ecosystem services is at the high end of this range and may actually exceed $265million per year. This is based on the observation that it was not possible to estimate the potential benefits associated with ecosystem services such as oxygen production, noise buffering, urban micro-climate regulation, and habitat protection. Furthermore, the estimates reflect only some aspects of the value of ecosystem services.

Source: AMEC Earth & Environmental for River Valley Alliance. October 2006. *The Current Status of Natural, Social and Economic Capital in the North Saskatchewan River Valley.*



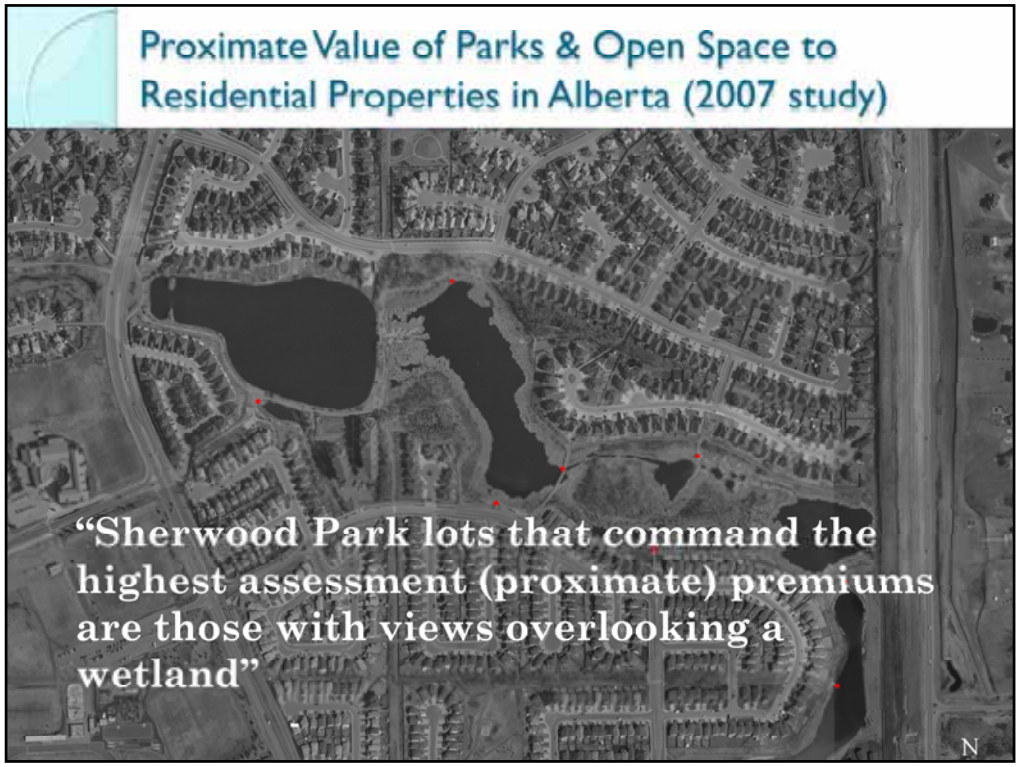
We also know, as we explored in our Natural Capital workshop series in 2010, that proximity to the North Saskatchewan river valley drives up real estate prices.

Background information:

Using 2001 Census data from Statistics Canada, a data set was produced to compare differences in median house prices between two groups of homes in Edmonton: those located near the North Saskatchewan River, and all homes in the City of Edmonton. Dwellings located near the river valley have a higher estimated mean selling price than a typical Edmonton dwelling. Single detached houses have a predicted median house price about 53% higher and apartments 21% higher.

Note that while the absolute price of homes have increased between 2001 and 2006 (the year of the report), the value of houses in relation to one another has likely remained relatively stable over that same time period.

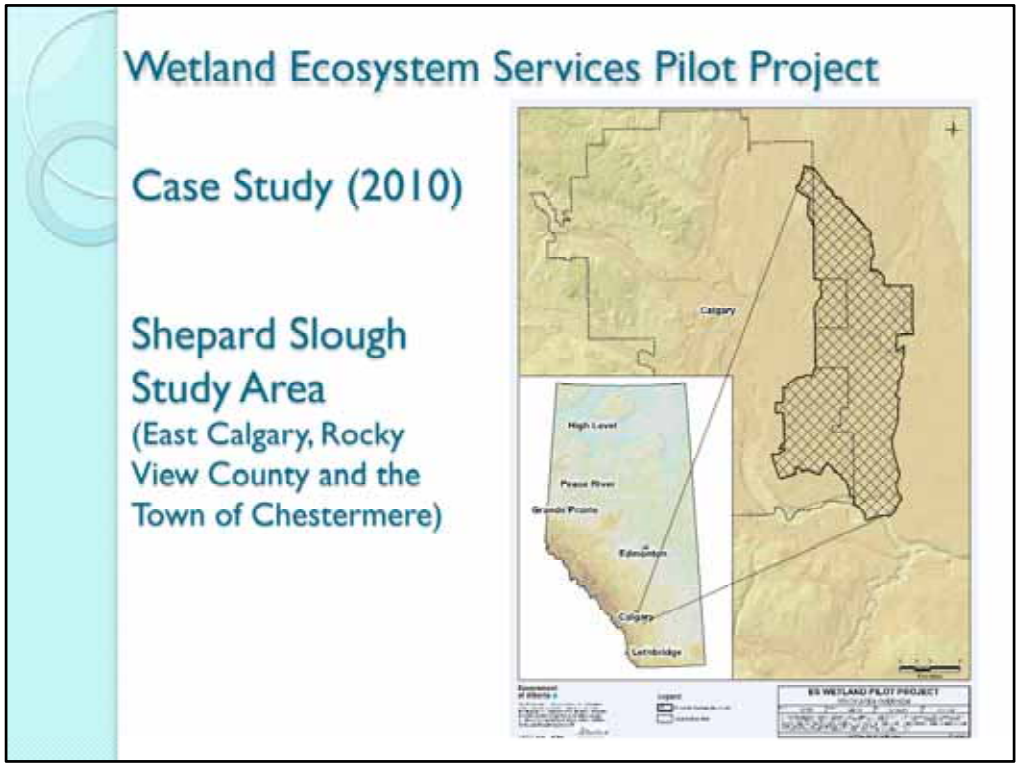
Source: AMEC Earth & Environmental for River Valley Alliance. October 2006. *The Current Status of Natural, Social and Economic Capital in the North Saskatchewan River Valley.*



Similarly, in Sherwood Park, developers have been able to charge high premiums of 30 to 40% for lots overlooking wetlands, much higher in fact than premiums of 12 to 20% for lots backing onto golf courses or other high activity parks such as sport fields or playgrounds. Privacy, less noise and viewscapes seem to drive higher prices for lots backing onto wetlands.

Reference:

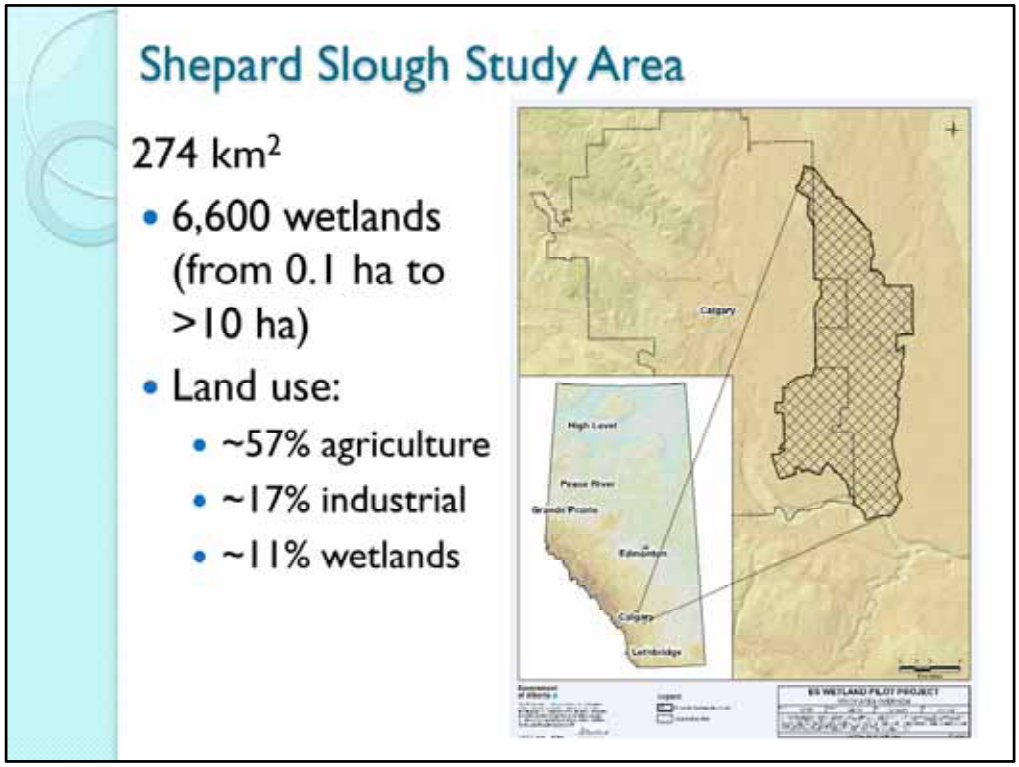
Healthy Parks, People, Communities. Assessing the Proximate Value of Parks and Open Space to Residential Properties in Alberta. July 2007. ARPA
Available from - http://s3.arpaonline.ca/docs/Proximate-Value-2007.pdf



One of the most comprehensive Ecosystem Services Pilot Projects done recently was in the Calgary Region for Alberta Environment and Sustainable Resource Development in the Shepard Slough Study Area.

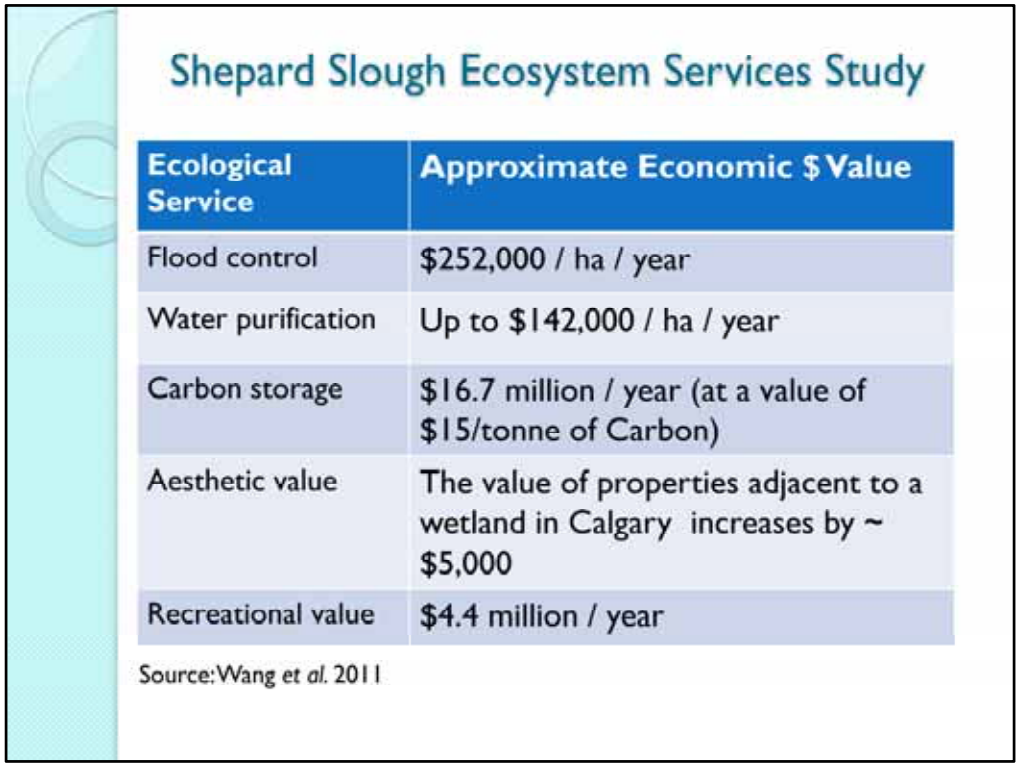
The Shepard Study Area encompasses the east part of the City of Calgary, Rocky View County and the Town of Chestemere. The Study focused on assessing the benefits people acquire from wetlands in a quote "qualitative, quantifiable and comparable" way.

Reference: Wang *et al.* 2011. Ecosystem Services Approach Pilot on Wetlands Economic Valuation Technical Report**.** Alberta Environment and Sustainable Resource Development. http://environment.gov.ab.ca/info/library/8684.pdf



The study area has more than 6,000 wetlands in a 274 km2 area.

Reference: Wang *et al.* 2011. Ecosystem Services Approach Pilot on Wetlands **Economic Valuation Technical Report.** Alberta Environment and Sustainable Resource Development. http://environment.gov.ab.ca/info/library/8684.pdf



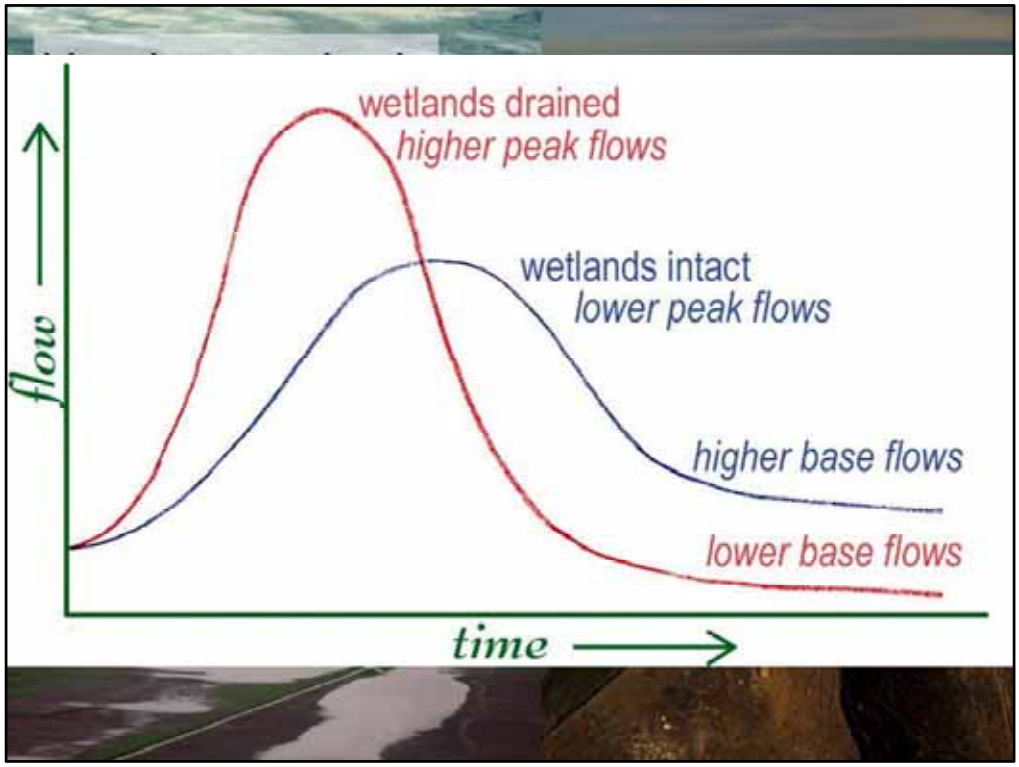
The study concluded that ecosystem services in the project area amounted to several hundreds of thousands of dollars / ha / year worth of flood control and water purification benefits in addition to providing nearly $17 million / year in carbon storage and over $4 million / year in recreational value.

Reference: Wang *et al.* 2011. Ecosystem Services Approach Pilot on Wetlands Economic Valuation Technical Report. Alberta Environment and Sustainable Resource Development. http://environment.gov.ab.ca/info/library/8684.pdf

Unfortunately, given their tremendous natural capital values, wetlands are becoming a vanishing feature of our landscape.

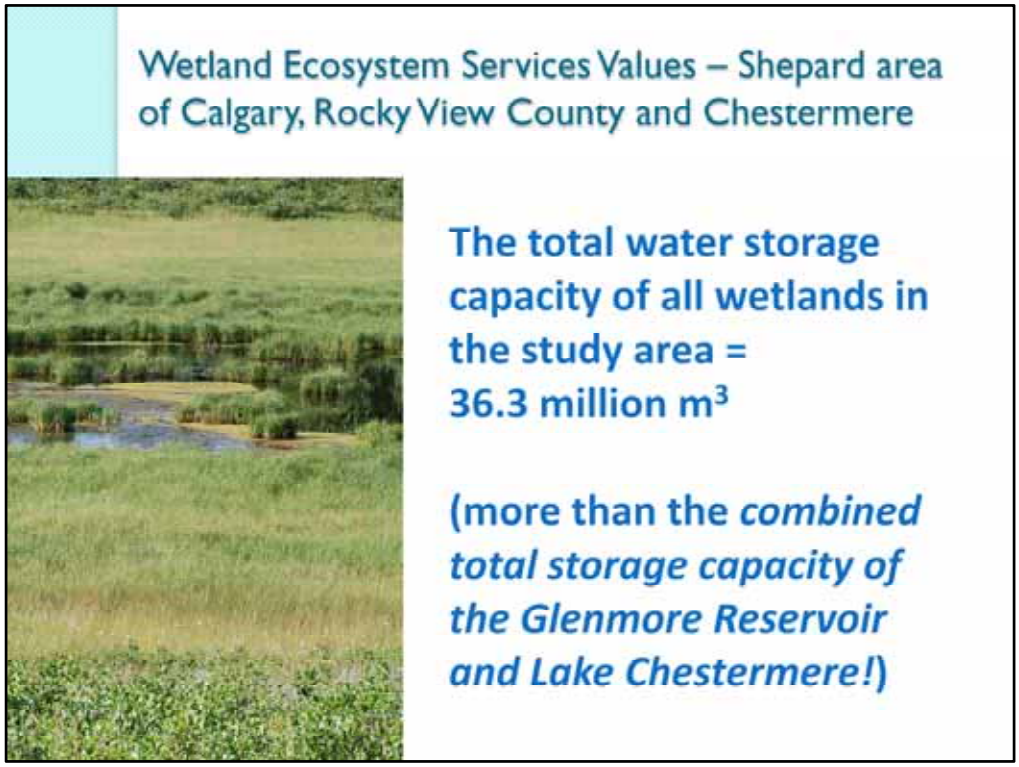
Ducks Unlimited estimates that in the southern settled part of the province we have already lost more than 65% of our wetlands. Wetland loss continues provincially at a rate of approximately 0.3% per year. (http://www.ducks.ca/how-you-can-help/be-voice/alberta/)

Reference: http://www.ducks.ca/how-you-can-help/be-voice/alberta/alberta-wide-wetland-policy/



Without wetlands, water flows off the landscape much more quickly contributing to increased flood risks.

(Graph shows a general conceptual overview of changes to peak flows when wetlands are drained compared to landscapes with intact wetlands).



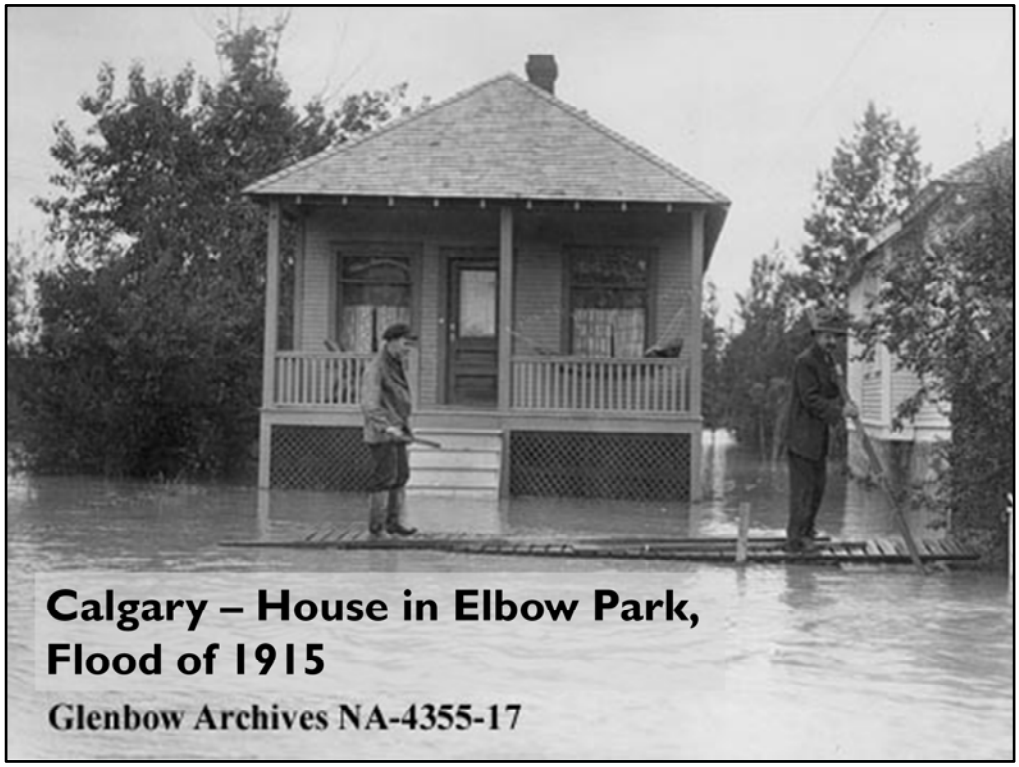
It was estimated that wetlands in the Shepard study area have a storage capacity of more than 36 million cubic meters of water. This is more than the storage capacity of Lake Chestermere and the Glenmore Reservoir combined. Keeping this in mind, wetlands are a critical part of our natural flood mitigation infrastructure. They may not prevent floods but they can attenuate flood impacts.

Reference: Wang *et al.* 2011. Ecosystem Services Approach Pilot on Wetlands **Economic Valuation Technical Report.** Alberta Environment and Sustainable Resource Development. http://environment.gov.ab.ca/info/library/8684.pdf

Another way of looking at the natural capital value of maintaining healthy intact riparian areas is to consider the costs and liabilities of NOT adequately protecting them, as we have unfortunately done with how we have over time built up many of our cities and towns in the Calgary region.

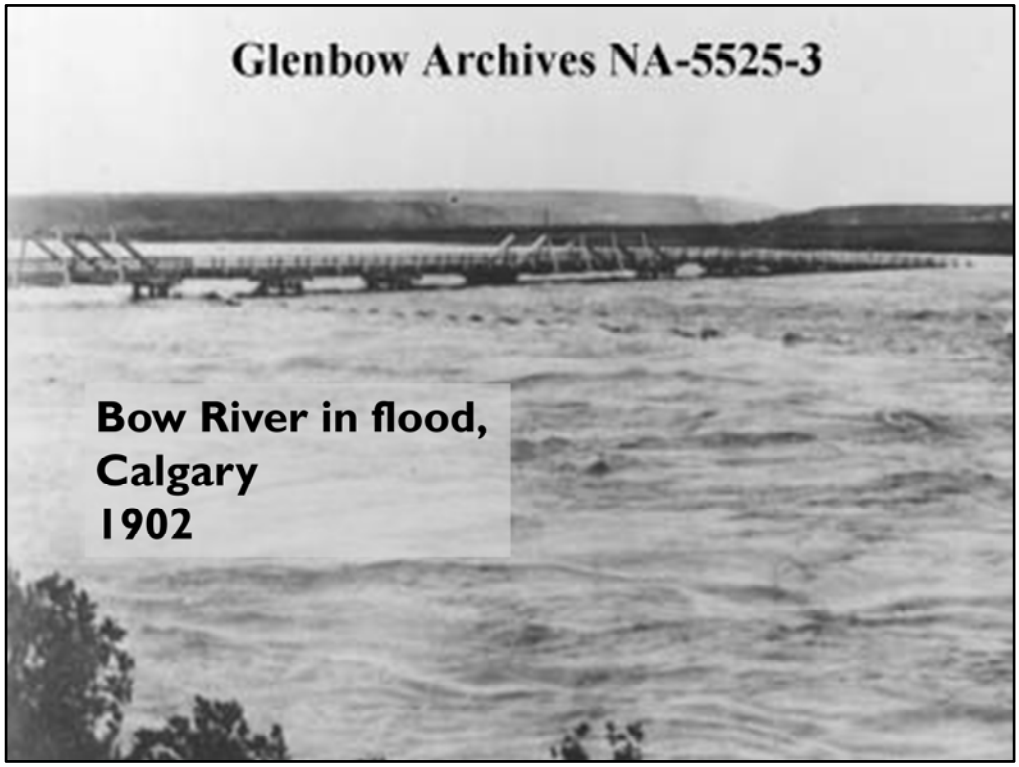
The price tag from the 2013 massive flood event has been pegged at $6 billion and rising. A truly staggering number. To many, such as those in the community of High River, the nightmare from this event is not yet over. Perhaps the real tragedy of this disaster is that much of this damage could have been prevented with more careful planning early on in Calgary's history and in surrounding jurisdictions had we paid more attention to warnings from historical flood events.

Flood headlines in Calgary are not unprecedented. Here we see the cover of the June 2, 1929 edition of the Calgary Herald. The photograph below of the Calgary Stampede in flood at that time looks eerily familiar to 2013 newspaper photographs.



Major floods have in fact hit Calgary several times such as in 1915

File number: NA-4355-17
Title: House in Elbow Park, during flood of Bow River, Calgary, Alberta.
Date: 1915



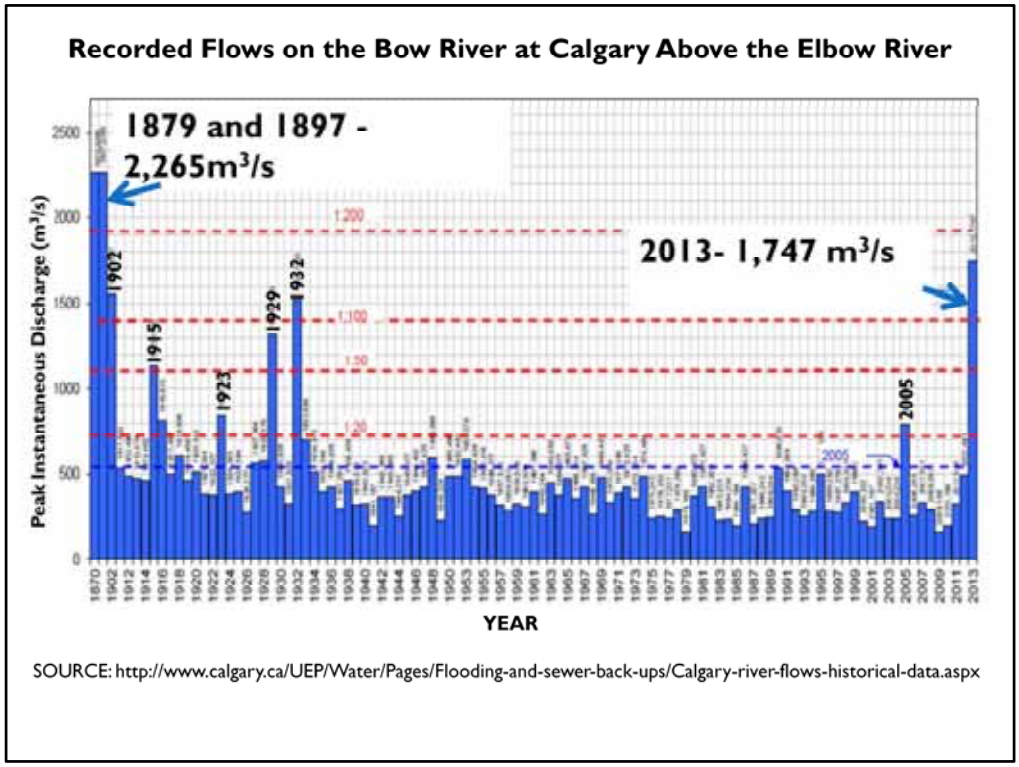
and in 1902.

Glenbow Archive Record:
Title: Bow River in flood, Calgary, Alberta.
Date: July 1902
Remarks: Looking north-westerly at Bow marsh Bridge from south shore. Eau Claire log channel in foreground.

Bow River, Calgary in Flood - 1897

One of the worst floods to hit Calgary dates back much further to 1897.

File number: NA-5525-2
Title: Bow River in flood, Calgary, Alberta.
Date: June 18, 1897

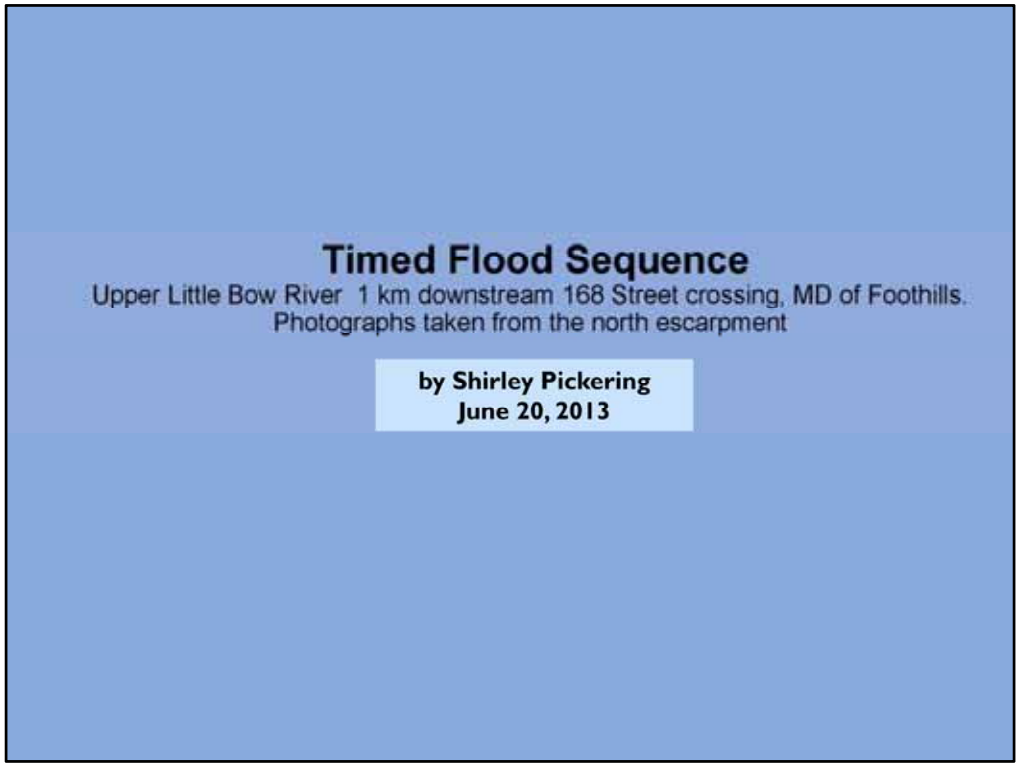


As you can see from this graph showing recorded flows on the Bow River at Calgary above the Elbow River, with the minor exception of 2005, since 1932 we have enjoyed a period of relative stability. Worryingly meteorologists tell us that this period of stability has been somewhat of a fluke, with periodic floods being more the norm. This long period of stability drew us in closer to the river and in so doing put more people in harms way.

Background information:
There are four dams located along the mainstem of the Bow River upstream of Calgary (Kananskis Falls, Horseshoe Falls, Ghost and Bearspaw dams), and an additional five hydroelectric facilities / dams located along tributaries of the Bow River. These dams have attenuated flood impacts; however, flood recurrence analysis for the unaltered, free flowing, Highwood River (with no dams) in the Bow River basin, shows a similar decline in flood recurrence from 1932 to the mid 1990s. Rood *et al.* 1999 suggest that part of the change in flood recurrence magnitude for this period is "due to weather patterns that produced fewer floods in the past half-century throughout the Bow River basin".

Reference:

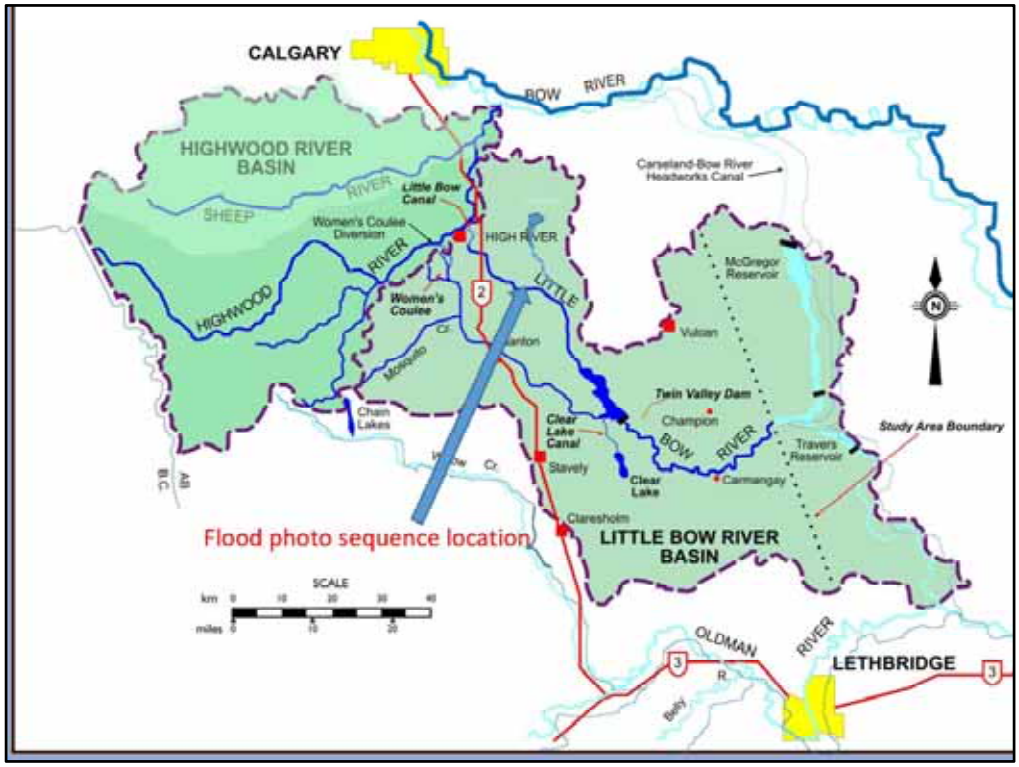
1) http://www.calgary.ca/UEP/Water/Pages/Flooding-and-sewer-back-ups/Calgary-river-flows-historical-data.aspx
2) Rood, S.B., K. Taboulchanas, C.E. Bradley and A.R. Kalischuk. 1999. Influence of flow regulation on channel dynamics and riparian cottonwood recruitment along the Bow River, Alberta. Rivers 7:33–48.
3) http://www.parc.ca/rac/fileManagement/upload/Hydroclimatic%20Variability_South%20Saskatchewan_River_Basin_%20March10.pdf



Because it originated in the headwaters of the rocky mountains, the flood of 2013, was a flood that happened fast and furiously.

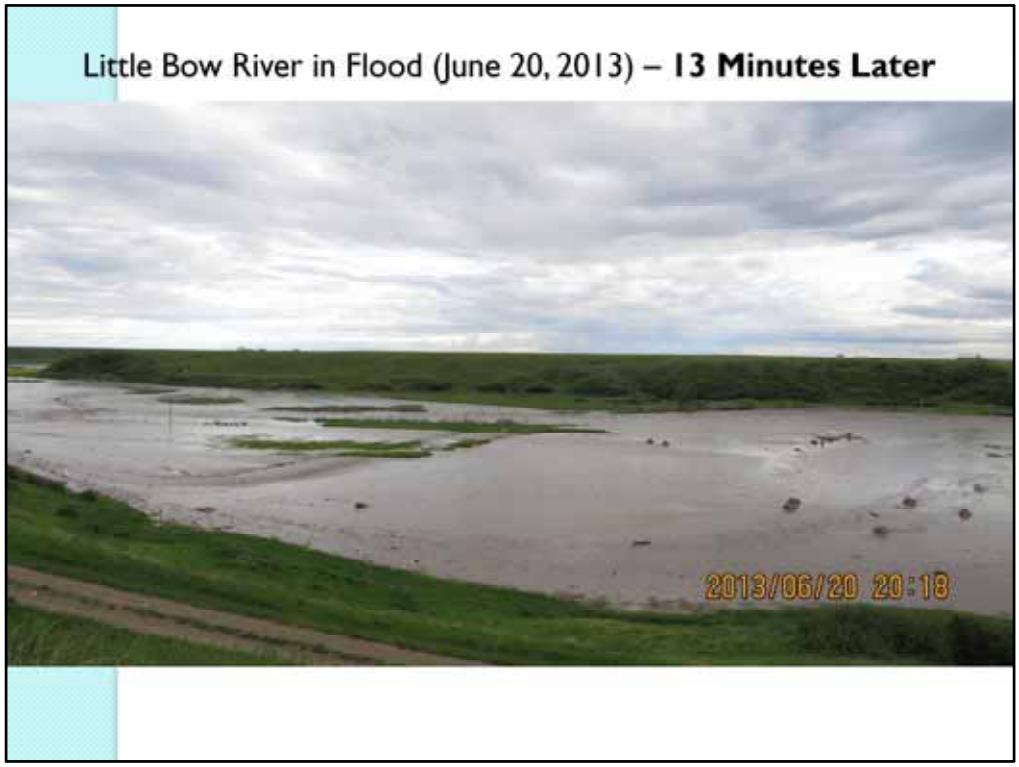
You can see this very well in the next series of flood images graciously given to me by Shirley Pickering a recent Emerald Award recipient for her work with watershed groups and advisory councils.

(Shirley Pickering is known for her work with the Oldman Watershed Council (OWC); she has been involved in many water and stewardship groups, such as the Upper Little Bow Basin Water Users Association and the Highwood Management Plan Public Advisory Committee.)



Shirley took these images from her vantage point on an escarpment overlooking the Upper Little Bow River downstream from High River

Here at 20:05 pm you can start to see the Little Bow River starting to overtop its banks.



Just 13 minutes later this is what the floodplain looked like

And this is what it looked like just 48 minutes later.

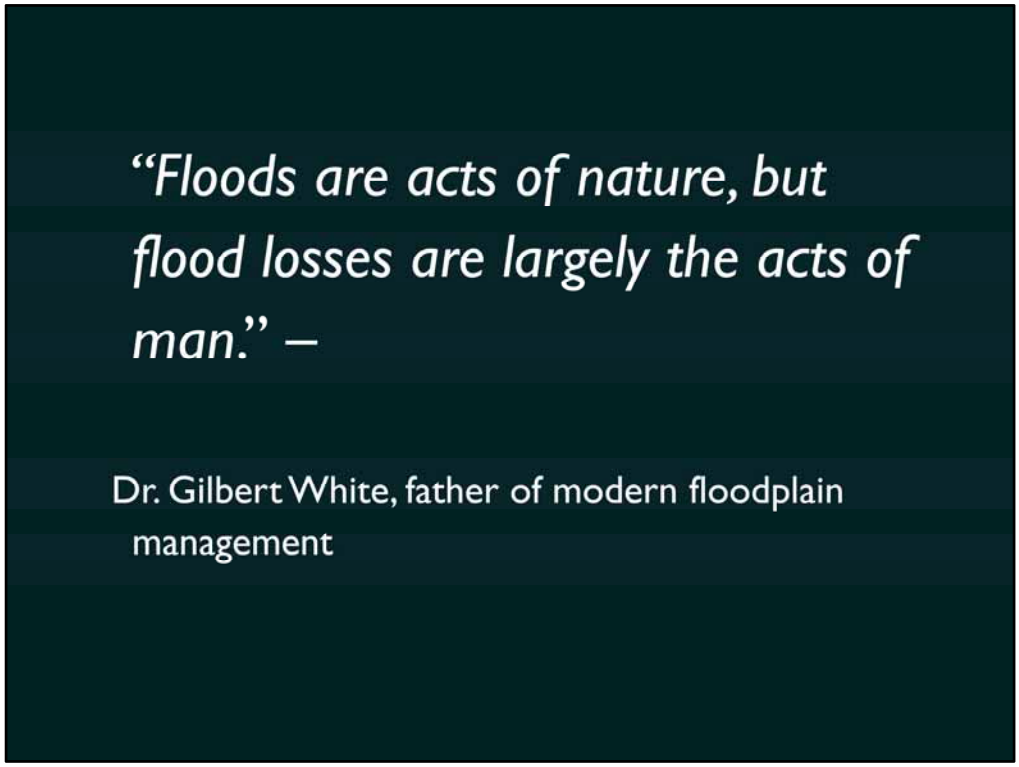
Shirley recounts that many people barely made it out in time and struggled to get their farm animals out as well. Had this flood struck at midnight my fear is the death toll of this flood could have been far worse.

Some of the most severe and alarming damage from the 2013 flood was seen in the upper headwaters such as in Benchlands northwest of Calgary along the Ghost River.

And in Bragg Creek along the Elbow River. Here you see before and after photographs showing just how easily floodwaters ripped through a rock riprap berm.

We also saw severely impacted riverbank reaches in Calgary particularly along portions of the Elbow River such as here opposite the Calgary Stampede grounds.

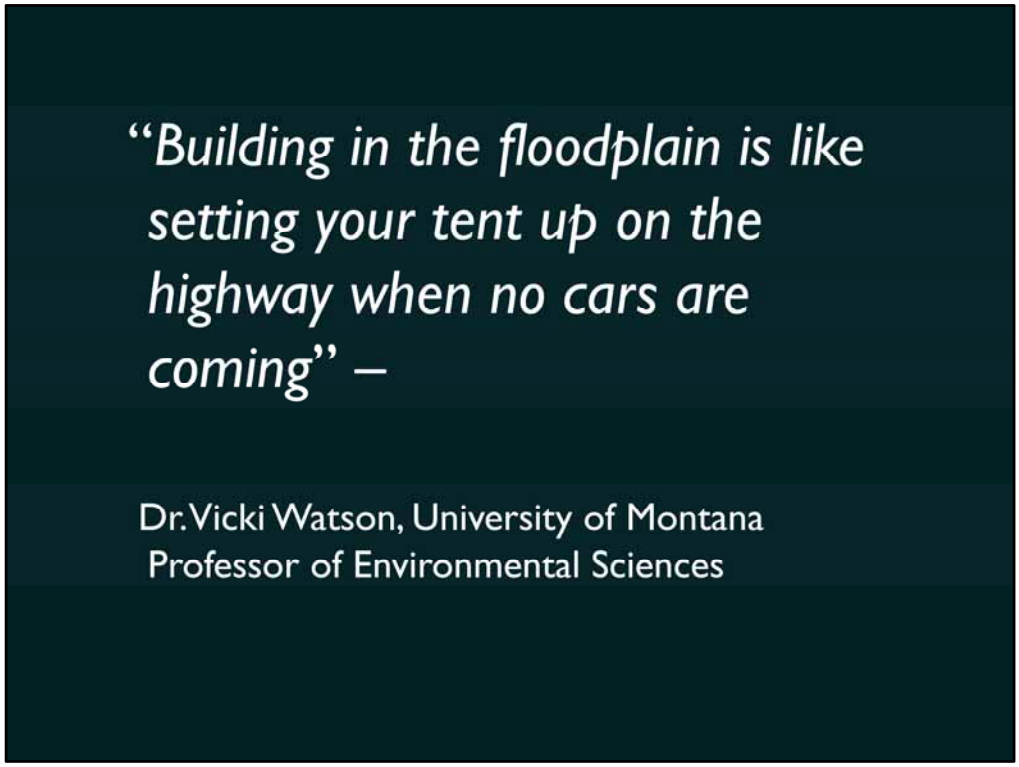
Most pedestrian bridges and small road bridges were entirely washed out or severely damaged along the Elbow River in Calgary.



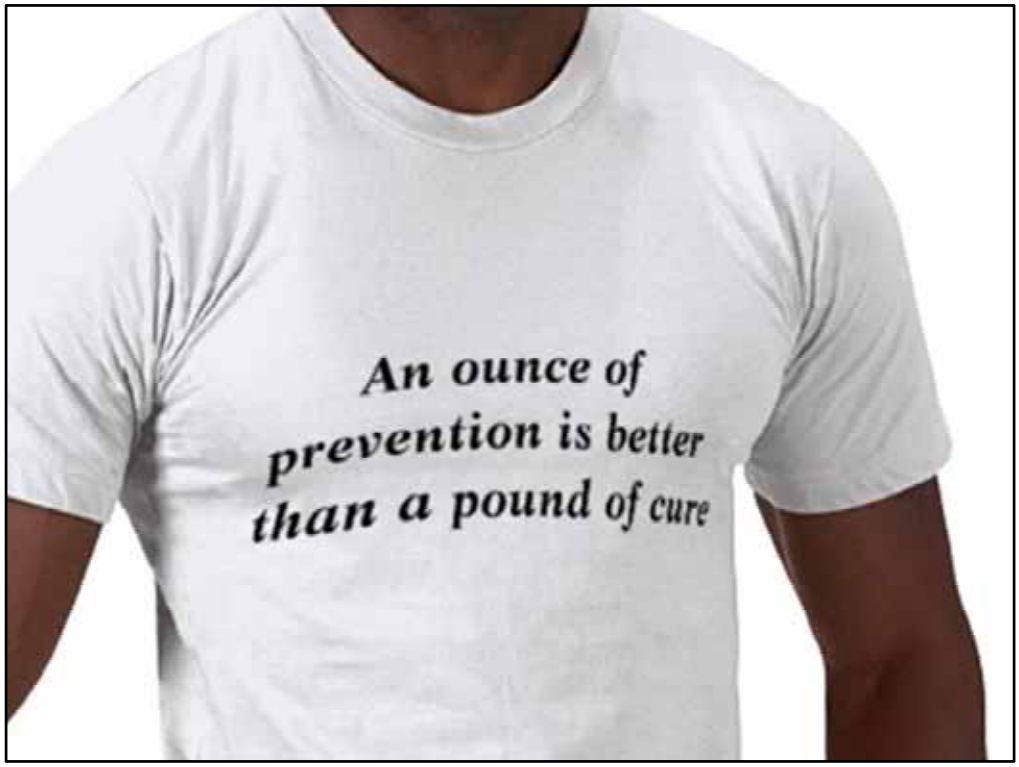
One thing to remember when it comes to flooding is that floods have happened periodically for thousands of years and will continue to happen as part of a natural cycle. Floods in and of themselves are not a bad thing. They help to replenish groundwater aquifer reserves and they have other renewal benefits to natural systems. It is where we have chosen to build that has gotten us into trouble.

As Dr. Gilbert White once said *"Floods are acts of nature, but flood losses are largely the acts of man*." –

(Background: Gilbert White was Gustavson Distinguished Professor Emeritus of Geography at the University of Colorado at Boulder, a position he held since 1980. Prior to that, from 1970 to 1978, he was Professor of Geography and the Director of the Institute of Behavioral Science at the university. He founded and directed the university's Natural Hazards Research and Applications Information Center from 1976 to 1984 and served as director again from 1992-1994. In May 2006 he received an honorary degree from CU.)



Or as Dr. Vicki Watson from the University of Montana more bluntly puts it - "*Building in the floodplain is like setting your tent up on the highway when no cars are coming*"



When it comes to avoiding flood damage, As the saying goes…. “An ounce of prevention is better than a pound of cure” and so it is with having and maintaining intact riparian areas within our cities and towns as well as in our headwater watersheds.

Where we saw the least amount of damage in Calgary from the 2013 flood is where we have intact riparian parks such as Edworthy Park along the Bow River as shown by these pre- and post- flood photographs.

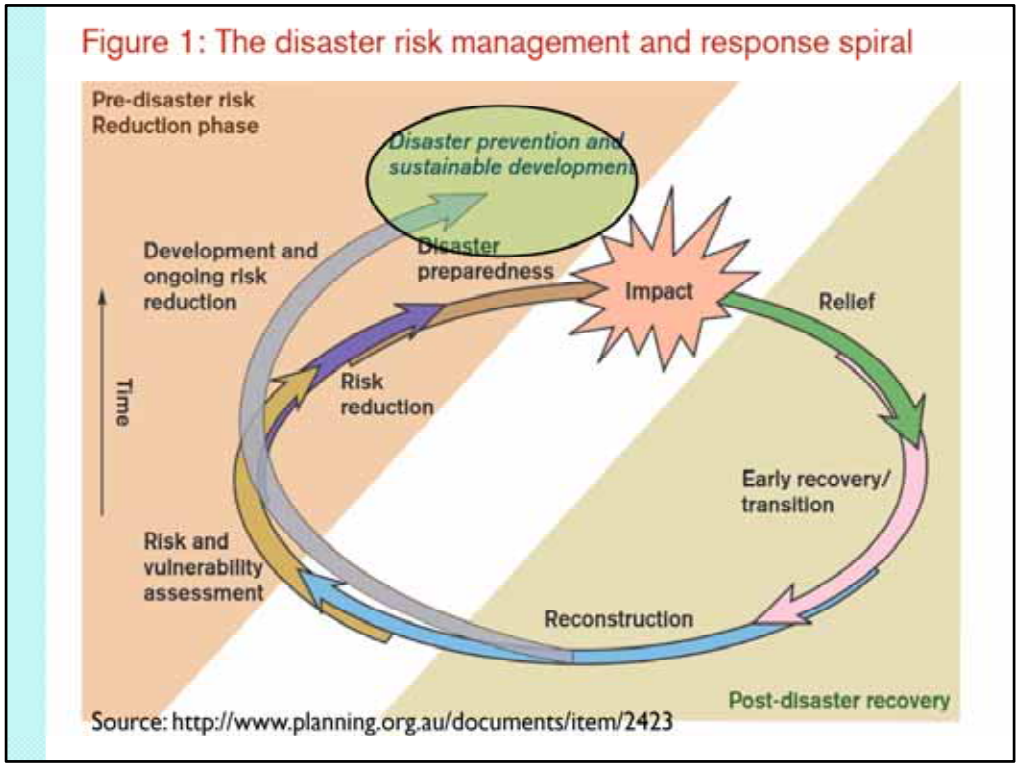
Similarly all of this silt and woody debris shown here did little damage to a natural area like Beaverdam Flats park along the Bow River downstream from the confluence with the Elbow River. In fact all of this organic material will break down, rebuild soils and naturally promote plant growth.

Here we see a positive benefit from flooding in the Inglewood Bird Sanctuary – in the foreground are thousands of little balsam poplar seedlings. Similar observations were made at several other sites along the Bow River in Calgary along new gravel bars and also along other scoured floodplain surfaces.

Until now we have been concerned for the long-term health and survival of aging poplar forests along the Bow River in Calgary. Ongoing research and monitoring of balsam poplar post-2013 flood recruitment and survival in Calgary is being done by Dr. Stewart Rood, an expert in ecophysiology of river valley cottonwoods, river regulation and restoration based out of the University of Lethbridge.

Background information: Balsam poplars require specific conditions for seedling germination and growth including scoured bare soils, abundant soil moisture and a lack of flooding during the post establishment period. Earlier studies show that compared to reaches of the Bow River below the confluence with the non-dammed Highwood River, fluvial geomorphic processes along the Bow River through Calgary have been influenced by flow stabilization and upstream damming (Rood *et al.* 1999). These factors contributed to reduced channel movement, braiding and island occurrence by 1991. This in turns has reduced suitable nursery sites for recruitment of riparian poplars.

Reference: Rood, S.B., K. Taboulchanas, C.E. Bradley and A.R. Kalischuk. 1999. Influence of flow regulation on channel dynamics and riparian cottonwood recruitment along the Bow River, Alberta. Rivers 7:33–48.

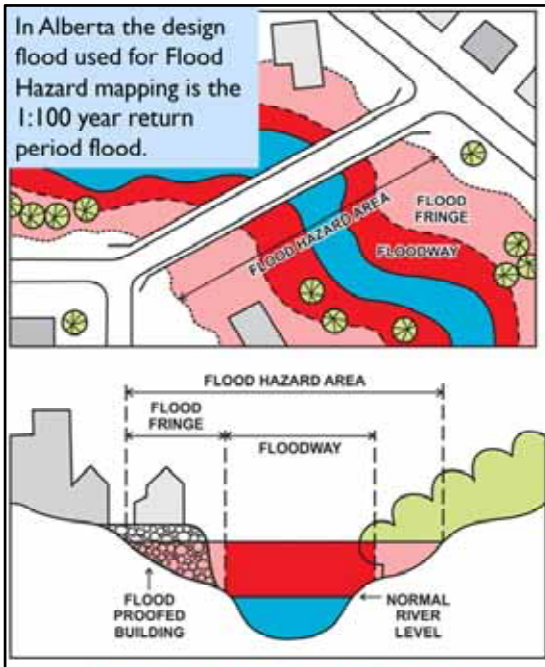


Recognizing that floods will keep happening, is it possible to get ourselves out of a perpetual flood impact cycle and set ourselves onto a safer course? Of course we cannot pick up and move downtown Calgary, but we do need to be considerate with where we build future developments. If we simply react to flood damages by building things exactly as they were before, we will find ourselves more than likely in a perpetual flood impact cycle.

Slide credit - *The Built Environment Professions in Disaster Risk Reduction and Response A guide for humanitarian agencies;* http://www.planning.org.au/documents/item/2423

For example, where possible, wider span bridges are a better long-term solution for reducing potential future flood damages for situations like this one. Re-building berms (as we see here) and maintaining existing shorter span bridges, constricts floodwater flows in the future, creating potential for future erosive impacts.

Simply rebuilding structures as they were pre-flood, in many cases may lead to similar flood-damages in the future. As Hobb's says, "the problem with the future is that it keeps turning into the present".



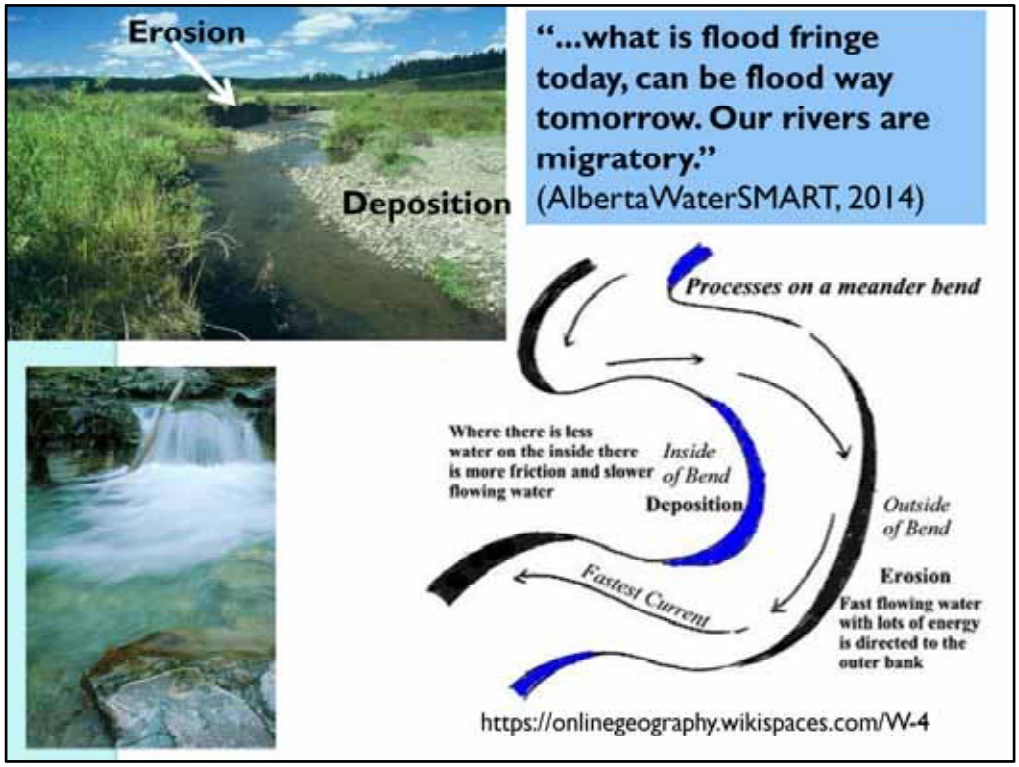
Source: http://esrd.alberta.ca/water/programs-and-services/flood-hazard-identification-program/flood-hazard-mapping.aspx

Floodway - The portion of the flood hazard area where flows are deepest, fastest and most destructive. The floodway typically includes the main channel of a stream and a portion of the adjacent overbank area. New development is discouraged in the floodway.

Flood Fringe - The portion of the flood hazard area outside of the floodway. Water in the flood fringe is generally shallower and flows more slowly than in the floodway. New development in the flood fringe may be permitted in some communities and should be flood-proofed.

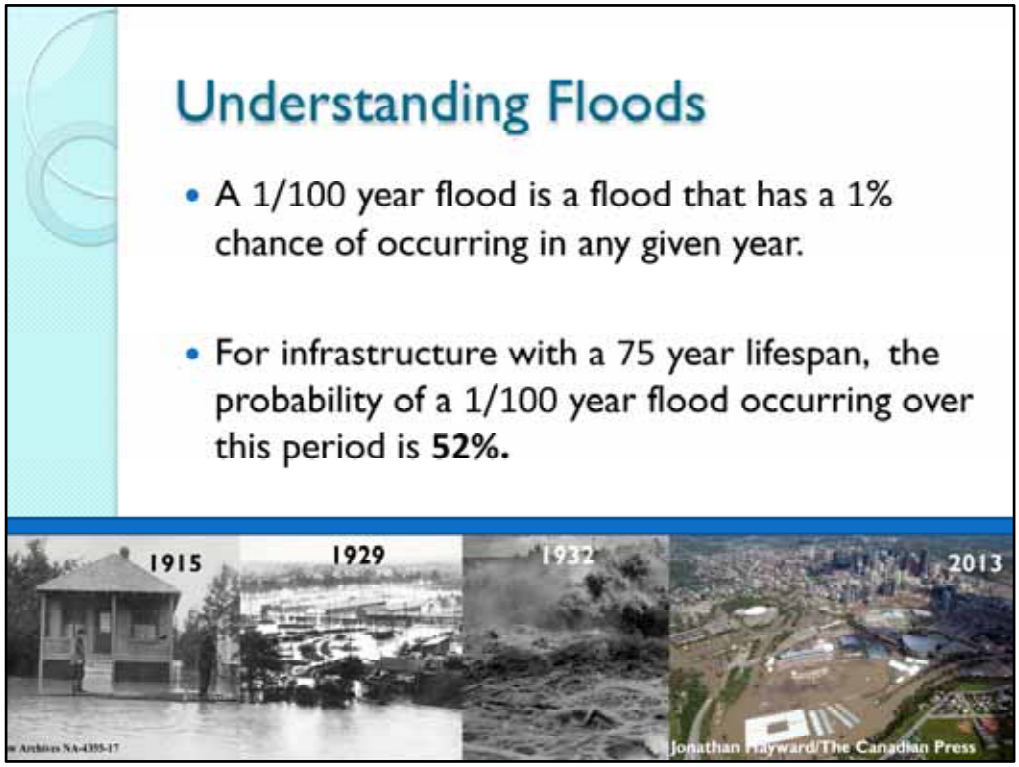
Overland Flow (Flood Fringe) - Areas of overland flow are part of the flood hazard area outside of the floodway, and are typically considered special areas of the flood fringe.

Under our current system in Alberta, there are development restrictions in the floodway – which is shown here in red – this is where floodwater flows are expected to be deepest, fastest and most destructive (i.e. More than 1 m in depth and flowing faster than 1 m/s). New development in the outer flood fringe – shown here in pink is generally permitted if buildings are appropriately flood-proofed.



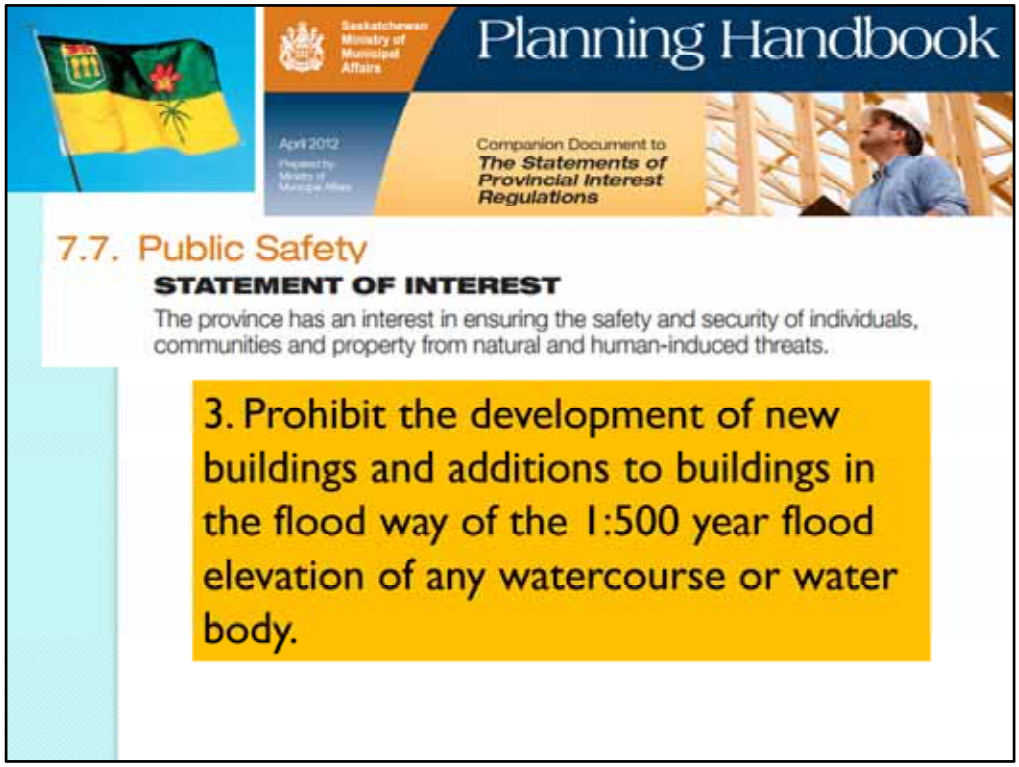
One of the flaws with this system is that what is flood fringe today can be floodway tomorrow due to channel migration processes.

A fundamental characteristic of meandering streams and rivers is that they are not static – these systems shift over time within a wide floodplain through the processes of erosion and deposition. As water flows downhill under the influence of gravity it has energy that allows it to erode and to deposit eroded material. Erosion will progress gradually along outside bends that are subject to fast flowing waters and eroded material will be deposited on slower flowing inner bends creating point bar features where we see willows establish and take hold. Essentially this means we loose land in places but gain land downstream. So where a river and stream channel is today is not where it will be in 5 or 10 years from now under the influence of continual erosion and deposition.



Another thing to remember when it comes to flooding is that a 1:100 year flood actually has a 1% chance of occurring in any given year. This may not sound like much. But what this means is that for infrastructure with a 75 year lifespan, the probability of a 1/100 year flood occurring over this period is **52%.**. So while developers may shoulder little short term risk for building in the floodplain, the rest of society shoulders tremendous risk over the long-term.

Mathematical probability equation:
If the annual event occurs with probability "p" then the chance that it will occur at least once in "n" years is 1 – (1-p)^n. (intuitively, it represents 100% minus the probability that the event does not happen every single year) – Credit: Dan Calistrate



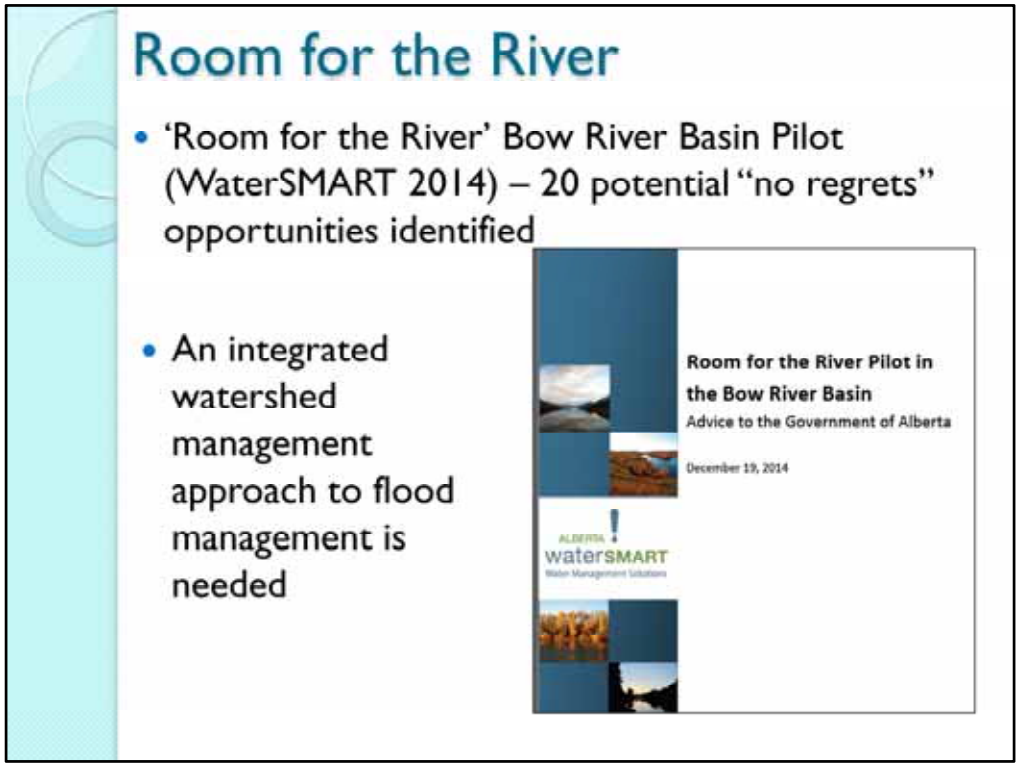
In speaking with Dwight Mercer, a senior planning professional based in Saskatchewan with more than 32 years of experience, it is exactly this type of risk analysis that prompted jurisdictions such as Saskatchewan to push for higher flood protection standards by requiring that developers abide by a 1:500 year flood design standard.

Source: http://www.saskatchewan.ca/government/municipal-administration/community-planning-land-use-and-development/resources/statements-of-provincial-interest

European cities such as in the Netherlands have been coping with flood disasters far more extreme and dire than what we have yet experienced in Alberta and for a much longer period.

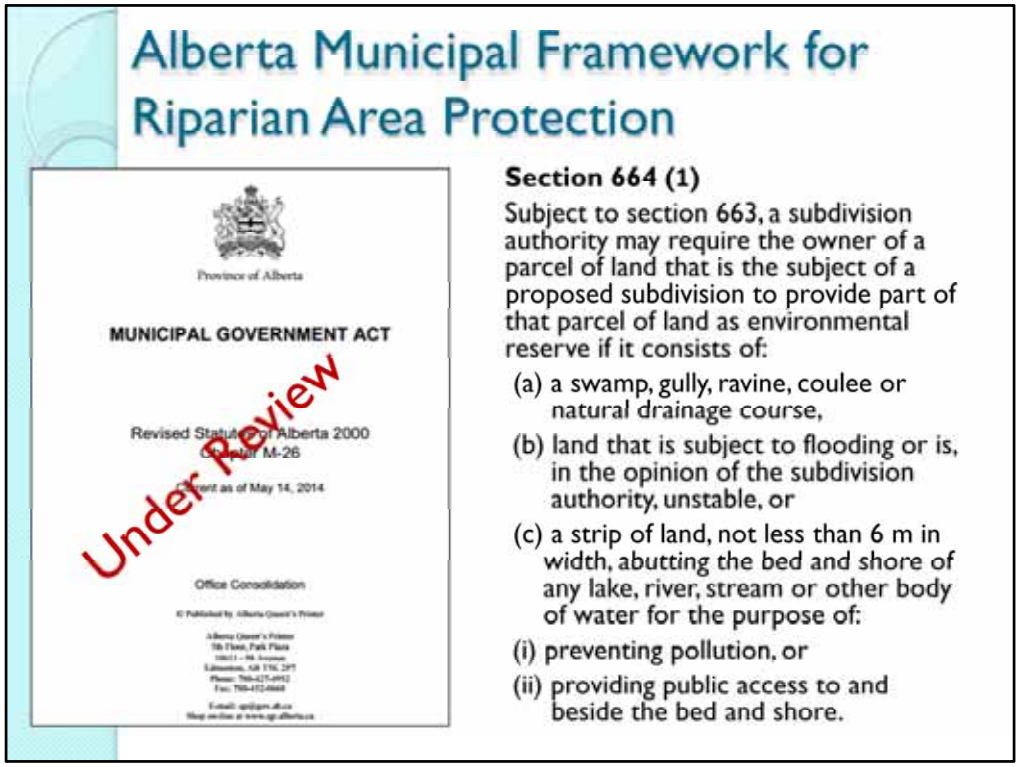
All of this experience has taught them, that giving more room to the river works out to be in the greater public interest. Under their *Room for the River program*, the Netherlands is looking to return over 4000 ha of land back to the river floodplain with the intent to reduce peak flow levels and thereby reduce flood damages downstream. They have understood the principle that floodplains are our best insurance policy they offer a place to store excess water and a safety valve for dispersing energy – reducing potential damages downstream

(Background: "The Netherlands lie at the downstream end of the major river catchments of Rhine and Meuse Rivers. These rivers are prone to high discharges during winter periods that lead to high water levels in Dutch rivers. The area available for Dutch rivers has decreased continually during the past centuries. The rivers are confined by increasingly higher dykes behind which more people are now living and the land is gradually subsiding. In addition, rivers are expected to discharge a continually increasing volume of water due to climate change." - source: https://www.mottmac.com/article/2362/room-for-the-river-netherlands)



Alberta WaterSMART just recently put out a report with advice to the Government of Alberta based on highlighting what we can learn from the Netherland's Room for the River approach. The report highlights for example the need for an integrated watershed management approach to flood management.

http://calgaryherald.com/news/local-news/room-for-the-river-report
http://albertawater.com/how-is-water-governed/what-is-room-for-the-river



Currently, our municipalities have obligations under the Municipal Government Act (MGA) to establish development and or environmental reserve setbacks to avoid flood prone or unstable areas as an example. The MGA is currently under review and public consultation was done on it just last year.

Background information:

Municipal Government Act Review Summary of Input and Identified Issues - Exert of applicable issues related to Reserve lands under the MGA:

SOURCE: Developed by KPMG for Alberta Municipal Affairs July 31, 2014 (**DIRECTLY COPIED FROM http://mgareview.alberta.ca/wp-content/upLoads/media/Input-and-Issues.pdf)**

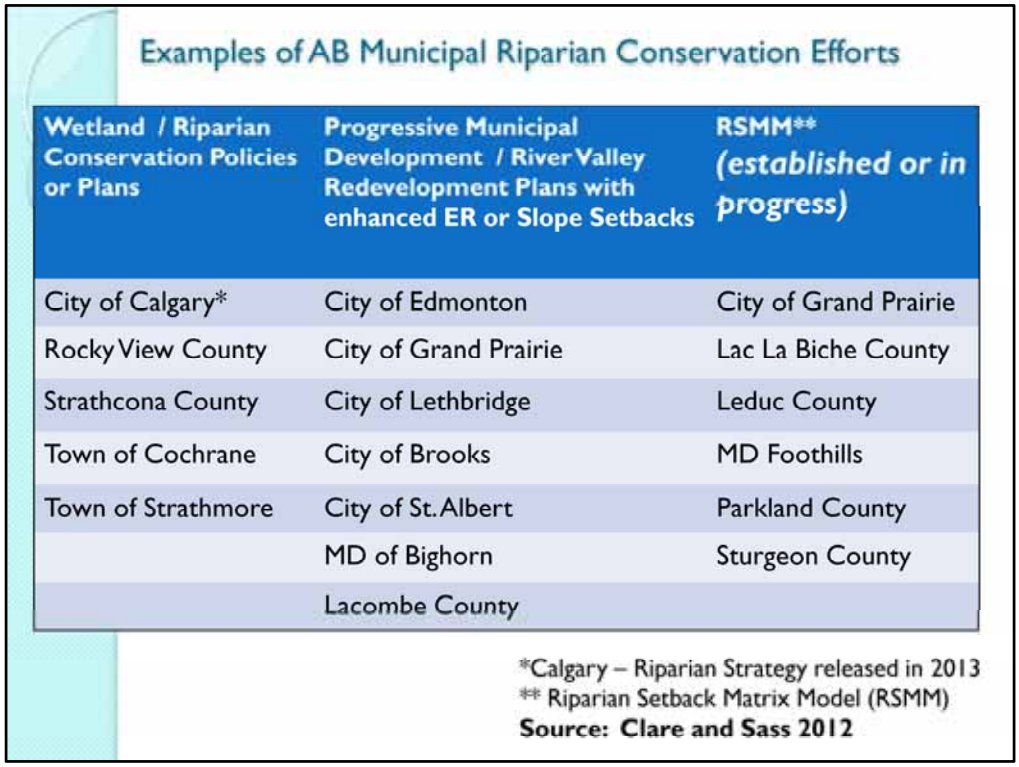
Reserve Land Dedication: *Should municipalities be given more flexibility in requesting land from developers?*
Status quo: *During the subdivision application process, municipalities can require up to 10% be dedicated as reserve land without compensation to the developer; however the land dedication process is not always appropriate in ensuring that there is enough suitable reserve land dedicated. During redevelopment, no additional land can be dedicated.*
Option 1 - *Municipalities can require that up to 10% can be dedicated as reserves. Enable municipalities to require land dedication during redevelopment.*
Option 2 *- Establish a new basis for reserve dedication related to the number of households created in the plan. Do not allow land dedication for commercial and industrial subdivision purposes.*

Permitted Uses of Reserve Lands: *Should municipalities be given freedom to use reserve lands that have been provided by developers with no compensation, as they deem appropriate?*
Status quo*: The MGA limits what municipalities may use various types of reserve land for (e.g. public park, school, buffer purpose,etc.).*
Option 1 - *Expand the scope to allow municipalities more flexibility in the uses of reserve land, but limit these uses for public use only.*
Option 2 - *Expand the scope to allow municipalities more flexibility in the uses of reserve land and these uses can be for public use and for public-private partnership use that is complementary to public use (e.g. coffee houses in recreation centers, libraries).*

Environmental Reserve: *Should the purpose of ER be expanded to include lands that are environmentally sensitive or in need of protection?*
Status quo *- The MGA identifies situations where municipalities may require ER land dedication, and states that it is to prevent pollution and to provide public access to a body of water. In practice, ER is typically used for land not suitable for development.*
Option 1 *- Expand the purpose of "ER" for environmental conservation and define "body of water."*

Currently, Section 640 of the MGA is written as follows:
Section 664 (1)
Subject to section 663, a subdivision authority may require the owner of a parcel of land that is the subject of a proposed subdivision to provide part of that parcel of land as environmental reserve if it consists of
(a) a swamp, gully, ravine, coulee or natural drainage course,
(b) land that is subject to flooding or is, in the opinion of the subdivision authority, unstable, or
(c) a strip of land, not less than 6 metres in width, abutting the bed and shore of any lake, river, stream or other body of water for the purpose of
(i) preventing pollution, or
(ii) providing public access to and beside the bed and shore.

Where this legislation (the MGA) falls down is that it has led in many cases to putting people in harms way and compromising the health of our riparian areas by promoting largely arbitrary, insufficient riparian setbacks of only 6 m. It also falls down in offering no legal mechanisms to protect habitat or biodiversity values. Minimum setbacks as you can see in these Alberta example photographs do not adequately protect aquatic or terrestrial habitat or wildlife travel corridors.



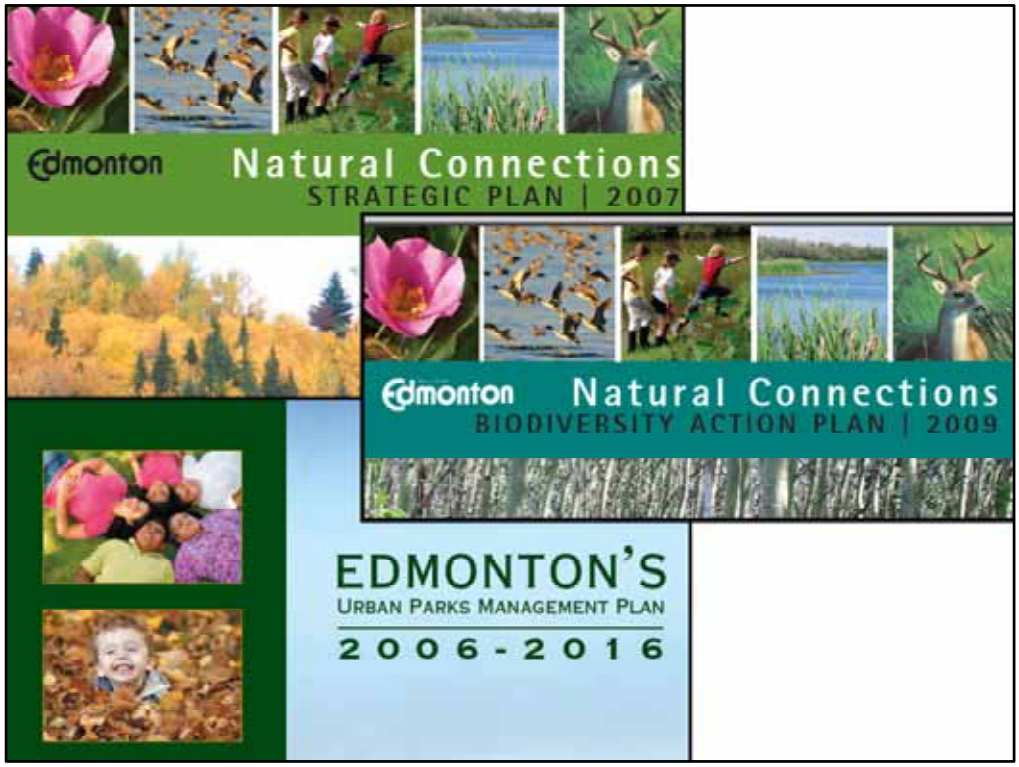
Examples of AB Municipal Riparian Conservation Efforts

Wetland / Riparian Conservation Policies or Plans	Progressive Municipal Development / River Valley Redevelopment Plans with enhanced ER or Slope Setbacks	RSMM** *(established or in progress)*
City of Calgary*	City of Edmonton	City of Grand Prairie
Rocky View County	City of Grand Prairie	Lac La Biche County
Strathcona County	City of Lethbridge	Leduc County
Town of Cochrane	City of Brooks	MD Foothills
Town of Strathmore	City of St. Albert	Parkland County
	MD of Bighorn	Sturgeon County
	Lacombe County	

*Calgary – Riparian Strategy released in 2013
** Riparian Setback Matrix Model (RSMM)
Source: Clare and Sass 2012

To account for some of these short comings and better protect our water bodies and water resources and associated riparian areas, many municipalities have been trying in recent years to raise the bar on riparian setbacks and riparian protection policies. For example, municipalities like Calgary, Rocky View County, Strathcona County and the Town of Strathmore have in place their own wetland and or riparian conservation policies or plans. Other municipalities are going toward a science-based tool to determine riparian setbacks. Others, like the City of Edmonton and the City of Lethbridge, have in place River Valley Redevelopment Plans with enhanced Environmental Reserve or Slope Setbacks that complement other strategic parks planning documents.

Reference: Clare, S. and G. Sass. 2012. Riparian lands in Alberta: Current state, conservation tools, and management approaches. Report prepared for Riparian Land Conservation & Management Team, Alberta Water Council, Edmonton, Alberta. Fiera Biological Consulting Ltd. Report #1163. (available from - http://www.awchome.ca/Projects/RiparianLandConservationandManagement/tabid/150/Default.aspx)

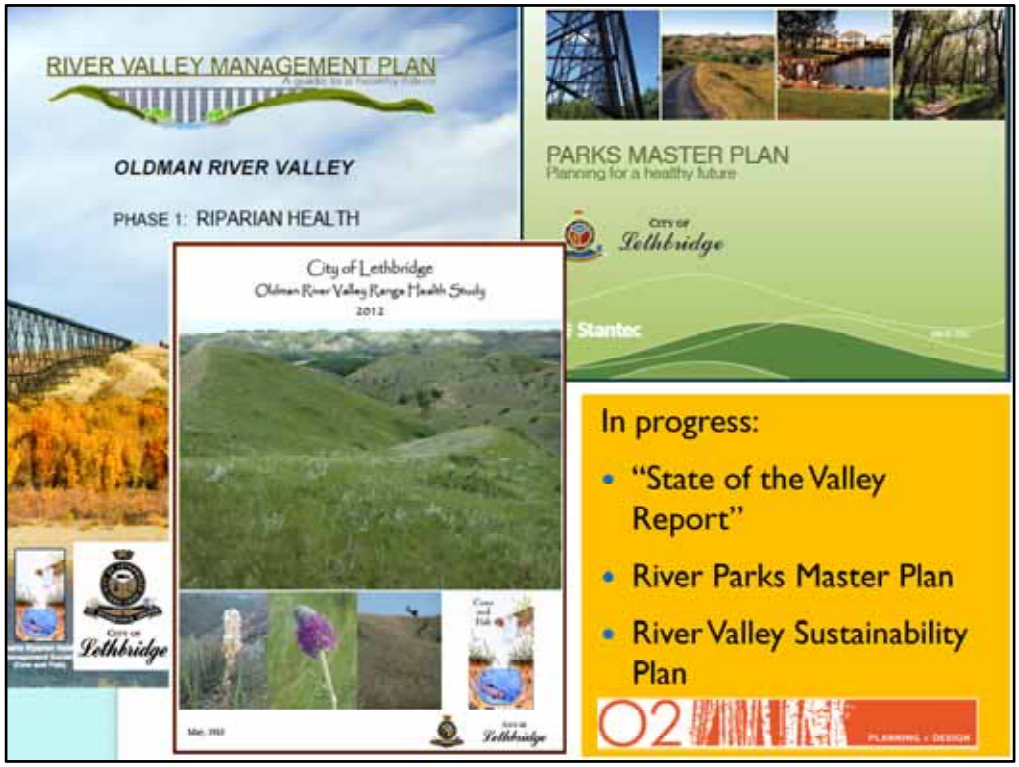


The City of Edmonton, for example, released in 2007 and 2009 respectively, its "Natural Connections Strategic Plan" and is "Natural Connections Biodiversity Action Plan". These documents form an important part of its newly released "Urban Parks Management Plan". All of these planning documents recognize the value of retaining protected networks of riparian areas and other green infrastructure. These plans build on from the "Ribbon of Green" concept plan prepared in 1990, which in turn builds on the initial vision laid out in the *North Saskatchewan River Valley Area Redevelopment Plan, Bylaw 7188*, as approved by City Council on February 26, 1985. The purpose of this founding Redevelopment Plan was to "protect the North Saskatchewan River Valley and Ravine System as part of Edmonton's valuable open space heritage and to establish the principles for future implementation plans and programmes for parks development..."

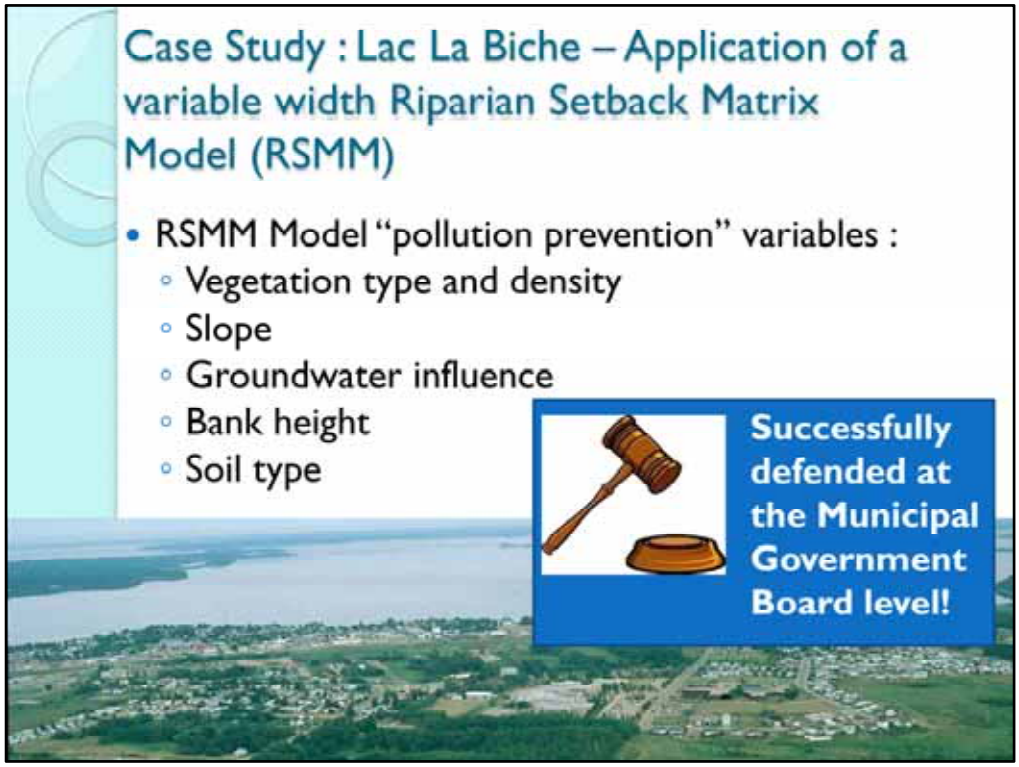
Sources:
http://www.edmonton.ca/city_government/documents/North_Saskatchewan_River_ARP_Consolidation.pdf
http://www.edmonton.ca/city_government/documents/PDF/UPMP_2006-2016_Final.pdf
http://www.edmonton.ca/city_government/documents/Natural_Connections_-_Strategic_Plan_JUNE_09.pdf
http://www.edmonton.ca/city_government/documents/Edmonton_Biodiversity_Action_Plan_Final.PDF

In 2007 the first Ecological Design Report was completed for the Big Lake Neighbourhood One in Edmonton that incorporated principles from the Natural Connections Plans. This neighbourhood was designed to "maintain and balance the highest possible levels of livability, ecological health and economic prosperity....", supporting the choice to practice sustainable living. Leta will also be talking about the LID innovations incorporated into the design of this Big Lake community in her presentation.

Source:
http://webdocs.edmonton.ca/InfraPlan/Consolidations/PDF%20Consolidations/Big%20Lake%20Neighbourhood%20One%20NSP%20Consolidation.pdf



The City of Lethbridge has had in place fairly stringent by-laws and plans since the 1970s to carefully restrict river valley developments and establish an impressive network of river valley parks. Cows and Fish has recently done riparian and range health inventories along the Oldman River Valley for the City of Lethbridge. This information is being integrated into an updated River Parks Master Plan and a River Valley Sustainability Plan being prepared by O2 Planning and Design. As part of this effort, O2 is modeling wildlife connectivity through the area as well as looking at existing recreation and development footprints in the valley to identify potential land use conflicts. The River Valley Sustainability Plan will be an internal city-document which will highlight management and monitoring recommendations for things like invasive species management, cottonwood maintenance, and setback policies.



An example of a municipality that has gone toward using a variable width riparian setback approach is Lac La Biche County.

Beginning in 2002, algal blooms and other water quality issues threatened the lake's appeal, potentially jeopardizing millions of dollars annually of outdoor based tourism activities (Hanneke Brooymans – Edmonton Journal, May 15, 2007). A Watershed Steering Committee was formed at that time to examine the problem and to find ways to reverse the alarming trends they were beginning to witness especially since several 1000 new lakefront lot developments were being proposed at that time.

At that time the MGAs 6 m minimum was the standard setback being applied to lakeshore developments. Looking for science-based solutions, Aquality Environmental Consulting was hired to examine the problem. A Riparian Setback Matrix Model created by Aquality was adopted by the local Council in 2007 – the model looks at things like vegetation type and density, slope, and soil type to determine what setback would appropriately allow for pollution prevention such as nutrient filtration, uptake and capture of sediments and bacteria.

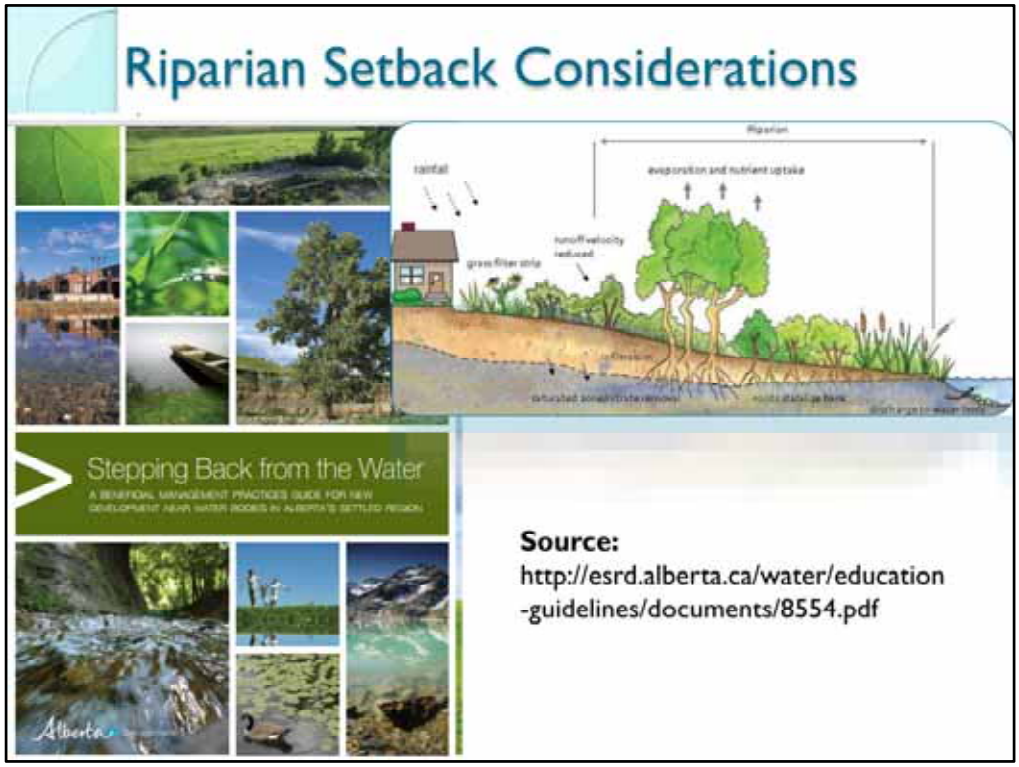
Early on this tool was challenged at the Municipal Governance Board level at least twice. *In both cases, the Board ruled in favour of the County because of the scientific basis of the assessment*. In speaking with Barry Kolenosky with Lac La Biche county recently, it appears that this tool is now very well accepted and it is rarely challenged anymore. The county is looking to apply this more widely, not just to subdivision applications but also on an individual lot basis. They are amending their Developer's Guide that accompanies this tool and they are working on developing an ER encroachment BYLAW.

Background -
The policy is jointly implemented by the Planning and Development department and by the Environmental Services department. A companion Developer's Guide and Backgrounder was developed to support the implementation of the RSMM which also specifies the qualifications needed to appropriately conduct site assessments needed to apply this tool.

References:
http://www.canada.com/story.html?id=973f9667-4f40-459f-a924-7cd11d959a92
http://www.laclabichecounty.com/files/labiche/pi-63-003_riparian_setback_matrix_jan_10.pdf
http://aquality.ca/index.php?page=riparian-setback-matrix-model
http://www.laclabichecounty.com/files/labiche/lac_la_biche_water_management_plan_-_sept_24_2009_3.pdf

Parkland County is also considering adopting this setback matrix tool as a way of better protecting environmentally significant features that were recently identified in its Environmental Conservation Master Plan completed last year. In this case they would also like to build into the tool wildlife habitat protection variables.

http://www.parklandcounty.com/About_Us/Projects_and_Studies_-_Current/Environmental_Conservation_Master_Plan_and_Policy_Updates.htm

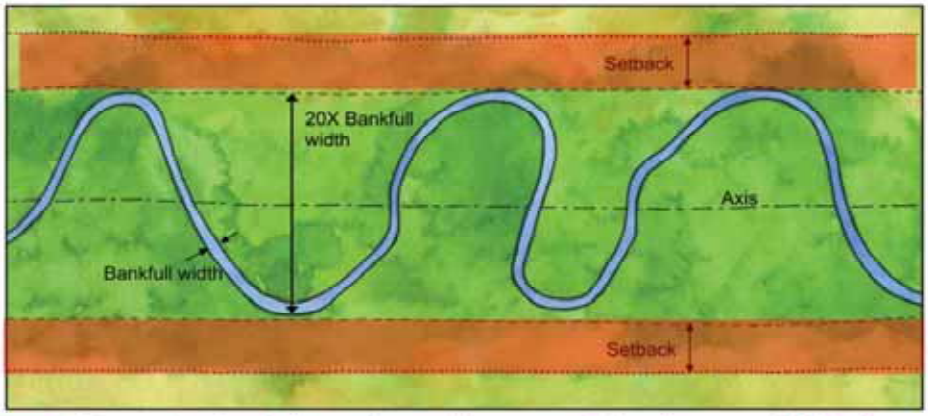


A provincial guidance document called “Stepping Back from the Water” was released in 2012 to help provide guidance on the subject of determining appropriate riparian setbacks.

Reference: Government of Alberta. 2012. Stepping Back from the Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta’s Settled Region. http://esrd.alberta.ca/water/education-guidelines/documents/8554.pdf

Setback considerations for medium to small meandering watercourses

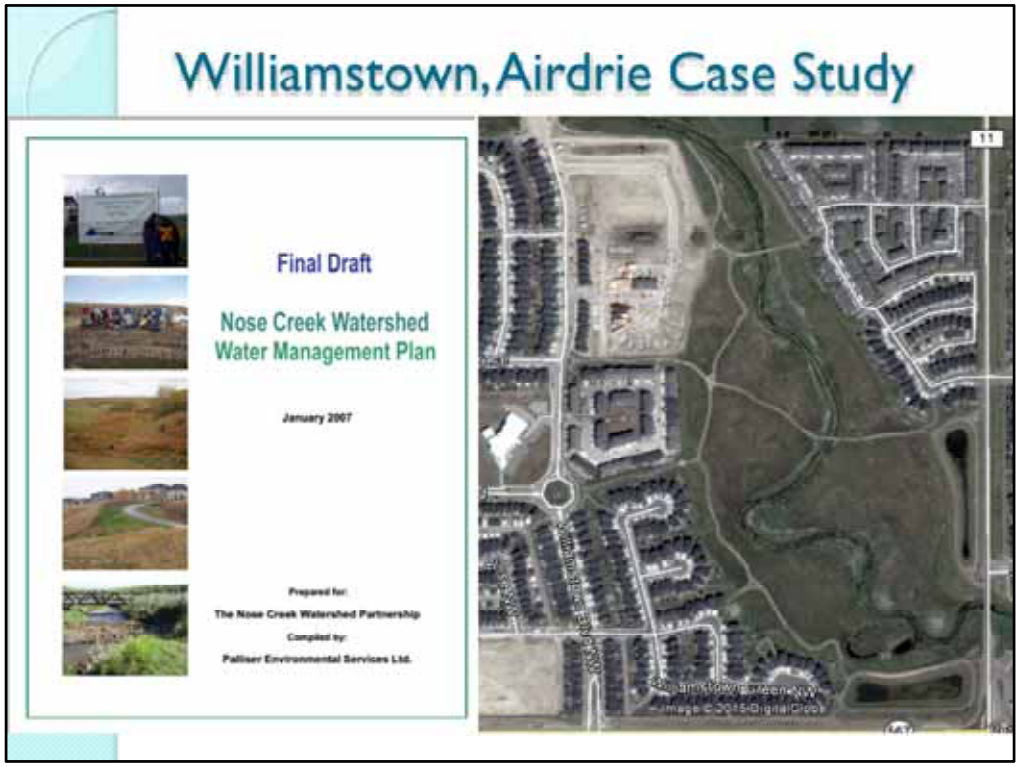
MEASURE SETBACK FROM THE EDGE OF THE MEANDER BELT NOT THE LEGAL BANK OF THE WATERCOURSE. MEANDER BELT = 20 X BANKFULL WIDTH



Source: http://esrd.alberta.ca/water/education-guidelines/documents/8554.pdf
Government of Alberta. 2012. Stepping Back from the Water page 21

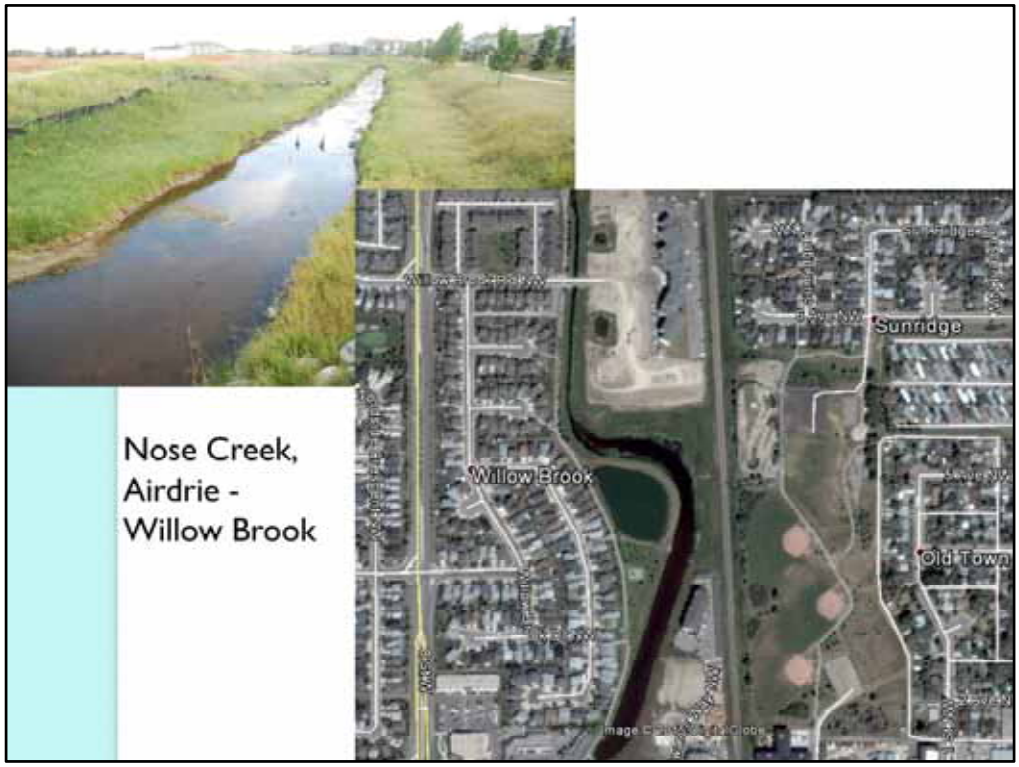
This document provides recommendations for developing riparian setbacks that account for issues such as shoreline migration and flooding. To allow for natural stream channel migration, the document recommends taking setbacks from the edge of the meander belt as opposed to from the bank.

This approach is designed to allow our streams to have room to maneuver within their floodplain under the influence of erosion and deposition processes. It is also designed to keep us and our infrastructure out of harms way.

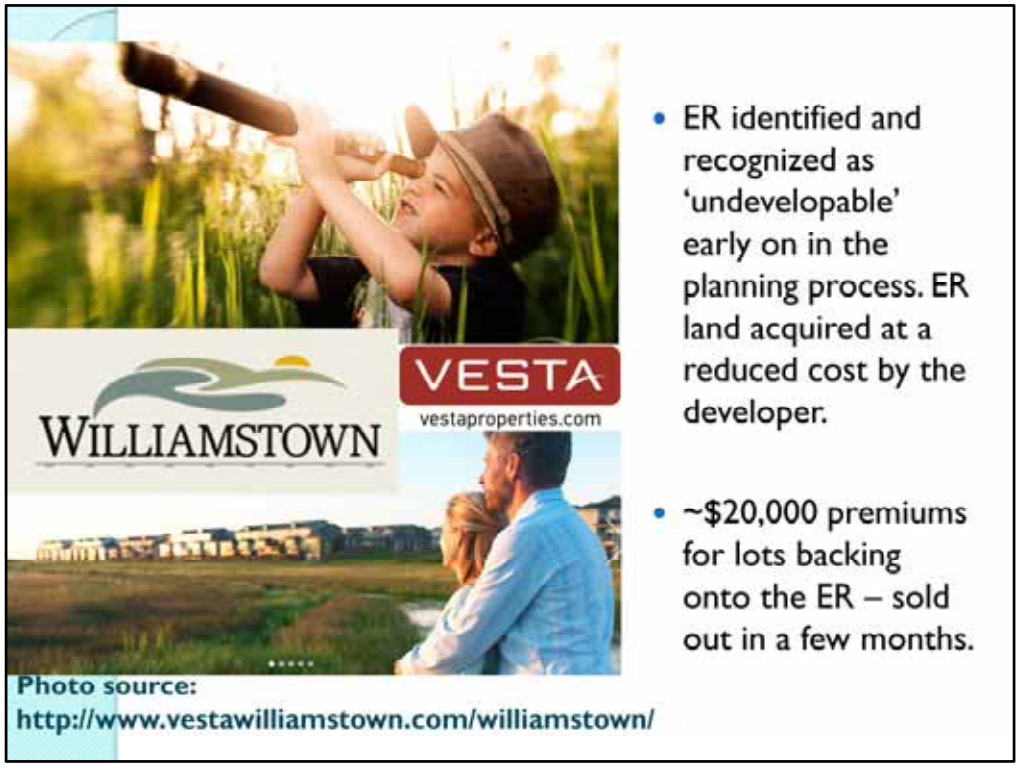


An example of where this approach was applied in accordance with recommendations made in the Nose Creek Watershed Management Plan, is the recent Williamstown development in Airdrie.

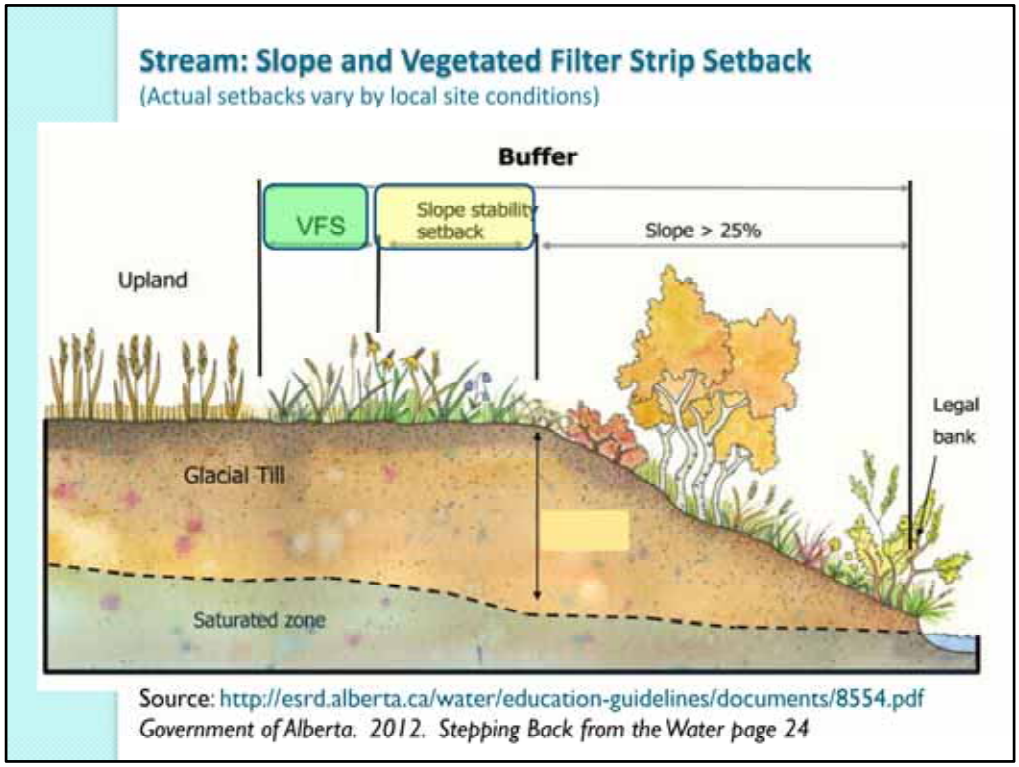
As you can see from this image a wide Environmental Reserve Setback was implemented along Nose Creek that encompasses the 1:100 year floodplain.



This is a great improvement from how other past developments have been done along Nose Creek in Airdrie such as shown here in Willow Brook. Here we see channelization of the creek, removing valuable fish habitat and entirely removing natural riparian edge habitat. The result is a straightened 'ditch' with agronomic and weedy plants along the edge. Straightening channels increases flow velocity, resulting in increased flood and erosion damage downstream.



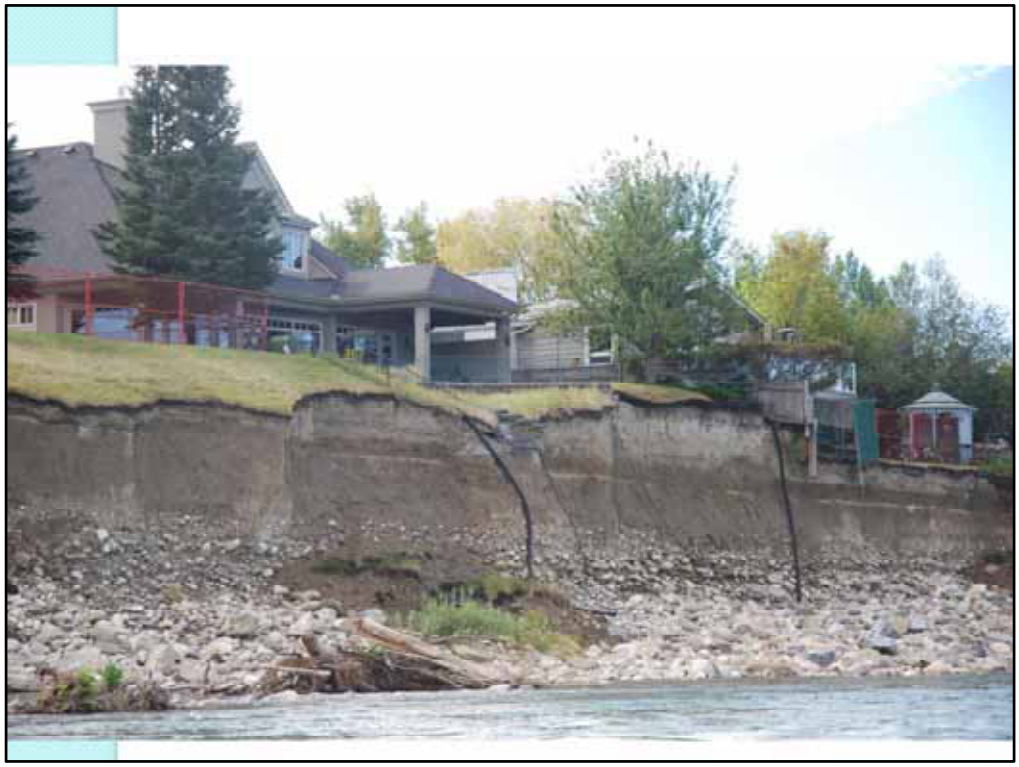
In the case of Williamstown, Vesta Properties, the developer, promoted the ER along Nose Creek as the prime selling feature of this development as you can see from these promotional photographs featured on its website. This worked out to be a win-win situation as Vesta acquired the ER lands for a reduced cost and they were able to sell lots backing onto the ER at premiums of around $20,000 /lot – lots that sold out very quickly.



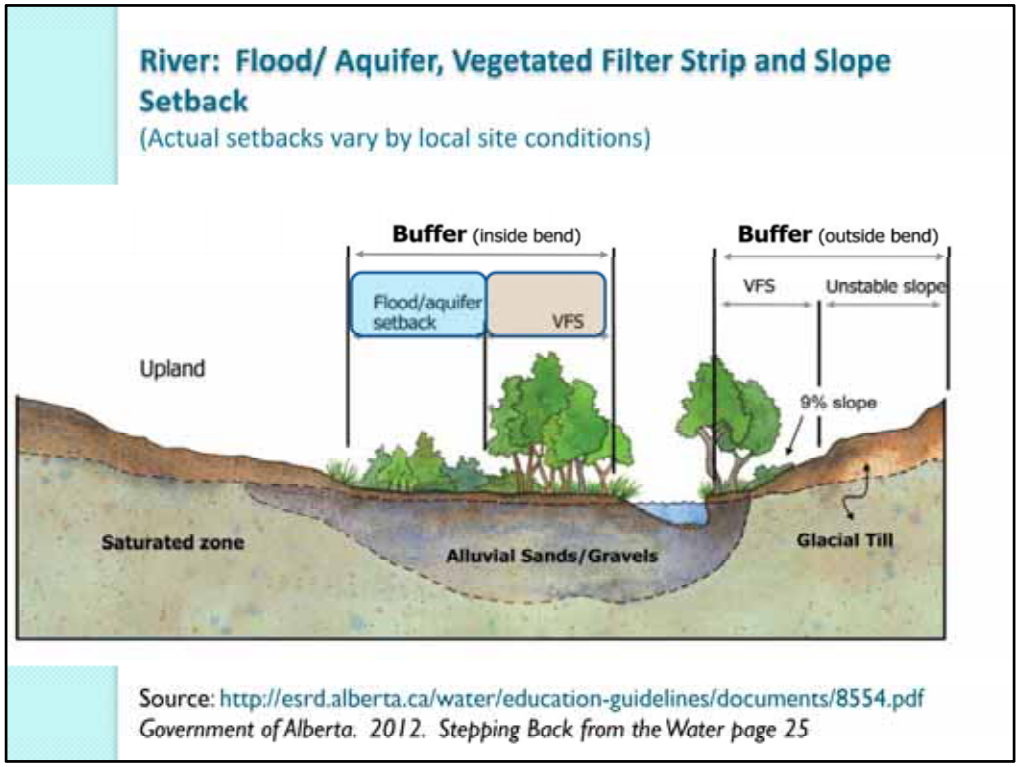
The Stepping Back document also has recommendations for slope setbacks including allowance for a vegetated filter strip beyond the slope stability setback

The need for this type of slope setback was again driven home by some of the impacts we witnessed in Calgary during the 2013 flood.

Here we see slope failure and erosion along the east side of the Bow River upstream from the Bowness Road bridge....

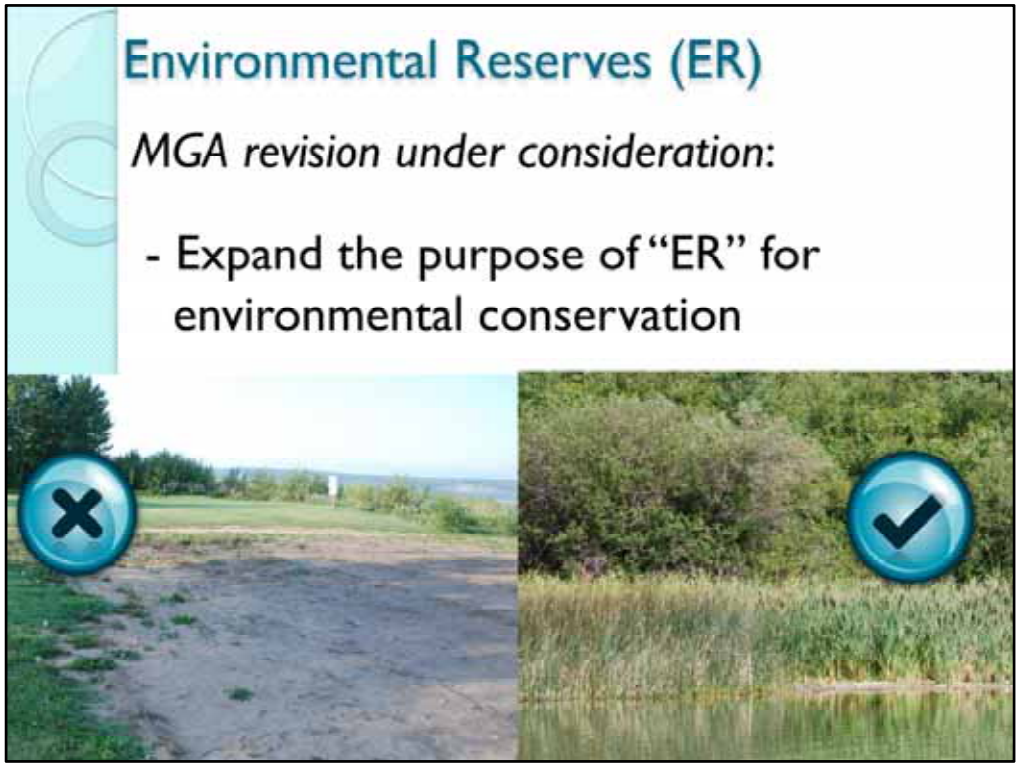


erosion that left these homes in a bit of a precarious position.



To address issues around the risk of shallow groundwater contamination and flooding, the Stepping Back document recommends taking setbacks along large rivers that encompass a vegetated filter strip along the bank and a flood or alluvial aquifer setback.

Alluvial aquifers were created when melt waters from receding glaciers filled our ancient river valleys with sand and gravel. This sand and gravel layer is highly porous, meaning that water from the river seeps into this layer very easily. This also means that any contaminants that seep into the alluvial aquifer on the floodplain can make their way into the river. It also means homes far out in the flood fringe are susceptible to flooding from seepage of groundwater into their basements.

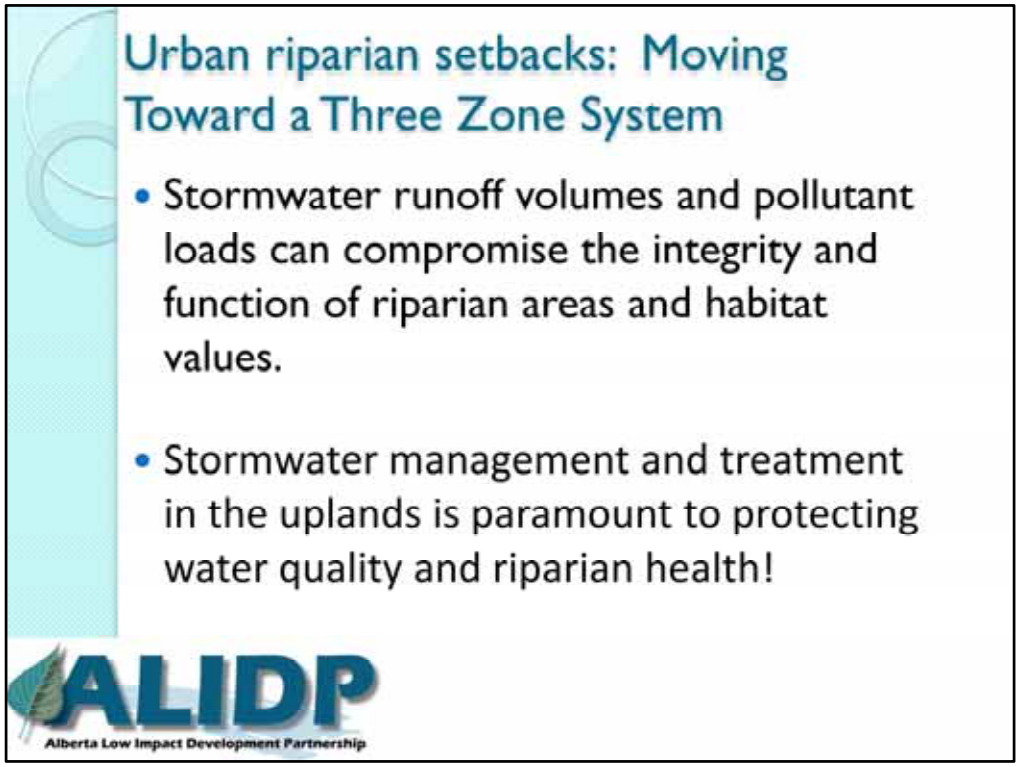


Getting back to the MGA for a minute. One of the key points of the MGA that is being challenged during the current review process is to expand the purpose of an Environmental Reserve for environmental conservation purposes.

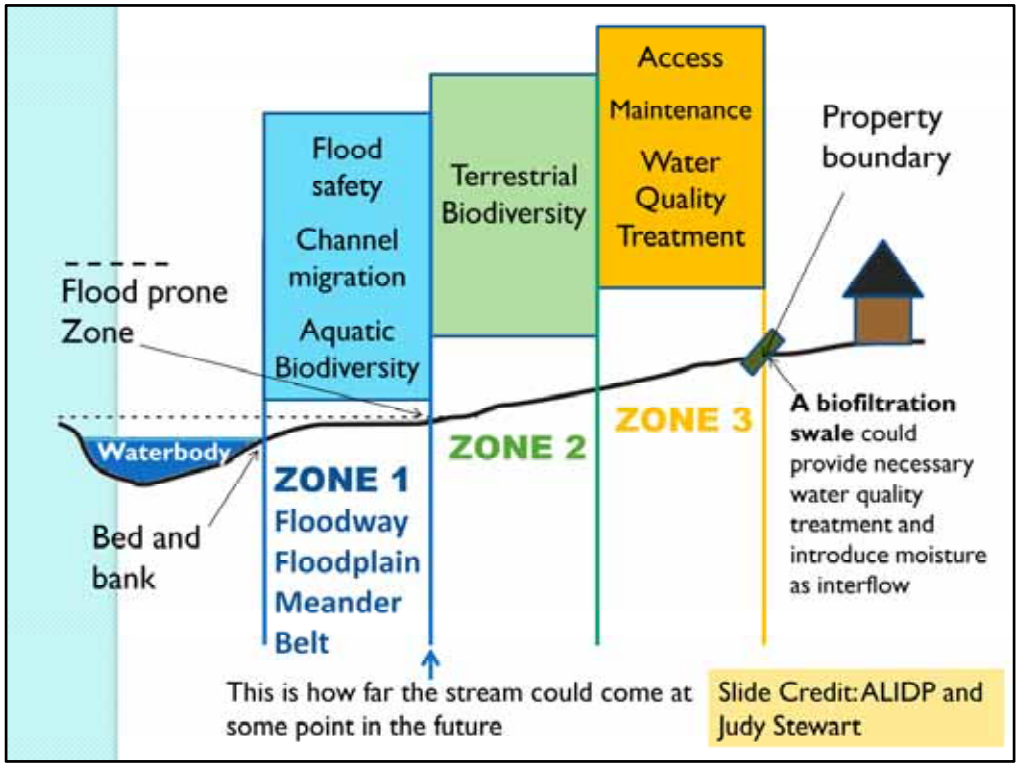
Presently there are requirements to provide ER setbacks "no less than 6 m" wide adjacent to the bed and shore of any lake, river, stream or other body of water for the purpose of preventing pollution or providing public access to and beside the bed and shore."

Under the current system, our Environmental Reserve land often ends up looking like this (ANIMATION ONE – X). Whereas instead if we are interested in watershed health, this is what these lands should like (ANIMATION TWO – CHECK MARK).

In landscapes with increasing adjacent upland development, even if we are careful with how we manage our environmental reserves, we cannot expect our riparian areas to be our solution to treating pollution. The integrity of our riparian areas is quickly compromised if we subject them to highly elevated pollutant and runoff loads. To retain habitat value, contaminant loadings and types of contaminants should be similar to pre-development conditions. Otherwise, the integrity of this area will be compromised!



Recognizing that stormwater runoff volumes and pollutant loads can very easily compromise the integrity and function of riparian areas, particularly in an urban setting, it becomes vital to treat and manage stormwater in the uplands as an appropriate means to protect not only water quality but also riparian health and fish and wildlife habitat values. This is something that the ALIDP is trying hard to promote as well.

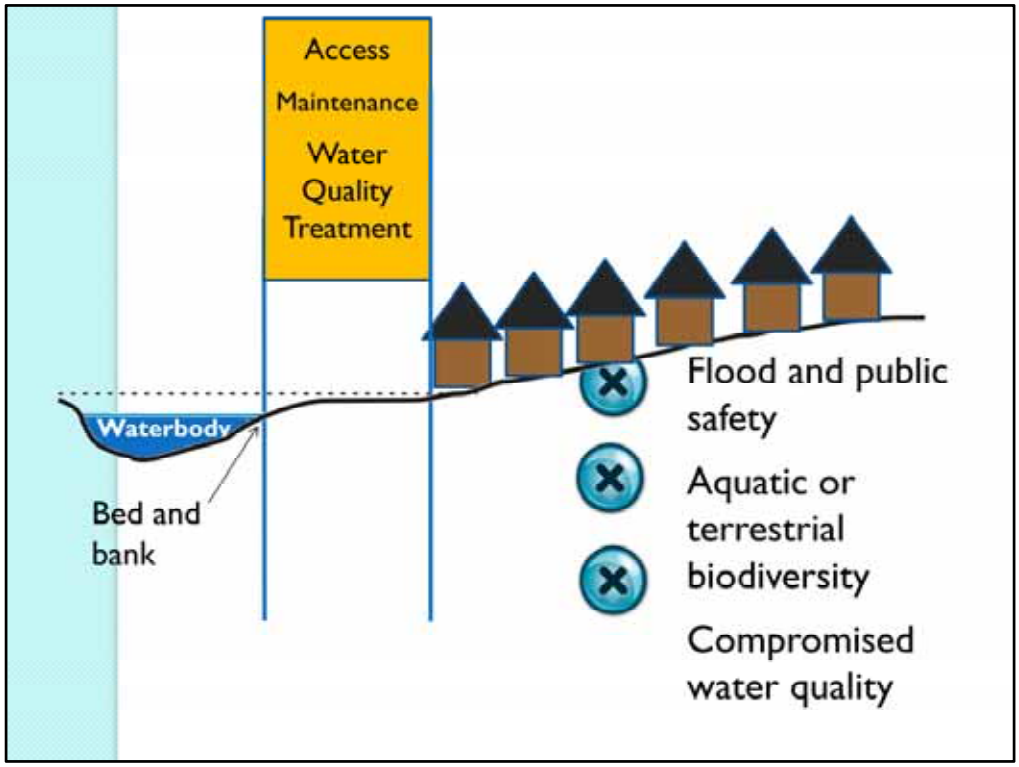


What the ALIDP and others are recommending is that we start moving toward a 3 zone approach to riparian setbacks.

Rather than establishing setbacks where we start measuring back from the edge of the bank, what is being suggested is that we need to actually start counting back from the edge of the meander belt or floodplain. This Blue Zone 1 essentially becomes recognized then as being integral for not only flood safety and to allow for channel migration, but it is also vital for meeting our goals of protecting aquatic biodiversity.

In Zone 2 we can then establish a meaningful setback to allow for protection of terrestrial biodiversity and habitat values. Our green setback zone.

In Zone 3 is where we can then have allowances for access, maintenance requirements and water quality treatment – with LID water quality treatment features being integrated into the back of private lots such as biofiltration swales.

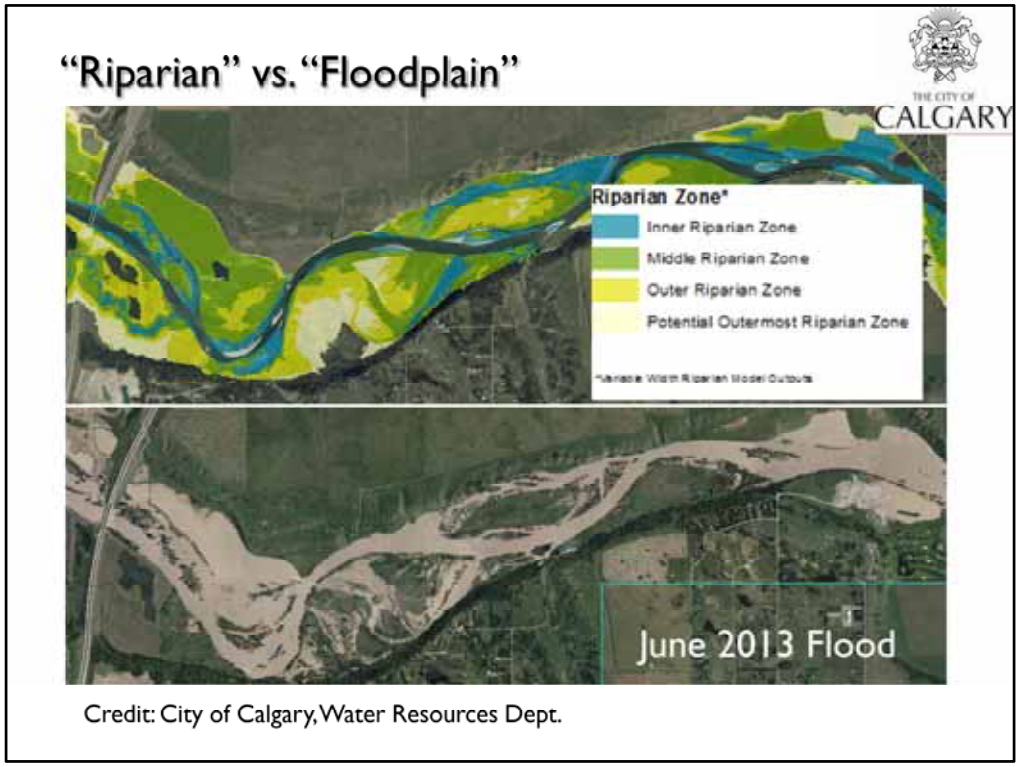


By comparison, under most minimal setback schemes we often end up with compromised flood and public safety, little opportunity to protect aquatic or terrestrial biodiversity and compromised water quality among other concerns. These concerns are compounded where there are high density adjacent developments.

The City of Calgary is attempting to consider some of these principles in its Area Structure Plans that are coming out for new communities such as Keystone Hills (north of Stoney Trail). In particular, the City of Calgary is working with the ALIDP to promote the idea of integrating LID features into the back of lots backing onto natural riparian corridors and using stormwater features like storm ponds to protect natural wetlands and drainages. It is also working toward retaining ephemeral and intermittent riparian drainages that traditionally would have been piped underground and developed over.

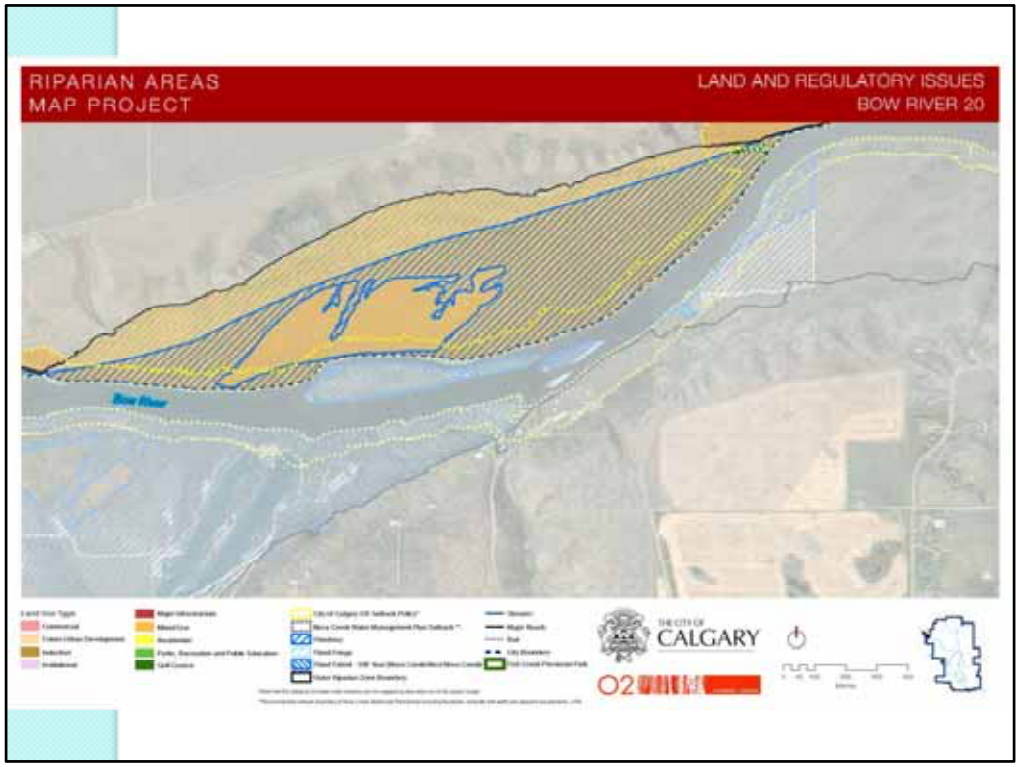
The mandate for the City of Calgary to head in this progressive direction has come out of its Stormwater management Strategy, its Wetland Conservation Plan that came out in 2004, and most recently with the release of its Riparian Strategy. The City is also working on developing a Biodiversity strategic plan.

http://www.calgary.ca/UEP/Water/Pages/Water-and-wastewater-systems/Storm-drainage-system/History.aspx
http://www.calgary.ca/UEP/Water/Pages/Watersheds-and-rivers/Riverbanks-and-Floodplains-in-Calgary.aspx

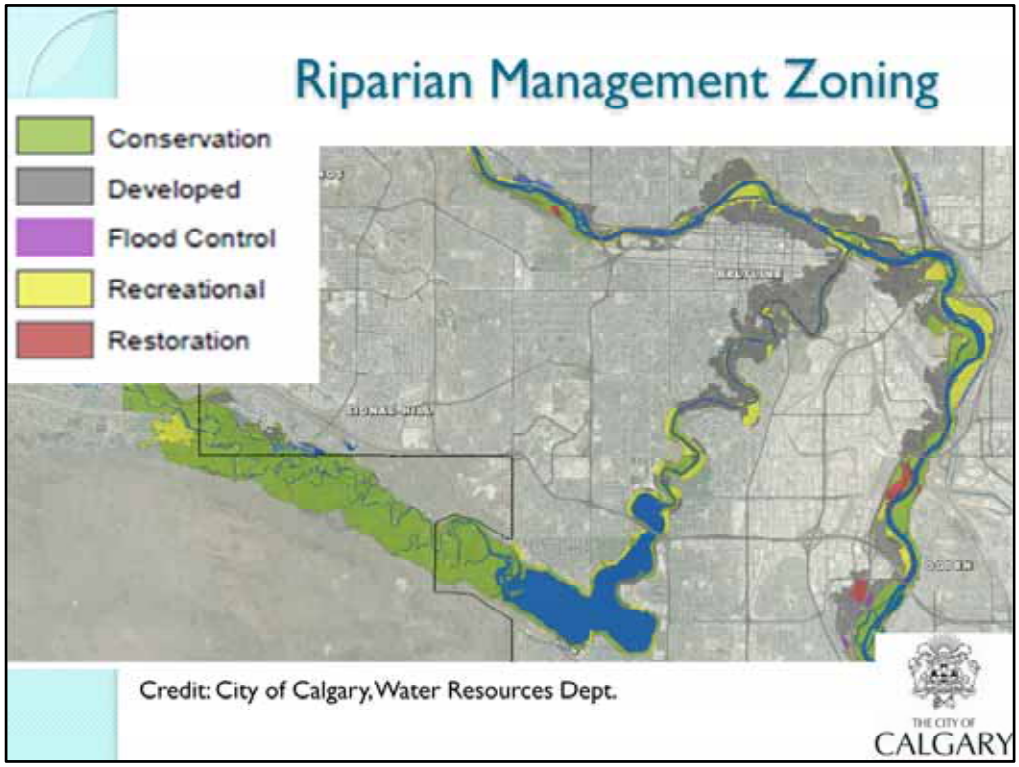


Credit: City of Calgary, Water Resources Dept.

Before coming out with its Riparian Strategy document, the City of Calgary did extensive work in terms of not only baseline riparian health inventories (conducted by Cows and Fish in 2007, 2008 and 2010) but also in terms of GIS mapping of its riparian areas in collaboration with AMEC and O2 Planning and Design. What is interesting is just how closely the mapped outer riparian zone aligns with the outer extent of the June 2013 flood as you can see here.



The City of Calgary also had O2 Planning and Design map out what its current environmental reserve and slope setbacks actually look like when overlain onto floodway maps for example. This will be useful in helping them determine where the ER setback policy looks appropriate and where it perhaps needs to be improved.

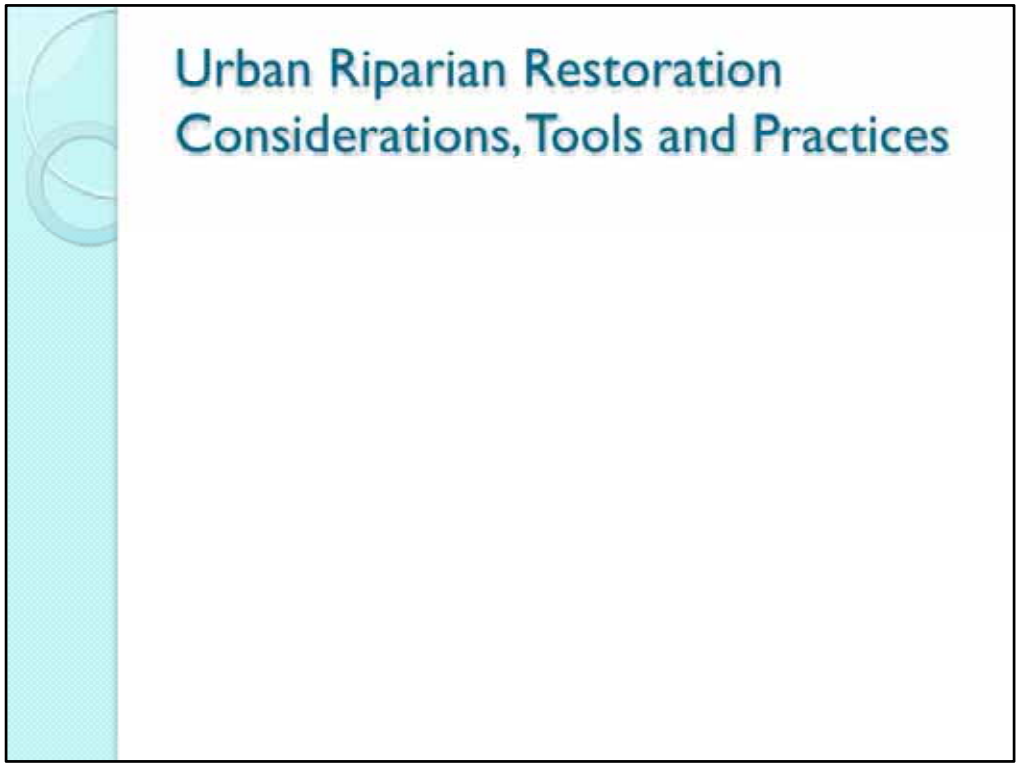


The City of Calgary has also developed a GIS based riparian management zone classification scheme developed by O2 Planning and Design using a multi-criteria spatial model that included over 47 layers of data representing current conditions.

The following five riparian management categories and definitions were developed with input from internal and external experts:

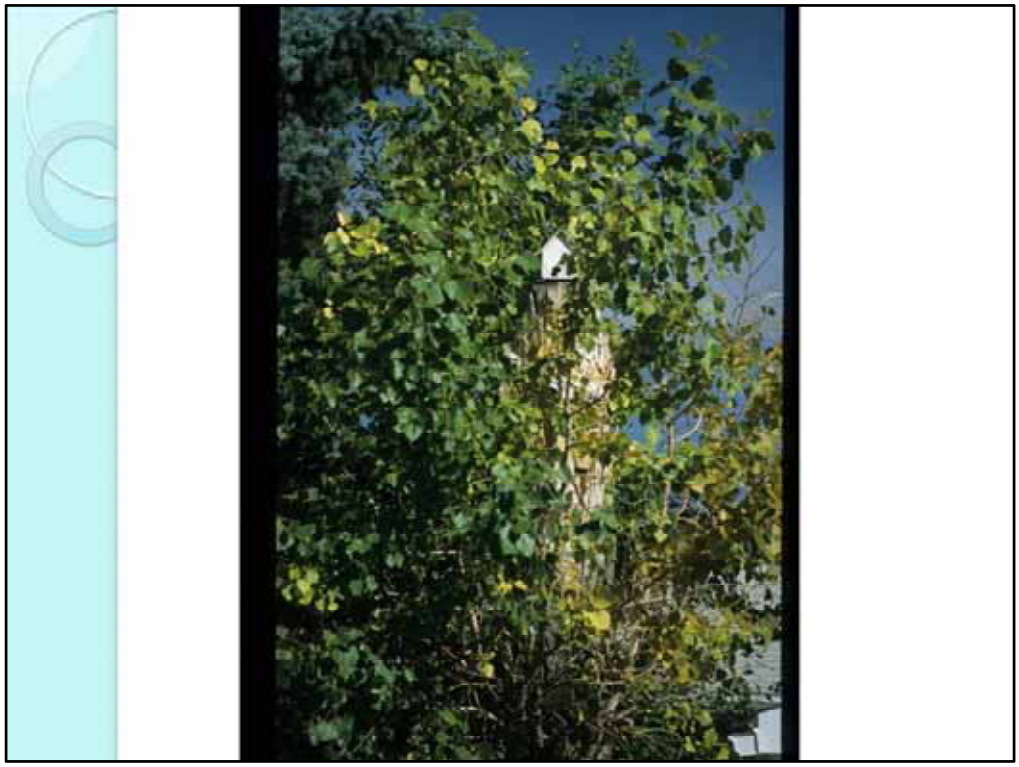
•Conservation: Riparian areas retained for natural open space
•Restoration: Riparian areas with suboptimal health / poor vegetative cover that are intended to be reclaimed or restored
•Recreation: An area of high recreational value and use where activities do not significantly compromise ecosystem health or biodiversity
•Flood + Erosion Control: Riparian areas subject to flood and erosion risk. The priority is to mitigate potential flood or erosion damage using the best options available.
•Developed: Riparian areas affected by development. If suitable opportunities arise (e.g., redevelopment, closure of a major industrial facility), these areas will be assessed for restoration.

This management zoning is intended to help the City prioritize for example conservation and restoration efforts while allowing other areas to be managed for recreation or flood and erosion control to protect critical infrastructure. In this way the City has a tool to help interpret and manage competing values.



As part of the City of Calgary's riparian strategy, they have not only acknowledged that riparian areas are worthy of protecting, but they also would like to set targets to improve riparian health. For the last few slides what I will focus on briefly are some principles to consider for restoring a riparian area.

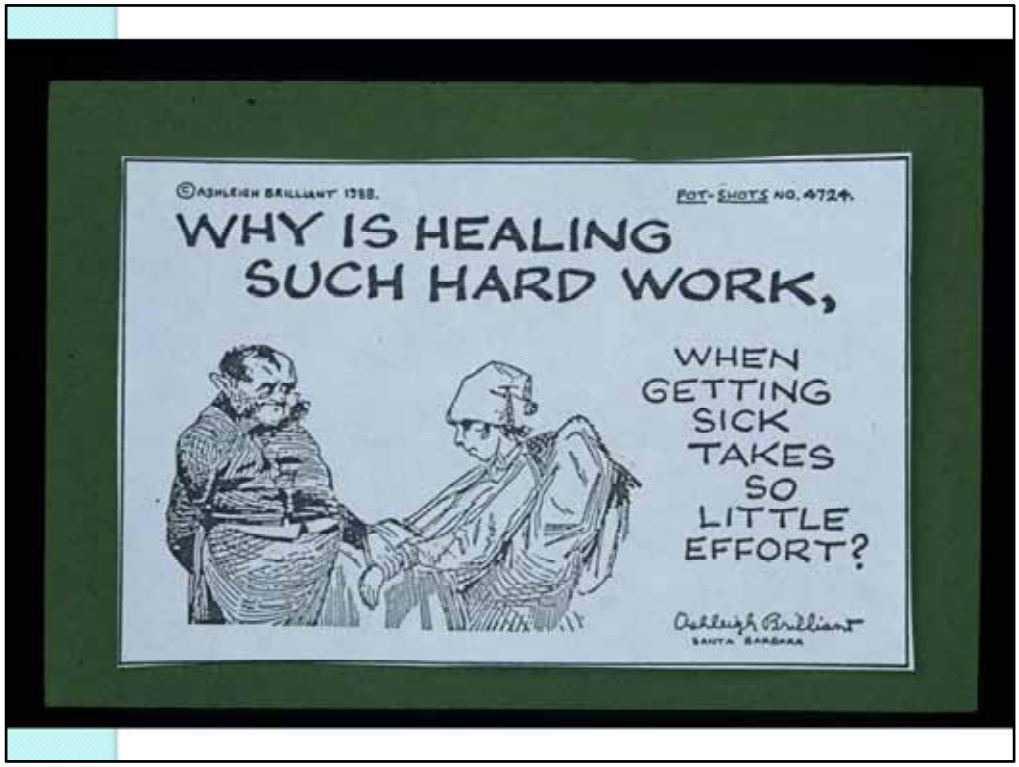
So what is an appropriate restoration solution for your riparian area? Does this qualify as replacing lost nesting habitat? Or as my colleague Lorne Fitch would say, is this more like "putting lipstick on a corpse"?



Well, the tremendous thing about riparian systems, is that given a bit of time, if we are patient, these areas can show tremendous resiliency. Balsam poplars and cottonwood trees are the prime example of this to the point that their tremendous regeneration ability is considered bothersome to park managers trying to maintain neat lawns. This is the same cut cottonwood stump as in the previous slide, several years later.

Natural recovery can be rapid for sites where we have relatively healthy and intact native plant communities to begin with. That was the case for this Sandy Beach Riverbank Rescue Project along the Elbow River in Calgary. This project was led by the City of Calgary Parks with funding and volunteer support from the Calgary Herald. Human-caused bare ground filled in very quickly after the site was fenced out from recreational access with native willows and sedges. Although some willow planting was done here, most of what you see here is natural recovery.

Having community groups involved with actively restoring an area as was the case for Sandy Beach, helps garner more support for these efforts, helping them to be successful in the long-term.



Unfortunately restoration projects can be challenging, particularly for sites that are in an unhealthy condition to begin with. Sites that still have some functional pieces intact are much easier to recover.

As this cartoon says – *why is healing such hard work when getting sick takes so little effort*? This is certainly true of urban riparian systems that can easily degrade in health where riparian plants are replaced with lawn or where we have a lot of weed encroachment or areas of bare ground from heavy recreational use.

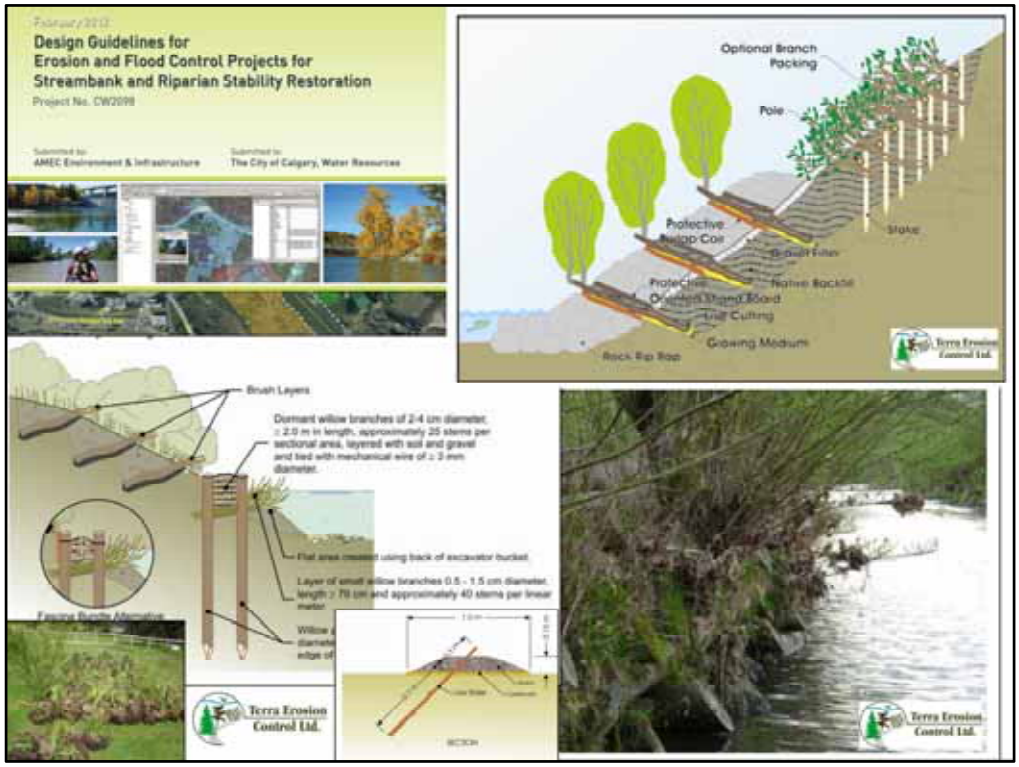
By contrast, for situations like you see here, when a site is really not in good shape to start with, recovery of beneficial native riparian plants will take a while. This is in what is now called Sue Higgins Park, a high use off leash dog park in Calgary along the southern reach of the Bow River in Southland. Beginning in 2008 shortly after this photo was taken, management changes were made to exclude use along sensitive riverbank areas and instead direct off leash dog use to adjacent already disturbed fields further back from the bank.

As you can see from this re-take photo taken just last summer, this site is on the road to recovery. But this is an example of an area where we will have to continue to do ongoing weed management and where we may need to look at re-planting beneficial native plants that otherwise are being outcompeted by disturbance grasses.

Sue Higgins Park is certainly an example of a park where the City of Calgary Parks department is trying to do innovative things with their signage, fencing and creation of hardened designated river access points for dogs to try to strike a balance between recreational use, conservation and restoration.

At Sue Higgins Park the City has tried to get away from traditional 'hard engineering' approaches to solving bank erosion issues as depicted here with the application of rock riprap. Application of rock riprap negatively impacts riparian health and can be detrimental to fish habitat. Stream flow velocity accelerates in reaches with riprap banks, potentially contributing to worsened erosion impacts downstream.

To get away from simply resorting to rock riprap as an erosion control solution, instead what is being promoted now in Conservation and Restoration zones in Calgary is the use of soil-bioengineering techniques which integrate native plant materials.



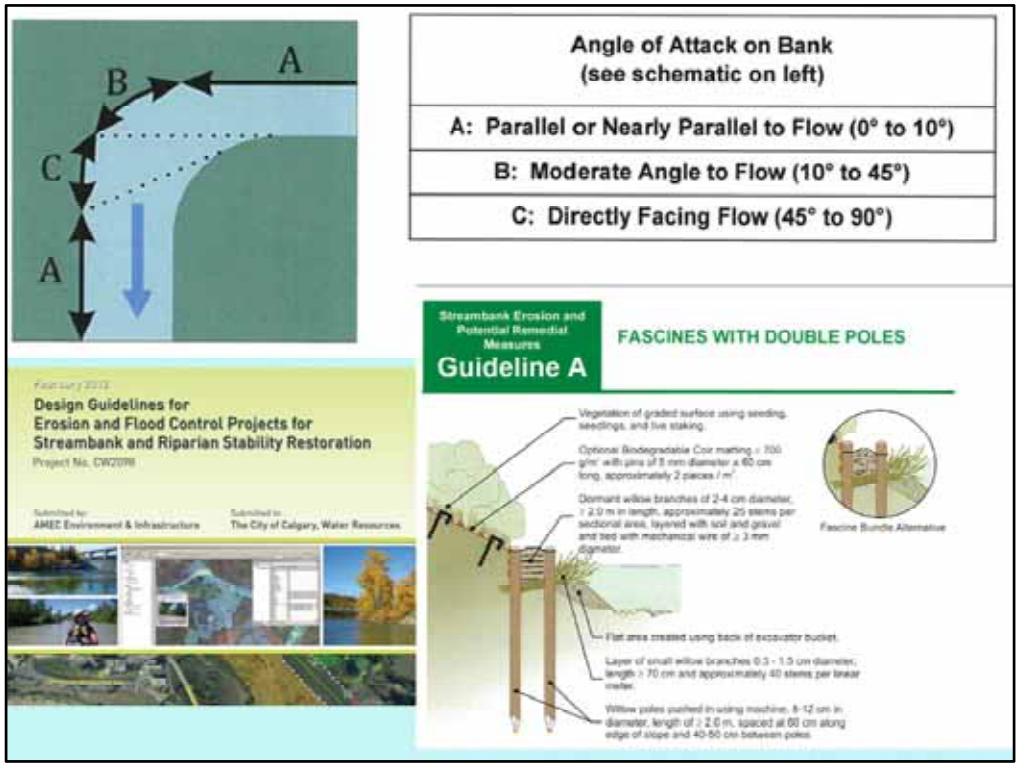
To promote a better understanding of soil bioengineering techniques suitable for use in Calgary, the City of Calgary has publically released a set of soil bioengineering *Design Guidelines* developed by AMEC and Terra Erosion Control Ltd with input on riparian planting suggestions from Cows and Fish.

The Design Guidelines are available from:
http://www.calgary.ca/UEP/Water/Pages/Watersheds-and-rivers/Riverbanks-and-Floodplains-in-Calgary.aspx

For more information specifically on riparian planting recommendations, Cows and Fish recently compiled this Fact Sheet “Planning your riparian planting project in Alberta” for Alberta’s Growing Forward Program (available from:http://www.growingforward.alberta.ca/Programs/index.htm?contentId=ON_FARM_STEWD_PRG&useSecondary=true&active=yes).

Woody plants that are best suited for riparian planting projects throughout Alberta are native willows, balsam poplar / cottonwoods, and red-osier dogwood shrubs. These plants will grow roots and shoots from cuttings when placed in contact with soil and moisture. Careful harvest, handling and installation of cuttings is needed for best results. For example, live cuttings should be harvested during the dormancy period (typically October to March) and they should not be exposed to direct sun and heat. When feasible, projects done in Autumn mean that live harvested material can be installed immediately without the need for lengthy periods of cold storage.

For more information: http://cowsandfish.org/pdfs/growing_restoration_en.pdf

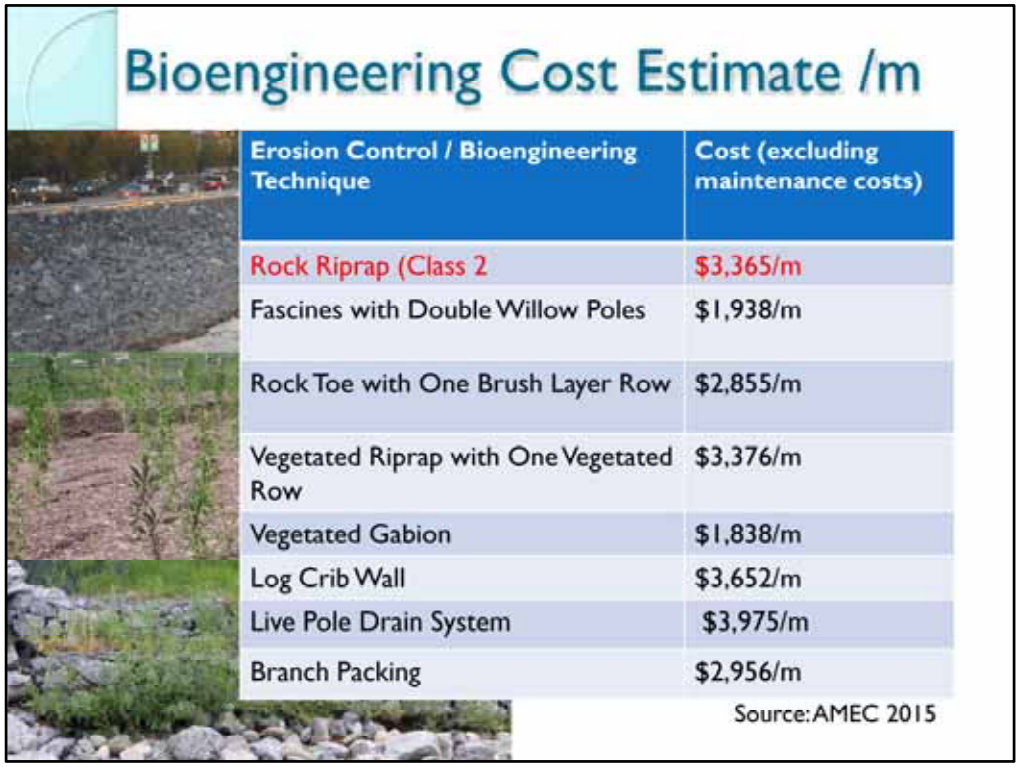


The type of soil bioengineering technique suited to a particular site will depend in large part on conditions such as angle of attack on the bank being restored. "Softer" techniques such as the use of willow poles and willow bundles (fascines) may be suited for use where you are restoring a portion of bank that is parallel or nearly parallel to flow. Integrating rock riprap or log crib walls into the structural design may be needed for sites that face a greater erosion risk because they directly face stream flows or they are at a moderate angle to the stream flow.

Vegetated log crib wall structures have been successfully applied in Calgary. This photograph was taken **after** the June 2013 flood. It shows an intact log crib wall structure at the north end of Sue Higgins Park (along a Bow River side channel) that successfully withstood the flood. Sandbar willow growth integrated into the crib wall structure will create natural root tensile strength and erosion resilience in the long-term. This structure was installed in 2008.

The City of Edmonton is also very interested in applying soil-bioengineering techniques where appropriate. Since 2007, at least 6 vegetated riprap bioengineering projects have been installed at stormwater outfalls along the North Saskatchewan River in Edmonton by Terra Erosion Control. The idea with vegetated riprap is that layers of willows are carefully embedded between the rock layers with careful attention to protecting the willow cuttings using oriented strand board making sure the cuttings are deeply embedded into soil material along the bank. The boards help protect the cuttings from the rocks and also help direct water to the roots.

The principle is that as the willow cuttings sprout and grow roots their roots form a network that has been shown to bind the rocks together and increase soil cohesion, essentially strengthening the erosion resilience of the structure over time in addition to providing cover for fish and nesting habitat for birds.



Most soil bioengineering techniques are less expensive than hard riprap solutions. However, there is also a monitoring and maintenance cost involved over and above the costs shown here. DFO and regional Alberta Fisheries biologists are very much in favour of the use of soil-bioengineering to be done where practical to lessen impacts to fish habitat from erosion control projects. Where soil bioengineering can be done without the need for a rock toe, fish habitat compensation requirements may be waived or lessened compared to if hard engineering solutions are used.

If anything, the flood of 2013 gave the City of Calgary an opportunity to put some new soil-bioengineering techniques into action. Several erosion control projects done in 2013 and 2014 were done using bioengineering methods – like this vegetated riprap example of restoration works done in Lindsay Park along the Elbow River. On the left is what the site looked like after the flood and the photo on the right shows the repair works done in 2014.

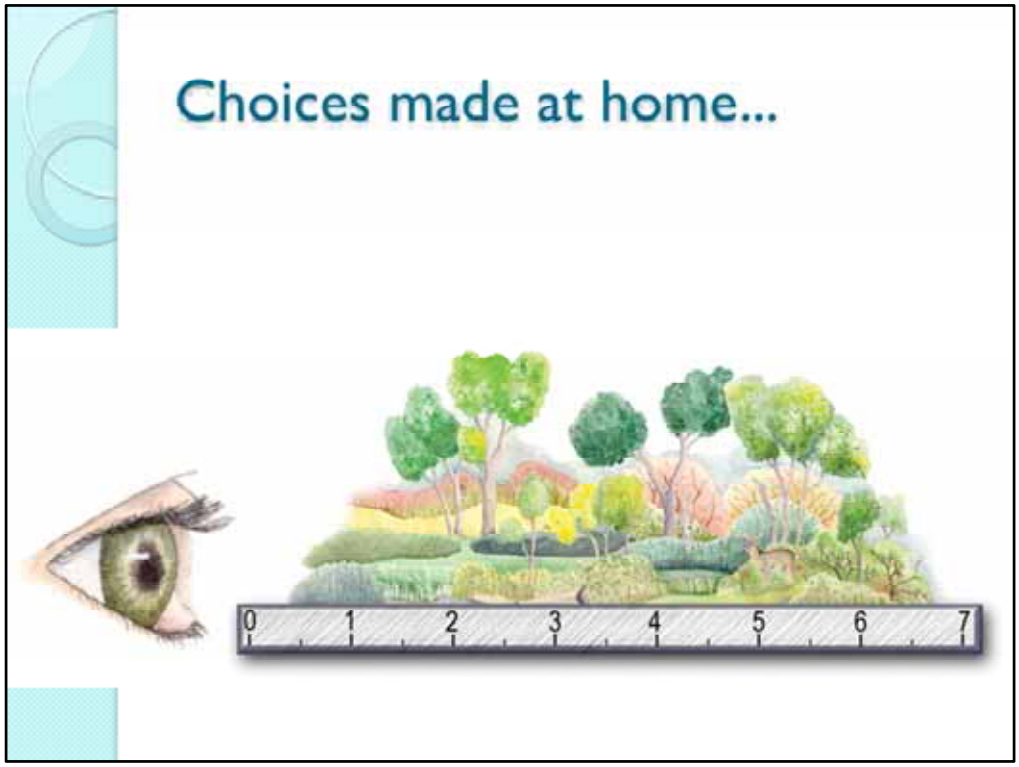
Here is a close-up of this bank repair project where you can see layers of native willows installed between and above the rock riprap.

It will be interesting to monitor these types of projects to see how they do in the long-term. In Alberta we are still in the very early stages of applying and implementing soil bioengineering techniques.

Perhaps we should be consulting the long-term expert with thousands of years worth of experience on this subject.

The beaver dam you see here in the foreground repaired flood damage done to a stormpond in Prince's Island Park in Calgary along the Bow River near Center Street bridge. This was one the City engineers could perhaps cross off their repair list.

Beavers can be a tremendous ally when it comes to restoring riparian areas – the simple act of flooding an area can drown out weeds and bring back native riparian plants. This could be an option for example in natural areas zoned for conservation purposes. The trouble is balancing the benefits of beavers with their tremendous appetite for wood. But then again there could be creative solutions like having arborists drop off excess branch cuttings to supplement the diet of our friendly neighbourhood urban beavers.



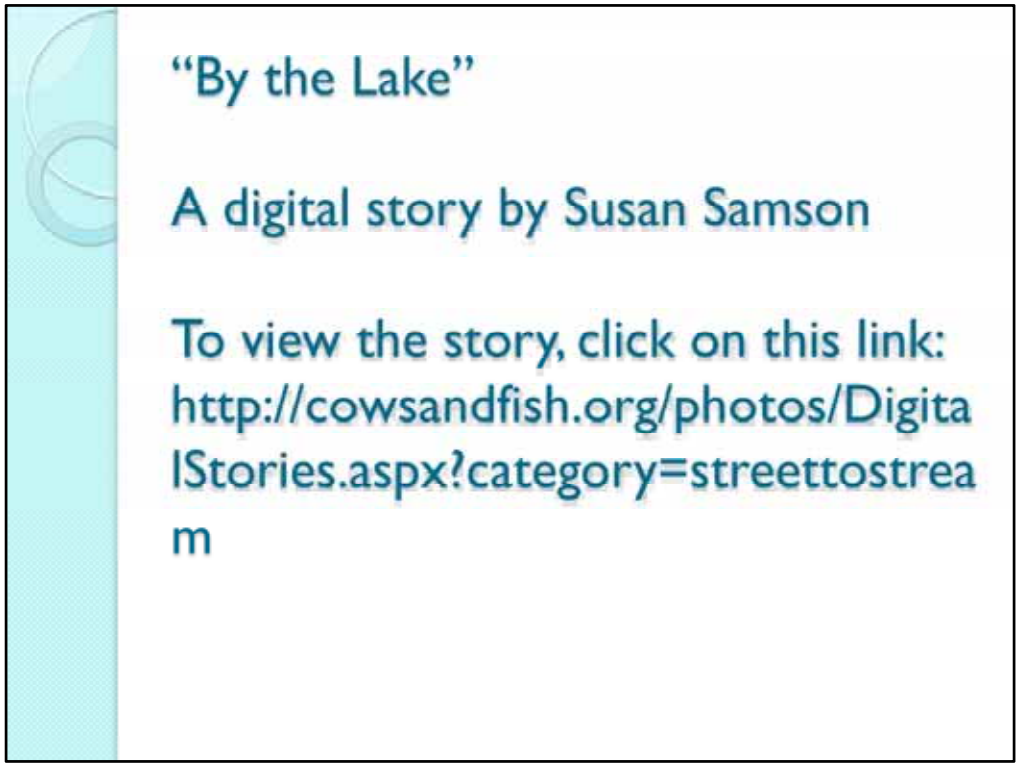
The solution to a lot of our riparian management problems, like learning to live with beavers, comes down to learning to view the landscape differently.

On the home front this means recognizing that (A) highly fertilized, mowed, neat and tidy yards aren't necessarily desirable if you live along the river.

Simply leaving an unmowed buffer along a property can encourage willows and beneficial native rushes to come back in naturally. This can do a lot to bring back ecological function into this landscape as shown in photo B.

The same is true for lakeshore properties. Clearing land along your lakefront property to allow for lake access or better views (A), can cumulatively contribute to increased runoff, with negative impacts to water quality and loss of fish and wildlife habitat. Finding ways to recognize the benefits of B, where we see minimal disturbance to lakeshore vegetation, is a far preferable solution to lake health and ultimately to property values in the long term.

Getting from A to B often requires firstly a journey of understanding to come to recognize the impacts of each of our personal choices on the landscape.



To conclude my presentation I will let Susan Samson tell the story of her personal journey from doing "regular things unthinkingly" to wanting to make better choices for her lake, her family and her community.

This digital story is one of 4 stories that were developed for this "Street to Stream" initiative. These stories showcase urban and lakefront community riparian stewardship activities and a stormwater youth education program in Alberta. These stories were created in a workshop facilitated by the Digital Storytelling Program, Faculty of Social Work, University of Calgary, in December, 2014.

To view Susan's story and others like it, please visit our website:
http://cowsandfish.org/photos/DigitalStories.aspx?category=streettostream

Acknowledgements

Thank you to the following people for providing photographs or other content used in this presentation:

- Liv Hundal and Scott Wagner (AMEC)
- Marina Krainer (Ghost Watershed Alliance Society)
- Dwight Mercer (DGMercer Eco Research)
- Marco Musiani (University of Calgary)
- Lesley Peterson (Trout Unlimited Canada)
- Shirley Pickering
- Pierre Raymond (Terra Erosion Control Ltd.)
- Susan Samson (Sylvan Lake Watershed Stewardship Society)
- Judy Stewart and the ALIDP
- Caitlin Smith (O2 Planning and Design)
- Valerie Veenstra (City of Calgary)
- Jay White (Aquality Environmental Consulting)