

# Dealing with Uncertainty and Managing Risk: How we can adapt Water Management Systems

**A Presentation at a Fraser Basin Council Workshop  
On Preparing for Climate Change in the Fraser Basin**

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By

Kim A Stephens, MEng, PEng, Program Coordinator  
Water Sustainability Action Plan for British Columbia



# Dealing with Uncertainty and Managing Risk: How we can adapt Water Management Systems

Fraser Basin Council organizes workshop on climate change  
to stimulate a dialogue on adaptive planning

In November 2007, the [Fraser Basin Council](http://www.fraserbasin.bc.ca)<sup>1</sup> (FBC) hosted a workshop in Vancouver on adaptive decision-making, water management and climate change. The workshop explored links between climate change adaptation strategies and decision-making processes in the Fraser Basin. To learn more about the workshop, please follow this link to [Preparing for Climate Change in the Fraser Basin: How Can our Water Management Systems Adapt?](http://www.waterbucket.ca/wcp/index.asp?sid=49&id=521&type=single)<sup>2</sup>



The workshop featured a panel session comprising four speakers representing diverse fields of thought. The panel included **Kim Stephens**, Program Coordinator for the [Water Sustainability Action Plan for British Columbia](http://www.waterbucket.ca/cfa/index.asp?type=summary&section=Water_Sustainability_Action_Plan&sid=4)<sup>3</sup>. He provided a water resource practitioner's perspective with a presentation titled [Dealing with Uncertainty and Managing Risk: How we can adapt Water Management Systems](http://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/102.pdf)<sup>4</sup>.

## Climate Change is a Variable



The panel was challenged to respond to a hypothetical climate change / water crisis scenario set in 2030. Kim Stephens opened his presentation by stating that the real issues are uncertainty and risk, more specifically how we deal with the first and manage the latter.

According to Stephens, "Climate change is not the driver; rather, it is a variable. Furthermore, climate change is only one factor to consider when we talk about [sustainable infrastructure](http://www.sustainis.org/)<sup>5</sup>.

"The key is to focus on what you want to do. Because many factors are in play, the objective is to build in resiliency to address risk," stated Stephens, "We have to know where we want to go. Then we can figure out the steps to get there. To adapt water



supply systems, the question boils down to: how much water do we need, and how can we make efficient use of what is available?

Stephens then referred to the **2005 Penticton Workshop** that the [Water Sustainability Committee](http://www.waterbucket.ca/wsc/)<sup>6</sup> of the [BC Water & Waste Association](http://www.waterbucket.ca/wsc/) held in partnership with the former Land & Water BC (LWBC) and the former Ministry of Water, Land & Air Protection. He explained that the 2005 workshop provided him with a frame-of-reference for answering the question that had been posed to the panel. "This is a subject matter in which the Water Sustainability Committee has invested considerable time to develop a philosophy and an approach," elaborated Stephens.

<sup>1</sup> [http://www.fraserbasin.bc.ca/programs/climate\\_workshop.html](http://www.fraserbasin.bc.ca/programs/climate_workshop.html)

<sup>2</sup> <http://www.waterbucket.ca/wcp/index.asp?sid=49&id=521&type=single>

<sup>3</sup> [http://www.waterbucket.ca/cfa/index.asp?type=summary&section=Water\\_Sustainability\\_Action\\_Plan&sid=4](http://www.waterbucket.ca/cfa/index.asp?type=summary&section=Water_Sustainability_Action_Plan&sid=4)

<sup>4</sup> <http://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/102.pdf>

<sup>5</sup> <http://www.sustainis.org/>

<sup>6</sup> <http://www.waterbucket.ca/wsc/>

In 2005, the Penticton [full-day technical transfer session connected the dots](#)<sup>7</sup> between water resource planning, climate variability and risk management; explored the tools and techniques available through demand-side management; and gave participants ‘hands-on’ planning practice to demonstrate how to achieve a water balance without relying on new sources and infrastructure.

## Reconciliation of Long-Term Visions with Short-Term Realities

### Conundrum?



Kim Stephens used a slide from the [2005 presentation by Robert Hicks](#)<sup>8</sup> to provide what he called a ‘point of departure’ for the Fraser Basin audience. “Retirement planning is something that most people understand and do intuitively,” commented Stephens, “So why is it that when it comes to community and/or resource planning, we are seemingly incapable of overcoming the gap between long-term and short-term thinking?”

Stephens noted that the objectives for water systems and infrastructure planning are similar to those for retirement planning, namely:

- Maximize return on investment
- Minimize risk
- Recognize financial limits (savings and withdrawals)

“Yet we struggle to make long-term decisions related to dealing with uncertainty and managing risk when it comes to sustaining the very infrastructure that our communities depend upon for life support,” summarized Stephens, “**Robert Hicks** of Metro Vancouver characterizes the disconnect in thought between retirement planning and water management as a **conundrum**.” (A conundrum is defined as a paradoxical, insoluble, or difficult problem; a dilemma.)



### Sound-Bites to Keep in Mind

This slide provided the road map for the presentation by Kim Stephens at the Fraser Basin Council workshop. “These three bullets reflect the essence of what I have observed in my 30-plus year career,” Stephens told his audience.

According to Stephens, “The average person may presume that the water management knowledge foundation is solid, thereby providing a platform to do better. But if there is a structural problem with the basic thinking of those who actually make the planning decisions, then a likely outcome is: *Houston, we have a problem.* I have seen too many of those situations.”

#### Takeaway messages:

- Teachable Moments
- Clear Thinking
- Water OUT = Water IN

<sup>7</sup> <http://www.waterbucket.ca/cfa/index.asp?sid=7&id=24&type=single>

<sup>8</sup> [http://www.waterbucket.ca/waterbucket/dynamicImages/495\\_4ReconciliationOfLongTermVision.swf](http://www.waterbucket.ca/waterbucket/dynamicImages/495_4ReconciliationOfLongTermVision.swf)

## Key Message #1: Teachable Moments

In speaking to this slide, Stephens observed that water is something that the population-at-large has always taken for granted, but that changed in 2003.

**Starting in 2003, we have had one teachable moment after another, and in rapid succession !**



- Droughts
- Floods
- Forest Fires
- Wind Storms
- Pine Beetle

“My 30-year career has been defined by floods and droughts, but the public memory has always been short,” commented Stephens, “When every possible natural disaster happened in 2003, and they have continued to happen, it finally caught the attention of the public.”

According to Stephens, “There was a realization that maybe, just maybe, there are forces beyond man’s control. We had the teachable moment because people were reachable. The **teachable moment** creates the window of opportunity to change behaviour.”

“Reachable, teachable – that’s the sequence,” he added, “Reachable means people have their minds open and are receptive to the teachable lesson (moment). They’re listening!”

To emphasize his point, Stephens said he was reminded of 1991 when there was a reachable-teachable moment related to the need for water treatment in British Columbia. He explained that there was sudden alarm because of the exponential increase in boil water advisories.

He asked a rhetorical question: “Were conditions actually worsening – for example, as indicated by “beaver fever” outbreaks – or was it that we now had the technology to look for things at an incredibly microscopic scale after not having thought about them in the past and/or not having paid attention?”

## Key Message #2: Clear Thinking

**Why clear thinking is needed now:**

- Often we create layers of complexity around assumptions

→ Ask a different question,  
Get a different answer

- There is a prevailing mindset that says there is only one right answer
- Computers are great, but are not a substitute for judgment

When he introduced this slide, Stephens prefaced his remarks by stating that he is an optimist: “The glass is half-full and the water level is rising.” He said that his purpose in providing three illustrations of typical engineering-planning practice was to make the point that ‘clear thinking’ is not necessarily the norm.

### Layers of Complexity:

“We practitioners sure like to make things complicated. It seems to be our nature,” observed Stephens, “In fact, it is a real challenge for practitioners to explain things simply.”

He provided an example from his conversations with elected representatives who express frustration with technical people. “How do they expect us to make an informed decision when we don’t understand what they are talking about,” he quoted one regional leader.

He also referred to the onion analogy and peeling back the layers to get to the core assumption. “In my career, I have seen many instances of simplistic assumptions underpinning major project decisions. Often, when you ask the ‘why are we doing this’ question, those assumptions do not stand up to scrutiny,” he elaborated.

## One Right Answer:

"We have a culture of expecting one answer; and this ignores uncertainty," continued Stephens, "Engineering standards are the epitome of the *singular answer* mindset."



Stephens commented on the collaborative effort involved in preparing his Fraser Basin Council presentation. His brainstorming with other members of the Water Sustainability Committee, notably Robert Hicks, had resulted in them reflecting on engineering education.

"We asked ourselves whatever happened to the decision tree of way-of-thinking for dealing with the reality that the answer is only as good as the data, such that you present ranges to deal with uncertainties," he asked rhetorically.

According to Stephens, "The key message is that the future will always be different than expected...because there are so many decision points along the way that influence the outcome."

## Computers versus Human Judgment:

"Too many people mistake precision for accuracy," observed Stephens, "Models are a great help if the results stimulate a person to think about the implications of the assumptions, but watch out when a person believes the model is reality."

To illustrate his point, Stephens then told an anecdote about the time he was invited to speak to local governments in Australia: "**Peter Coombes** of the University of Newcastle made the point that good engineering is about observation and deduction, and we have forgotten that."

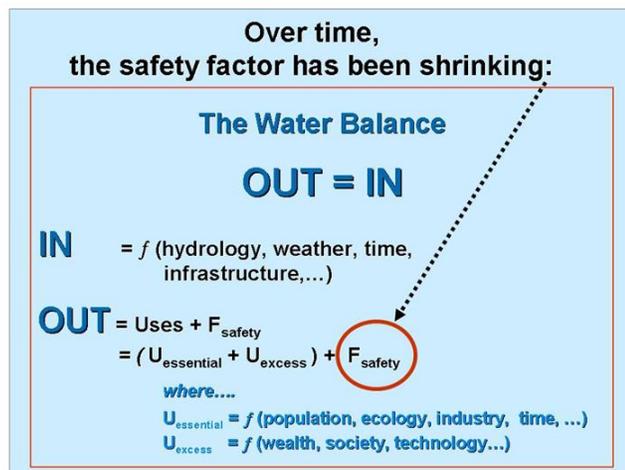
## Key Message #3: Water OUT = Water IN

The meat of the presentation by Kim Stephens was contained in this signature slide for the Water Sustainability Committee. First unveiled at the [2005 Penticton Workshop](#)<sup>9</sup>, it was then published in [Convening for Action in the South Okanagan: Moving Towards a Water Balance Way-of-Thinking and Acting](#)<sup>10</sup> in February 2006.

It has also been presented at a variety of forums, both technical and non-technical, including [the keynote address at the World Water Day 2006 hosted by UBC-Okanagan](#)<sup>11</sup> and the June 2006 meeting of the [elected representatives steering committee for the South Okanagan Regional Growth Strategy](#)<sup>12</sup>.

According to Stephens, ensuring a safe and adequate water supply depends on understanding the science behind the **Water OUT = Water IN** equation, as well as understanding what this means on the ground...at the operational level.

**This deceptively simple equation embodies the basic principles and concepts for dealing with uncertainty and managing risk**



<sup>9</sup> <http://www.waterbucket.ca/cfa/index.asp?sid=7&id=24&type=single>

<sup>10</sup> <http://www.waterbucket.ca/cfa/index.asp?sid=28&id=38&type=single>

<sup>11</sup> <http://www.waterbucket.ca/cfa/index.asp?sid=18&id=37&type=single>

<sup>12</sup> <http://www.waterbucket.ca/cfa/index.asp?sid=28&id=54&type=single>

Because of his engineering background, Stephens used a safety factor analogy and pointed out that the safety factor has been shrinking over time: “When you have a large water resource versus a small demand, variability is not that noticeable. But when the demand is large relative to the available resource, a small variation on the supply side magnifies the perception of impact. In many cases, BC communities are operating on narrow margins.”

Stephens again asked his Fraser Basin Council audience a rhetorical question: “How do you solve the  $OUT = IN$  equation when both sides are variable? After all, it is mathematically not possible to solve for two or more unknowns when you have a single equation.”

“The inherent variability creates uncertainty which in turn creates risk,” he continued, “There are multiple *what if* combinations and permutations.”

Stephens then drew upon his career experience to illustrate the nature of water supply for communities large and small in British Columbia. “While it rains a lot in BC, we don’t have an abundance of supply when demand is greatest. In my experience, many communities have been vulnerable for decades because we typically tap small creeks and we have few major groundwater aquifers. In short, the issue is already one of *under supply*.”

“The nature of the British Columbia geography/topography is that we are typically storage-constrained, and what storage we do have is measured in weeks to months,” he elaborated.

“We already have an efficiency issue, and climate change is aggravating an existing vulnerability,” Stephens added, “So, if we are vulnerable on the IN side of the equation, then we have to build in resiliency on the OUT side. But where will we do that, keeping in mind that everything is in flux?”

He answered his own question by explaining that “We look for the little things that will yield cumulative benefits – for example, requiring a foot of soil for all development sites so that there is a sponge that reduces *water need* and prevents *water runoff*.”

## Build Resiliency Incrementally

Kim Stephens concluded his presentation with a slide that he said came out of a conversation with Jamie Swanson, an engineer who formerly was on staff with the Cowichan Tribes on Vancouver Island.

**In conclusion,  
we can create our future  
if we keep in mind that...**

**To get to the big picture...  
start with the smallest pieces**

**To deal with uncertainty  
and manage risk....  
build resiliency incrementally**

Stephens prefaced his remarks by reflecting on his experience as a project manager: “The essence of project management is that an effective project manager has to operate on two tracks: one track is the big picture, which is the destination; the other track comprises the details, because if you don’t take care of the details you can easily be derailed.”

“Jamie’s example of the big picture was protection of the Cowichan River, and the smallest piece was the engineering standard that he developed for the foundation drain around the Band Administration building,” reported Stephens.



“When it comes to dealing with uncertainty and managing risk, there is no silver bullet,” concluded Stephens, “We need to do a whole bunch of little things because the flip side of a problem is an opportunity; hence, the flip side of a cumulative impact is a cumulative benefit. Over time the benefits accumulate.”

Kim Stephens wrapped up his presentation by pointing out to the Fraser Basin Council audience that this **cumulative benefits way-of-thinking and acting** had closed the loop on the retirement planning opening thought.