WSUD Case Study: TALBOT PARK

About Talbot Park

The Talbot Park Community Renewal project aimed to improve living conditions for Housing New Zealand residents by providing medium-density housing, quality urban design and community strengthening that addressed key community concerns: personal and community safety, lack of local employment and poor community health. The project, completed in 2007, used WSUD and CPTED principles to deliver sustainable urban design for about 750 people within 219 homes. Strong community support for sustainable design features was given by iwi, conservation and recreational groups. A land exchange with Auckland City Council transformed the long, narrow, unsafe Talbot Park to two highly-visible individual parks.

Rain gardens along the new, narrow roads are the most highly visible WSUD features, along with retention of several large specimen trees in prominent places and planting of new trees. These are supported by small areas of permeable paving and 31 rainwater storage tanks which were plumbed to enable reuse in toilet flushing and garden watering. Overland flow paths were retained, defined and protected from development by using permeable decks and plantings to passively exclude vehicles.

Stormwater management approach

Talbot Park had some of the first roadside rain gardens in Auckland city, constructed in January 2006 and enabled by an Infrastructure Auckland grant from Auckland Regional Council (c. $450 K) and cost-sharing between Auckland City Council and Housing NZ. Talbot Park has 14 roadside rain gardens on three new roads in the 5 hectare redevelopment.

Despite significant design, construction and maintenance flaws, the rain gardens have largely functioned since installation:

- Road runoff is no longer piped directly to Omeru Creek. The rain gardens have intercepted sediment washed into them during the building phase, and since then intercepted pollutants such as concrete cutting wash, detergents (from car washing), grass clippings and other gross pollutants.

- Even with minimal current maintenance, and low cover of ground-cover plants, the raingardens contribute to street aesthetics and cohesiveness of the social housing cluster; the use of trees in rain gardens are core to this. The use of CPTED principles[1] in landscaping greatly improved the sense of open space, sense of safety through accessibility and greater passive surveillance.

- The rain gardens' location as 'bump-outs' and shapes together with the narrow roads are fundamental to slowing traffic speeds[2], and enhance the walkability of the area – a specific objective of the project. Children can walk and bike safely on or near the roads.

Talbot Park before redevelopment (left photo) and as redesigned and implemented (right photo).

Talbot Park Renewal Project

The Talbot Park rain gardens illustrate the types of issues which surface when new devices are designed and implemented within a city or region:

- Auckland City Council (ACC) roading engineers did not want rain gardens on the streets – they were concerned about water affecting the road subgrade.
- ACC asset managers were not supportive as they considered point source contamination (galvanised zinc from roofs) to be the key stormwater issue, that rain gardens would not fix this, and they did not want to maintain the rain gardens.

[1] Crime Prevention through Environmental Design uses design to create naturally safer environments by reducing fear and incidence of crime and increasing public surveillance and positive public interactions. https://www.mfe.govt.nz/publications/towns-and-cities/national-guidelines-crime-prevention-through-environmental-design-new and see Auckland Design Manual www.aucklanddesignmanual.co.nz

[2] At the time there was no way to designate a 30 km/hr zone

- ACC consenting staff were not supportive of the narrow roads or reduced car park provision despite the close proximity to trains, buses and Glen Innes centre. However, the ACC policy staff were supportive of the approach.
- Housing NZ did not want rain gardens on private lots because they would require maintenance (for which there was no additional budget), and the small yards were already compromised by rain tanks in some units.
- The design company had experience with rain gardens, but the construction contractors had no experience with rain gardens. This resulted in 10 of 14 rain gardens being constructed with flaws:
    - Inlets were specified as 500 mm wide but were constructed 200 to 300 mm wide, so were prone to blockage.
    - Sloping parking plus gutter design exacerbated bypass flow and reduced inflow in some rain gardens, then overloaded other raingardens.
    - Some inlets were very close to overflows, resulting in short-circuiting of flow.
    - The design 150 mm live storage was not achieved due to a combination of low overflow grates (constructors thought they were fixing a design fault) and overfilling with media and/or mulch.
    - Some inlets concentrated flow as their bases were not absolutely flat – this caused scour in 8 of the 14 rain gardens in 2008.
    - Several overflow grates were 50 mm too high, so water ponded on the road.
    - In one case the impermeable plastic liner installed to protect the road subgrade from water was displaced, diverting stormwater into the subgrade.
- To allow issue of 224c title certificates, rain gardens had to be completed before the adjacent buildings were constructed. Subsequent building construction filled some rain gardens with up to 20 cm of sediment, killed a high proportion of ground-cover plants, and broke branches of trees. The rain garden surface was compacted by waste and building materials stored in them, and builders walking through them.
- Some individual plants were too tall and bulky for rain gardens because they grew into sight lines e.g. some flax and toetoe.

Scouring at raingarden inlets displaced mulch and soil (left). Stormwater inflow showing concentration of water to one side of the cut, but no scouring or leaf litter displacement (centre) and stormwater prevented from entering the raingarden due to overfilling with media/mulch (right). All photos in June/July 2008.

A joint, post-construction assessment undertaken in June 2008 identified implementation issues and workshopped solutions. Solutions included:

- To reduce scour, increase kerb cuts by 250 mm minimum, install 'wings' or baffles in the drainage gutters to slow flow, and install concrete rock aprons.
- To restore design ponding depths, raise overflow grates where they are too low and excavate rain gardens where they are overfilled. Because trees had already been established for 2 years, a pragmatic decision was made to only excavate sections of raingarden without tree root mass and avoiding creating trenches that would short-circuit stormwater from inlet to overflow.
- One raingarden was near a large-leafed deciduous tree. Its leaves covered the stormwater grate in autumn; this grate was identified as needing more regular maintenance in autumn to keep clear.
- Local soils were suitable rain garden media unless overly-compacted. The design minimum permeability was 300 mm/day (c. 20 mm/hr) as per TP10 (2003). Infiltration rates in September 2006 were 30 to 74 mm/hr and in March 2007 the median infiltration rate was 480 mm/hr. The organic mulch surface layer effectively protected the soil from sediment in runoff causing surface sealing. By 2018 the mulch had been replaced by dense carpet of fallen magnolia tree leaves in most raingardens.


The combination of inlet placement and gutter design means most runoff bypassed this rain garden, so overloaded the next raingarden; blue marks indicate where new kerb cuts were to be made (left) 2008. Newly renovated raingarden with c. 150 mm of media removed except around retained trees and plantings, e.g. dense flax at the far end. New inlets improve flow from the street gutter (right) 2008.

Solutions identified to scouring issues, June 2008. At this stage most groundcover plants and trees were about 18 months old, but the tree on the right is new (left). Overfilled rain garden with concrete gutter 'wing' to improve runoff entry (2008) (right).

The following strategies are suggested for cities/ districts where rain gardens/bioretention are new to minimise the potential for similar mistakes and retrofitting:

- Use hold points for pre-construction meetings to ensure contractors understand critical design features (especially ponding depth and overflow function) and use a pre-planting inspection/sign-off to check levels, inlets, overflow locations.
- Ensure all key stakeholders, including councils, support the WSUD approach. Councils can incentivise WSUD by not slowing-down consents and considering removing reserve or stormwater connection contributions. Early discussion of WSUD with the community during consultation helped optimise plant selection.
- The objective of local employment was met by Housing NZ in the short term, with a Talbot Park resident maintaining the rain gardens and landscape. This work was reported as 'vital for removing weeds and litter' but unfortunately stopped. There is huge potential to create such local maintenance jobs, but council contracting methods can be hostile to this approach, especially if they require large insurances, and/or if traffic controls are needed.
- Rain gardens should be commissioned (surfaced and planted) after construction of buildings or bonded and physically protected from construction sediment and traffic, and the raingardens regularly monitored throughout the build to ensure compliance. Bonds must be adequate to allow replacement of all plants, mulch and media.
- Retain dominance of rain gardens in public spaces, as raingardens within individual lots are probably vulnerable to removal. For example, substantial areas of landscaping in individual lots that were protected by bollards have been removed and replaced with grass, used for carparking.
- Avoid very small and/or narrow rain gardens. At Talbot Park the presence of two new adjacent parks could have allowed larger rain gardens and wetlands in each park as attractive and multi-functional landscape features (e.g. as in Westgate and Flat Bush) that also contribute to native biodiversity, carbon sequestration, and potentially weaving resources. Lots of small rain gardens are more expensive to maintain and are susceptible to 'edge' effects.

Features which should be replicated include:

- Conserve space for community gardens where high quality natural soils are present. The Tamaki area has deep, free-draining soils and the existing community gardens could be expanded into the parks as orchards.
- Conserve mature trees and create 'street corners' where space for additional large trees can be placed (and these are also useful places for raingardens as corners receive greatest inputs of contaminants from tyre and brake wear).
- Employ local people to maintain the rain gardens and landscaping, especially during establishment – this can be a cost effective approach as people on the ground can quickly remove litter and weeds, treat scour/erosion and identify damage.

Further lessons from the Talbot Park experience are detailed in the following:

- Bracey S, Scott K, Simcock R. 2008. *Important lessons applying low impact urban design: Talbot park.* NZ Water and Wastes Association Conference. https://www.landcareresearch.co.nz/publications/researchpubs/Bracey_etal_NZWWA_2008.pdf
- Bracey, S. 2007. *Making Talbot Park a better place to live*. Building Magazine June/ July 2007. https://www.buildmagazine.org.nz/assets/PDF/B100-41-TalbotPark.pdf and http://www.cmnzl.co.nz/assets/sm/2306/61/1600StuartBracey.pdf
- Community renewal – Housing New Zealand Corporation, Talbot Park, Auckland https://www.mfe.govt.nz/publications/towns-and-cities/urban-design-case-studies-local-government/community-renewal-%E2%80%93-housing
- Scott K. 2009. *Talbot Park residents' perceptions of sustainable urban design*. Landcare Research Report.
- *Talbot Park Low Impact Urban Design and Development Case Study*: https://www.landcareresearch.co.nz/publications/researchpubs/Talbot_July2007.pdf


Tall toetoe were removed to ensure sight lines were maintained (2013)(left); Large trees planted in large spaces on street corners provide sense of place and welcome summer shade (right).

Talbot Park assessment

What works well	Missed opportunities
Reduced road width reduces impervious areas and, with raingarden 'bump outs' that lower traffic speeds, and off-street parking (fewer on-road parks) deliver safer roads.	Many rain gardens are very small, increasing risk of damage and cost of maintenance. Some weeds have established in bare areas of rain gardens: these include privet, moth plant and agapanthus. Inlets and overflows are not adequately maintained, and some have reached a condition where stormwater inflow is restricted; performance is also hampered by initial construction flaws
Landscaping and stormwater devices fulfil some additional values; trees provide shade and shelter; hedge and groundcover species are mainly native and provide resources for insects and birds. Native trees are growing well in some areas of Talbot Park (non-raingardens) and provide a range of ecological and cultural values. **Some large trees were retained and these provide disproportionate amenity, shade and shelter, especially where integrated into small public spaces.**	Rain garden trees are all evergreen magnolias, which have low ecological values and do not reflect site history or local culture, but do create a long-lasting, dense leaf mulch that is supressing weeds in most rain gardens. The two parks are dominated by mown grass and non-native species including weedy palm trees; the free-draining, fertile soils would support a range of locally-depleted native trees (kohekohe, titoki etc.); the parks could also have contributed to stormwater treatment.
Four groundcover species were initially used in each rain garden, increasing resilience to variable conditions.	There are extensive linear and bulk plantings of single plant species such as broadleaf (*Griselina littoralis*), hebes and sedges. Summer droughts have led to substantial deaths of broadleaf; these hedges have been removed and not replaced.
A restricted number of native plant species with few colourful flowers were used in general landscaping areas (hebe being an exception) and these established well. Some tenants have added or replaced this planting – generally with non-native colourful foliage or flowers, or edible plants (vegetables and fruit).	Some sedges have sharp edges – this may have contributed to their removal, including from overland flow paths where the plants were protecting areas.
Most landscaping had relatively low maintenance; annual trimming of hedges and occasional remulching along edges and weeding. Some of this landscaping has been removed and replaced with lawn – and this needs more maintenance	Find out why landscaping has been replaced with grass as grass lawns are available in parks less than 5 minutes-walk from any house.
Community gardens and private gardens	There is lots of space for gardens and orchards (citrus, plums, feijoa) in the two parks as local parks have (unusually) high-quality, free-draining soils.

Benefits and costs of Talbot Park green infrastructure

"*More than Water*" Assessment Tool

Using the newly developed "More than Water" Assessment Tool[3], the costs and benefits of the WSUD Talbot Park redevelopment were assessed and compared with a traditional (business as usual – BAU) approach to development. The tool allows the user to select the level of each benefit or cost criteria (from low to high), level of importance of a particular criteria, and reliability of the information used to make the assessment. Detailed guidelines are available to guide the user as they make their assessment.

The assessment was undertaken via a workshop approach by the research team using project information provided by consultants involved in the redevelopment of Talbot Park, a site visit and discussions with development consultants. The detailed rationale behind the assessments can be found in the "More than Water" Assessment Tool report[3].

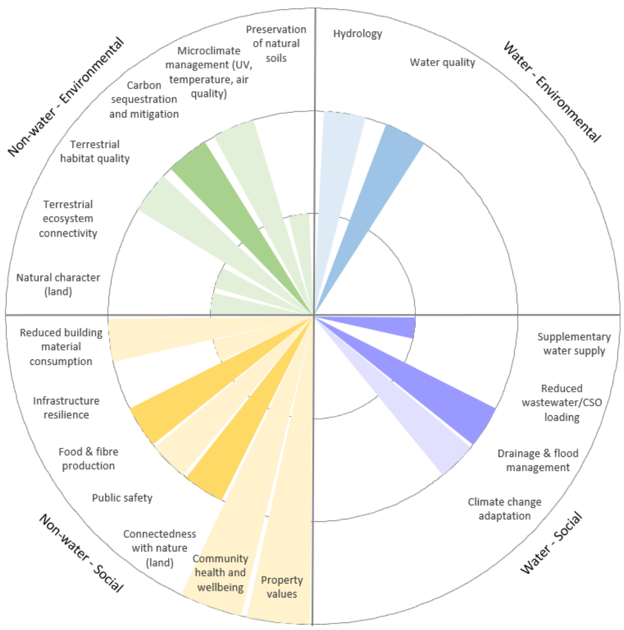
Talbot Park 'as constructed' was assessed as delivering better outcomes than 'business as usual' (BAU). In the case of benefits, 'business as usual' was assessed as delivering all of the non-water criteria at exactly the same level as Talbot Park 'as constructed' (see identical left-hand sides of MTW outputs, in the figures overleaf). This reflects the assumption that, for this assessment, the BAU version of Talbot Park uses trees and landscaping to the same extent as actually exists. The majority of non-water benefits were assessed as being delivered at a medium level under both scenarios, with two delivered at a high level (community health and wellbeing and property values). However, because plantings in the BAU version were assumed to provide no stormwater management function, the water benefits criteria were virtually all assessed to be 'none' (with two exceptions: Hydrology and Drainage and Flood management, assessed as low). In contrast, four of the water benefits criteria were assessed being present at a medium level under Talbot Park 'as constructed'. The reliability of the assessment of benefits criteria was high for six criteria, but otherwise low.

Eight of the cost criteria were assessed as being delivered at a medium level by Talbot Park 'as constructed', only three of these were also assessed as being delivered by the BAU. These were all project scale criteria: development yield, health and wellbeing affordability and avoided property operation costs. The BAU performed much more poorly than Talbot Park 'as constructed' in terms of the assessed level of environment scale criteria (see left-hand sides of MTW cost outputs overleaf). The 'as constructed' version was assessed as delivering one criterion at a high level (avoided costs of future proofing) and four at a medium level. The BAU was assessed as failing to deliver on the majority of environment cost criteria (level of "none"), with three exceptions delivered as a low level. The reliability of the assessment of all cost criteria was considered to be low.

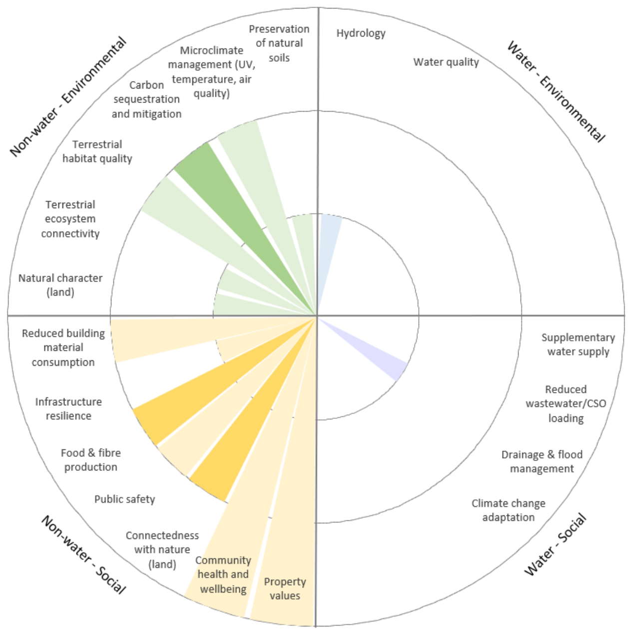
[3] More than Water Assessment Tool: https://www.landcareresearch.co.nz/science/living/cities,-settlements-and-communities/water-sensitive-urban-design

"*More than Water*" Benefits Assessment

Talbot Park: As constructed



Talbot Park: BAU



"*More than Water*" Costs Assessment

Talbot Park: As constructed

Talbot Park: BAU