BAYSIDE – THE TRANSFORMATION OF A STORMWATER ASSET INTO A COMMUNITY ASSET

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ABSTRACT

This paper case studies a recently completed project in which an old stormwater pond and lined concrete channel are transformed into a valued community asset.

The stormwater pond in the Bayside reserve in North Shore City was in need of de-silting and the section of stream downstream of the pond had been identified to trial community based stream restoration and enhancement on private property. This provided the opportunity for an integrated project involving the Water Services, Parks, Environmental Programmes teams from North Shore City Council and the local community.

This paper presents those components of work which were carried out by council on public land. The project included the transformation of a concrete channel into a natural stream, construction of new forebays, de-silting the pond, installing two floating islands, a boardwalk, improved access, a unique outlet structure and re-vegetation. The project provided multiple benefits to the community such as: increased ecological values; improved water quality; increased amenity and improved access to the area, it also involved the community in parts of the decision making process.

A close working relationship with the contractor was necessary to achieve the best solution. All requested changes from the public were also included if possible. A number of new soft engineering solutions were used throughout the project.

KEYWORDS

Stream restoration, soft engineering, stormwater quality, stormwater pond, floating islands, amenity, community involvement, integration

1.0 INTRODUCTION

The Bayside Project was a pilot project and was intended as a demonstration project for sustainable design, that included an "integrated project" approach to stormwater management and was to deliver on multiple and diverse objectives. The objectives included improving the water quality treatment efficiency of an existing pond, enhancing the surrounding landscape and improving ecological values. The Bayside project also set out to obtain the support of local residents for stream restoration activities in the catchment and to encourage the local community to take more ownership of their local reserve.

1.1 Site Description and Location

The Bayside stormwater pond is located on the southern tributary of the Taiaotea stream above Browns Bay. The pond is situated in a 2.4ha Council owned reserve in a residential neighbourhood which was developed in the late 1980's. The reserve was pre-dominantly grassed with some mature vegetation including cabbage trees and flax and an area of crack willow on the southern side of the pond. The reserve also has a children's playground.

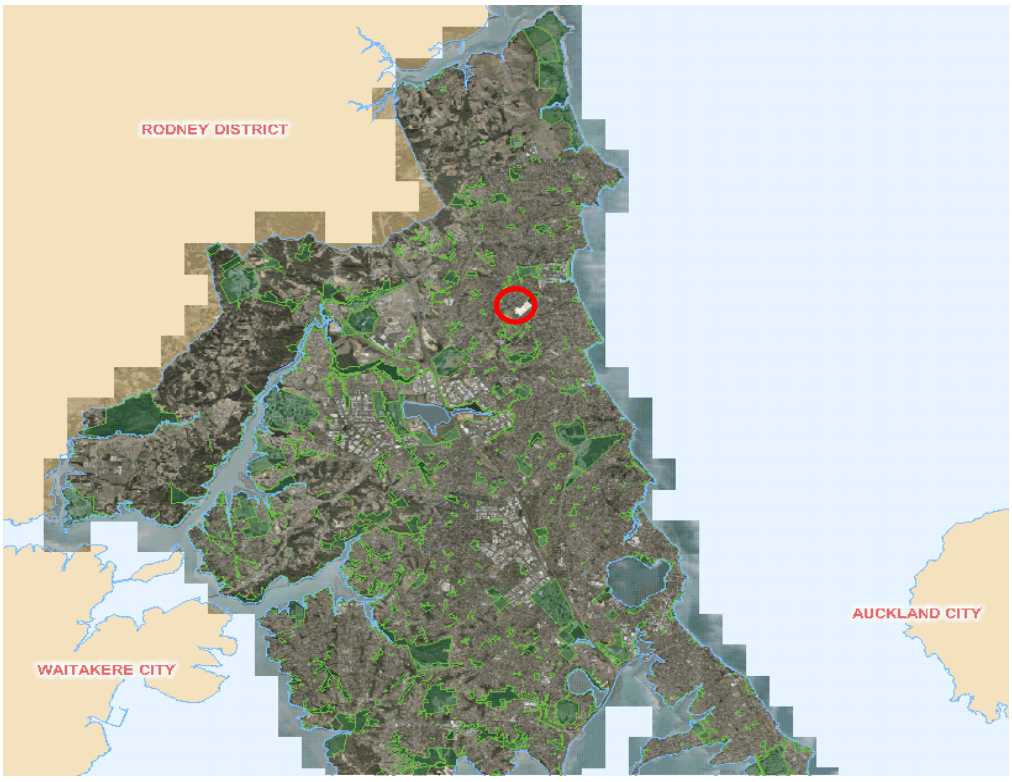

Figure 1: Location of Bayside Stormwater Pond
(In relation to North Shore City)

Figure 2 : Location of Bayside Stormwater Pond

The Bayside stormwater pond has two main stormwater inlets - the northern inlet discharges into the pond via an 85m concrete lined channel, and the southern inlet is piped to the pond.

Two wooden bridges cross the concrete channel and the pond itself. There was no connecting footpath between the bridges.

Figure 3: Northern inlet before restoration

Figure 4: Southern inlet before restoration

Figure 5: Northern concrete channel before restoration

Figure 6: Bayside stormwater pond before restoration

Figure 7: Existing bridge before restoration

Figure 8: Outlet (debris screen) before restoration

2.0 ISSUES

The Bayside stormwater pond is an artificial pond which was constructed in 1986 as part of the local subdivision to capture sediment and attenuate flood flows. It was last maintained in early 2004 when it was drained to remove silt and aquatic weeds. Over the last five years there had been significant silt accumulation due to poor management of upstream development and it once again required maintenance.

2.1 Hydrological Issues

As the pond was built in 1986, it did not meet current design standards. In particular it did not provide any extended detention for downstream channel protection. Hydrological modelling revealed that implementing extended detention would increase localised flooding and the frequency and velocity of discharge over the spillway for the 1% and 10% AEP events. This would produce unacceptable flow rates within the downstream environments of the Taiaotea Stream and Browns Bay business area which is already at risk from flooding. Opportunities for raising the embankment were also discarded as these would result in increased flooding of private property during the 1%AEP event.

Therefore other means of water quality enhancement within the stormwater pond area other than by extended detention was required.

The existing pond also had large volumes of sediments which led to Raupo establishing, which in turn increased localised sediment deposition.

2.2 Ecological Issues

The pond was overrun by aquatic plants requiring ongoing manual removal and a group of large crack willows had established along the banks of the pond.

The existing outlet structure created a barrier to fish passage between the pond and downstream watercourse. Existing fish species in the pond included introduced grass carp, eels, a few naturally occurring banded kokopu and introduced exotic fish. Improved fish passage would provide opportunities for increased ranges for inanga and common bully.

An 85m concrete channel conveyed stormwater through the reserve and into the pond. This provided no habitat, increased water temperatures and provided no ecological value.

2.3 Amenity Issues

The Reserve is surrounded by residential properties. There are a number of these, mainly on the southern side of the reserve, which have direct access to the reserve via private gates in fences. There were concerns for access and public safety during the works. The community also reported a smell and midge problem associated with the stormwater pond during summer months.

There were two existing bridge structures on the site. One bridge crosses the open concrete-lined channel to the north and another crosses the southern forebay. These bridges were retained. There were no sealed pedestrian footpaths leading to or from these bridges and no formed pedestrian paths around the pond. The area around the pond can be very wet in winter months and this reduced the accessibility to the area by the public.

The children's play ground in the reserve and unfenced stormwater pond presented a safety risk. Children are naturally attracted to water and it was necessary to maintain a satisfactory level of safety for the public. The option of fencing was not considered a viable option.

3.0 OBJECTIVES

3.1 Engineering Objectives

The objectives for the Bayside project were diverse and varied and would thus require input from a number of different specialists. Expertise from Landscape Architects, Engineering Specialists, Ecologists and Arborists were all required to meet all the project engineering objectives.

The principal objectives were: to de-silt the existing pond; to improve stormwater quality and treatment effects; to improve habitat; to naturalise the stream channel; to improve access for maintenance and the local community; to enhance amenity and ultimately to transform a stormwater asset into a community asset.

3.2 Community consultation

The Bayside project set out to achieve two goals for the community, the first was to encourage community buy-in to the project, and the second was to encourage private land owners to maintain their streams (downstream of the pond) on their own properties.

An innovative community engagement approach was therefore required to cover both public and private elements.

During extensive research of communities with streams, conducted in 2007, the residents of North Shore City told us that they would be willing to maintain the streams on their private properties if they saw Council leading by example and walking the talk with stream restoration on public land first. Bayside reserve gave us the perfect opportunity to demonstrate this.

3.3 Artwork

There are many ways artwork can increase the amenity of a surrounding area, greatly increasing both the look and feel of the area, while still providing a necessary function. The existing outlet / debris control device at Bayside pond was targeted for replacement. Due to the existing shape and height of the debris control device there was a high possibility of it becoming blocked by debris during a significant storm event. It was decided that it could be possible to replace the debris control device with a piece of functional artwork.

4.0 WHAT WE DID

The Bayside project set out to resolve all these issues whilst utilising best stormwater management practices and soft engineering approaches. These issues were resolved by the use of wetland margins and bank planting, a re-formed forebay in the southern tributary to prevent short circuiting and a new forebay on the northern tributary, pre-planted floating wetlands and the naturalisation of an existing concrete channel.

4.1 Pond and Forebays

The work in the pond and forebays included removing the existing sediment and re-contouring the existing pond to increase capacity and provide a shallow bench. A new forebay was constructed for the northern channel and the existing forebay at the southern channel was re-formed to prevent short circuiting, increase capacity, and improve sediment removal rates. Access tracks for maintenance vehicles were also constructed to each of the forebays.

The forebays were designed using gabion cages at the forebay outlet which were planted at the top by utilising vegetated Filtrexx™ socks and coir fascines.

Floating islands were installed within each forebay, to filter sediments and remove nutrients and heavy metals from the water that passes through each forebay to the main pond. They are expected to provide additional benefits by reducing turbulence at the exit of the forebay and aiding flocculation in the forebay. Floating islands also provide shade and refuge for aquatic life.

A shallow bench of approximately 1-3m wide was constructed around the pond for wetland planting. This added two main benefits - the wetland plants will assist in the uptake of nutrients and the shallow wetland planted area will provide a natural safety barrier to the pond, which is now substantially deeper.

Fish passage was installed through the outlet structure (debris screen) using spat ropes.

Proposals were also sought from various local artists with a list of requirements for replacing the debris screen. The preferred options were then presented to the community and the local community board who voted on their preferred option. The favoured design was then commissioned and installed

4.2 Rehabilitation of Northern Channel

The northern stream is piped into the reserve and used to emerge from an outlet wing wall into a concrete channel approximately 85m long that then flowed into the pond.

The concrete forming the base of the northern channel was removed and the channel was realigned. This slightly increased the length of the channel, reduced the gradient, and 'naturalised' the appearance by use of meanders. The northern channel, which had an existing gradient of approximately 4%, was reduced to a gradient of 1% by using a series of cascading weir structures.

The final rehabilitated channel consisted of weir structures, boulders set into banks to dissipate flows, and riparian vegetative planting. The purpose of rehabilitating the channel was to provide a more effective means to treat stormwater quality while improving the aesthetics of the area improve habitat and increase aeration.

4.3 Rehabilitation of Southern Channel

Similar to the northern channel, the southern channel emerges from an outlet pipe, but travels only a short distance through an eroded and undercut channel to the southern forebay area. To achieve a functioning forebay, the southern channel was re-aligned to emerge in the centre of the forebay (to prevent short circuiting).

4.4 Pedestrian Footpath and Maintenance Track

A maintenance track and pedestrian footpath around the circumference of the pond was constructed. The maintenance track is to be utilised for general maintenance, to access the pond outlet structure, and to periodically maintain the forebays. The maintenance track consisted of permeable grass pavers (2m wide) with the concrete footpath (1.5m wide) adjacent to it forming a 3.5m wide access track The placement of the forebay access track avoided steep areas and existing vegetation.

4.5 Vegetation Removal and Restoration Planting

It was necessary to remove a number of trees to enable the project to take place. All the crack willows were removed from the riparian margins as part of the ecological enhancement of the wetland. Several other trees around the pond were also removed to allow for the channel rehabilitation, restoration of the pond and/or the construction of the new footpath/maintenance track.

The effects of removing some of the existing vegetation were offset by the extensive revegetation and planting programme. The planting was carried out to enhance the wetland margin of the pond, to improve water quality treatment, to provide long term stabilisation and to enhance habitat and recreational values of the reserve.

4.6 Community consultation

A wide range of community engagement strategies and community based social marketing tools were implemented to actively engage the community. These strategies and tools ranged from a regular community newsletter, to prompts for community events, to incentives and rewards for involvement.

The consultation methodology we employed was in direct response to our community research findings. It was characterised by:

- Having one key contact person for the community (The Stream Restoration Project Leader)
- Working with a manageable, discrete community group (132 properties)
- Involving the community from the start
- Making use of innovative communications and social marketing tools and approaches
- Providing regular feedback and fostering open and honest communications between the Council and the community
- Encouraging local problem-solving and flexibility
- The Council being supportive and friendly.

Although physical works in the reserve did not commence until early 2009, the first contact with the community was made in September 2008. This was followed by a 'Bayside information pack' that included: the concept plan; a project information sheet; general information about streams, low impact design and the local catchment and its history, and a feedback form. The pack invited public feedback on the 'negotiable elements' of the project via a range of options.

Following the distribution of the pack, a reminder was mailed, telling the residents we'd had lots of great feedback from their neighbours and that we still wanted to hear from them, and gave details for a 'drop in day' at the local Scout Den. This 'drop in day' gave the community the last chance to give their feedback (in person) and to meet and talk with council staff involved with the project.

5.0 ACHIEVEMENTS

5.1 Hydrology

The main purpose of the project was to improve the stormwater treatment efficiency of the pond whilst not adversely affecting its capacity to attenuate flood flows. We therefore had to provide alternative mechanisms for improved water quality treatment which included:

- Wetland margins and bank planting to provide uptake of in-pond contaminants and provide additional shade;
- Forebays to retain coarse sediments; and
- Pre-planted floating islands to add to the function of the forebays, including uptake of nutrients and metals and improved flocculation of fine sediments.

Overall the outcome improved the stormwater function of the channels and pond and introduced a treatment wetland component to the existing system. The project did not result in any adverse effects in the catchment either upstream or downstream. As such the works were in accordance with the catchment management plan. The channels have improved water quality and environmental outcomes with no discernible change of flooding characteristics as flooding will still be contained within the channel and planted area.

Figure 9: Northern Channel after restoration

Figure 10: Southern Channel after restoration

5.2 Ecology

The rehabilitation of the pond provided a net increase to planted areas for wetland margins and banks of the pond. Additional areas were planted along the northern stream channel after rehabilitation. Willow wetland areas were replaced by kahikatea-swamp maire forest, an under-represented plant community in the district. Overall plant communities were more viable, representative, and diverse as a result of the work and correspondingly provided for increased habitat opportunities for fauna and aquatic life.

With properly functioning forebays and pre-planted floating islands, additional silt is captured prior to the main pond. This will reduce the required frequency for draining and dredging of the main pond and allow for stable long-term ecological systems and their associated values.

The project resulted in increased fish habitat in the rehabilitated northern channel. The proposed 1% gradient and addition of pools allows for increased depths for fish refugia. A dedicated fish passage was installed using spat ropes through the existing outlet structure to promote fish (climbing species) passage between the pond and the downstream environment.

5.3 Landscape

While the project involved a considerable amount of earthworks, this did not alter the integrity of the existing landform of the park. The enhancement of the pond, wetland margin and channels through biotechnical stabilisation and re-vegetation resulted in significant positive landscape values. There were a small number of trees removed, but in the context of the trees retained, and the replanting undertaken, the potential adverse effect was considered to be negligible.

Figure 11: Planted Areas and New Footpath

5.4 Community consultation

The approach of partnering with the community resulted in huge positive outcomes. Even though the reserve was closed to the public for 6 months and looked, for a while, far worse than it did before the work commenced, there were no complaints from the community about the lack of access or the physical works. The community could see the vision for the upgraded reserve, and thus could see that the lack of access and the 'mess' would be worth it because it marked the transformation of a stormwater asset into a community asset with greatly enhanced amenity and ecological values.

For the official opening day approximately 150 people attended and helped to plant over 600 native plants. The community could see that their feedback and decisions on the plant choices, location of the path and access ways, and the artistically designed scruffy dome in the pond was incorporated into the project.

The community also expressed an interest in learning more about the different components of the stormwater pond and reserve, so four interpretation panels were installed to provide information on how the main components of the reserve treat stormwater, what plants and animals can be found in and around the stream and the history of the area.

The project saw great examples of social networking and a real sense of community involvement, with neighbours helping neighbours and with high participation rates for all events.

In addition to the positive response of the community, the project also enjoyed great support and feedback from the East Coast Bays Community Board and has enhanced Council's reputation with the community.

Figure 12: Opening day and artistically designed scruffy dome

Figure 13: Interpretation panel

5.5 Artwork

The creatively designed scruffy dome resulted in a functional, operational and beautiful piece of artwork that added considerable amenity value to the project. It also contributed to community ownership of the reserve as they community was instrumental in selecting the final design.

6.0 LESSONS LEARNED

During the construction phase of the project a number of challenges arose. But these challenges were resolved onsite by closely working together and with a clear understanding between the contractor and the client of the project outcomes.

When transforming a concrete channel into a naturalised stream it is important to mimic nature as closely as possible. During the construction of the stream the coir fascines where set out with string lines, thus making the edge of the stream perfectly straight. This oversight was corrected and the stream edge curved slightly to more closely resemble a natural stream.

Figure 14: Stream constructed with string lines

Weather also played havoc with the stream, with a heavy downpour lifting up some of the coir fascines and washing them downstream. This was corrected by staking the coir fascines down with “cross over” stakes and at more regular intervals.

Figure 15: Coir fascines washed away during heavy rainfall

Additionally the reserve had a history of the presence of very wet areas; parts of the new all year round footpath got permanently covered in water for a number of weeks, making access difficult. This was resolved by installing cut drains in the footpath and then piping them into the pond.

7.0 CONCLUSIONS

Transforming stormwater assets (ponds) into valued community assets that can be enjoyed by the local community, while providing stormwater treatment and enhancing both ecology and landscape values is not only achievable, but highly beneficial. The benefits that the environment and the community have gained by implementing integrated and sustainable stormwater management solutions are numerous.

The project outcomes meet all the objectives for an integrated project approach to stormwater management, including the following:

- The project enhanced the landscape values of the reserve, its recreational use and overall amenity
- Habitat values were enhanced through weed eradication (both aquatic and terrestrial) and restoration of representative habitats
- The project improved the water quality function and water storage capacity of the existing stormwater pond and tributaries through wetland margin planting, channel rehabilitation, and the use of innovative floating island technology in association with re-formed forebays
- The project utilised biotechnical stabilisation approaches for long-term system stability
- The community engagement was highly positive and provided significant benefits to both the local community and to Council.

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