“BRIDGING THE DIVIDE – THE OMEGA POND PROJECT”

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Successful Integrated Catchment Management Planning includes establishing the connectivity between catchment issues and the other landuse driven complexities, such as transportation development, to ensure that multiple benefit solutions are achieved.

The Te Ara Alexandra Project encompasses the integration of a major public cycleway project with stream restoration, wetland enhancement and stormwater infrastructure improvements. One component of this wider catchment project involves enhancing Omega Pond, located adjacent to the Alexandra Stream in the Oteha Valley, North Shore City.

This project is a shining example of how stormwater and transport practitioners can bridge often conflicting philosophical approaches to the management of the riparian area. The result being improved performance of a Council asset, enhanced public amenity of the open space area and an optimised cycleway design.

This paper documents the planning and design processes that have underpinned this project. In particular it will address the following key elements:

- Overcoming often divergent views between council entities regarding management of riparian reserves,
- Blending stormwater, amenity, transport and environmental objectives to get the best bang for your buck,
- Identification of design elements through the planning phase of the project,
- Linking design elements back to planning objectives throughout the design process.

KEYWORDS

Integrated catchment management planning, water quality, cycleway, integration, bioengineering.

PRESENTER PROFILE

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Rowan Carter is a Senior Stormwater Catchment Management Planning Specialist at Auckland Council. He has spent much of that time scoping stream restoration projects, many of which have required integrated approaches in order to maximise the potential of each project.

1 INTRODUCTION

This paper details the process, procedures and design philosophy's used in the development of the remedial design for the Omega Pond. This project is a component of the Te Ara Alexandra Project which encompasses the integration of a major public cycleway project, with stream, pond and wetland restoration. This work was planned and associated options developed as part of the Oteha Stormwater Catchment Management Plan (CMP). The CMP identified a number of enhancement and optimisation opportunities within the Alexandra Stream corridor including:

- Contaminant management and removal,
- Erosion management and remediation,
- Ecological enrichment,
- Amenity enhancement and;
- Improvement to public access.

These objectives have been developed from the North Shore City Councils (NSCC) stormwater strategy 2004 and are endorsed through the combined catchment integrated catchment management plan for the area. The relevant outcomes/objectives sought for the Oteha stormwater catchment, and this enhancement project included:

- To provide mitigation measures to enhance ecological values,
- To improve public access within the stream corridor,
- To ensure sediment control requirements are met,
- To minimise quantities of zinc and copper entering the receiving environment,
- To recognise and protect heritage and cultural values of the stream and environment,
- To manage stream erosion,
- The use of low impact design and other on-site mitigation methods for new development or redevelopment to reduce contaminant discharge at source, manage stream erosion and protect stream health,
- Protection against future stream bank erosion and damage to native vegetation,
- Maintaining and/or enhancing amenity and ecological values by retaining existing native riparian vegetation where practicable, implementing new planting and ongoing weed management,
- Protection and enhancement of existing wetland's and its/their associated natural treatment capability by restoring and maintaining in a more natural condition;
- Enhancement of general stream ecology by other means where appropriate, for example by habitat enhancement,
- Minimising in-stream works as far as practicable,
- Encouraging current and future community involvement in stream management,
- Mitigation of the effects of erosion at Council outfalls, and
- Removal or mitigation of man-made barriers to fish

1.1 THE OMEGA POND SITE AND PREWORKS SITUATION

The Omega Pond is located within the Alexandra Stream catchment which drains a 270 Ha area and flows in a south-north direction for approximately 5 km (mostly within reserve land) from the headwaters in the Unsworth Reserve through to it's confluence with the Oteha Stream at Bush Rd, Albany (refer figure 1). Omega Pond is located at 33 Omega Street, Albany, adjacent to the Upper Harbour Highway (refer figure 2).

The Omega Pond was designed as an extended detention dry pond and was constructed in 2000 by Neil Construction as part of the Unsworth Views and North Harbour Industrial Estate development. A design report prepared by Bruce White (source: Auckland Council Omega Pond) states that the Pond was designed to manage stormwater run-off from a 100 year 6 hour summer storm event, the critical rainfall event for flooding in the lower catchment area. It serves a small industrial catchment within the Oteha Valley Stormwater Catchment of approximately 174,000 m^2.

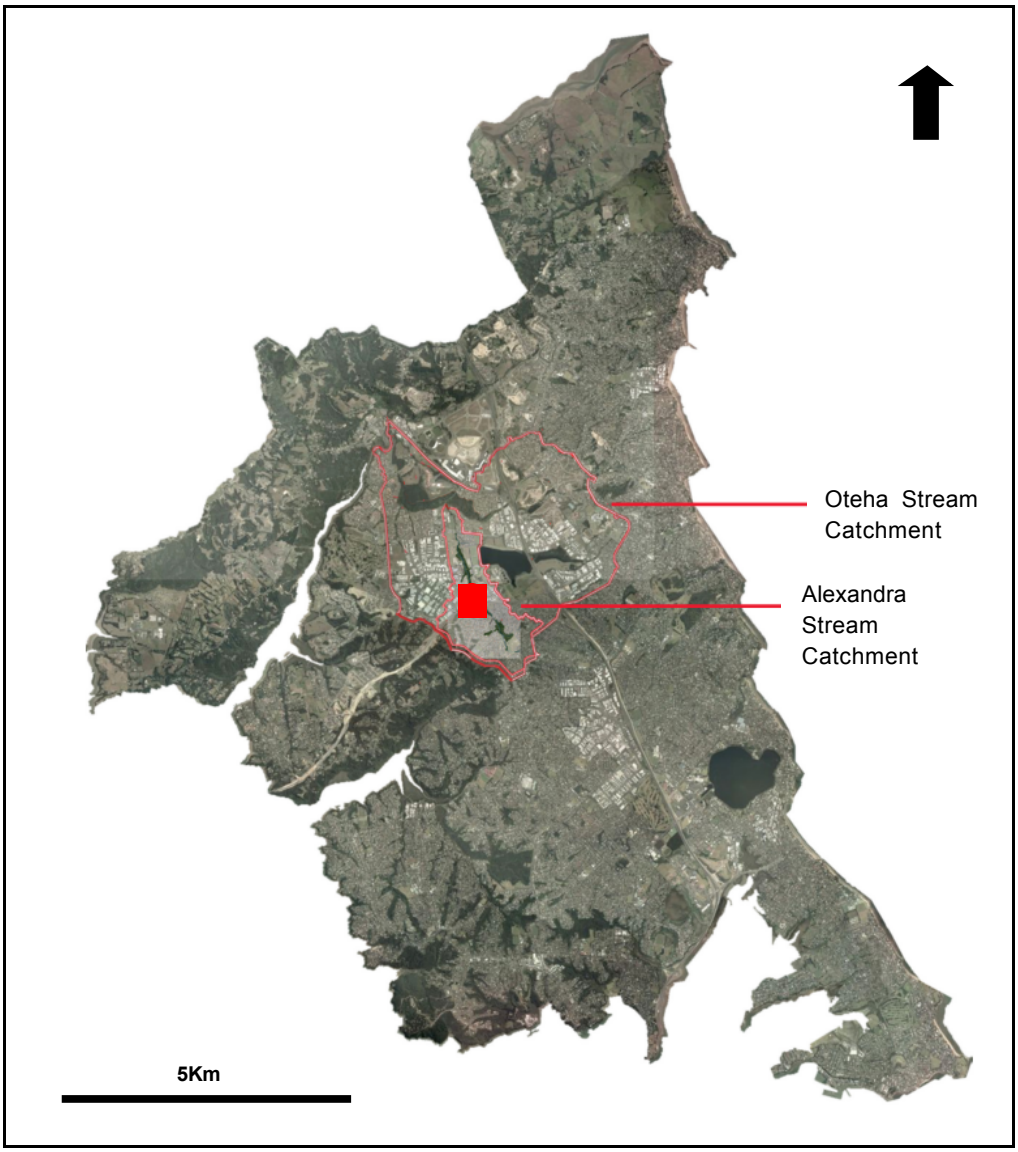

Figure 1: North Shore Area Showing Oteha and Alexandra Catchments with Omega Pond (red circle).

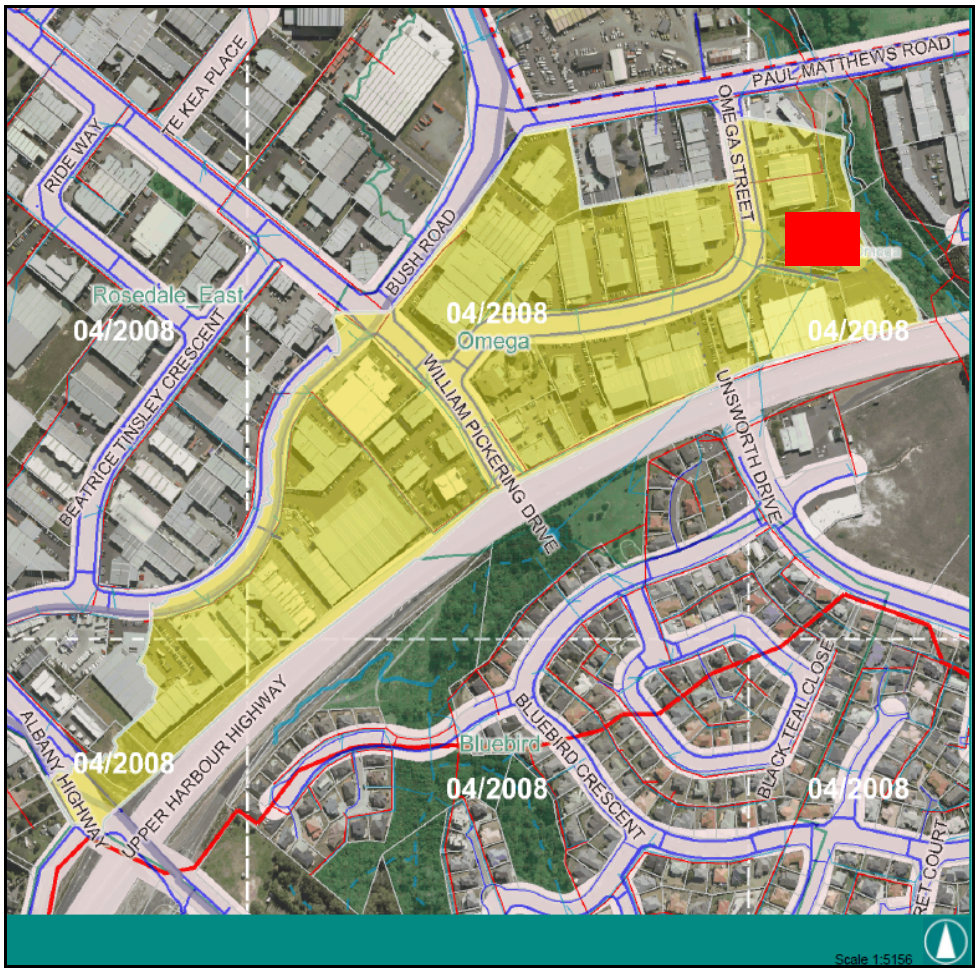

Figure 2: Omega Pond Catchment Area Map and Location (red circle).

1.1.1 WHY THE SITE WAS SELECTED FOR RESTORATION

The Omega Pond site was selected for investigation as part of the CMP process because of the potential to improve the water quality function of the Pond. The wider catchment has been identified for improved contaminated management as the loadings are considered high and the marine receiving environment has the potential for accumulation of containments of concern.

The potential of the Omega Pond to be more than a stormwater asset was clear from the beginning of the project. The number of viewing shafts from adjacent commercial business and Omega Street indicated any increase in amenity would naturally benefit the surrounding area (refer figure 3). Furthermore many of project objectives had the potential to be achieved through implementing improvements at the site including:

- To provide mitigation measures to enhance ecological values,
- To improve public access within the stream corridor for commuter and recreational purposes,
- To minimise quantities of zinc copper and other contaminants entering the receiving environment, and
- Encouraging current and future community involvement in stream management.

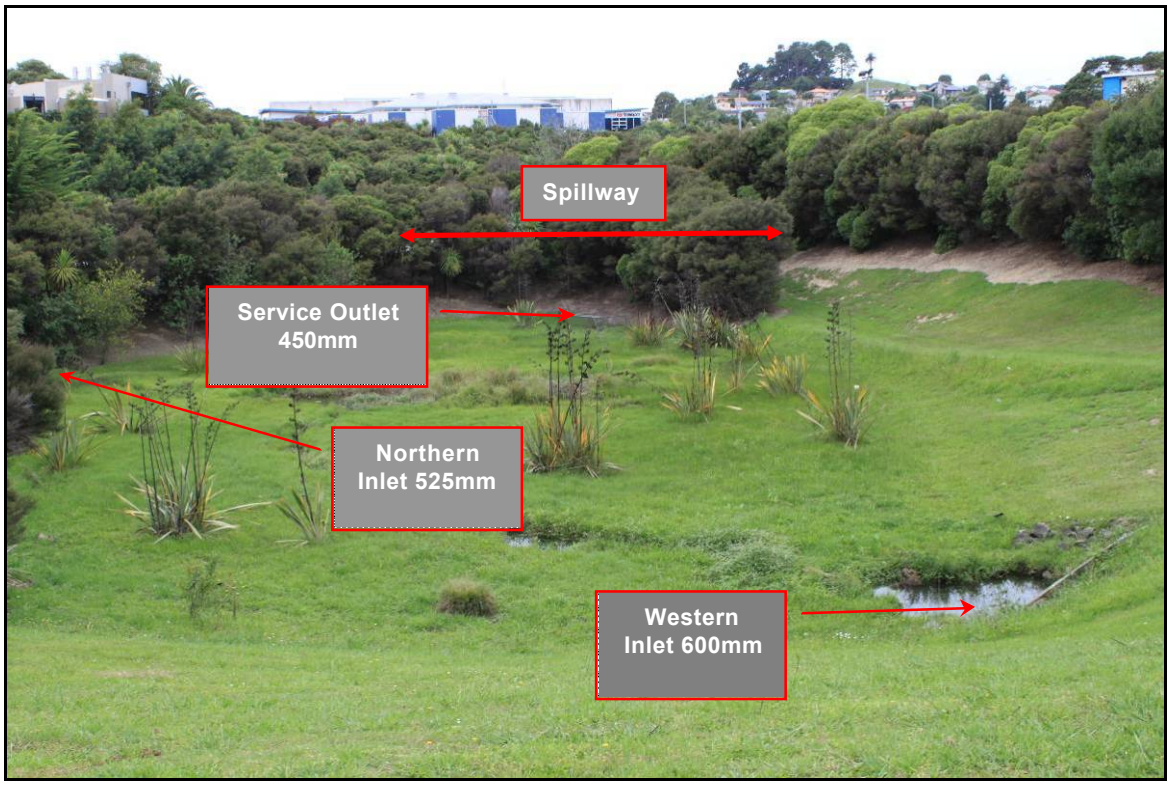

Figure 3: Showing Pre Works Omega Pond (facing East)

1.1.2 NETWORK CONFIGURATION

There are two public stormwater lines discharging to the pond. A 600 mm diameter pipe enters the west side at a discharge invert level of 30.8 m. There is a diversion present upstream of the 600 mm inflow pipe in the west side of the pond. This results in smaller flows entering the pond with larger flows being diverted through the bypass that discharge directly into the Alexandra Stream. A 525 mm diameter pipe enters the northern end with a discharge invert level of 32.0 m (refer figure 3). There are three outlet structures serving the pond. The service outlet structure is a 450 mm × 450 mm catchpit manhole with a lid level of 29.79 m and a 150 mm low flow outlet pipe at an invert level of 28.8 mm. There is a secondary high level service outlet which is a 1200 mm circular manhole with a lid level of 31.7 m and a 600 mm outlet pipe at an invert level of 28.8 m discharging to Alexandra Stream. An emergency spillway to the Alexandra Stream is provided at a level of 33.4 m.

1.1.3 DEPOSITED SEDIMENT

While still performing its original function as a detention pond, the ponds effectiveness had been reduced by the large volume of the deposited sediment which had filled the pond to the invert level of the service outlet. This build up on the bed of the pond had resulted in wetland type vegetation colonising the surface. The outcome being that the pond was functioning as a dry detention pond but had wetland type features.

Prior to physical works Omega Pond contained approximately 250 mm of deposited sediment. A sediment depth model was built in AutoCAD Civil 3D in order to calculate the volume of deposited sediment in the Pond. The result of this analysis was that there is an estimated volume of sediment of 290 m^3. This was undertaken using existing LiDar but also a refining the digital terrain model with additional infill GPS survey points to produce the sufficient resolution for modeling.

Figure 4: Showing Test Pits Dug into Accumulated Sediment

Sediment testing was undertaken to determine the nature of any contamination (Figure 4). The results of the sediment testing for typical anthropogenic inputs (zinc, copper, lead, VOC) due to previous and current landuse, indicated the deposited sediments did not contain significant concentrations of tested contaminants. The deposited sediments were therefore suitable for disposal at a managed cleanfill site.

1.1.4 WATER QUALITY VOLUME

The water quality volume (WQV) required to treat the upstream catchment was determined in accordance with ARC TP10. The ARC Technical Publication No. 108 'Guidelines for stormwater runoff modelling in the Auckland region' were used to calculate the peak flow rate for the catchment, supported by current and future flows (maximum probable development) documented in the Oteha Valley Stormwater Catchment Modelling Report, 2008.

The WQV required to meet 75% total suspended solids (TSS) removal in accordance with ARC TP10 guidelines for the Omega Pond catchment was calculated to be 3614 m^3, which is 1/3 of the 2 year Annual Recurrence Interval (ARI) total flow volume. However, TP10 makes an allowance for extended detention volume (EDV) to reduce the required WQV to 50% of the water quality storm (WQS) 24 hr runoff total volume, when a wetland is used. The existing EDV is 68% of that required; therefore the WQV required is reduced by 34% to 2385 m^3. This was calculated using the maximum probable development (MPD) of 90% as the catchment is a zone 2 stormwater management area (SMA) with business landuse. The imperviousness was calculated to be 88% using North Shore City Council GIS layers. This data and associated parameters formed the basis for the design development.

1.1.5 CHOSEN DESIGN OPTION

After a detailed options analysis including cost estimation it was decided that the most feasible, effective and appropriate option was the construction of a wetland with a kidney shaped forebay at the north side of Omega Pond. This would improve the sediment removal efficiency, dissolved contaminant removal and amenity values of Omega Pond. The constructed wetland would consist of a forebay with a volume of 485 m^3 and a vegetated wetland area with an equivalent volume of 378 m^3. This would allow Omega Pond to capture approximately 54% of suspended solids as well as quantities of copper, zinc and hydrocarbons.

2 PROJECT PHILOSOPHY AND INTEGRATION

The Te Ara Alexandra Project is supported by some key environmental data and assessments that have identified restoration opportunities. These include a complete stream and asset assessment undertaken by an engineer and ecologist. This involved physically walking the entire length of the Alexandra waterway assessing all built and natural structures including:

- Stormwater outfalls,
- Cascades and waterfalls,
- Stream morphology,
- Riparian features,
- Erosion and stability.

Part of this process involved considering the existing ecosystem services and how they might align with regulatory requirements and/or guidelines for the management of contaminants. This resulted in the identification of the Omega Pond site as a potential restoration works site in 2004 along with a number of semi-modified wetlands including the Barbados Wetland upstream and lower Alexandra Wetland downstream.

Other related benefits such as amenity improvement and social engagement, economic development, ecological enhancement, cultural sensitivity, educational components, etc. were also considered early in the project development and this involved rigorous dialogue with other Council departments including and in particular the Transport Department.

A traditional stormwater management approach might have excluded many of these enhancement opportunities because they would have been considered outside the scope of the standard stormwater management envelope. However, the objectives and outcomes sought of the project go beyond simple flood, erosion and/or water quality to include quadruple bottom line outcomes including social, economic, environmental and cultural.

2.1 THE CHANCE FOR INTEGRATION

As outlined a holistic approach goes beyond simply stormwater management and must consider objectives of other stakeholders. The NSCC Transport section had at the time of the preparation of the Omega Pond options, developed designs for a cycleway that followed the Alexandra Stream corridor, being part of Transport's Strategic Cycling Plan. Because of the open dialogue between the departments at the time it was soon understood that both parties had projects planned that could be modified to provide mutual benefits. The immediate benefits being:

- Combine planning resources to work towards achieving overlapping project objectives.
- Take advantage of the opportunity to maximise cost savings.
- Minimising disruption to the environment and the community.
- Chance to combine design resources and technical expertise.
- Combined tendering to reduce redundancy and ensure project success.

As a consequence of these identified benefits a planning and design group was established with members from the stormwater planning, transport planning/projects and the key design and consenting consultancy resources. This led to sharing the management and optimisation of project budgets, swapping of key information sets and modification of design.

One of the ways this sharing was done for the wider project, including Omega, was by establishing a joint file folder storage arrangement. This meant that reports and data could

all be located in a single location on Council drives, so reports and studies which would otherwise not be known about, were made available. A good example of this was the landscape design plans for the cycleway and stream restoration projects.

2.2 PROPOSED CYCLEWAY ALIGNMENT "WIN WIN"

The key objective of the "share with care" Cycleway was to provide an off-road commuter and recreational cycle route that would connect a significant residential population upstream with a key employment area and recreational reserves downstream. The alignment of the cycleway interacts with several of the stormwater projects planned for the Alexandra Stream corridor and there has been considerable integration between the two planning teams to ensure the best stormwater and transport outcomes might be attained. One of these touch points was the alignment from Paul Mathews Drive through to Rook Reserve under State Highway 18. During the course of a site walkover with the Transport Team a number of feasibility issues were identified. These included stormwater consenting, land ownership and most significantly linkages of the Cycleway to adjacent feeder systems.

It was suggested that the alignment be moved from the eastern side of the Alexandra Stream (which was along the existing walking track) to the western side of the watercourse, adjacent to Omega Pond (see Figure 5). This new route made access to Omega Street possible. Because the landownership and access through the Pond reserve did not immediately seem to be feasible from a transport planning perspective it was discounted. However, the Pond design option at the time included a bund through the middle of the Omega pond separating a proposed constructed wetland from a kidney shaped forebay at the north side of the pond.

Figure 5: Original Cycleway Alignment in red, proposed change in green and access through the Pond in yellow

An elevated Cycleway along the Omega Pond bund alignment would provide an ideal access route from Omega Street to the main Cycleway alignment along the stream. This in effect would put the community in better contact with the environment through this new cycle route selection, incorporate enhanced amenity, reduced possible runoff caused by

the Cycleway, and thereby reduced the Cycleway's environmental footprint (refer figure 5).

The design development phase of this project has been inclusive and iterative. In order for this process to be successful it required open collaboration, great communication and a willingness to share contracts, outputs, budgets etc.

2.2.1 TENDERING AND DESIGN

The design of the Cycleway was prepared in association with the pond remedial designs with two design teams bringing together a single set of drawings and schedules for Council approval and tender documents. The design needed to meet the operational and performance requirements of Stormwater and the specifications Transport had set for the Cycleway.

The Stormwater Department organised partial funding for this side link into the Cycleway as the Cycleway Project initially had only planned an alignment to pass by the pond. However, Transport provided a substantial proportion which supported the raised boardwalk component and access paths. Consequently this provided the potential to let the physical works contract for all the required works including pond upgrade, plantings and boardwalk construction. This provided economy of scale with associate cost and time savings.

Figure 6 shows the overall plan of the Omega pond and the Cycleway. The pond geometry is the dominating feature of the design with the Cycleway design effectively draping over the proposed contour (refer figure 6).

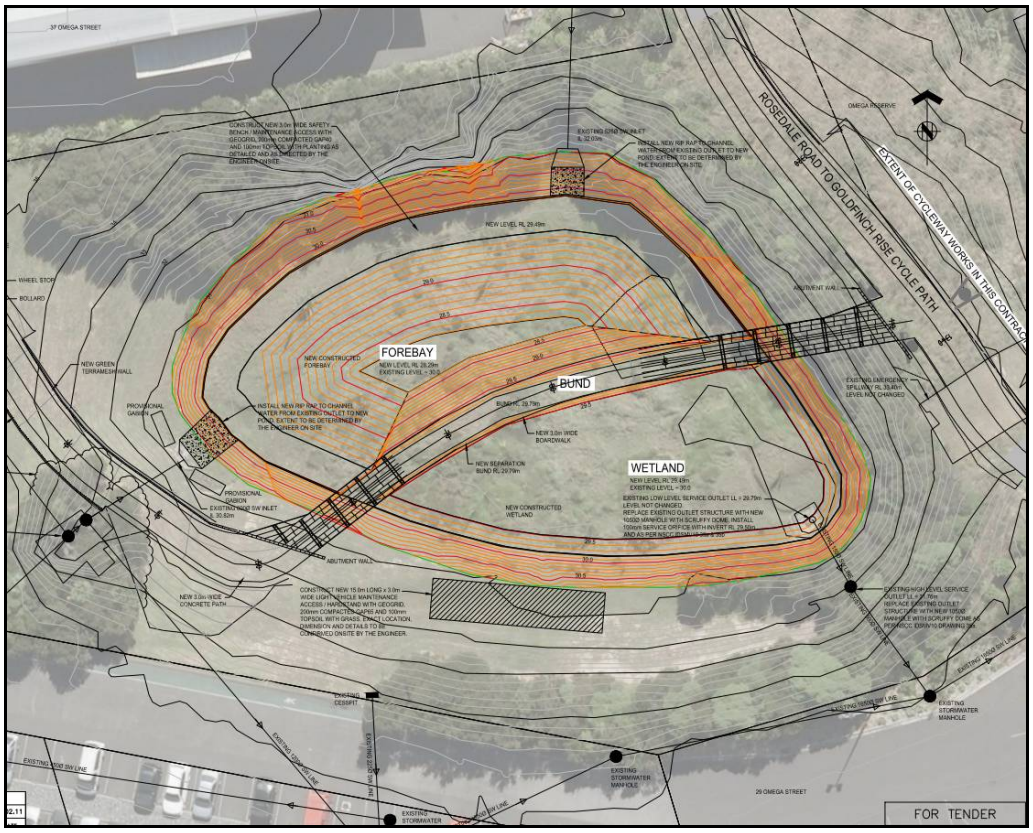

Figure 6: Showing Design Layout of Omega Pond Showing Cycleway

2.2.2 FUNDAMENTAL DESIGN SHIFT- PERVIOUS PAVING

Although this paper focuses on the integration around the Omega Pond, the influence stormwater technical input had on the design of the Cycleway at a more fundamental material level may have been of equal or greater significant. Because of the total area to be developed, from largely grassed pervious surface to impervious concrete, the Cycleway project ran the risk of needing to mitigate any increases in stormwater volume required through the consenting process. This would have added additional cost and also technical complexity to the project. Because Stormwater raised this risk to Transport and together recognised the significance an alternative design was investigated.

Stormwater suggested the use of pervious concrete to be used in the areas where slope allowed and alternative materials suggest as hoggin material could not be used. Through previous research and trialing a local manufacturer had developed a pervious concrete recipe into production. The simple outcome was one of the largest pours of pervious paving in New Zealand at the time (refer figure 7).

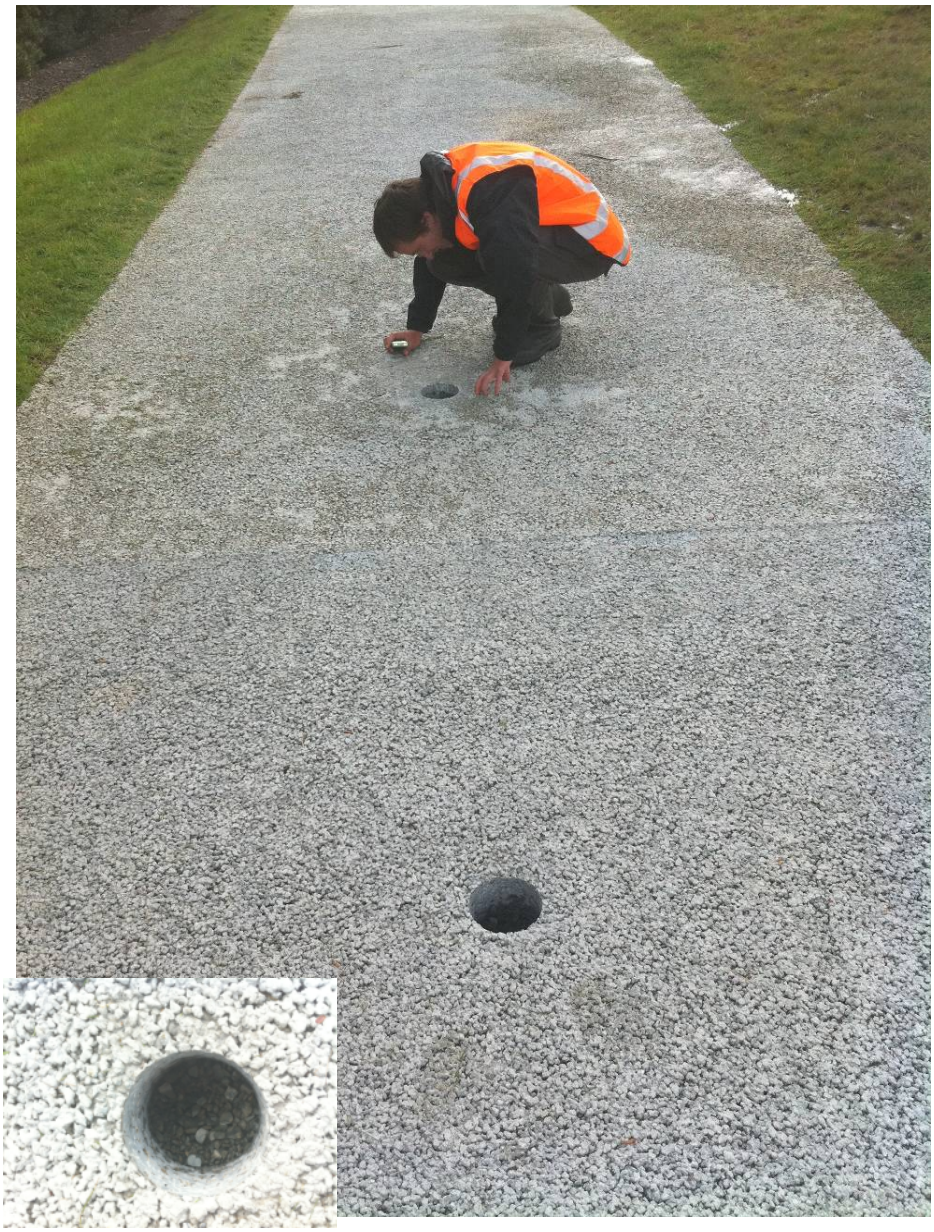

Figure 7: Showing example Section of Pervious Paving and Test Pits

3 THE BUILT OUTCOME

The final design and works for the Omega Pond and Cycleway included the following elements:

- The construction of a 3 m wide share with care pathway and timber boardwalk from Omega Street, across Omega Pond, to link with the proposed Goldfinch pathway.
- Abutment walls, drainage and terramesh retaining walls associated with Cycleway.
- The removal and disposal of sediment and underlying material to create a pond forebay and wetland within an existing temporary detention dry pond
- The construction of a clay bund between the forebay and wetland.
- Planting of the wetland, bund and pond perimeter with wetland plant species.
- Extension of the existing rip rap from the pond inlets to the forebay edge.
- The construction of a wetland planted safety bench and dual maintenance accessway around the perimeter of the deep water forebay.
- Upgrade of existing low level and high level service outlets.
- The construction of a maintenance access way to the pond for heavy vehicles.
- Supply and installation of all Cycleway rails and pond and Cycleway signage.
- Interpretative signage on the boardwalk explain the function of the forebay/wetland.

The deep water forebay (refer figure 8) incorporated a 3 m wide planted safety bench which was designed to accommodate a long reach digger for the digging out of the accumulated sediments over time. This planted bench is anticipated to improve the amenity and water function of the Pond.

Figure 8: Omega Pond Showing Construction of Deep Water Forebay

Figure 9: Cycleway Developed on top of the Seperation Bund.

The raised Cycleway follows the clay separation bund (refer figure 9) between the forebay and wetland. Because of the temporary detention function of the Pond the deck level of the Cycleway was in the order of 2.8 m above the normal operating water level. The planted bund will eventually be thickly vegetated with flax and over time blend into the wetland pond setting. The wetland area is considerably shallower than the deep water bund being 600 mm at its deepest point it has been designed to act as both a freshwater habitat and as a water quality enhancement area.

Figure 10: Omega Pond showing Stage 1 Wetland Plantings before Infill Planting

4 CONCLUSIONS AND LEARNINGS

The integration between Auckland Transport and the Auckland Council Stormwater Unit has been a key success of this project. Identifying opportunities for integration is often the most significant issue to resolve when attempting to meet the objectives of the public and wider stakeholders.

The alignment of the Cycleway has significantly benefited from the technical advice the collaboration with the stormwater department. The original alignment would not have provided access for the catchment of people on the western side of Alexandra Stream including Bush Road, William Pickering, Ride Way and Beatrice Tinsley Crescent. It now does.

The public money spent on stormwater treatment devices often results in only limited benefits which in general do not include recreational amenity and/or access. This project is an example of how integration can benefit the community and the environment.

The mitigation design of the Pond from temporary detention dry pond to deep water forebay and wetland has significantly improved contaminant removal, retained the erosion mitigation function of the original design and provided valuable wetland habitat with both ecological and amenity benefits.

Turnover of staff at Auckland Transport has led to difficulties in project integration due to lack of continuity and lapses in understanding of project objectives. Having documented agreement on project objectives and responsibilities at the outset of the project would have helped in providing this continuity.

There were some differences in opinion between what Stormwater and Transport believe is amenity value. This was particularly relevant in regards to the style of boarding to be used on the Cycleway over bridge which was specified to be constructed with solid boarding. However, during the construction phase the positive relationship with Transport resulted in a request from Stormwater for a less solid finish which was adopted.

Additionally Auckland Transport only seems willing to consider off-road share with care cycle routes if they attract funding from NZTA. The criteria for funding stipulates the path dimensions (being 3000 mm), which can reduce amenity value and design flexibility.

To investigate avenues and establish process for integrated planning, open communication between stormwater and transport departments needs to be encouraged for the future. This is particularly relevant in the current Auckland environment where geographic barriers and organisation boundaries resulting from the new 'super city' council structure will need to be overcome.

Sharing contracts between Auckland Council departments (or other council controlled organisations) can be a cheaper and more efficient method of design and construction. This was demonstrated by the single built contract let for both the Cycleway and the Pond works.

Integrated projects like this one require planning staff to be closely involved in the design component to ensure consistency and integration of design components with the project objectives. In order to maximise the benefits of a stormwater project, a holistic approach is required. This involves unlocking the overall potential of a stormwater project early in the planning process through the identification of related ecological, amenity, other social and cultural issues.

ACKNOWLEDGEMENTS

We would like to acknowledge the following groups and people:

- Auckland Transport (principal partner)
- Auckland Council Parks department
- Barry Carter – Stormwater Northern Planning Manager
- Nick Maier- Former North Shore City Transport Planning Engineer
- Ex-NSCC Albany Community Board for their endorsement of the project

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