COSTS AND BENEFITS OF ON-SITE STORMWATER DEVICES

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ABSTRACT (300 WORDS MAXIMUM)

The Auckland Plan and the Proposed Auckland Unitary Plan (PAUP) place significant emphasis on green growth and water sensitive design. Freshwater policies seek a water sensitive design approach for new developments such as Special Housing Areas (SHAs) and for comprehensive brownfields development. Additionally, stormwater discharge, flow and quality rules in the PAUP apply to both new development and redevelopment in Auckland.

This paper summarises the Auckland Council Technical Publication TR2013/043, which compares the life cycle costs of a range of stormwater management devices that can be used to meet controlled activity requirements in the PAUP stormwater management flow and quality rules. This includes the reduction of runoff volumes through retention of small, frequent events in SMAF areas and the treatment of high-contaminant generating areas at source. The flow requirements in particular cannot be met using solely catchment-scale management devices such as wetlands. This, along with policy supporting a Water Sensitive Design (WSD) approach shifts the focus from end-of-pipe treatment to on-site management of stormwater quality and quantity (for flows less than the 2 year ARI).

This paper compares the cost implications of traditional wetland treatment with on-site stormwater management for different development scenarios. Construction, average annualised maintenance and total present cost of the various options have been presented to inform decision making and transparency of costs in implementing the stormwater provisions.

Since limitations associated with quantifying non-market benefits make it difficult to conduct a solely quantitative cost-benefit analysis, TR2013/043 does not attempt to provide Auckland specific monetary values for the wider benefits provided by stormwater management options. The benefits are broadly assessed in terms of detention, retention and water quality outcomes. Case studies have been presented in the publication to show examples of cost-benefit analysis that have been undertaken locally and internationally.

KEYWORDS

Proposed Auckland Unitary Plan, Auckland Plan, Water Sensitive Design, Green Growth, Green Infrastructure, Life Cycle Costs, Benefits

PRESENTER PROFILE

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1 INTRODUCTION

The Auckland Council has notified the Proposed Auckland Unitary Plan (PAUP) to guide and manage the growth and development of Auckland and to give effect to the vision of the Auckland Plan and national policy direction. The Auckland Plan places significant emphasis on green growth and sustainable urban development. The aim of this approach is to meet the challenges of providing for significant growth, while at the same time providing communities with safe, healthy and high quality environments to live in (i.e. a liveable city). In relation to freshwater and stormwater management, national policy direction, primarily the National Policy Statement for Freshwater Management (NPSFM), the New Zealand Coastal Policy Statement (NZCPS) and the Hauraki Gulf Marine Park Act (HGMPA), generally seek to maintain or improve the quality of freshwater and the coastal environment.

Key aspects of stormwater approach in the PAUP are summarised below:

1. Integration of land and freshwater management through aligned land use and stormwater management requirements;

2. A greater emphasis on water sensitive design and green growth for development;

3. On-site management of stormwater quality and quantity for both new development and redevelopment, targeted to activities/areas where the greatest benefits can be achieved;

4. A new regime for managing stormwater quality applying to high contaminant generating activities (HCGA), including establishing treatment device effluent quality requirements that target contaminants of concern for particular receiving environments;

5. Management of stormwater volume and flow from impervious areas in catchments of streams with high sensitivity and value that are likely to be subject to future development pressure i.e. Stormwater Management Area – Flow (SMAF);

The purpose of this paper is to present the findings of the Auckland Council Technical Publication TR2013/043 'Auckland Unitary Plan Stormwater Management Provisions: Cost and Benefit Assessment' so that life cycle costing and the wider benefits of stormwater management options are understood and taken into consideration at an early stage of development design and planning.

2 BACKGROUND

The Auckland Council Technical Publication TR2013/043 'Auckland Unitary Plan Stormwater Management Provisions: Cost and Benefit Assessment' was produced as a guidance document to:

- collate and present the costs (construction, on-going maintenance and total present cost) of typical stormwater management devices that can be used to meet the requirements for on-site stormwater quality and flow management.

- understand the costs of implementing the PAUP provisions for stormwater management from two perspectives – in terms of absolute costs (construction and on-going maintenance) for a range of development scenarios and also in terms of relative costs when compared to the current Air Land and Water Plan (ALWP) statutory provisions. Benefits are also broadly assessed for a range of development scenarios.

The approach to managing contaminant and flow are summarised below. It is worth noting that these provisions are subject to PAUP submissions and are currently being heard through the plan process.

2.1 CONTAMINANT MANAGEMENT (QUALITY)

High Contaminant Generating Activities (HCGAs) are those that contribute significant levels of contaminants to stormwater runoff. These comprise certain cladding materials (including uncoated galvanised iron, zinc and copper based products), car parks that are exposed to rainfall and high use roads. These activities generate and discharge contaminants at a level where treatment will result in a substantial reduction in contaminant concentration and load.

Under the PAUP, stormwater treatment is no longer specified in terms of the removal of total suspended sediment (TSS), but rather as a Design Effluent Quality Requirement (DEQR). The range of indicator contaminants now includes TSS, metals (copper and zinc) and temperature, for which DEQR must be met depending on the nature of the receiving environment into which they discharge. Since temperature has now been identified as a contaminant of concern, traditional treatment devices such as ponds will not meet the DEQR for temperature where the discharge is to a river or stream. However, on-site devices can meet the required DEQR.

2.2 STORMWATER VOLUME AND FLOW MITIGATION (QUANTITY)

Stormwater Management Area – Flow (SMAF) rules seek to manage stormwater runoff peak and volume from new or redeveloped impervious areas on sites/developments that are located in areas identified as SMAF 1 or 2.

In general, SMAF1 areas are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area, while SMAF2 areas typically discharge to streams with moderate to high values and sensitivity to stormwater, but generally with higher levels of existing impervious area within the catchment (TR2013/035).

2.3 COSTS AND BENEFITS

Cost estimates for two SMAF and one HCGA scenario have been provided to demonstrate the range of stormwater devices and associated costs to meet the PAUP requirements. The stormwater management devices align with some of the principles of WSD and Green Growth. Further scenarios are discussed in TR2013/043. These costs have been compared to catchment-wide wetlands (taken as an example of the current approach to stormwater management under the previous regional planning framework). For costing purposes the cost of a wetland servicing a 25 hectare catchment has been chosen as a representative size for urban developments, with land values in the range of \$50 to \$300/m^2. Due to cost variability, a range of costs have been provided.

TR2013/043 present costs under the following headings:

- Construction costs – the initial capital cost (including design and consenting fees).

- Average annualised maintenance costs, undiscounted - the total summed annual and intermittent maintenance costs divided by the appraisal period, with no discounting. This indicates the average cost that the owner of the device would need to pay each year on maintenance.

- Total Present Cost – the combined construction and maintenance costs discounted over the appraisal period back to today's dollars. It is acknowledged that costs fall on different parties, but due the number of possible construction and maintenance payment options, this report simply presents the total present cost (equivalent to a Net Present Value (NPV) analysis) for each stormwater treatment scenario i.e. the payment is considered but who bears the cost isn't.

The 'Total Present Cost' has been estimated through the use of the discounting method. The discounting method uses a 'real discount rate' of 4% and an 'appraisal period' of 60 years to represent current and future costs as one current value. A result of discounting is that costs (and benefits) borne today have more weight than costs (and benefits) further in the future. The use of real discount rate removes the need to include inflation in the analysis.

Unless otherwise noted the costs include:

- Civil and landscaping construction works.

- Consent and consultant/design fees.

And exclude land costs (unless specifically included as for wetlands) and GST.

Due to the difficulties in undertaking a solely quantitative cost-benefit analysis, benefits have been broadly assessed in terms of detention, retention and water quality outcomes in this publication. The report also discusses a number of local and international case studies where different methods have been used to capture the range of benefits versus costs of different stormwater management approaches.

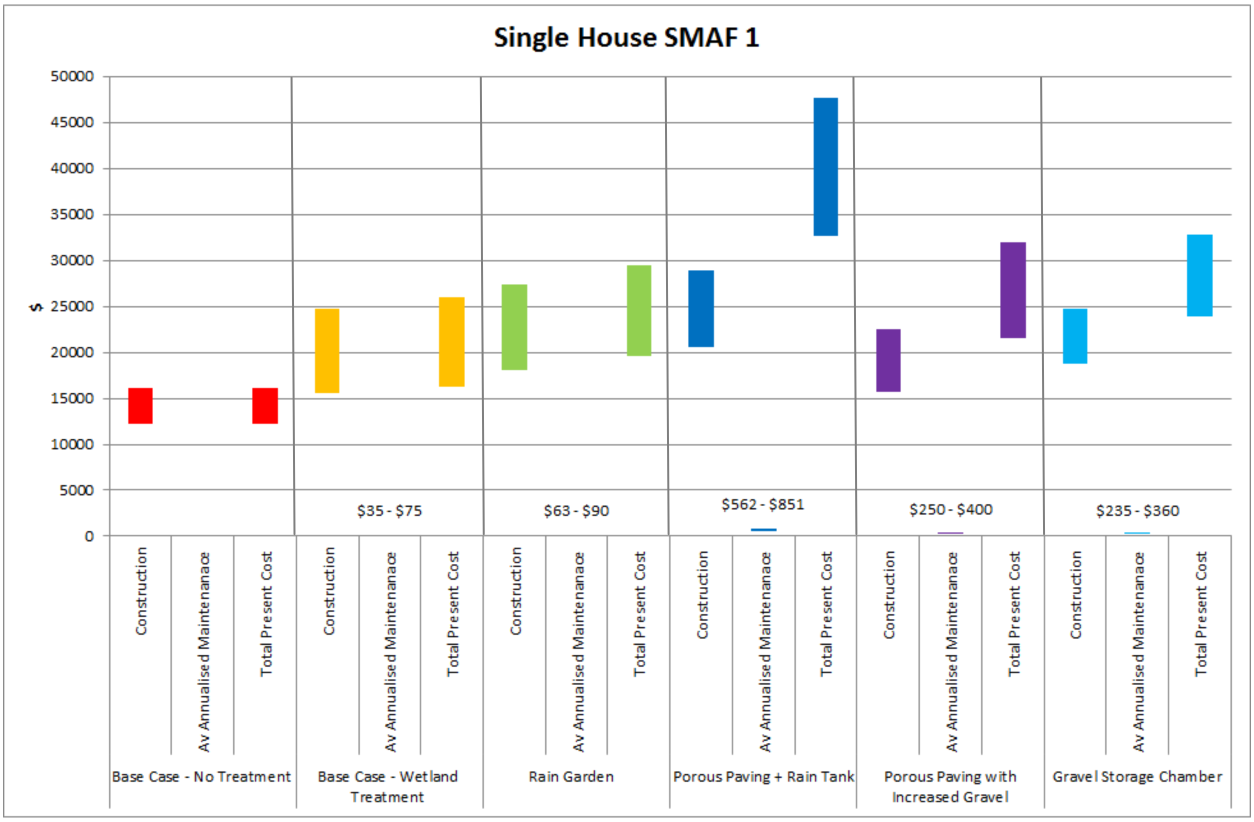
2.3.1 SMAF STORMWATER SCENARIO COSTS

In order to demonstrate the range of stormwater devices and associated costs to mitigate hydrological changes and quality effects, costs are summarised below for a single house on a 500m^2 lot and a 2,000m^2 parking area.

SINGLE HOUSE

Four on-site treatment scenarios have been costed, together with the "Do Nothing" and an end-of-pipe solution for a single house site:

- using rain gardens to manage runoff from all impervious areas
- using porous paving for pavement areas, plus rain water tanks
- using porous paving with additional thickness of gravel basecourse
- using a gravel storage chamber



Detention	x	✓	✓	✓	✓	✓
Retention	x	x	✓	✓	✓	✓

Figure 1: Single House SMAF1 Costs and Management Functions (TR2013/043)

- The cheapest construction cost option is using porous paving with increased gravel thickness. It provides both detention and retention, compared to wetlands that provide detention only.

- The next cost options are the rain garden and gravel storage chamber, with the porous paving and rain tank being the most expensive option.

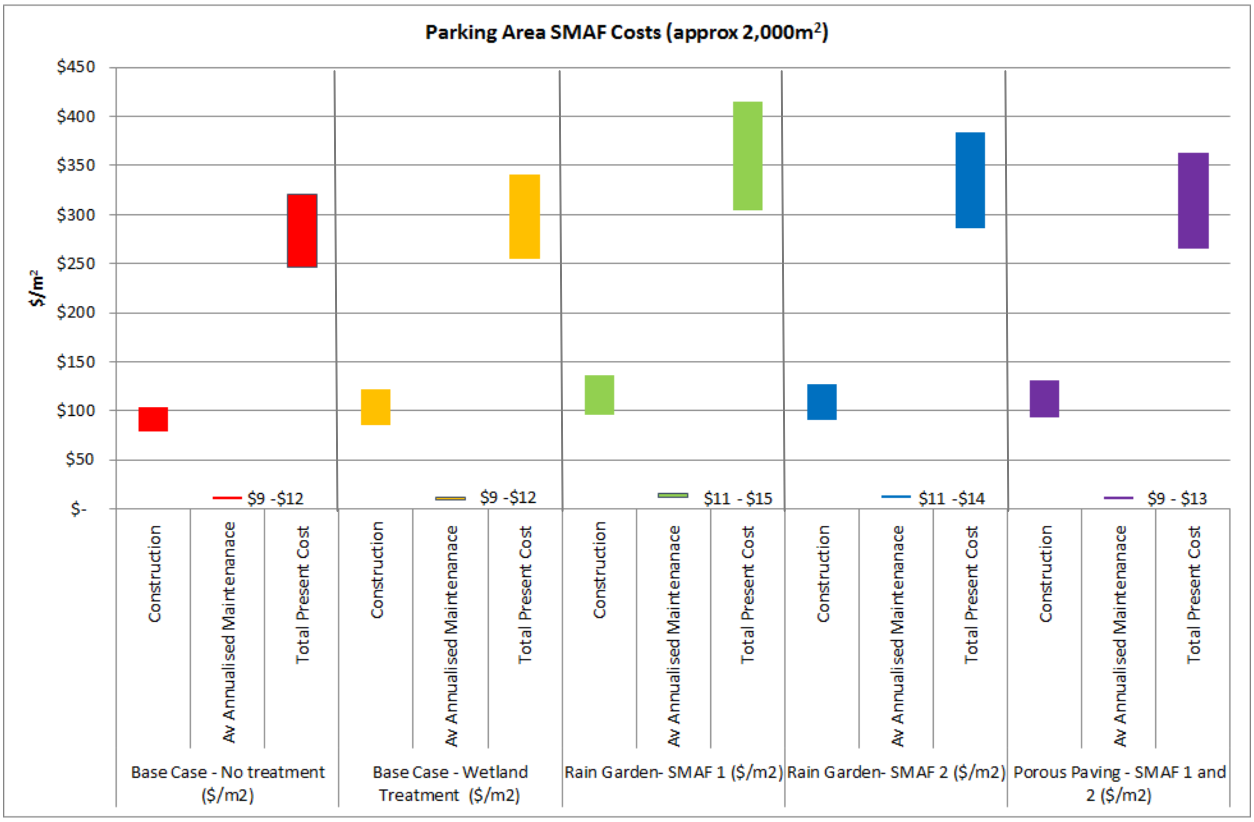
- The cheapest maintenance cost is for the Base Case – Wetland Treatment scenario of $35 - $75 per year, followed by treatment using rain gardens ($63 - $90 per year).

- Order of increasing extra present cost is as follows: Rain garden, porous paving with increased gravel thickness, gravel storage chamber and then porous paving with rain tank.

PARKING AREA

The use of rain gardens and porous paving are effective ways of managing parking areas to meet the SMAF hydrology controls. Costs have been summarised below for a typical 2,000m^2 parking area using:

- Rain gardens for SMAF 1 and SMAF 2
- Porous paving for SMAF 1 and SMAF 2



Detention	x	✓	✓	✓	✓
Retention	x	x	✓	✓	✓

Figure 2: Parking Area SMAF Costs and Management Functions (TR2013/043)

- For achieving SMAF 1 mitigation, the extra construction cost above wetland treatment is similar for porous paving ($8 - $10/m^2) and rain gardens ($11 - $15/m^2). Porous paving and rain gardens provide both detention and retention, while wetlands provide detention only.

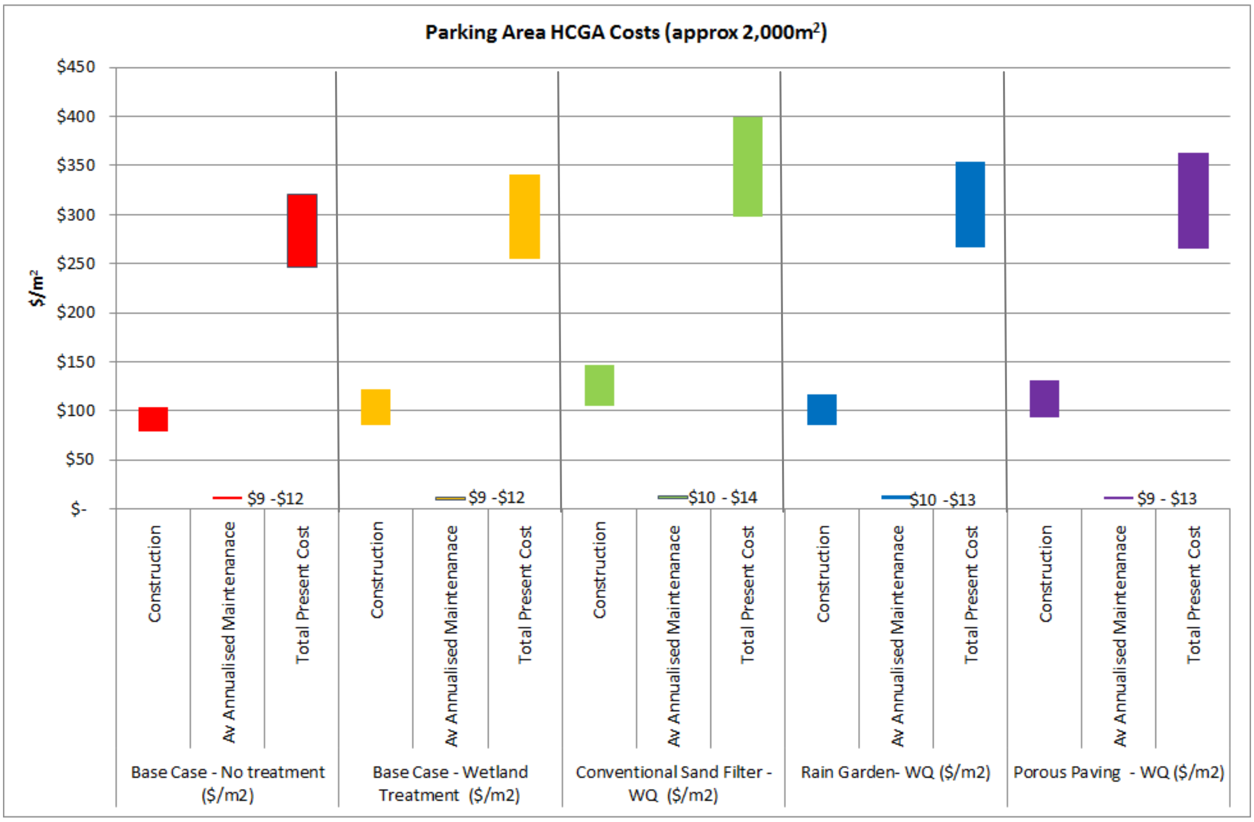
- Maintenance costs vary from $9- $12/m^2 per year for the two Base Case Scenarios (No Treatment and Wetland Treatment). To achieve SMAF 1 requirements, there is an increase in maintenance costs when utilising porous paving ($9- $13/m^2) and rain gardens ($11 - $15/m^2).

- Porous paving has a lower total present cost when compared to rain gardens.

2.3.2 HCGA STORMWATER SCENARIO COSTS

In order to demonstrate the range of stormwater devices and associated costs to meet design DEQRs, costs are summarised below for a typical 2,000m^2 parking area.

Three on-site treatment scenarios have been costed, together with the "Do Nothing" and an end-of-pipe solution for a 2,000m^2 parking area.



Detention	*x*	✓	*partial*	*partial*	✓
Retention	*x*	*x*	*x*	*partial*	✓
Water Quality	*x*	✓	✓	✓	✓

Figure 3: Parking Area HCGA Costs and Management Functions (TR2013/043)

- The cheapest construction cost option to treat a 2,000 m^2 parking area is the use of rain gardens. The conventional sand filter is the most expensive option. The rain garden construction cost is approximately the same cost as the wetland.

- The average annualised undiscounted maintenance costs of the sand filter, rain garden and porous paving options (in the range of \$9 to \$14/m^2) are similar to the wetland treatment base case at \$9 to \$12/m^2.

- The total present cost above the Base Case – Wetland Treatment is approximately 5% higher for both the rain garden and porous paving options. The sand filter is 17% higher than the base case wetland treatment option.

Table 3: Summary of Results (adapted from TR2013/043)

Scenario and PAUP Requirement	Least Construction Cost Option	Least Average Annualised Maintenance Option	Least Total Present Cost Option
Single House SMAF1	Porous Paving with Gravel	Rain Garden	Rain Garden
Parking Area SMAF1 and 2	Porous Paving and Rain Garden similar	Porous Paving	Porous Paving
Parking Area HCGA	Rain Garden	Porous Paving, Rain Garden and Sand Filter similar	Rain Garden and Porous Paving similar

2.4 WSD APPROACH CONSTRUCTION COSTS

The New Zealand case studies below present construction costs of a comprehensive water sensitive design (WSD) approach for greenfield developments. These case studies have been presented to demonstrate that a WSD approach in greenfield development may not necessarily increase initial construction costs. Most of the savings can be achieved at the land use phase planning stage i.e. early consideration is critical. The reduced costs of the WSD approach over the conventional are generally from (Shaver 2009):

- Less clearing and earthworks costs from clustering and working with the landscape contours.

- Less pavement length with reduced costs from clustering.

- Less stormwater infrastructure costs, swale drainage systems are cheaper to install than pipe systems.

Table 4: Comparison of Construction Costs between Conventional and WSD Site Development (adapted from Shaver 2009)

Project	Total Development Costs		Conventional development	LID* development	Percentage Difference
	Conventional development	LID* development	($/Ha)	($/Ha)	
Heron Point	1,844,000	1,590,000	$249,189	$214,865	14%
Palm Heights	7,218,000	5,936,000	$260,578	$214,296	18%
Wainoni Downs	5,963,000	4,478,000	$419,930	$315,352	25%

* Water Sensitive Design (WSD) in PAUP replaces Low Impact Development (LID).

2.5 BENEFITS

Historically, decision makers focused on direct use values that can be measured through observable quantities of products as well as market prices. In recent decades, there is growing recognition of the value of 'indirect use' or non-market benefits (i.e. benefits that are not usually traded in market places). Monetary valuation attempts to estimate the value of both market and non-market benefits and use them in economic decisions via cost-benefit analysis or other economic incentives (Farley J 2008).

Limitations associated with quantifying non-market benefits make it difficult to conduct a solely quantitative cost-benefit analysis. TR2013/043 summarises the values associated with ecosystem services (benefits people derive from ecosystems) and work done locally and internationally to quantify the benefits of protecting receiving environments from the adverse effects of stormwater runoff, but does not attempt to provide Auckland specific monetary values. A full economic analysis including costs and benefits was beyond the scope of this publication.

However, it aims to iterate the benefits of WSD and green growth, so that future infrastructure investment decisions recognise the full spectrum of benefits provided, many of which lie outside of influence of pure stormwater management practice.

2.5.1 BENEFITS OF WSD AND GREEN INFRASTRUCTURE

Water quality and stream health are the key drivers for WSD and other provisions in the PAUP. The wider benefits are summarised below (USEPA 2013).

Water Supply

- Recharge of groundwater aquifers and stream base flows where appropriate through infiltration measures.

- Rainwater harvesting and infiltration-based practices can significantly reduce municipal water use and provide an alternative source of non-potable water for domestic and commercial uses.

Air Quality

- Green infrastructure can reduce ground level ozone by reducing air temperature and particulate pollution with subsequent increased health benefits.

Energy and Climate Change

- Urban heat islands form as cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. Trees, green roofs and other green infrastructure features can cool urban areas by shading building surfaces, deflecting radiation from the sun and releasing moisture into the atmosphere. This lowers the cooling and heating demand for buildings with reduction in energy demand.

Private and Public Cost Savings

- Green infrastructure developers often experience lower capital costs, derived from lower costs for site grading, paving, landscaping, and smaller or eliminated piping and detention facilities.

- In areas with combined sewer systems, green infrastructure controls may cost less than providing additional CSO storage capacity. It can also reduce the volume of water to be dealt with via the combined sewer system.

- Reduced need for rehabilitation and maintenance of downstream water environments.

Habitat and Wildlife

- Vegetation in the urban environment provides wildlife habitat and connectivity.

Community

- Health Benefits: More green space and parks encourages outdoor physical activity, reducing obesity and preventing associated health issues.

- Recreation Space: Green infrastructure's vegetation and trees can increase publicly available recreation areas, allowing urban communities to enjoy greenery without leaving the city.

- Property Values: Enhanced quality of life for residents, expressed through premiums on land values due to enhanced amenity values and local and regional water quality.

2.5.2 DISADVANTAGES AND RISKS OF WSD AND GREEN INFRASTRUCTURE

Some disadvantages of WSD and Green Growth include (Braden and Ando 2011; Water by Design 2010):

Private and Public Costs

- Many WSD practices focus on local on-site management rather than large single catchment wide devices. These smaller on-site devices are often located on private property whereas traditional large scale assets are largely public infrastructure. This shifts the initial cost and on-going maintenance responsibility to the private lot owner.

- Greater risks of poor maintenance with the reliance on private owners to carry out the on-going maintenance.

- Additional development assessment, compliance checking and enforcement costs associated with the many smaller private assets. It is expected that these costs will reduce over time as WSD becomes mainstream practice.

Community

- Increased community/private initial capital costs and on-going maintenance costs.

- The reluctance of the community to take up these costs and responsibilities.

- Greater need for public education and awareness programs so private land owners are aware of and carry out these additional maintenance responsibilities.

- More complex/dispersed public health and safety risk management with multiple small devices.

2.5.3 METHODS OF QUANTIFYING BENEFITS

Various frameworks, tools and valuation methods are available to quantify receiving environment outcomes under alternative urban development and stormwater management scenarios. These reinforce the need for considering economic, social, environmental and cultural values when considering the impacts of stormwater management and incorporating it into the decision making process.

- Some studies use the four interests (economic, social, environmental and cultural) framework to categorise values (e.g. Moores et al., 2013) to develop a decision making tool. The four interests model is also widely known as 'quadruple bottom line' (QBL).

- Another approach is the 'use' and 'non-use' classifications, also referred to as Total Economic Value (e.g. Rohani 2013) to describe the value provided by natural systems. TEV is a framework for identifying values that could be quantified rather than a method for measuring values and potential impacts of a project.

- The 'Mauri Model' is a decision making framework that combines a stakeholder assessment of worldviews, with an impact assessment of indicators to determine sustainability and trends over time. This tool uses the concept of mauri as the measure of sustainability – in place of monetary values used conventionally. The use of mauri as the measure of sustainability allows for a more accurate representation of the impacts of certain actions/options – which may not always be best represented or included in monetary based assessments of sustainability, but are nonetheless important to the decision making process (www.mauriometer.com, August 2013).

- International and local monetary valuation studies have also been used to quantify the benefits of environmental goods and services.

- Valuation methods such as Willingness to Pay (WTP) surveys and questionnaire survey responses.

2.5.4 COST - BENEFIT ANALYSIS CASE STUDY

TR2013/043 presents a number of local and international cost- benefit case studies to demonstrate the range of benefits versus costs of different stormwater management approaches. The South East Queensland case study is presented as an example in this paper (Water by Design 2010). Further examples can be found in TR2013/043.

A simple cost-benefit framework was developed and populated with the likely costs and benefits of using WSD practices to meet the proposed design objectives for typical low density residential (400 to 700m^2 lots), medium to high density residential, and commercial and industrial developments. The frameworks brought together both quantitative and qualitative values of likely benefits and costs to assist in approximating the net benefits.

By way of summary, the quantifiable costs and benefits of their low-density development are presented in Table 5 and 6. Note: An appraisal period of 25 years and a discount rate of 5.5% have been used. Table 7 below lists unquantifiable potential benefits and other minor costs that may be incurred.

The incremental cost of going from the 'base case' to the WSD case has been presented. Additional costs as a result of best practice management were the difference between the 'base case' and the 'WSD case'. The 'base case' comprised of conventional stormwater drainage management, flood management and rain water tanks as per Queensland Development Code.

The ‘WSD case’ comprised additional WSD practices above and beyond the base case, including bioretention systems for compliance with the stormwater quality and frequent flow objectives and detention storage for compliance with the waterway stability objective.

It should be noted that some of the Queensland objectives and designs are somewhat different to those for Auckland. For example, Queensland’s objectives do not appear to have Auckland’s focus on reducing runoff volumes. Wetlands in Queensland focus more on nutrient removal, which is not a target contaminant in Auckland.

Despite these differences, the case study is still relevant as a demonstration of the type of cost-benefit study that can be carried out and some of the benefits are applicable to Auckland. Examples of the types of benefits that are common to both are the potentially avoided costs associated with downstream waterway rehabilitation and maintenance; potential increased property values and potentially avoided development costs.

Table 5: Likely WSD Costs for Typical New Developments ($AUD, 2010) (Water by Design 2010), reproduced with permission)

Major Quantifiable Costs (Estimated)		
Type of Cost	**Cost per lot**	**Costs per hectare**
Acquisition (capital + design costs)	$1,600 to $4,000/lot	$21,100 to $39,750/ha
Annual maintenance	$20 to $40/lot	$260 to $520/ha
Life cycle costs (acquisition + maintenance + renewal + decommission)	$2,365 to $5,410/lot	$29,675 to $71,690/ha
Annualised life cycle costs (acquisition + maintenance + renewal + decommission)	$95 to $215/lot	$1,185 to $5,410/ha

Table 6: Likely Benefits for Typical New Developments ($AUD, 2010) (Water by Design 2010), reproduced with permission)

Major Quantifiable Potential Benefits (Estimated)		
Type of Benefit	**Benefit**	**Compared to Costs of WSD treatment train**
Value of the reduction in Total Nitrogen loads in stormwater (wastewater treatment costs)	$2,110 to $5,150/ha/yr	95% to 180% of the annualised life cycle cost
Potentially avoided costs associated with downstream waterway rehabilitation and maintenance	$8,000 to $60,000/ha (life cycle cost) of development	25% to 85% of the life cycle cost
Potential increased property values (premium):	$11,000 to $44,000/ha	52% to 110% of the acquisition cost
Potential development costs that are avoided (applicable only to flat sites, i.e. <5%)	$36,000/ha	120% of the average capital cost

This example shows that although there are limitations to the number of benefits that can be quantified in monetary terms, it does not take many of these monetised benefits to equal and surpass the quantifiable acquisition and maintenance costs.

Table 7: Major Unquantifiable Benefits and Minor Potential Costs (Water by Design 2010), reproduced with permission)

<table>
<tr><th colspan="2">Major unquantifiable potential benefits</th></tr>
<tr><td colspan="2">Contribution to protecting the numerous values associated with healthy downstream waterways:
- ecosystem services
- recreational and commercial fishing
- tourism
- seafood industry
- option, existence and bequest values
- Community amenity at local and regional scale (i.e. connection to water cycle).</td></tr>
<tr><th>Minor potential costs</th><th>Minor potential benefits</th></tr>
<tr><td>- Additional development assessment, compliance checking and enforcement costs associated with WSD assets (relatively minor and reducing over time as WSD becomes mainstream practice)
- Potential increase in maintenance tasks for residents (for at source or streetscape WSD)
- Environmental costs associated with sourcing materials for the WSD measures (e.g. biofiltration media).</td><td>- Increased rate of sales and amenity associated with developments with landscaped WSD features, such as streetscape bioretention systems.
- Shading and urban cooling (potentially reducing energy consumption).
- Some direct and indirect aspects if implementing WSD will result in changes to the configuration of development that could enhance open space.
- Education and research.</td></tr>
</table>

The conclusion regarding the relative magnitude of likely costs and benefits was (Water by Design 2010):

"Considering all the costs and all the potential benefits of applying WSD to achieve the proposed stormwater management design objectives it is concluded that the benefits are likely to outweigh the costs for low-density residential development in Queensland".

3 CONCLUSIONS

TR2013/043 provides construction, average annualised maintenance and total present cost of various stormwater management devices that can be used to meet the PAUP contaminant, volume and flow management requirements. Life cycle cost estimates have been provided for rain gardens, porous paving, rain water tanks with water reuse, living roofs, gravel storage, sand filters and wetlands**.**

While there is a general perception that providing for WSD is generally more expensive than traditional solutions, the findings of this paper show that there are a number of devices that can be implemented on-site which have comparable construction costs. Maintenance and total present cost is generally higher. As a comparison to a traditional wetland:

- single house SMAF1 - porous paving with increased gravel construction costs are similar;
- parking and secondary arterial road HCGA - rain garden construction costs are similar; and
- all other SMAF construction costs and SMAF/HCGA maintenance and total present costs are generally greater.

The main change with the PAUP provisions is the focus on water sensitive design and green infrastructure to reduce the generation of stormwater runoff and contaminants, followed by their management and reduction on-site or though communal measures.

This allows for more comprehensive stormwater management functions and a targeted approach on site specific areas and contaminants of concern compared to, for example, a catchment wide wetland approach that has to collect and treat stormwater runoff from the entire catchment area. However, on-site devices can have increased maintenance costs and associated risks, particularly if under private ownership.

These on-site devices focus on the smaller, more frequent rainfall events (less than the 2 year ARI) and have minimal impact on the larger 1 in 10 and 100-year flooding events. If management of these larger flooding events is required, other measures such as catchment wide ponds/wetlands would be required. These costs are not covered in this report.

As discussed previously, TR2013/043 is not intended to provide a full cost-benefit analysis of the PAUP requirements for on-site stormwater quality and flow management. However, it provides the foundation that will enable a cost-benefit analysis to be undertaken in the future.

The on-site devices costed in this report provide both detention and retention requirements, which will help achieve the vision of the Auckland Plan and the objectives set out in the National Policy Statement for Freshwater Management (NPSFM), the New Zealand Coastal Policy Statement (NZCPS) and the Hauraki Gulf Marine Park Act (HGMPA). It is important to consider the additional stormwater management function provided by the new provisions, and the corresponding spectrum of benefits and to factor it into the decision-making process.

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