

Aquatic Resource Protection: Are We on the Right Track?



International Ltd.

Disclaimer

I know that you may disagree with some or all of my presentation. That's ok.

I think you are wrong.



Implementation of stormwater management is not just about building ponds, wetlands, rain gardens or water tanks.

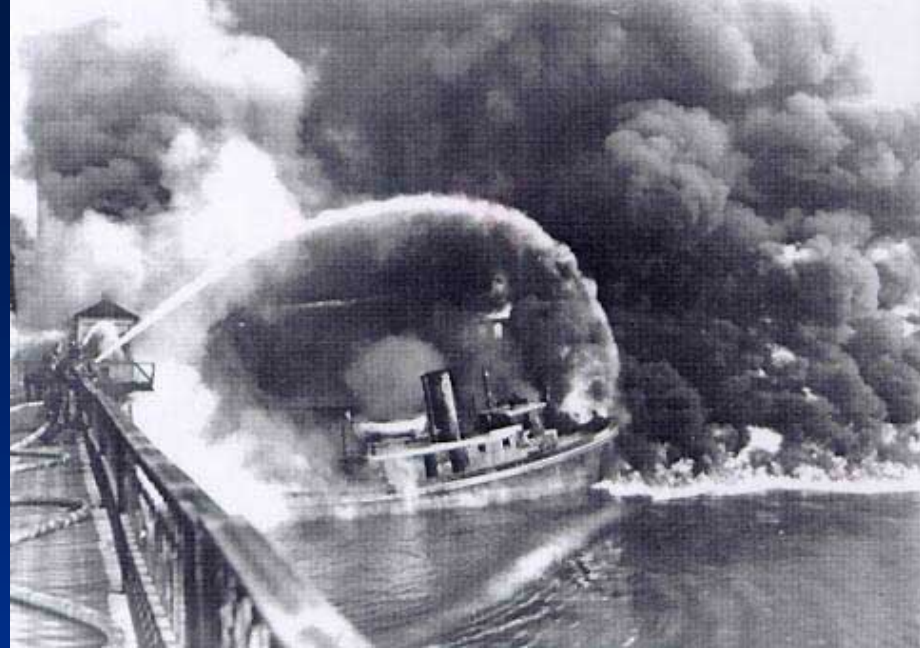


When Implementing a Stormwater Management Programme, There are a number of Elements that need to be Present

- Clearly defined programme goals,
- A recognition of the various programme elements that are necessary to have a successful programme,
- Adequate resources,
- An evolutionary path,
- A stable political environment,
- A recognition that change is inevitable, and
- A way to measure success



Clearly Defined Programme Goals



Cuyahoga River Fire
1969

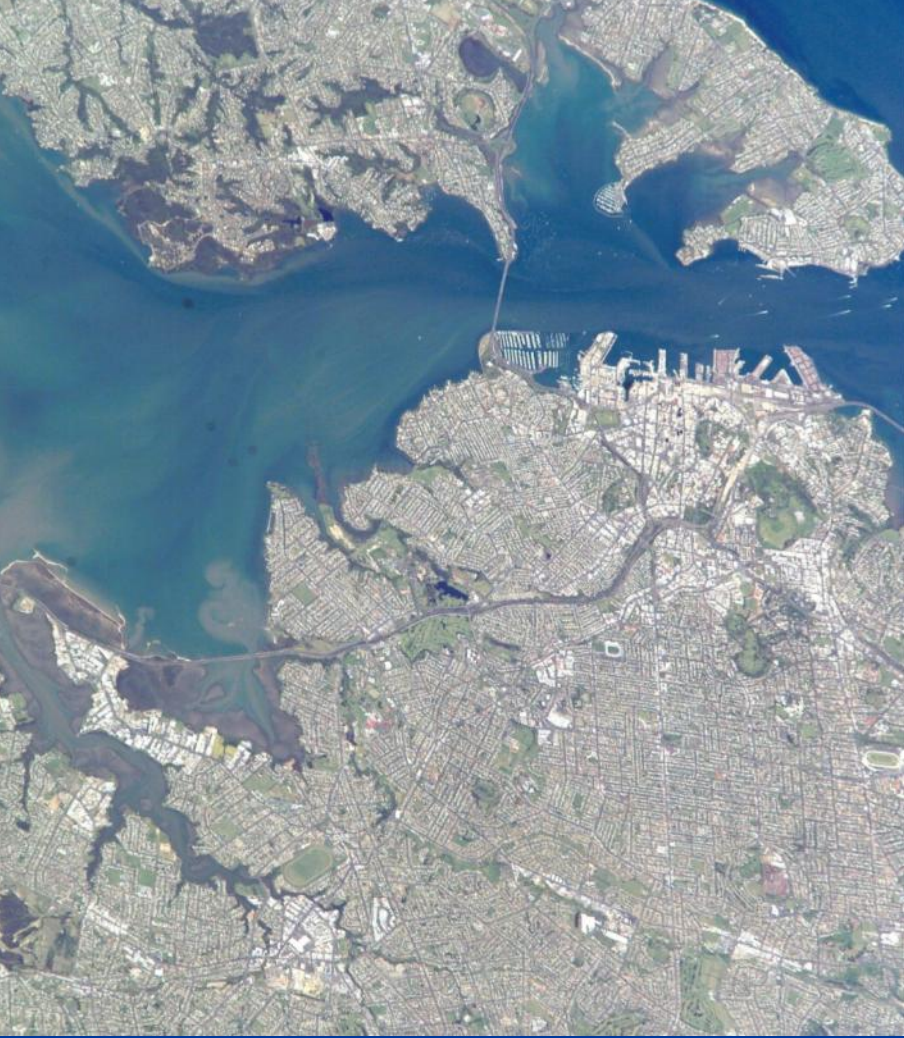
Often credited with being
responsible for passage of the
U.S. Clean Water Act



The River caught fire due to
industrial chemical pollution

Chesapeake Bay
Programme
has focused on
nutrients due to
anaerobic
conditions



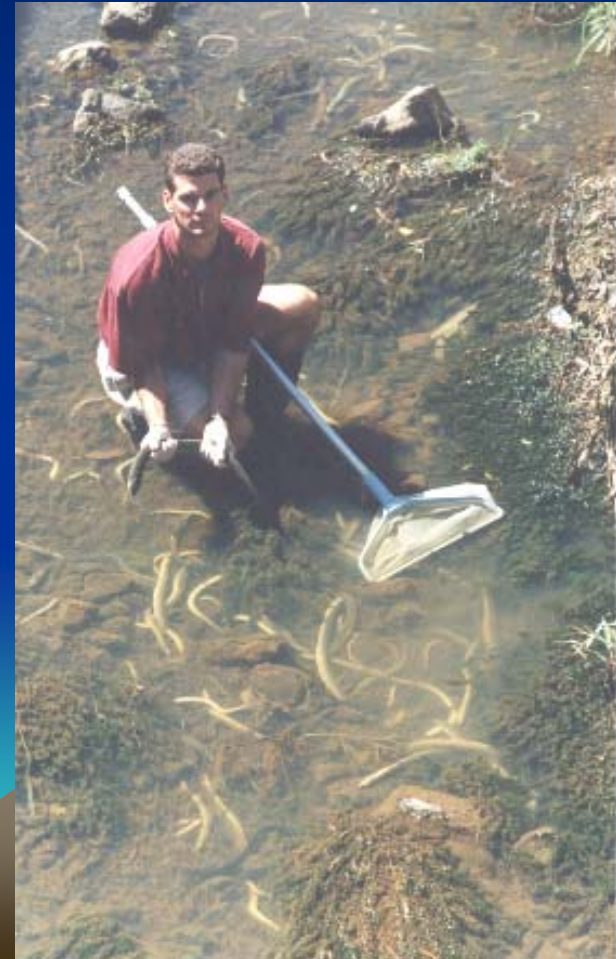


The Auckland
Region has
focused on
sediment and
metals



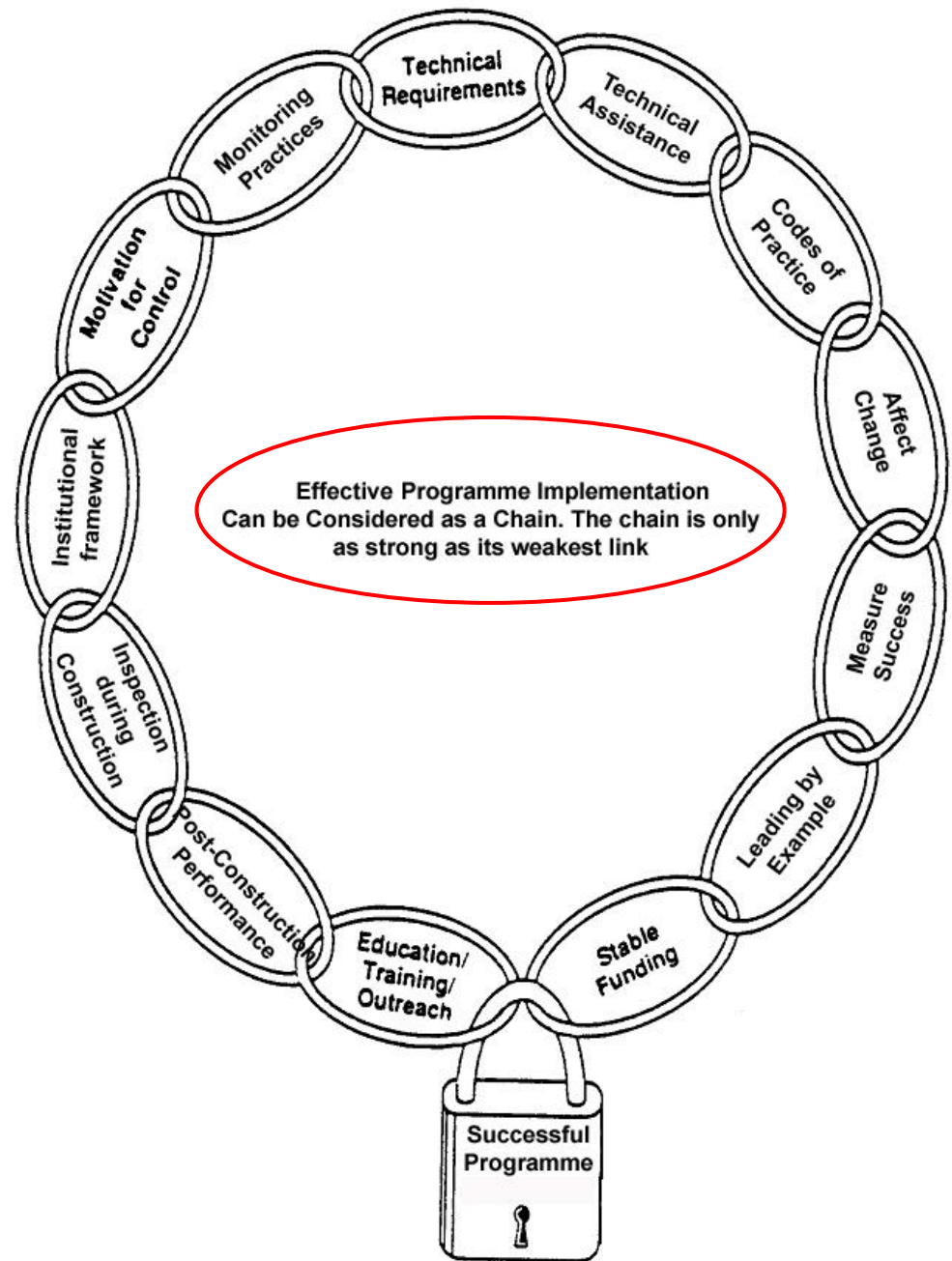
You have to have a clear understanding of what problems you want to solve by implementing a programme. Then you have to communicate that understanding.

An educational programme has to convey to politicians, management and the general public why programme implementation is important.



Programme Elements

Issuance of consents or criteria for permitted activities is the easiest part of programme implementation



Adequate Resources

It all comes down to cash



Mechanisms that can be used for funding capital works

- Borrowing,
- Vested interest or financial contributions
- Development contributions



Mechanisms that can be used to fund capital or operational and maintenance works

- Allocations and grants from national roading charge revenues
- Regional sales tax
- General rate based on property value
- Uniform annual general charge
- Targeted rate based on land area
- Targeted rate based on impermeable surface area
- Targeted rate based on hydrological contributions
- Fees and charges
- Penalties



Funding Mechanisms that could be used to reduce stormwater runoff

- Voluntary offset credit and incentive mechanisms
- Negotiated agreements
- Market based quantity instruments (similar to carbon credits)



Debt financing is still one of the most widely used and accepted mechanisms to fund replacement or upgrading of stormwater infrastructure. However there is increasing nervousness among authorities about further increasing debt and having to increase rates to service increased borrowing.



Impervious Area Charges: an emerging approach to financing

Impervious area charges are now used in over 600 jurisdictions in North America and over 60% of cities in Germany.

Based on site impervious surfaces, the charges are considered equitable.

Credits can be given to those who implement source control or mitigation to reduce rates.



Lessons from International Literature

- Funding systems adopted in individual jurisdictions in North America and Europe are highly context specific
- Common elements, however, include concern over increasing urbanisation, declining environmental health, increasing resistance to non-specific taxes and rates, and to public debt. Consistent trends are toward recognising the private benefits of services, differentiating between specific services and implementing target use-based charges.
- There is considerable international experience in the detailed design and implementation of impervious area charging systems



Environmental programmes are as important as other programmes and funding as to be institutionalised.

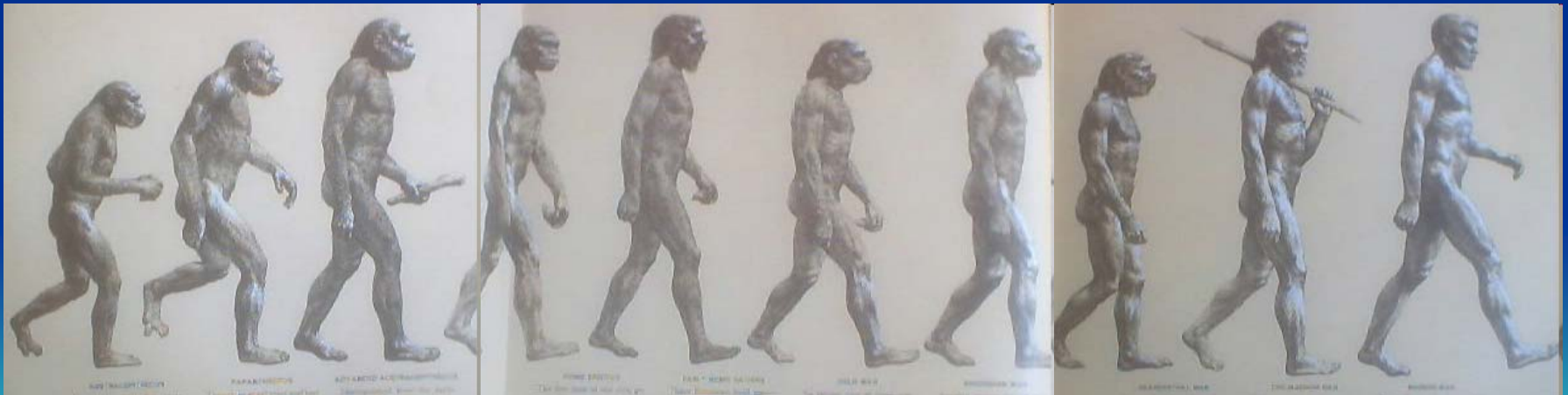
Right now is a good example. New projects still need to be accounted for but budgets for environmental programmes are being cut.

We are too willing to compromise environmental outcomes when cost cutting needs to be done.

Our funding approach to environmental programmes has to change or we are just reducing the rate of decline and transferring costs to future generations.



Evolution has to Occur



Most of us live in fairly sterile environments, where the landscape is dominated by buildings, streets, footpaths and other impervious surfaces. We are, for the most part, disconnected from nature.

Only by preserving something of the natural environment can we retain a sense of place, an identity with the land, and have a distinctive sense of being part of our environment.

Programme evolution is slowly gravitating to blending human use with environmental safeguards.



Low Impact Design Water Sensitive Urban Design Sustainable Urban Drainage Conservation Design

These are all design approaches to site development that **protect** and **incorporate** natural site features into the site development plan.





Examples of LID Practices



LID Misconceptions

Stormwater and
development
infrastructure



LID costs more

Initial costs can be greater but overall costs are generally less.

Why does the developer get away with minimising his cost when society has to cover the greater whole-of-life costs.

Table 9. Summary of Cost Benefits of LID vs. Conventional from Case Studies

Case Study	LID Costs More	LID Reduces Infrastructure Costs	Faster home sales	Overall Project Savings *
Laurel Springs	No	Yes	Yes	Yes
SEA Streets	Yes	Yes	--	Yes
Rivergate	--	Yes	--	Yes
South Kingstown	--	--	Yes	Yes
WSSI	Yes	No	--	--
Pembroke Woods	No	Yes	Yes	Yes
Somerset	No	Yes	Yes	Yes
Jordan Cove	--	No	--	--
Forest Ridge	--	--	Yes	--
Forest Brooke	Yes	Yes	Yes	Yes
Boulder	Yes	Yes	--	Yes
Figtree Place	--	Yes	--	Yes
Glencourt	Yes	Yes	--	Yes
Rappahanock	Yes	Yes	--	Yes
Henrico	Yes	Yes	--	Yes
Frederick Retail	Yes	Yes	--	Yes
Germantown Office	Yes	Yes	--	--

Sources: CWP (2006), Coombes (2004), CWP, (1998), Alexander and Heaney (2002), Hardy et al (2004), and Huber at (2006)

--: study did not examine this benefit

LID Misconceptions (cont.)

LID is still considered to be an innovative practice.

The listings are all for catchments where LID is being implemented on a catchment-wide basis.

It is generally accepted to be a valid approach to providing stormwater and environmental benefits on a catchment-wide basis.

Catchment	Purpose
Green Cove Basin, Washington	prevention of further aquatic habitat damage
Huntersville, North Carolina	Protection of streams and lakes
U.S. EPA headquarters retrofit	Anacostia River restoration project
Longfellow Creek, Seattle	Improve water quality and stream flows
Santa Monica Bay, California	Reduce runoff and pollution
Rappahannock River, Virginia	Resource protection and preservation
Puget Sound, Washington	Protection of streams, rivers and wetlands
Jordan Cove, Connecticut	LID demonstration projects
Patuxent River, Maryland	River restoration
Lynbrook Estates, Melbourne	Protection of downstream aquatic resources
Figtree Place, Australia	Treatment train approach to stormwater
Portland, Oregon	Downstream aquatic resource protection

PROPOSED VARIATION 66 LONG BAY STRUCTURE PLAN draft land use strategy

(to be read in conjunction with Zoning Map 2)

Legend

- RIDGELINE HEIGHT CONTROL
- ■ ■ TYPE A & B STREAM PROTECTION AREAS
- RIPARIAN CORRIDOR
- 1C- LONG BAY STREAMS

LANDUSE

- PROPOSED ROAD
- LONG BAY 5A (VILLAGE CENTRE)
- LONG BAY 4 (URBAN VILLAGE)
- LONG BAY 3 (URBAN NEIGHBOURHOOD)
- LONG BAY 2 (SUBURBAN NEIGHBOURHOOD)
- LONG BAY 6 (STORMWATER MANAGEMENT)
- LONG BAY 7
- LONG BAY 1A (LARGE LOT RESIDENTIAL 2500m2)
- LONG BAY 1B (LARGE LOT RESIDENTIAL 5000m2)
- LANDSCAPE PROTECTION AREA - CONSERVATION
- LANDSCAPE PROTECTION AREA - ENHANCEMENT / PARK INTERFACE
- LANDSCAPE PROTECTION AREA - ECOLOGY / STORMWATER
- STREAM INTERFACE MANAGEMENT AREA
- HERITAGE PROTECTION AREA
- 10m SETBACK
- EXISTING RESERVE
- EXISTING ROAD
- SCHOOL
- SERVICE UTILITY

**Interim Decision Version
28 November 2008**

N

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250 125 0 250 Metres



LID Misconceptions (cont.)

Performance is unknown

There are numerous other studies that have documented peak flow reduction but these relate to total annual runoff volumes.

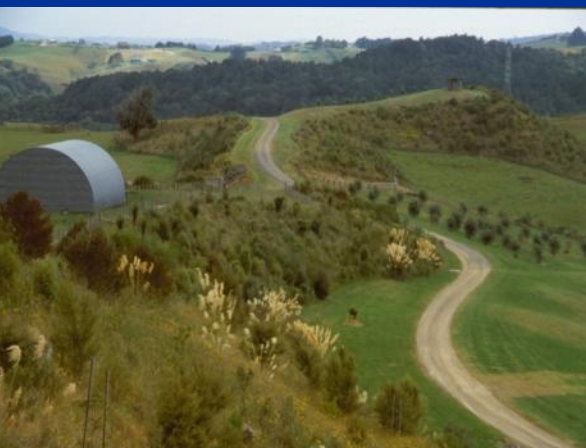
Project	Reduction in Annual Runoff Volumes
Sea Street (Seattle, UA)	99%
Linbrook Estates (Melbourne, Au)	54%
Anacostia (USA)	Matched pre-development hydrology
Glenco, Portland (USA)	94%
BES Lab, Portland (USA)	20 – 50%
Prince Georges Co. (USA)	20%

LID Misconceptions (cont.)

LID is about implementation of rain gardens and water tanks only. It's not!

LID is a philosophy that encompasses a variety of elements including:

- Clustering
- Reducing imperviousness
- Use of biofiltration practices
- Revegetation
- Incorporation of natural site features into overall site or catchment design
- Water reuse
- Maximising open space in the urban context



LID Misconceptions (cont.)

LID is only appropriate on greenfields sites

While easier to implement, LID can be used on any site. Elements can include:

- Rain gardens
- Water reuse
- Swales
- Revegetation
- Green roofs
- Clustering
- Stream daylighting

Christchurch
urban stream
restoration
programme



Birkdale Road
Permeable Paving

Constellation Drive
Park & Ride



LID is being Implemented Globally

Actual practices and uses are very similar (some differences) from location to location around the world but some terminology may be different.

In the U.S. it is called LID or Conservation Design

In England, WSUD is called Sustainable Urban Drainage Systems (SUDS).

In New Zealand, it can be called LID or Low Impact Urban Design and Development (LIUDD)

In Australia is is called Water Sensitive Urban Design (WSUD)



But There are Some Real Impediments

- Institutional barriers
 - Codes of practice
 - Lack of willingness of many TA's to accept LID
- Time frame costs to developers for the consent process
- Lack of willingness by developers to change
- Lack of leadership and champions
- Poor construction and ignorance of long term operation
- Lack of willingness by all of us to change ==>



Why Don't We Change?

- Failure to anticipate a **problem** before it arises
- When the **problem** does arrive, a failure to perceive it
- Once the **problem** is recognised, a failure to solve it
- Try to solve the **problem** but don't succeed

(Diamond, J., 2005)

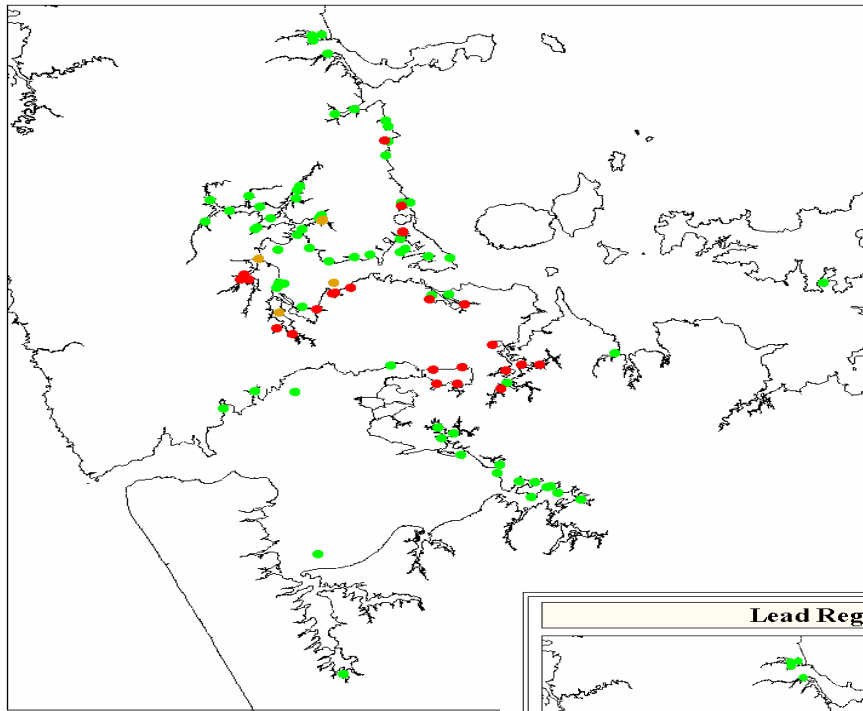


I would put LID in this category

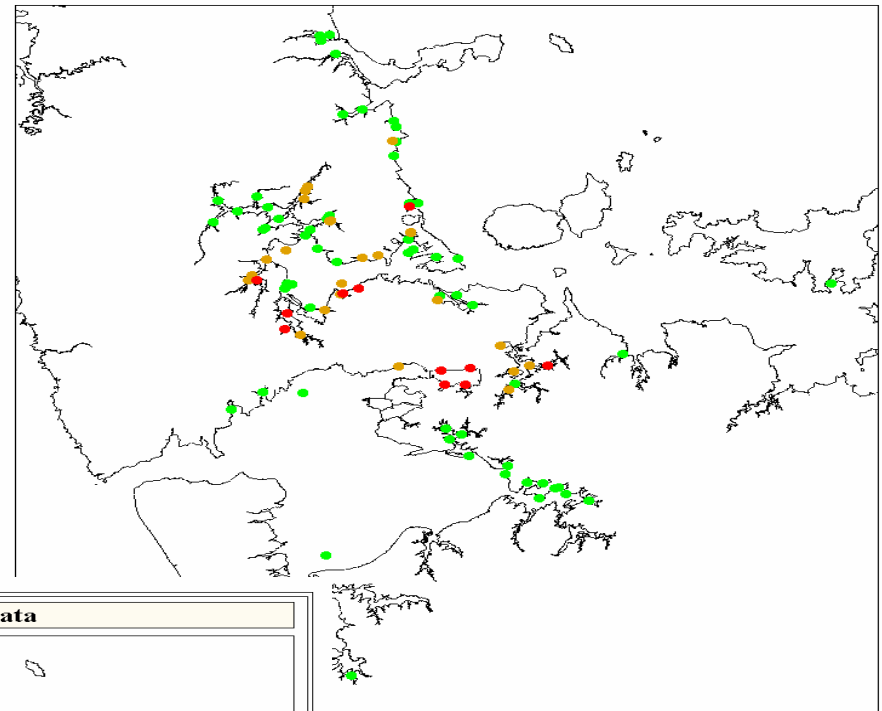
So, what is the **problem**? =>



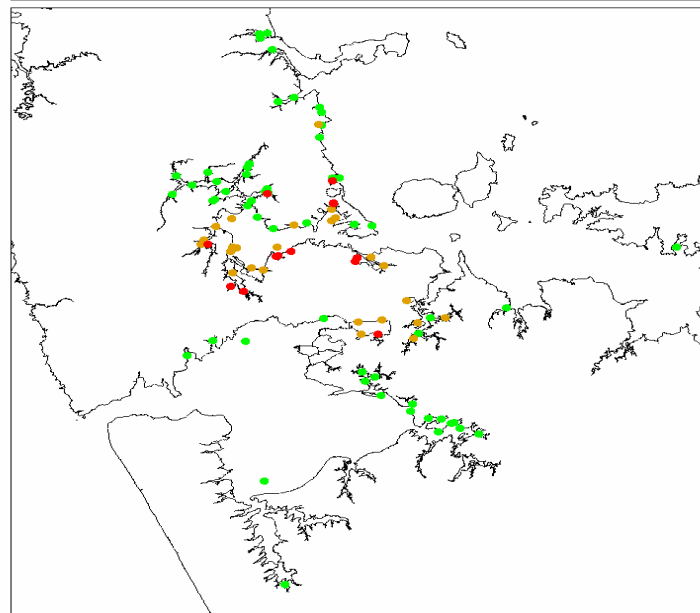
Zinc Regional Data



Copper Regional Data

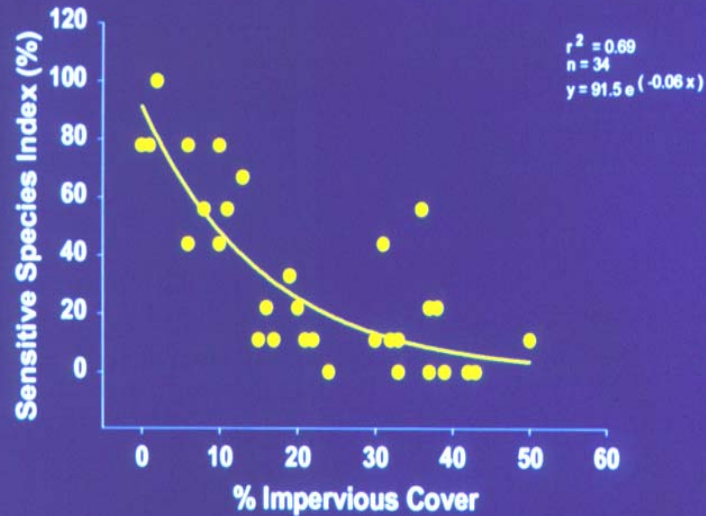


Lead Regional Data



Contamination
of Estuaries

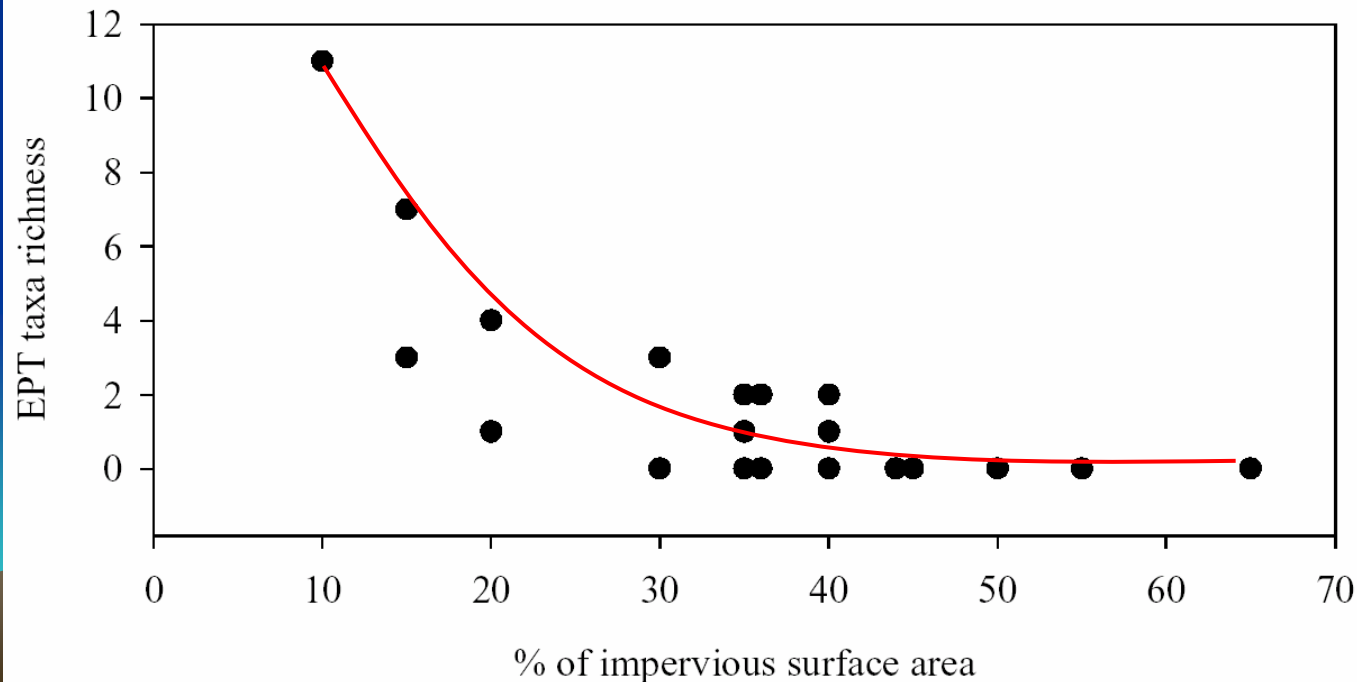
Northern Piedmont Region - Delaware



Macroinvertebrate Diversity and Abundance Impacts in Streams

Auckland Data (Allibone, 2001)

U.S. Data





Impacts to Stream Physical Structure



Loss of Streams

Auckland region streams			Number		Length	
Order	Number of streams ¹	Length (m)	% of total	Cumulative %	% of total	Cumulative %
1	810	1,961,112	60.18%	60.18%	68.25%	68.25%
2	365	598,097	27.12%	87.30%	20.81%	89.07%
3	108	187,888	8.02%	95.32%	6.54%	95.60%
4	56	105,073	4.16%	99.48%	3.66%	99.26%
5	7	21,233	0.52%	100.00%	0.74%	100.00%
Total	1,346	2,873,403	100.00%		100.00%	

There is a perception that small streams have small value



Aquatic Resource Problems

Table 1 Hydrologic and Physical Predictions According to the ICM				
Stream Hydrology Indicator	ICM Stream Classification			
	High Quality	Impacted	Non-Supporting	Urban Drainage
Stormwater Runoff as a Fraction of Annual Rainfall	2 to 7%	10 to 30 %	25 to 60 %	60 to 90 %
Ratio of Post to Pre Discharge 100 Year Storm	1.0 to 1.05	1.1 to 1.5	1.5 to 2	2 to 3
Frequency of Bankfull Flood Events	1.0 to 1.2 per year	1.5 to 3 per year	3 to 7 per year	7 to 10 per year
Fraction of Original Stream Network Remaining	90 to 95%	60 to 90%	25 to 60%	10 to 30%
Fraction of Riparian Forest Buffer Intact	70 to 90%	50 to 70%	30 to 60%	less than 30%
Stream Crossings	0 to 1 per stream mile	1 to 2 per stream mile	2 to 10 per stream mile	No stream to cross
Adapted from Schueler (2004)				

ICM stands for Impervious Coverage Model

Table 4 Aquatic Diversity Predictions According to the ICM				
Aquatic Diversity Indicator	ICM Stream Classification			
	High Quality	Impacted	Non-Supporting	Urban Drainage
Aquatic Insect Diversity	Good to excellent	fair to good	Poor	very poor
EPT Taxa	70 to 90%	40 to 70%	20 to 50%	0 to 20%
Fish Diversity	Good to excellent	fair to good	Poor	very poor
Riparian Plant Diversity	Fair to good, depending on grazing	stressed, with reduced native plant diversity	simplified community with many exotic species	isolated remnants; dominated by exotics
Adapted from Schueler (2004)				

Water has potential energy based on its elevation above sea level. It dissipates that energy as it travels to the sea.

Urbanisation tends to shorten flow paths which, in turn, increases slope



Stream Health with and Without Stormwater Management Ponds

There is benefit from an estuary standpoint but not for streams

Conventional approaches don't protect streams.

Figure 6 - The effects of urbanisation on the macroinvertebrate community; numbers denote BMP sites.

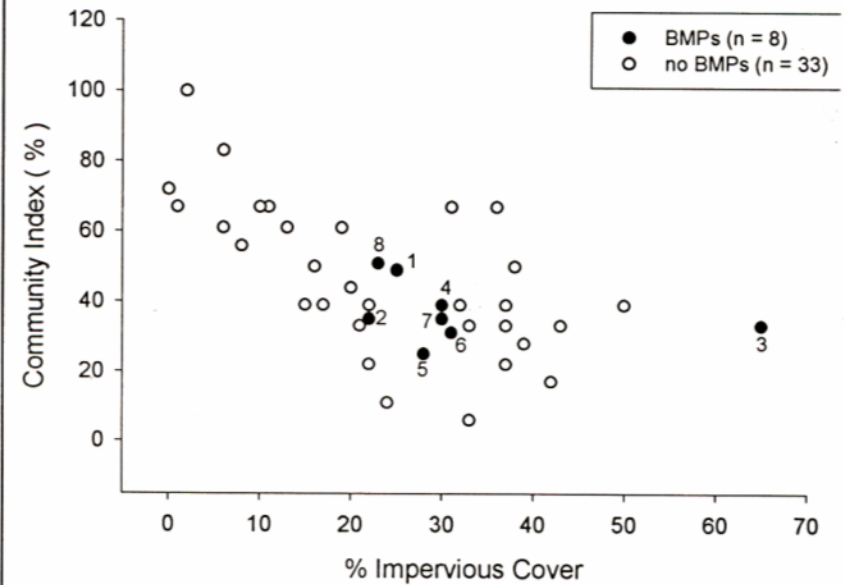
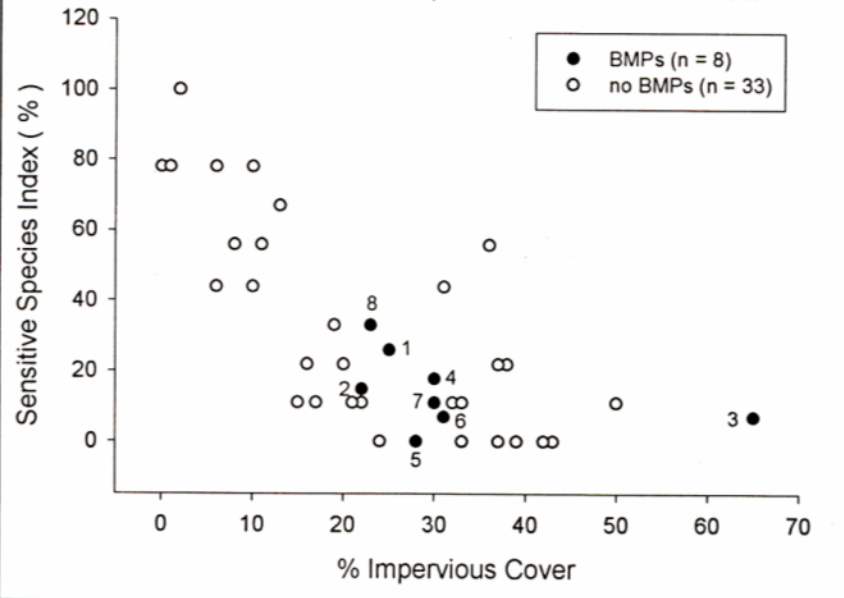
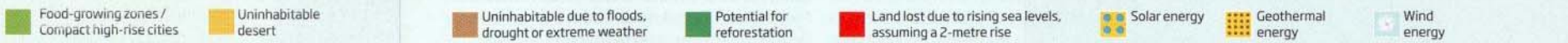
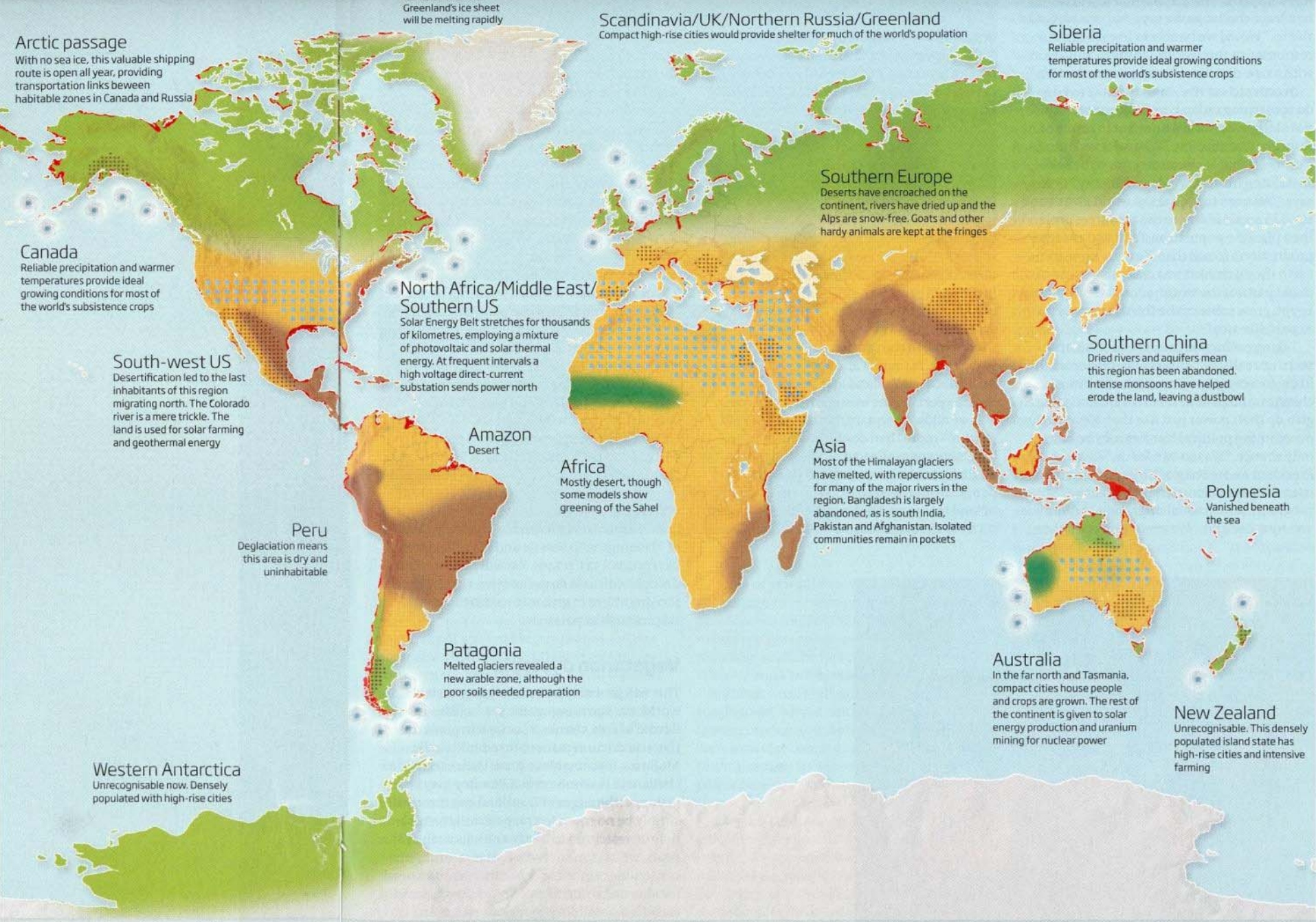


Figure 7 - The effects of urbanisation on sensitive species of macroinvertebrates; numbers denote BMP sites.



● Stormwater ponds as treatment on first order streams
○ Subdivisions having no stormwater ponds as treatment



We need to Aim Higher than We Do

Too often we operate by using minimums as standards. Very seldom do people try to exceed minimum standards. This approach has to change.



A Stable Political Environment



Commitment

All of us in the room are here because of political commitment.

Political commitment represents the recognition that a problem exists and lays out a framework for how to address it.

Politicians seldom act. They react. Political commitment generally comes from having to address a clear problem a river that has caught fire, a bay that is in serious decline, and so forth.

In response to a clear problem, political commitment is relatively straightforward to obtain.



Political Commitment

That is only one part of the equation and it is the easiest part. What happens after that initial creation is where problems and programme success are really determined.

The hard part is to keep programme implementation running effectively to accomplish objectives.

Politicians, rightfully, feel that they have addressed the issue and move on to other priorities. The initial optimism that created the programme dies off and the programme becomes part of the “bureaucracy”.



Case Studies

I would like to discuss 3 programmes.

They will be called:

Case Study 1

Case Study 2

Case Study 3

Those programmes were initiated with the best of intentions.



People Make Programmes

All the programmes were created, they flourished and started to effect change in attitudes and more importantly, on the ground.

Make no mistake, people make programmes. They are the key element and champions in a programmes success or failure. This is seldom recognised in a political environment.



Programme Initiation

In all three programmes, significant advances were realised and all three programmes were recognised either nationally or internationally.

Where politics initially raises its head relates to situations where an existing programme has to work in conjunction with a programme mandated at a higher level. The final decision in terms of programme responsibility and structure may be based on the politics of an organisation rather than appropriateness. But this is a minor problem compared with other ones.



Case Study 1

The stormwater programme had a high profile and was recognised as being proactive and effective for its time.

Background

- Significant political support to protect a valuable resource
- Two primary agencies in 2 different cities were responsible for water quality issues. The relationship wasn't great but it was adequate and they could work together

and then





And then

- A new political leader was elected
- Someone had the idea of a central environmental agency incorporating major elements of both agencies, one of which was forced to move to a different city.
- The immediate effect was that 25% of the staff left the programme to avoid moving to a new city
- Tremendous adverse effect on morale for the stormwater programme
- A key crippling factor – the individual who was appointed to run the agency was unable to interact with staff, was very aggressive and dramatically increased staff stress levels and more people resigned.



Case Study 1 (cont.)

Over the years the programme has become very political. The educational elements were curtailed and to this day 19 years later, the stormwater programme has not completely recovered.

It was a potentially worthwhile effort to create this environmental agency but the physical structure and the wrong people at the top severely affected the programme.

Key people and programme champions left the agency



Case Study 2

This programme was created in an atmosphere of working with other entities to improve stormwater efforts. It was low key and was supported by industry as a vehicle to comply with programmes mandated at a higher level.

I wouldn't call the programme outstanding but it was good, steady, has maintained its low profile and has been left alone by politicians.



Case Study 2 (cont.)

There is continuity in the programme and modest advances have been made over time.

A key element here is that individuals responsible for programme initiation and implementation have moved up within the organisation and have continued to support the programme.

The programme started 19 years ago and is still active and making advances. They recently closed down a U.S. Air Force Base for pollution and won the case and cleanup is now occurring.



Case Study 3

Another good programme having strong political support



And then

- Key politicians changed
- A new manager was appointed who wanted to restructure
- There was significant shifting of agency priorities



Case Study 3 Results

- There was a new organisational structure
- Existing programmes were split into different categories



Results

- Existing programmes were split up
- Overall staff morale crashed
- Over 60% staff turnover in 12 months (most marketable people – over 1000 man years of experience gone)
- Development of a silo mentality with reduced communication between programme elements
- An enormous amount of institutional memory and programme experience were lost



Discussion Points

- The higher a programmes profile, the greater the chance it will be restructured
- The best staff, those who are marketable, leave – almost universally management does not recognise the value of people
- The hiring and training process for new staff takes years
- Programmes can also be adversely affected for years
- For the most part, the general public is unaware of the impact that changes will make.



Governmental structure should be governed by science as much as any other field of endeavour.

Trials can reveal that structures do not work well or worse. The road to hell is often paved with good intentions.

Why aren't trials held to determine effectiveness? One reason is that policy makers and their supporters don't like it when their ideas are shown to fail.

Science can not tell us what a societies aims should be, but once we decide on a given direction, science can provide the best way to achieve them.

We should be indignant when political appointees or politicians implement untested or failed organisational structures.

(adapted from a New Scientist Magazine editorial 24/5/08)

What Can We Do About It

- We can't be complacent when initial discussions are being held
- When things are going good we have to educate, educate, educate politicians, management, environmental groups, general public about the good things that are being done.
- We have to understand how the politics of an organisation work
- Prepare briefing papers
- A good programme leader may not want to go higher in an organisation, but it may be the best way to protect a programme
- Don't rely on luck



How this all relates to stormwater management

- It can be informative to look at the organisational change literature for guidance.
- Mostly bad news: It has been reported that ~70% of major change management initiatives in organisations fail (Beer and Nohria, 2000). Can also take many years (7-10 years is common) to effect positive response.



Change is Inevitable



Why don't we as individuals act

- Our approach tends to be crisis driven where chronic problems are placed to one side.

Or

- We don't want to make waves, knowing that the changes will have political overtones

Or

- We are afraid to “cry wolf” and have our concerns dismissed

Or

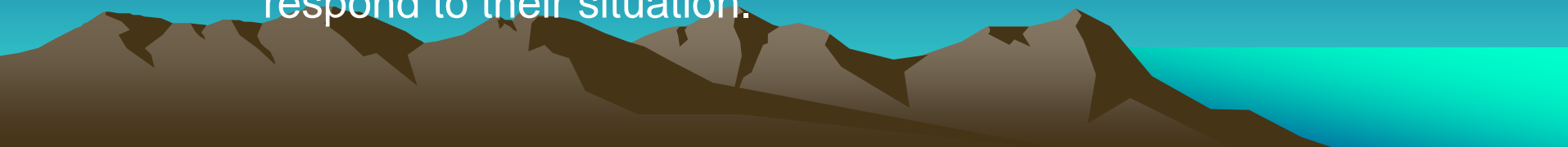
- Psychological denial



The Environment Has to be Balanced Against the Economy

- Are environmental concerns a luxury?
- Do measures to solve environmental problems mean incurred costs?
- If we don't solve environmental problems, do we save money?
- Environmental messes cost huge sums of money both in the short and long term to clean up.
- Preventing messes saves us huge sums in the long term
- In caring for the health of our surroundings, just as our bodies, it is less expensive to prevent problems than to solve them once they have occurred.

Societies either thrive or decline depending on how they respond to their situation.



A Measurement of Success



Ways that Success can be Measured

Basic level

- How many consents have been issued
- Consent review times
- How many complaints handled
- How many inspections accomplished
- Evaluation forms completed by interested parties
- Capital projects completed

A slightly higher level of measure

- How many practices installed
 - Area covered by those practices
 - Contaminants captured
 - Maintenance activities
- 
- A decorative silhouette of a mountain range is positioned at the bottom of the slide, spanning the width of the content area. The mountains are rendered in dark brown and black tones against the blue background.

A Better Measure of Success

- Aquatic response to development is either unaffected or improved
- Flooding problems being reduced
- Chemical monitoring of receiving system or stormwater management practices
- Stream flow monitoring
- Sediment monitoring

Programme evolution relies, to a large extent, on measuring success. We can't get better if we don't know how well we are doing.

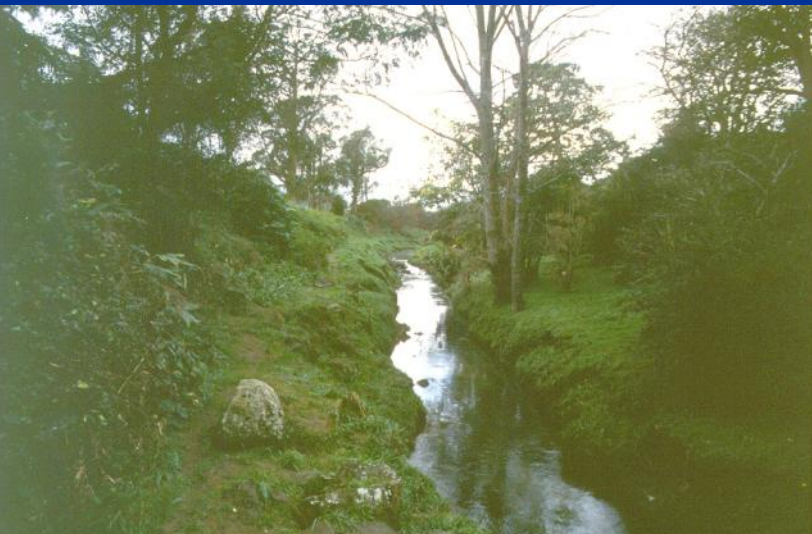


Some Real World Examples



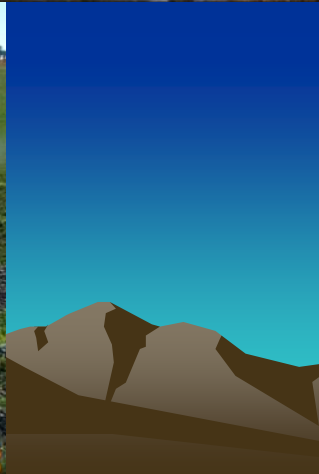
Colours
Water
isn't
supposed
to be







Good Things
are Happening



8.3.2000 08:33

Reality

- Poor implementation
- Lack of good land use control
- Lack of political will and support
- Ineffective baseline controls

How do we get today's overall reality to evolve into our goals for the future

- Catchment based approaches
- Ecological restoration or protection
- Sustainable development
- Achievable outcomes

Goals



Back to the original question:

Are we still making a difference

Lets look at the various elements that have been discussed:

Clearly defined goals	☹	Overall Rating
Adequate resources	☹	
An evolutionary path	☹	☹ - ☹
A stable political environment	☹	
Change is inevitable	☹	
Measurement of success	☺	

In times of crisis, the environment always seems to suffer.

We are having an economic crisis and the environment is often seen as being less important than other issues.



We need to realise that there is no one else that we can turn to solve our problems and we need to learn to live within our means.

A hundred years ago we all lived on farms. Our environment was the valley that our family lived in. We did not understand the impacts that we were having downstream.

Now we do understand the impacts that we have on the environment and failure to act is on our heads.



We are here



When all is said and done

We

only protect what we care about
only care about what we understand
will only understand what we have been taught
must always be willing to teach
must never cease to be students