



Stream Daylighting

Identifying Opportunities for Central Auckland: Concept Design

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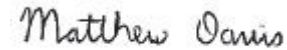


Stream Daylighting: Identifying Opportunities for Central Auckland - Concept Design has been prepared for council representatives, consultants and the general public to demonstrate the possibility for bringing water to the surface in Auckland City. Stream daylighting takes water out of pipes to restore open stream environments, and provides for high-amenity open space corridors that reinvents nature in our cities.

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Title Stream Daylighting
Identifying Opportunities for Central Auckland: Concept Design

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Executive Summary

Stream Daylighting: Identifying Opportunities for Central Auckland has been prepared for council representatives, consultants and the general public to demonstrate the possibility for bringing water to the surface in Auckland City. Stream daylighting takes water out of pipes to restore open stream environments, and provides for high-amenity open space corridors that reinvents nature in our cities.

In a political, social and economic climate that places increasing demand on our representatives to deliver on environmental matters, stream daylighting provides an opportunity to improve the environmental track record of our cities, while directly engaging its citizens with their natural heritage. Best practice international examples of stream daylighting have demonstrated significant economic returns and social benefits. Waterfront property commands a premium and proves a driving factor in urban revitalisation. Citizens have quickly engaged with the idea of “setting something right” in their neighbourhoods.

Through a method of desktop surveys of historical plans, photographs, and surveys, Stream Daylighting: Identifying Opportunities for Central Auckland reveals the location of historic streams in central Auckland including the Waipapa in Parnell, the Waihorotiu in the Central Business District (CBD), and the Tunamau in Freemans Bay. Investigations into individual catchments present the geology, landscape character, and ecology that underlies our cities and defines their development patterns. Individual stream reaches were assessed in terms of storm and wastewater infrastructure, land-use, protected and significant features, future project sites, and potential sink costs of recent investment.

Constraints were identified as much as was practicable without broader consultation and feasibility studies. A broad scope was adopted to identify daylighting opportunities and optimise the function of the report as a visioning document. Preliminary concepts were presented as potential future opportunities for stream daylighting in all three of the focus catchments. These opportunities were then presented for individual reaches of the streams.

It is clear that due to significant sink costs and infrastructure constraints, the Waihorotiu is the least feasible option for daylighting within central Auckland. However, the Tunamau and Waipapa catchments provide very real opportunities in the short to medium-term to progress stream daylighting projects and greenway planning provisions.

The Tunamau Stream

Daylighting of the Tunamau in Freemans Bay would provide for contiguous open space connections between Western Park on Ponsonby Road, Victoria Park in Freemans Bay, and the Viaduct. A stream in this location would wind through schools, residential estates, commercial and industrial areas.

Daylighting has the potential to act as a catalyst for other stormwater management in the catchment through partnerships with residential estates, commercial properties and schools, promoting low impact design (LID) retrofit. These stormwater initiatives would provide the daylighted stream with additional flow, primary water quality treatment, and educational opportunities for on-site stormwater treatment

Daylighting of the Tunamau would provide primary treatment for stormwater before it enters the Waitemata Harbour. There is further potential to combine with proposed future development on Wynyard Wharf. The daylighted project also has the potential to collaborate with the New Zealand Transport Agency’s proposals for the Victoria Park Tunnel, and the second Waitemata Harbour crossing.

The only significant impediment to daylighting in this catchment is an industrial building at the bottom of Freemans Bay. Future potential development of this site should therefore be considered in light of the potential “opportunity costs” for stream daylighting.



This daylighted stream in Kalamazoo, Michigan is channelised for much of its length, but has acted as a catalyst for many stormwater management initiatives in the catchment to enhance water quality

Courtesy of the Downtown Development Authority, City of Kalamazoo, Michigan

The Waipapa Stream

Of the three streams, the Waipapa is the last to retain vestiges of open water. These have been restored to some degree by citizen groups, but also modified by recent development. There are opportunities to restore open sections of the stream as well as daylight the Waipapa and its tributaries from the stormwater system. Parallel and in-flow treatment wetlands have the potential to provide preliminary treatment of non-point source contaminants. Contamination in association with industrial areas and railway embankments would require further mitigation work or capping.

A potential future wetland complex at the historic outfall of the Strand could provide a significant amenity and formal entrance to the Domain. This would occur in connection with proposed future cycle/walkways with access from Beach Road and Quay Park to Parnell and the Domain. A wetland in this location could provide additional detention of stormwater for proposed future development in Parnell and Carlaw Park, while also lessening the downstream effect of the Waipapa on overloaded stormwater infrastructure in Mechanics Bay.

The Waihorotiu Stream

There are bold possibilities to create a parkland environment in the heart of Auckland City through the daylighting of the Waihorotiu in Myers Park, Aotea Square and Queen Street. This possibility was mooted for the 2007 Queen Street improvements but was considered infeasible in the short-term for reasons of existing infrastructure and the lack of stormwater management within the catchment to achieve appropriate water quality. The concept has therefore been relegated to the upper reaches outside of Queen Street or as a long-term opportunity.

Daylighting options for the Waihorotiu would require significant investment in infrastructure and a vision that is shared by politicians, the public, and council departments. The scale of work and cooperative effort would be on par with the daylighting of the Cheong-Gye Chon in Seoul (summarised on page 4 of this report).

Next steps

Opportunities identified in this report require detailed analysis and broad consultation to determine their feasibility and cost/benefit to the community. Further studies can be undertaken in areas where opportunities are seen as immediately relevant and/or having the greatest potential benefit. It is also hoped and anticipated that the methodology for rapid assessment developed by Stream Daylighting: Identifying Opportunities for Central Auckland could be applied to other catchments in Auckland City and the region.

The Local Government Act (LGA) provides for desirable community outcomes through strategic planning. Daylighting opportunities could be considered for inclusion in the Long-Term Council Community Plan (LTCCP), potentially appearing in the Vision and Strategy or Policy and Statement sections. This would then inform the Annual Plans and Stormwater Asset Management Plans, and provide a mechanism to allocate future funding for feasibility studies and/or rehabilitation works. The LGA also provides for structure plans which can inform District Plan changes.

To facilitate daylighting projects it will be necessary to provide for broad consultation, including Iwi, and to form partnerships between the ARC, district councils, government ministries, the New Zealand Transport Agency, community boards, business associations and community groups.



Grassroots demonstrations and fete days to celebrate streams in Berkeley, California. Public interest eventually led to several daylighting projects and a new by-law that prevents the piping of existing waterways

Courtesy of Wolfe Mason Associates / Design Community & Environment

Introduction

The urban landscape

Landscape and ecology are essential organising elements of the urban environment. In Auckland's landscape, Pukekawa (Auckland Domain) and Maungawhau (Mt Eden) are some of the green open spaces and backdrop to Auckland City. The ridgelines are thoroughfares to the university and fashionable ways through Parnell, Ponsonby and Karangahape. The coastline is a mercantile centre of activity for transport, industry, residential living, and commerce.

The urban ecology and environmental health of Auckland City is becoming of paramount importance to its citizens. This is in no small part due to a general awareness around environmental issues, from regional issues such as air pollution and swimmable beaches, to global issues such as climate change. The environment has become fundamentally linked to the economic and social well-being of our culture and there are firm expectations upon our city planners and urban designers to deliver upon an environmental manifesto. Other motivating factors include:

- Urban areas produce noise, heat, airborne and waterborne pollution. This is especially inappropriate for densely populated regions, with background levels of contamination in our urban centres often representing a chronic threat to life.
- As populations increase in density and the hinterland shrinks in size, more open space is required. This requires efficient use of resources in terms of connecting open spaces and utilising marginal landscapes, such as floodplains.
- Parklands and ecological habitat in urban areas improve quality of life through benefits to the community, mental health, education, and recreation.
- Ecological systems intended for a singular purpose such as flood attenuation provide a suite of ancillary benefits, including dust inception, noise dampening, and temperature moderation.

The streams in central Auckland that were once vital to the city's growth and industry have not realised their full potential in the contemporary urban landscape. Early in Auckland's European history they were compromised by uncontrolled pollution and were confined to engineered structures due to a profound lack of understanding of ecological systems. By default the streams became the flushing system for the city's stormwater and sewerage or have become overtopped by road and rail.

Auckland's main thoroughfare Queen Street ("the golden mile") is aligned from coastline to ridgetop at the base of a steep gully. Queen Street provides a visible datum that connects the coast and ridgeline environments of the city. Many Aucklanders fail to realise that the road follows the original alignment of the Waihorotiu Stream, with visible kinks revealing where the road once spanned the stream. The Waihorotiu Stream, the water source for early European Auckland, a stream that once harboured sailing ships on the incoming tide and supported healthy fisheries, still runs beneath the street in a maze of stormwater pipes and the remnants of 19th century culverts.

Stream daylighting

One of the most radical expressions of stream restoration is to bring buried streams to the surface and restore their natural systems and processes. This form of restoration was coined "stream daylighting", by an early proponent, Douglas Wolfe, who was integrally involved in one of the first dedicated daylighting projects, now considered an archetype, at Strawberry Creek, California in 1984. Stream daylighting is a radical form of stream restoration, which returns pipes and culverts to open water systems. These streams restore ecological function and processes to a city, enhancing urban habitat and mitigating deleterious effects of the urban environment. Urban streams provide new and multifarious functions, representing open space, urban habitat and ecological infrastructure. The benefits of stream daylighting and associated open spaces are many and varied, and have many allies from different social groups. In this way, the benefits of stream daylighting are at once economic, social and environmental.



Stream Daylighting

Identifying Opportunities for Central Auckland: Concept Design

Economic benefits of stream daylighting:

- Provides open stormwater infrastructure that can be more easily and cheaply monitored and repaired.
- Approximately equivalent costs to replacing a culvert.
- Diverts urban run-off from combined sewer systems, reducing combined sewer overflows and burdens on treatment plants.
- By their linear nature streams enhance the utility value of existing facilities and natural areas by linking them together to protect a diverse resource base and increase public access to recreational opportunities.
- Connects coastal environments and the CBD with retail centres and residential neighbourhoods.
- Provides an attraction for recreation and tourist based economies.
- Increases values of adjacent properties and enhances tax bases.
- Encourages revitalisation of urban waterways; improving safety in these unused spaces.
- Creates value for land limited by physical constraints, such as subsidence and flooding.

Social benefits of stream daylighting:

- Builds civic pride and relationships as residents, businesses and governments form restoration project teams.
- Provides corridors for cycling, walking, and traffic-free routes between schools, shops and parks.
- Provides a strategic growth boundary, directing development away from sensitive areas.
- Re-establishes connections between people, their catchment and their local flora and fauna.
- Provides the public with a sense of "setting something right".
- Improves public amenity, potentially serving as a focal point for parks or neighbourhood revitalization.
- Serves as an "outdoor classroom" for local schools.
- Provides recreational open space close to urban neighbourhoods, often providing links between diverse age and socio-economic groups.
- Enhances community character and a sense of place by protecting natural and cultural resources.

Environmental benefits of stream daylighting:

- Relieves choke points, increases hydraulic capacity, and diminishes flooding problems caused by under-capacity stormwater infrastructure.
- Improves water quality through natural systems and processes.
- Reduces run-off velocities through natural stream channels, preventing downstream erosion.
- Enhances aquatic and terrestrial habitat and provides for fish passage and wildlife movement.
- Provides contiguous protected fish and wildlife habitat.
- Connects isolated habitats, allowing individual and genetic migration.
- Flood attenuation and flow reduction.
- Shading of the stream and retention of base flows.
- Buffer of green space against urban noise, dust and pollution.

Greenway and riverways

Greenways, also known as lineal parks, wildlife corridors, and riverways are lineal open spaces linking natural, cultural and recreational areas in coincidence with streams or other lineal landscape features. Greenways provide the impetus to integrate open space networks, not only providing master planning objectives, but also capturing the imagination of the public, environmental groups, and planners alike.

Greenways provide the framework to protect, conserve and link natural resources and open spaces, including isolated urban habitats. A riverway network in central Auckland would connect the CBD to its wider context of the harbour, suburban parks and regional parks. Opportunities exist for cycle and pedestrian connections between different areas of the city. These connections within the stream corridor are along a central datum and natural feature that is already understood, recognised and cognitively mapped by the citizens of Auckland.

Scope

An objective in redevelopment can be to introduce water features into the urban environment. One of the most significant opportunities to accomplish this is through the practice of stream daylighting, which provides the added benefit of rehabilitating a natural system.

This report was commissioned to demonstrate the methodology for identifying historic watercourses, and rapid assessment of constraints and opportunities to determine opportunities for daylighting. Case studies were chosen within the stormwater/rainwater catchments of Freemans Bay (the Tunamau Stream), the Central Business District (the Waihorotiu Stream), and Parnell (the Waipapa Stream).

Methodology

The project team included members of the ARC Stormwater Team, Boffa Miskell, and Pattle Delamore Partners. The alignment of historic watercourses was determined with reference to maps, plans and photographs from Auckland City Council (ACC) and ARC Archives, Auckland City Libraries and Land Information New Zealand. ACC GIS provided topography and historic floodplains.

Focused studies looked at land environments of individual catchments to determine the underlying geology, potential vegetation types and valley gradients. Catchments were described in terms of existing land use, landscape character, inherent cultural values, and future landscape connections.

Preliminary constraints mapping was also undertaken to determine storm and wastewater infrastructure, protected features, future project sites, and potential sink costs of recent investment.

Future opportunities for stream daylighting have been presented for individual stream reaches. In some instances, opportunities were compromised by land ownership and infrastructure issues. However, these were not interpreted as absolute constraints in order to allow a broad field of reference for daylighting opportunities and optimise the function of this report as a visioning document. It is left to further consultation and feasibility studies to determine suitability of identified daylighting opportunities in the long-term. For the most part, the scope of this project does not include landowner consultation and was directed to identify opportunities without confinement to the public domain, or the short to medium-term infrastructure requirements for Auckland City. In this regard consultation with Auckland City was limited to information sharing.

Ngati Whatua O Orakei are long-term advocates for stream daylighting and were involved in initial scoping for Stream Daylighting: Identifying Opportunities for Central Auckland. Their insight would provide significant benefit to feasibility studies going forward. Engagement with Ngati Whatua would provide for the cultural value of streams in Auckland, and direct management options to enhance the mauri of these streams and the most appropriate methods to acknowledge their heritage.

Exclusions

This report is not intended as a response to a statutory requirement. It therefore does not include a comprehensive planning review in relation to the concept of daylighting or case studies as they might impact on existing statutory provisions. The document also omits economic analyses, since this is impractical at this level of study.

This report is intended as a document to encourage discourse on the subject of stream daylighting in Auckland. The opportunities identified are based on rapid assessments and are not intended to represent “as-built” concepts. It would require the analysis of a multi-disciplinary team of engineers, planners, environmental scientists, ecologists, and designers with detailed data to determine the feasibility of the concepts produced in this report, and therefore they should be taken as case studies for discussion purposes only.



Visions for the recently daylighted Cheong-Gye Chon in Seoul, Korea

Courtesy of the Seoul Metropolitan Government and Professor Jong-Ho-Shin

Vision and Objectives

Vision

Auckland's urban form is strongly integrated with a supporting ecological infrastructure. Mountains, volcanoes and coastlines are connected through well managed riparian open spaces, providing for discernible natural character within the city and accessible connections for humans, flora and fauna between parts of the city.

Objectives

The objectives of this project are:

- To provide a document to foster support for stream daylighting and open the concept to a wider audience.
- To act as an information source for historic streams in central Auckland.
- To inform potential future stream daylighting projects within the focus catchments.
- To provide a methodology for ongoing investigations in other stormwater catchments.



Daylighted river and associated public open space in downtown Kalamazoo, Michigan
Courtesy of the Downtown Development Authority, Kalamazoo, Michigan



The options presented for daylighting Strawberry Creek in downtown Berkeley, California
Courtesy of Wolfe Mason Associates / Design Community & Environment / City of Berkeley

Best Practice Examples

Seoul, Korea

In 2002 Seoul's Myung-Bak Lee won the mayoral election on a promise to replace the city's main primary expressway with the daylighted Cheong-Gye Cheow River. Lee's proposition had the support of 76 per cent of the population, half of which slated environmental considerations were the primary reason for their support.

By October 2005 Lee had removed twelve lanes of traffic carrying over 150,000 commuters to the city centre. The expressway was replaced with the Cheong Gye Cheow River within a green network connecting eastern and western Seoul. Objectives for the project were to provide a catalyst for revitalisation in the downtown, to form an image for Seoul as an environmentally friendly city, and to recover the natural and cultural heritage of the city.

The expressway had been built over the Cheong Gye in the early twentieth century. Considered a showpiece of modern planning in the 1970s, the expressway had become heavily polluted from traffic congestion, an eyesore for the public and was held responsible for disinvestment within the city.

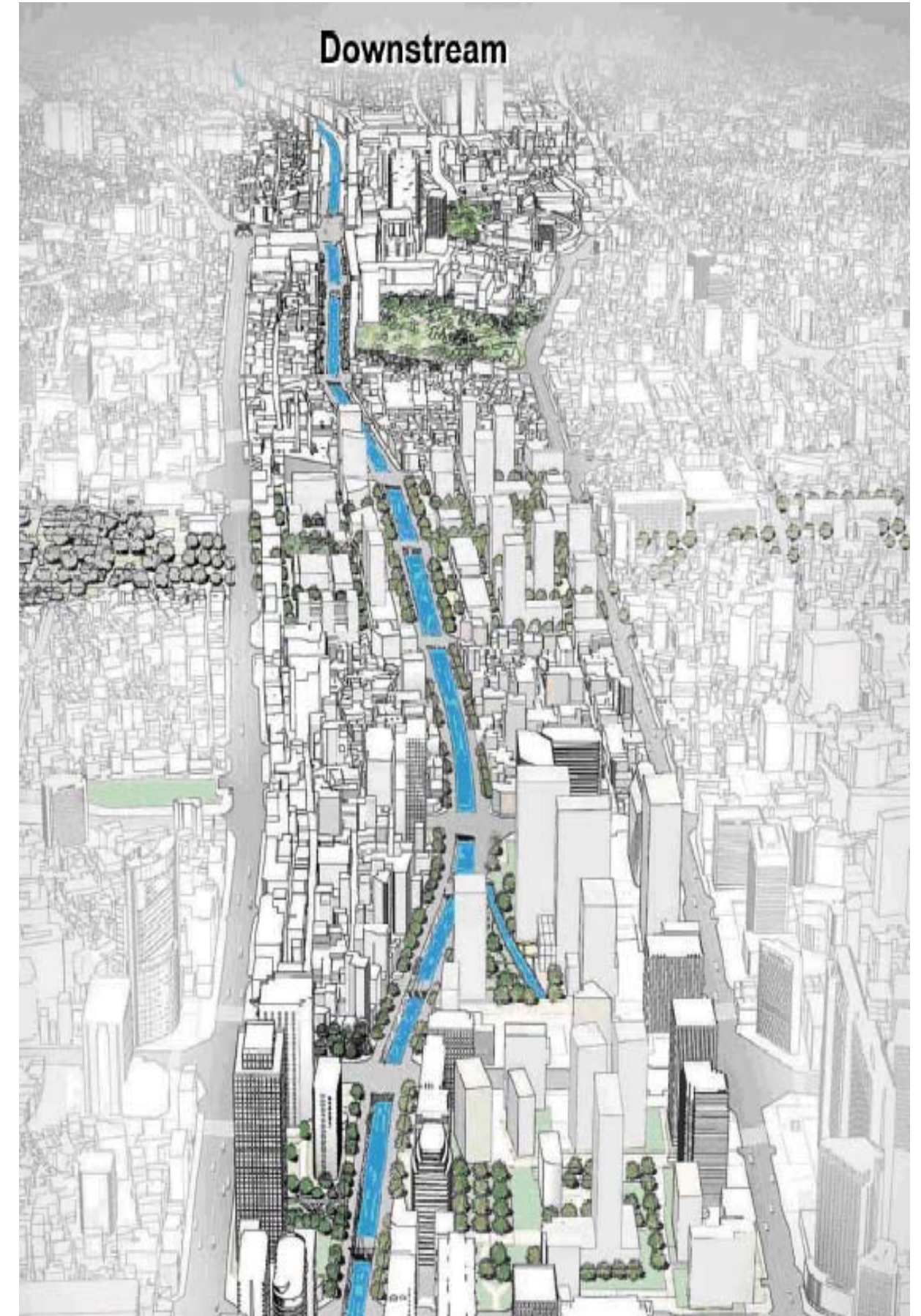
In exchange for the \$360 million cost for the daylighting Project, Seoul's council anticipates \$12 billion in new investment, including several miles of waterfront development opportunities, the expansion of the financial district, and the creation of new developments at the terminus of the daylighting project.

Daylighting eliminated the need for repair of the expressway, restored sewerage services, and appropriated stormwater from the city centre to instream flows. Public transportation systems were reconciled to remove car dependency and ultimately improve inner-city congestion. The historic centre, which had one of the lowest resident populations in Seoul, has seen residential development thriving with the advent of the river restoration project.

The mayor has seized on the momentum of the Cheong Gye daylighting project with a World Mayors Forum at the opening of the river in October 2005. Themes of the forum were urban sustainability and revitalization. Lee has since been considered a strong contender for South Korea's presidency.

Seoul's Expressway was removed to daylight the Cheonggyecheon River

Courtesy of the Seoul Metropolitan Government and Professor Jong-Ho-Shin



Zurich, Switzerland

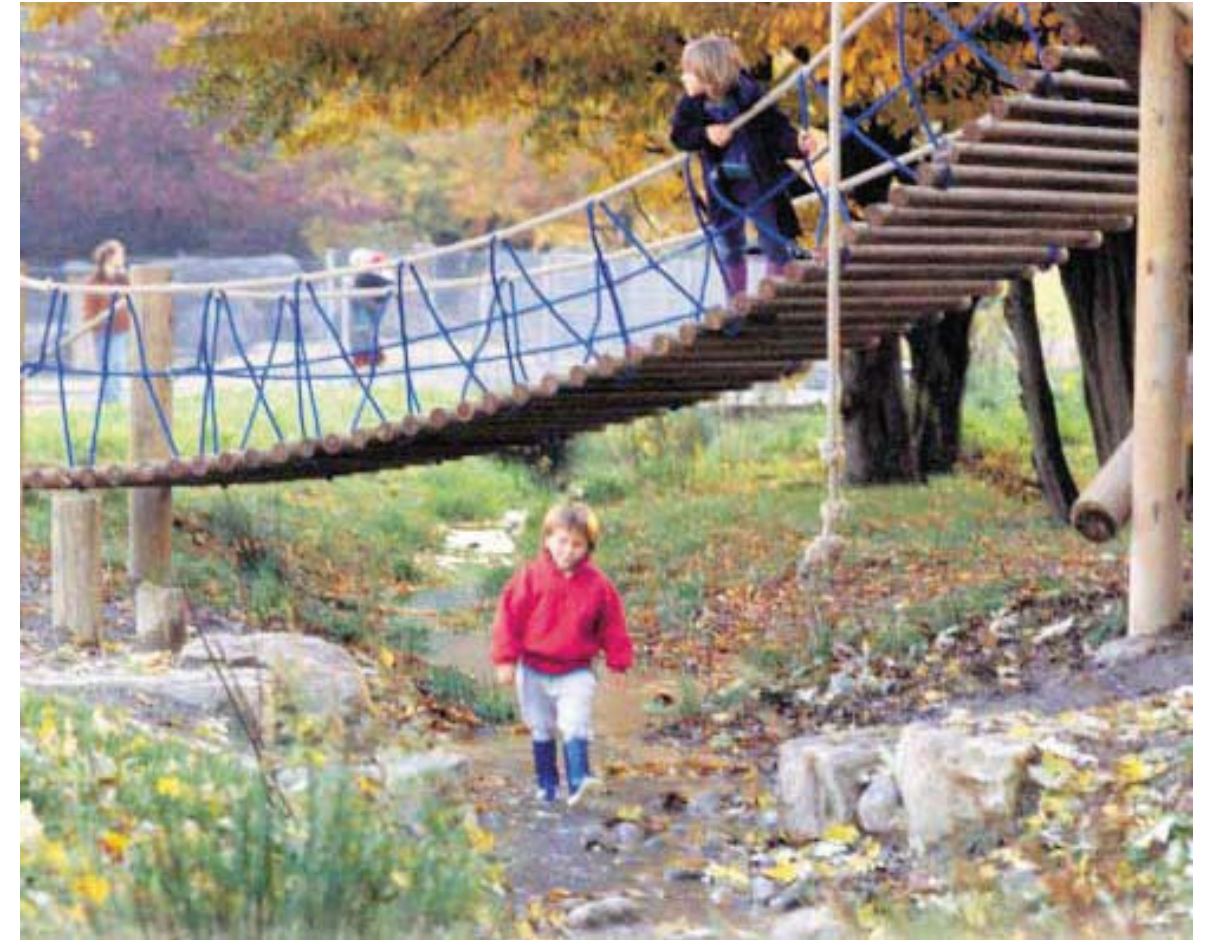
Many streams flow from the mountains and foothills behind Zurich and into Lake Geneva. Sixty miles of these streams have been placed in pipes and in many cases have become part of the city's sewer network as combined sewer flows. This has overloaded the wastewater treatment plants, escalating operational costs and diminishing plant capacity. For these reasons, along with a 1991 Swiss law mandating the removal of combined sewer systems, the city's sewerage department led a multi-department initiative to develop the Bachkonzept ("brook concept"). This working group collaborated closely with the population, politicians, city departments and specialists.

The "brook concept" diverted stormwater, groundwater inflows, and clean water overflows from the combined sewer system into newly formed streams. The Zurich stream daylighting program was presented to the press and the public in 1988. Since that time, the city has daylighted, or newly created over 18,000 lineal metres of naturalised channels that eventually connect with the Limmat River. Streams flow down main streets, through local parks and schools, and across the private yards of residential streets.

The program, conducted for over a decade, has been successful in diverting millions of gallons a day from the sewerage treatment plant. The daylighted streams also delivered on the wishes of the public for more nature in the city. The streams are especially popular with children, where they often coincide with playgrounds and schools. The brooks have become important determinants of open space connections, acting as planning tools to organize landscape and urban residential planning.

Zurich's naturalised "brook system" leads through city streets, schools, and private residences

Images from ERZ Publication *Brooks in the City Zurich* (2003) (www.ez.ch)



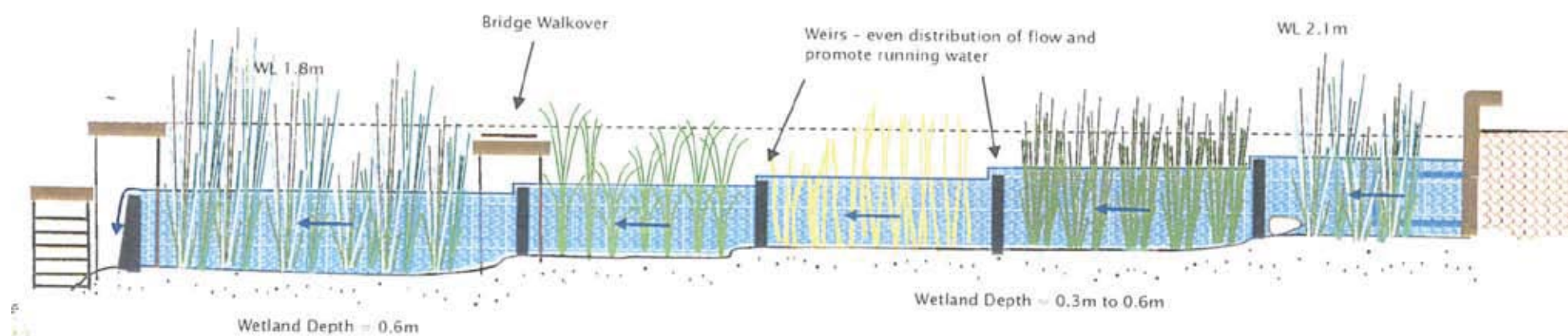
Wellington, New Zealand

Waitangi Park is located on Lambton Harbour between Oriental Parade, Cable Street and Herd Street on Wellington's waterfront. The park is at the mouth of the large Newtown (Waitangi Stream) stormwater catchment which extends across 440 hectares. The catchment supports large areas of open space and residential properties, as well as commercial and light industrial areas.

Water sensitive urban design (WSUD) was put forward as an approach to the revitalisation of the waterfront. Daylighting of the Waitangi Stream was seen as an opportunity to interpret and commemorate the cultural, historical and environmental significance of the site.

The daylighting of the Waitangi River involved the direction of stormwater flows through a series of treatment systems within a park landscape. The "eco-technological" approach involved the separation of solids and films through underground treatment solutions, and the removal of fine sediments and contaminants in a subsurface wetland, polishing wetlands and finally stream flows through salt marshes to the harbour. Some of this water is collected for surface irrigation in the associated park. The stormwater treatment train and accompanying interpretive materials provides significant educational opportunities for park visitors.

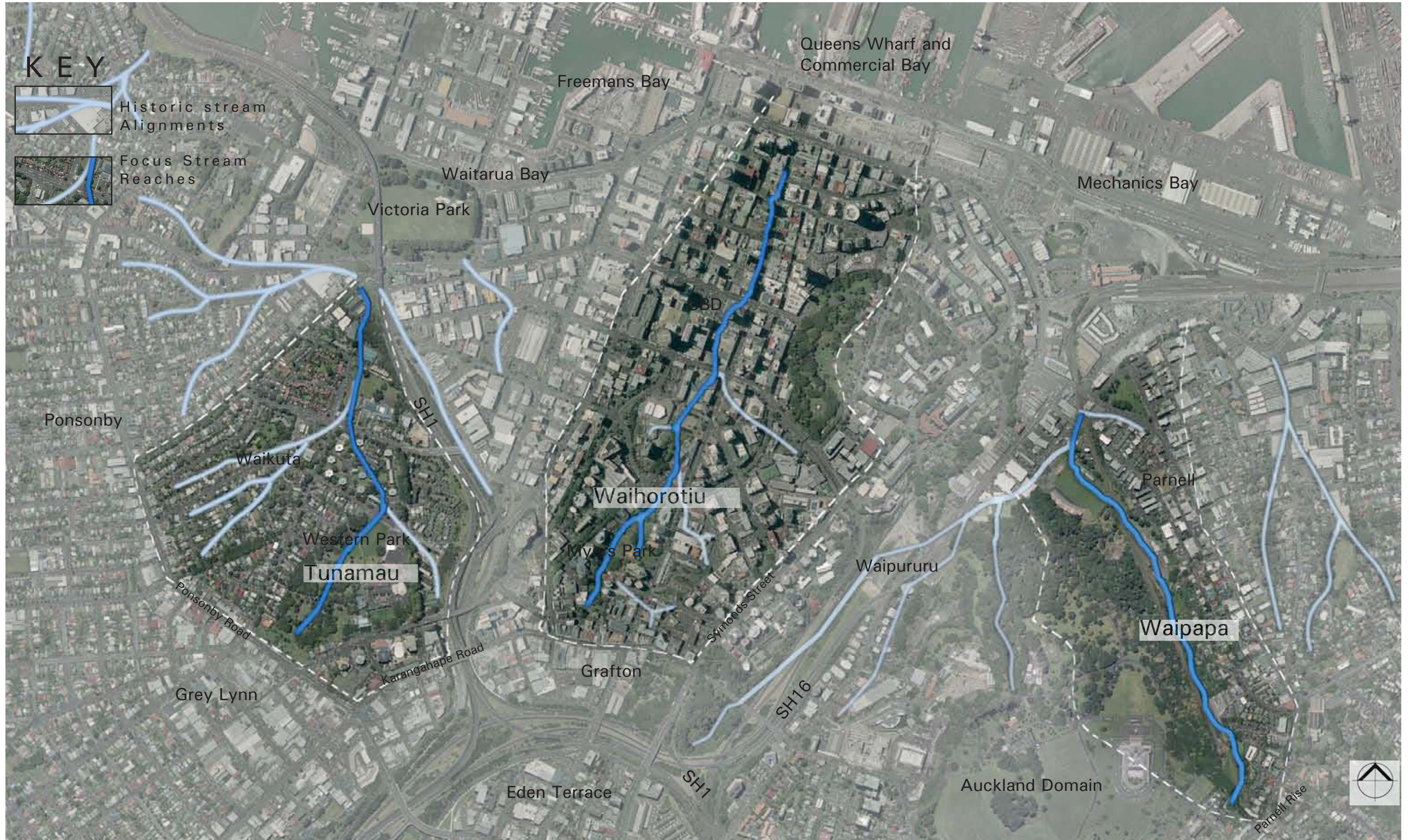
The park portrays Wellington as a city that promotes integration of ecology and urban landscapes, through using ecological systems in a functional manner to treat the effects of urban catchments. Objectives for the project were to enhance the natural landscape and ecological features of the park through integration with water/stormwater. Waitangi Park has come to represent a contemporary urban park that integrates natural and built landscapes, weaving history, culture and ecology together to reference the significance of the Waitangi River and Lambton Harbour.



The concept for daylighting the Waitangi Stream is yet to be realised due to contamination issues, but Waitangi Park does provide a wetland habitat in the urban centre of Wellington and at the location of the historic mouth of the Waitangi Stream

Courtesy of Boffa Miskell Ltd. and Environmental Engineering Ltd

Focus Stream Locations












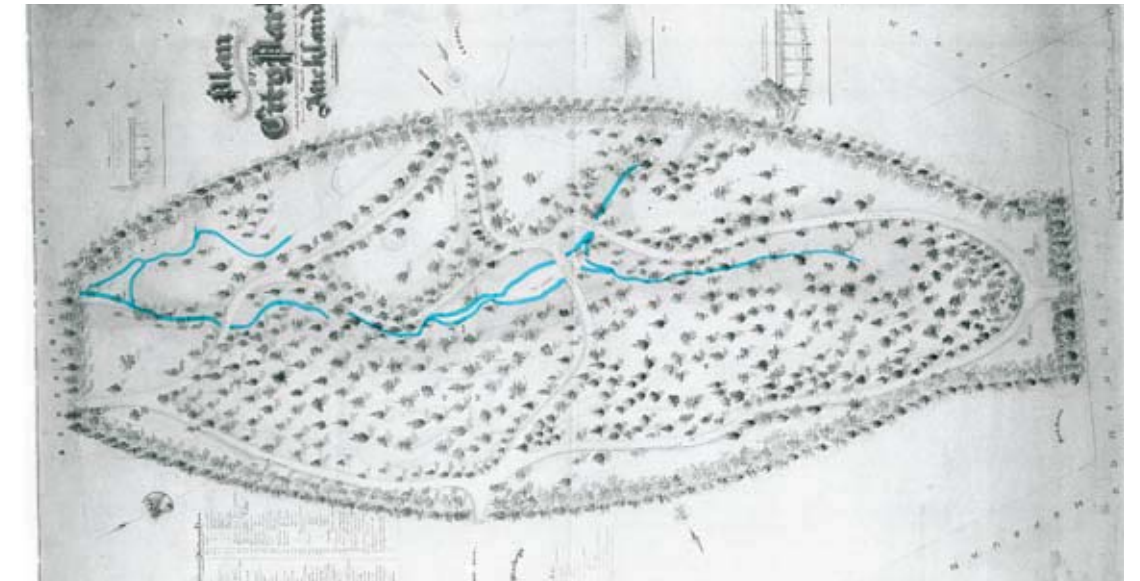
Tunamau Stream



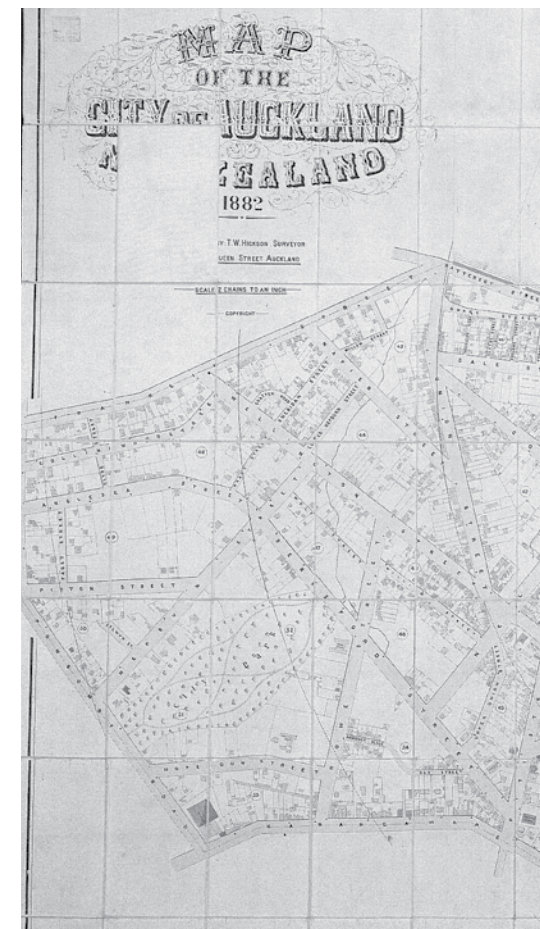
Tunamau Historic Alignment

KEY

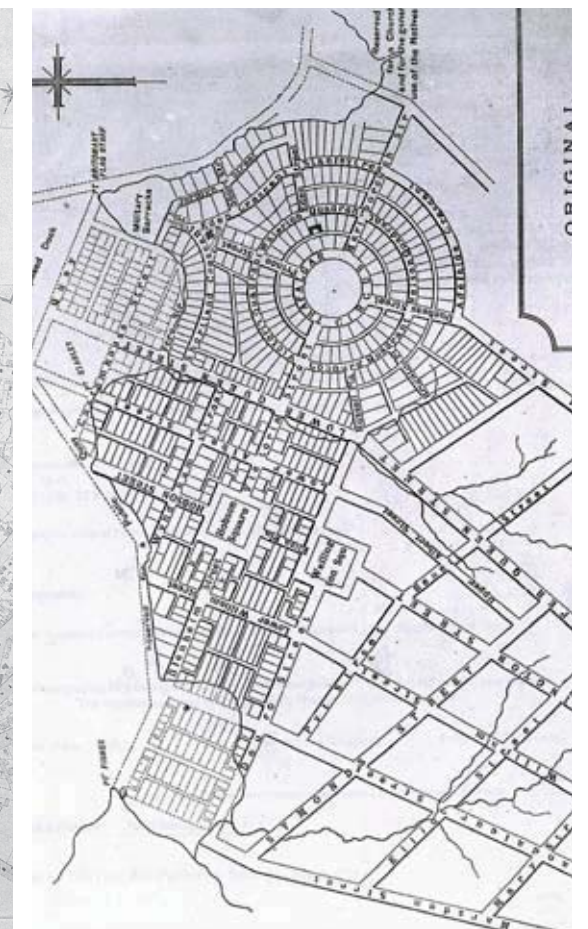
-  Early Auckland, undated map
Special Collections, Auckland City Libraries (NZ)
-  Historic flood with topography
Auckland City Council GIS data
-  Felton Mathews 1841
NZ Map 2664, Special Collections, Auckland City Libraries (NZ)
-  Waihorotiu circa 1840
Bateman's Historical Atlas
-  Tamaki Makau Rau Tamaki Isthmus
Lesley Kelly
-  Alma Bay Allotment Map
NZ Map 4495-28, Special Collections, Auckland City Libraries (NZ)
-  City Park plan 1874
NZ Map 4686, Special Collections, Auckland City Libraries (NZ)
-  Historic stream map, undated
ARC Heritage
-  Map of Auckland 1882
NZ Map 91, Special Collections, Auckland City Libraries (NZ)



Plan of City Park, Auckland City Council 1874
NZ Map 4686, Special Collection, Auckland City Libraries (NZ)



Map of Auckland 1882
NZ Map 91, Special Collections, Auckland City Libraries (NZ)



Felton Mathews Plan of Auckland 1841
NZ Map 2664, Special Collections, Auckland City Libraries (NZ)

The stream alignments as indicated on the plan above were traced from historical maps sourced from ACC and ARC records, Auckland City Libraries and Land Information New Zealand. Maps were scanned rotated and scaled according to tags on individual plans, or were placed according to coincidence with existing road networks and the known historic coastline. Distortion was inevitable since historic maps were often stylised, never orthorectified, and often poorly surveyed.

Other reference material included historic photographs, historic aerial photography, allotment maps from the 19th century, focus site plans and early city planning documents. GIS information also provided topography and historical floodplains which when mapped together provided for logical historic drainage patterns.

Derived stream alignments did not overlap with precision but there was regularity in terms of stream forms in relation to specific gullies as they occurred in the mid-19th century. These reoccurring systems appear as a blue wash on the plan above, sitting atop the coincident stream alignments.

Tunamau History

Freemans bay was known to Maori as Waiatarau, "reflecting waters". On a western headland stood the Pa, Te Tou ("to haul up a waka"), one of a number of satellite fishing stations along the inner Waitemata Harbour. The area also had importance to Maori as a food gathering place, reflected in the name for the eastern bay, Waikokota, meaning "the place where cockles could be harvested".

Into shallow tidal flats flowed a number of streams from the gullies rising toward Ponsonby Road, Karangahape Road and Nelson Street ridges including the Waikuta ("waters of the reed"), west of Franklin Road, the Tunamau ("to catch eels") from the Karangahape ridgeline along Beresford Street including small streams through Western Park, and other watercourses from the vicinity of Nelson and Union Streets.

Europeans initially named the headland of the bay Pt. Fisher, and later Acheron Point. The shoreline that approximates Victoria Street today was known as Waipiro or "stinking water", in mockery of early drunken residents. The area along the Drake Street cliffs was known as Te Koranga ("the scaffolds"), where fish and shark would be hung on scaffolds to be processed (Cambell 2005).

Reclamation of Freemans Bay was mostly undertaken from 1873 to 1901, although the first reclamation levelled an island in the bay in 1859, creating Patteson Street (later part of Victoria Street West). Land sales began in 1842, starting with development along the accessible shoreline. This became a home to early brickyards, timber milling and boat building. By 1860, Freemans Bay was full of seafaring men, wharf labourers, employees of the nearby brickworks and Fanshawe Street sawmills (Terrent 1973). They settled their families into scores of small makeshift cottages. There was no internal plumbing and roofwater was supplemented by carrying jugs from a well in Sale Street (Webster 1963).



Freemans Bay 1860. Auckland Art Gallery Toi o Tamaki. Gift of Harry Kinder, 1937 (accession no. 1937/15/28)

Brick barrel drains would have come into use soon after they were used in Queen Street, as residential development of Freemans Bay intensified in the latter quarter of the 19th century. A "sewer reserve" at the intersection of Beach Road (now Victoria Street West) and Franklin Road was indicated on early plans of the Auckland Gas Company at Beaumont Street (LINZ DP 629). This company channelised both the Tunamau and Waikuta. These works, originally drawn in 1880, would change the form of the Tunamau from the wide stream mouth and serpentine waterway cutting through wide coastal flats as indicated on the Reverend Kinder's 1860 painting above.

By 1908 most of the Freemans Bay valley was in use as intensive working class residential housing, with the upper slopes towards Ponsonby and Karangahape ridges also housing rich merchants. By this time, many of the waterways draining the area would have become brick-lined drains and from 1886 the bay itself was steadily reclaimed. By 1903, engineered drains along the western slopes of Western Park were in place, but some evidence of the Tunamau could still be seen from aerial photographs in 1940.



View Northeast from Beresford Street with Howe Street left to right and Beresford Street School (AGGS) in the foreground and Western Park behind 4-1003, Special Collections, Auckland City Libraries (NZ)

A Ponsonby resident named James Stichbury recalled for the Auckland Star in 1926 what it was like to live in Freemans Bay in the mid 1860s:


"To get to Ponsonby from Auckland, was not a picnic, but we had to take it as a matter of course. The road (unmade) was up Victoria Street West, through Drake Street (now Victoria Street West), then across the sawdust-made roads, at either side... Under this part of the road was a wood culvert to take the drainage from the gully running down the south side of College Hill. The drainage in Freemans Bay before the brick sewer, which ran from the foot of College Hill to the foot of Patteson Street was put down, was a great trouble to those living in Ponsonby, on account of the enormous body of water at storm times that ran down from Union Street, Franklin Road, Alma Place and the Convent gullies. The bay being shallow for a great distance out would not allow the rain water to get away and, consequently, men who had to be at their work on time, would have to off with their boots and socks on College Hill side, then resume them on Drake Street side."

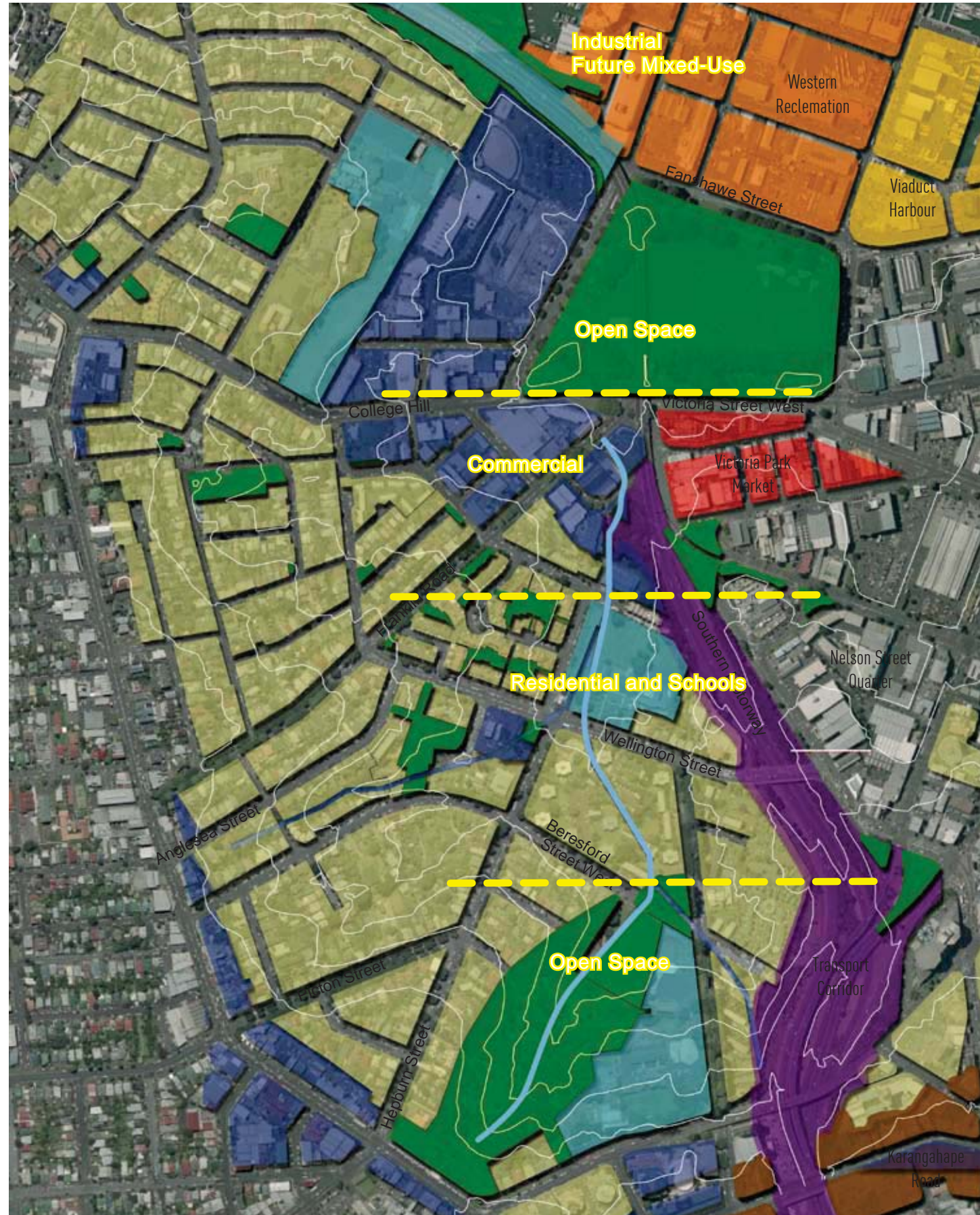


View east from Hepburn Street of Western Park with AGGS in the foreground and the Congregational Church on the ridge-line of Howe St 762, Special Collections, Auckland City Libraries (NZ)

Tunamau Land Use

KEY

-  Residential
-  Special designation
-  Open space
-  Business
-  Tunamau historic stream alignment
-  Transport corridor
- CBD Precincts (Feb 2007)
-  Victoria Park Market
-  Western Reclamation
-  Viaduct Harbour
-  Karangahape Road
-  Character area boundaries









For the majority of its length, the Tunamau flows through open space and residential zoning. The alignment flows beside Auckland Girls' Grammar School (AGGS) and Freemans Bay Kindergarten in Western Park and across the western boundary of Freemans Bay Primary School on Wellington Street.

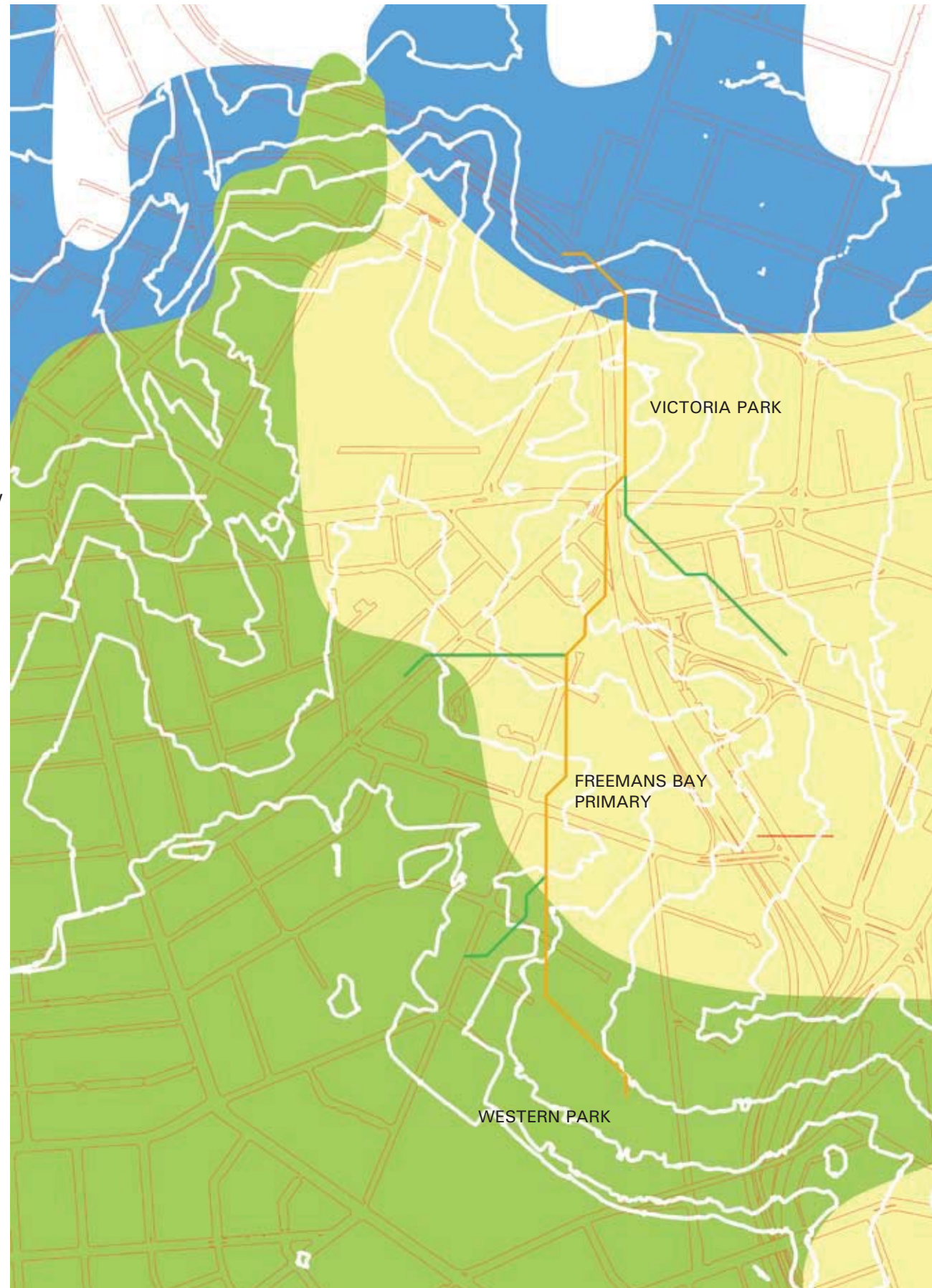
In its lower reaches the Tunamau flows through commercial areas and transport corridors within stormwater and combined sewer systems. Stormwater systems extend into reclaimed areas of Freemans Bay, now Victoria Park, and flow to an outlet at the northern extent of the Western Viaduct (or "Tank Farm") on Wynyard Wharf. The Tank Farm is an industrialised marine precinct that is slated for redevelopment. This is likely to include sizeable areas of public open space and the forming of landscape connections.

The eastern catchment boundary for the Tunamau is the transportation corridor for State Highway One, which accordingly is the border of the Central Area Section of the Auckland City District Plan. This section of the plan has planning provisions based on "quarters" or "precincts". Adjacent to the Tunamau Catchment is the Victoria Park Market Precinct supporting retail, the Nelson Street Precinct supporting living and business, and the Karangahape Road Precinct supporting nightlife and retail.

Tunamau Land Environments

KEY

-  Reclaimed land
-  5 metre contours
-  Level 2 - A2
Estuarine Flats with moderate drainage and poor fertility
-  Level 2 - A6
Undulating hills of weathered greywacke and sandstone. Very low fertility and moderate drainage
-  NZREC low valley gradient
-  NZREC moderate valley gradient



The information relating to environments in the Tunamau catchment has been derived from databases associated with Land Environments New Zealand (LENZ), New Zealand Geological Society, New Zealand River Environment Classification (NZREC) and Land Resource inventory (LRI) of the former Ministry of Works.

The catchment is generally undulating land that is strongly rolling in the upper catchment and undulating to flat in the lower catchment. The stream is generally of a consistently low gradient except for tributaries that feed from moderately steep gullies to the east and west of the stream, and Western Park.

For the majority of the upper catchment of the Tunamau the underlying rock is undulating hills of weathered greywacke and sandstone sedimentary rock. This is in contrast to the general geology of the Auckland isthmus where basalt predominates. This geology is generally of a low fertility and supports moderate drainage through to subsoils.

With these soils and the Auckland climate the valley would be expected to support kauri, tanekaha and kanuka forest on the upper slopes and ridgelines, with mid slopes supporting a greater diversity of podocarps such as rimu, miro, totara and northern rata. Gully systems would have included broadleaf stands of kohekohe, taraire and puriri with nikau and tree ferns prevalent. On lower slopes, in damp areas and in deeper soils kahikatea, matai and pukatea would have featured. The coastal environment would also have favoured pohutukawa with coastal shrub species such as ngaio, mangeao, whau, houpara, parapara and tawapou.

Before European arrival, fires would already have induced bracken and manuka on the slopes, and produced gumland areas of sedges, rushes and tanglefern. Podocarps were logged after European settlement to provide timber and produce farmland. Broadleaf species would have been felled to produce fence posts and firewood.












Lower areas of the catchment, including the historic margins of Freemans Bay have the same underlying geology with alluvial soils in lower valleys, and mudflat and sandflat environments of leached sands in the lowland environments. These soils generally have moderate drainage properties and poor fertility. Vegetation in these areas would have included coastal shrubland species interspersed with coastal wetlands supporting manuka with Baumea and Schoenus species, raupo and Dracophyllum.

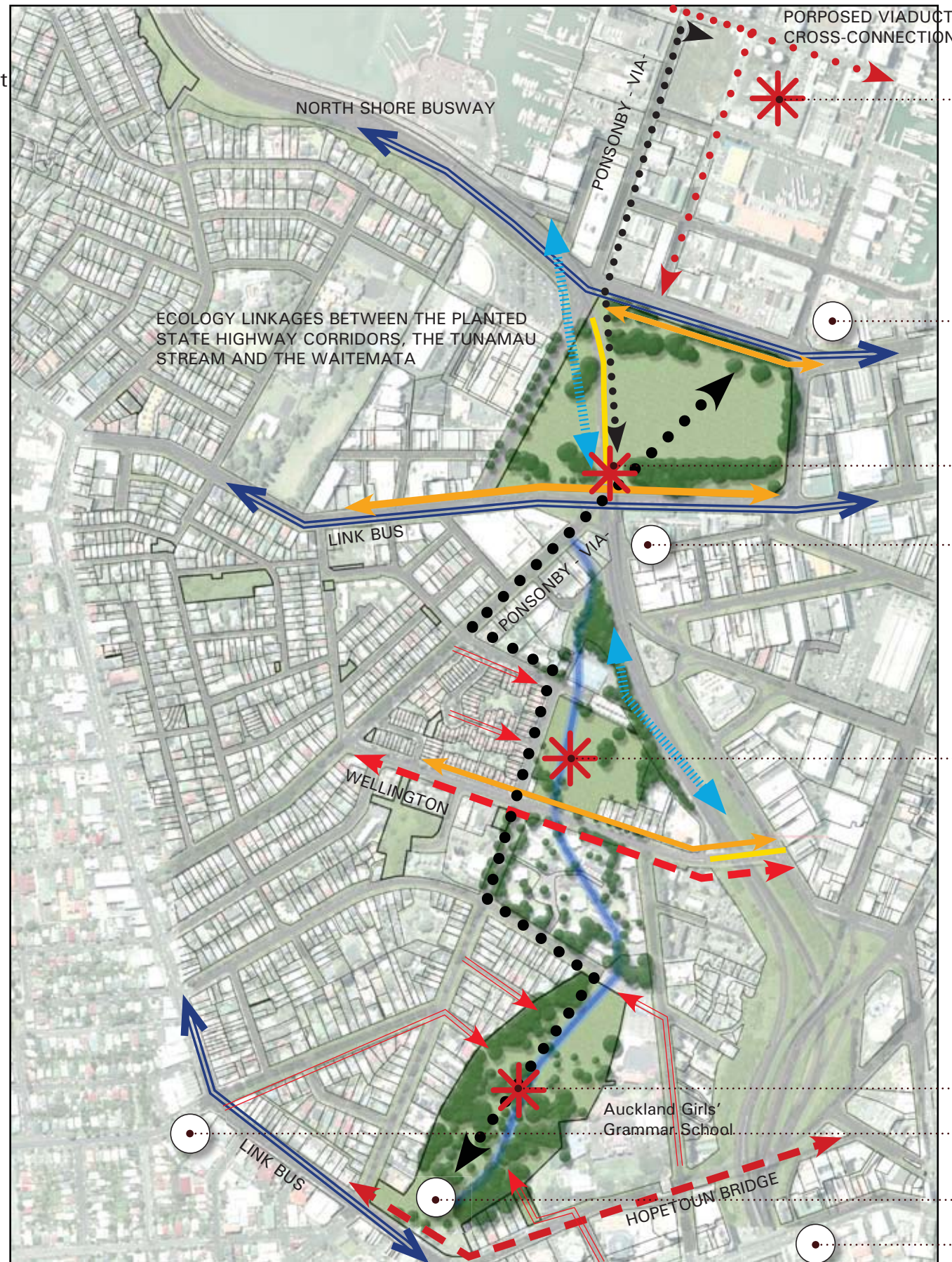
The reclamations of Freemans Bay predominantly originate from Te Tou headland, which once stood near the corner of Beaumont and Fanshawe Streets. This original geology is visible along the St. Mary's Bay cliff line that serves as a reminder of the original foreshore.










Many of the soils in Freemans Bay have been affected by dominant land use in the area, including the gas works to the west of the bay and the destructor works, now Victoria Park Market. Industry has left many areas within Freemans Bay contaminated, and this has potentially affected stormwater infrastructure, in terms of infiltration of groundwater to storm and combined systems. Auckland City has recently removed and replaced contaminated soils in Victoria Park and Freemans Bay, and dredging of contaminated sediments at the outfall of the stormwater system at Wynard Wharf occurs.

Tunamau Landscape Connections

KEY

-  Future proposed Viaduct cross connections
-  City "Netwalks"
-  Ecological linkages
-  Strategic bus routes
-  Proposed art bridges
-  Major arterial roads
-  Major pedestrian cross connections
-  Neighbourhood connections
-  Nodes of activity
-  Point of interest
-  Historical stream alignment



-  Proposed future open space within Tank Farm redevelopment.
-  Entrance to the Viaduct Harbour.
-  Proposed node of activity for pedestrian connections and public transport with future proposals for a transportation hub, and gathering space or art feature.
-  Victoria Park Market Precinct with heritage buildings.
-  Freemans Bay Primary School.
-  Western Park arboretum with century old specimens.
-  Ponsonby retail and entertainment.
-  John Radford sculptures.
-  K Road commercial centre.



Artist's impression of a wetland in Western Park associated with the daylighted Tunamau
Courtesy of Neil Coleman

Upper Tunamau

Western Park is a moderately steep gully and mature park environment making it an ideal candidate for stream daylighting. The valley appears to support a stream and associated riparian vegetation but ironically this planting is supported by regular irrigation while overland flows are directed to storm drains beneath.

There is insufficient data on the base flows of the Tunamau through Western Park to guarantee perennial flows, but there are significant opportunities for contribution from Low Impact Design (LID) retrofit along Hepburn, Howe and Picton Streets. Stormwater from these streets could be conveyed through bioretention and/or overland flow through existing gullies to sand filters or wetlands in association with the Tunamau. Sand filters could provide primary treatment for urban run-off and provide flows over an extended period. There are also opportunities for LID retrofit at Auckland Girls' Grammar School (AGGS). Rain gardens, green roofs and rainwater planter boxes could be utilised as outdoor classrooms along with the wetland environments of the daylighted Tunamau.

At the base of Western Park is a large basin that has saturated soil conditions after rain events. A permanent water feature is possible at this location in association with existing playground facilities and within the circle of recent kahikatea planting. A wetland in this location would provide water quality treatment and detention for the controlled release of flows downstream. The wetland would represent significant habitat within an urban park and an amenity that would bring more people to enjoy this unique park (artist's impression appears on previous page).

Downstream of the wetland there are opportunities to align the Tunamau along the AGGS boundary to enhance landscape amenity values and further enclose the park. Existing detention areas in association with public tennis courts and Freemans Park housing complex provide further opportunities for watercourses and wetlands to control run-off rates and add amenity features to the park and communal open space.

The daylighting of the Tunamau through Freemans Park would require the buy-in from Housing New Zealand and the incorporated society of the residential estate. It would require the loss of small trees and the reconciliation of a dozen parking spaces. However, it is anticipated that the restoration of a stream through this neighbourhood would align the neighbourhood around a restoration project and increase amenity and property values in the estate.

Health and safety along with flooding issues will require an increased margin of error in relation to stream corridor design and may require a parallel reticulated stormwater system. This would take advantage of existing infrastructure to ensure newly laid pipes are not undercapitalised.



John Radford's Sculptures at the corner of Ponsonby Road and Western Park



Stream vegetation is irrigated, while the stream is piped underneath



Valley bottom of Western Park as a potential wetland detention area within the newly planted kahikatea



Eastern side gully to Western Park



Potential for LID retrofit in Hepburn Street to provide additional flows to a daylighted stream






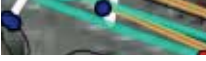








Overland flow path through Western Park as a potential site for daylighting



Overland flow path through Freemans Park housing estate as a potential site for daylighting

Upper Tunamau Stream Daylighting Constraints

KEY

-  Historic stream alignment
-  Gravity stormwater pipe
-  Gravity wastewater pipe
-  Gravity combined storm and waste
-  100-year flood plain
-  Manholes
-  Catchpits
-  Significant protected feature
-  Significant trees
-  Treatment device
-  Inlet/Outlet
-  Cadastral boundaries
-  Public open space



Upper Tunamau Stream Daylighting Opportunities



- Wetland in existing detention area to accommodate culvert under Wellington Street.
- Daylighted stream within accessways and parking and coincident with existing floodplain.
- Enhance existing overland flow paths and promote LID retrofit within apartment complex.
- Daylighted stream within existing overland flow paths. Lost parking bays may need to be relocated.
- Stormwater Wetland parallel to the Tunamau Stream integrating overland flows from adjacent streets.
- Daylighted stream between AGGS and Western Park sports grounds.
- Stormwater wetland in existing basin would accept overland flow from gullies of Western Park and reticulated connections.
- LID streetscapes augment stream flows through extended detention sand filters.
- Potential for LID retrofit of Auckland Girls' Grammar School.

Mid Tunamau

Freemans Bay Primary School offers an exciting opportunity to demonstrate daylighting the Tunamau. The area is already within an overland flow path and the bottom of the catchment currently supports wetland plants such as flax and cabbage trees. Daylighting proposals would benefit from the retention of sufficient outdoor play areas, and prioritising water safety. Design of this stream could incorporate controlled access points to the stream, barriers to outlets and inlets, safety shelves and an appropriate planting scheme, while still providing a natural environment that provides opportunities for both an outdoor classroom and informal play areas.

Freemans Bay School is at the base of Ponsonby Rise and at the bottleneck of Franklin Road and SH1 ridgelines. Flooding has the potential to be a significant issue. Hydrological modelling will reveal more about these constraints, but there may be a requirement for parallel infrastructure to accommodate stormwater high flows. This would take the form of existing parallel reticulated systems that are separated from the combined sewer systems.

Next to the Production Village on Napier Lane daylighting of the Tunamau would potentially require the removal of a building and reconstruction of infrastructure to level the existing grade. As of April 2007, the area was subject to a resource consent for redevelopment. Alternatives at this constriction point include channelisation of the Tunamau and provision of separate access for existing parking. Such an option is unlikely to provide full benefits to the stream but would provide a contiguous flow path and provide for associated pedestrian access.

An alternative would be to direct the Tunamau underground in this location but continue the presence of surface water by forming a wetland in association with transit land adjacent to SH1. This wetland could receive stormwater from SH1's "Spaghetti Junction", the Victoria Park Viaduct, and the surrounding commercial and residential neighbourhoods.

A daylighted stream and wetland complex in this location would provide for an ecological corridor between Victoria Park, the daylighted Tunamau, and restoration plantings associated with "Spaghetti Junction". In urban environments motorway corridors can represent significant urban habitat areas that connect isolated vegetation remnants through the city. The wetland would replace an area that is currently dominated by canopy and understorey weed species.

Near the historic outlet of the Tunamau and at the base of Franklin Road there is a narrow corridor providing sufficient space for a stream. This area could be increased in width to include buffer planting and a pedestrian track. This would require the removal of single storey prefabricated buildings and a parking area associated with an emergency access ramp to SH1. In addition, there may be conflicts with sewer, combined sewer and contaminated soils in this location requiring further detailed investigations. A stream in this location would connect the wetland discussed above to Franklin Road and the lower catchment.

The Tunamau has its historic outlet at the corner of Franklin Road and Victoria Street. A daylighted stream flowing from the wetland to this location would coincide with an important future public gathering place, proposed sculptural elements and public transport interchanges noted in the CBD Public Artwork Development Plan. The area is close to popular retail areas and is at the crossroads for the LINK bus service, and pedestrian connections to Freemans Bay and College Hill.



Entrance to Freemans Bay Primary School on Washington Street



The Production Village commercial area of Freemans Bay



The overland flow path at the bottom of Freemans Bay Primary, planted in flood tolerant flax and cabbage trees









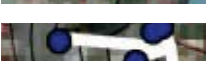
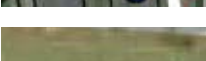



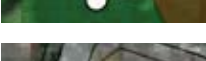


Overgrown transit land between SH1 and commercial area



Exit to Franklin Road, behind the Bird Cage Hotel

Mid Tunamau Stream Daylighting Constraints

KEY

-  Historic stream
-  Gravity stormwater pipe
-  Gravity wastewater pipe
-  Gravity combined storm and waste
-  100-year flood plain
-  Manholes
-  Catchpits
-  Significant protected feature
-  Significant trees
-  Treatment device
-  Inlet/Outlet
-  Cadastral boundaries
-  Public open space
-  Land to be potentially affected by Victoria Park Tunnel works



Mid Tunamau Stream Daylighting Opportunities



- Stormwater connection to potential wetland.
- Potential future retrofit to provide for an LID supermarket.
- Potential Network connection over Victoria Street in association with the existing viaduct.
- Potential surface flow beside utility access ramp.
- SH1 stormwater directed to a treatment wetland to augment existing flows and/or substitute Tunamau flows entering the stormwater system. Sand filters may be utilised to increase long-term flows.
- Tunamau is directed to stormwater infrastructure. Potential exists for future overland flows if grade changes and access constraints in conjunction with the industrial lots are rectified.
- Daylighted stream through Freemans Bay Primary with a wetland constructed in the existing flood protection area.
- Retrofit opportunities to create an LID primary school.

Lower Tunamau

A daylighted stream through Victoria Park and the western viaduct could extend beyond the original mouth of the Tunamau into the reclamation of Freemans Bay. As they appear in historic illustrations, tidal creeks from the Tunamau and Waikuta once meandered through the sand banks and mudflats of Freemans Bay at low tide. Victoria Park is the focal point for this reach, looked over by buildings that occupy the original coastline, including residences of the Beaumont Quarter (the former gasworks site), commercial buildings on Halsey street, and the retail area of Victoria Park Market (formerly the destructor buildings).

A daylighted stream in Victoria Park could effectively integrate the natural heritage of the bay into the “left over” spaces of the park beneath the Victoria Park viaduct and in underutilised open spaces. This could occur in coincidence with the works of the proposed Victoria Park tunnel or the second harbour crossing.

A stream in Victoria Park would provide a public amenity, and a significant natural feature in a heavily trafficked area, and at the cross roads of major roads, public transportation corridors and pedestrian links from the CBD to residential areas. The stream would connect the western viaduct to Victoria Park through inter-tidal creeks and wetlands, providing lower-catchment detention and treatment of urban stormwater before it enters the coastal environment. A stream in this location could represent diverse ecological zones between inter-tidal and freshwater environments. There may even be opportunities for restored fish passage and/or spawning habitat for inanga. Accompanying pedestrian trails could interpret the original coastline, cultural values, and the heritage of Freemans Bay. Connections could extend from Freemans Bay to St Mary’s Bay, Point Erin and beyond.

Wetlands in Victoria Park could be augmented by the Waikuta stormwater catchment, which has a relatively steep gradient and sufficient hydraulic head to bring to the surface. The wetland could also provide treatment for Victoria Park supermarket run-off or from SH1. Of particular concern for the quality of surface water is contamination by groundwater. This is the result of contaminated soils in the Freemans Bay area. Ideally this would motivate the daylighting of the historic watercourse from its interface with contaminated soils into a stream over the capped or remediated soils.

The Tunamau’s alignment to the Waitemata Harbour could occur through a number of alignments. There are opportunities to combine daylighting with proposed future plans for the Tank Farm. Existing plans indicate connected open spaces and wide boulevards. Connections eastward to the viaduct could likewise take advantage of the Tank Farm redevelopment connecting the existing and historic coastlines along a tidal creek.



Underutilised areas beneath and to the west of the SH1 viaduct in Victoria Park



CBD Public Artwork Development Plan illustrating connections to the coastline



Vast undeveloped areas between Victoria Park and the Viaduct



Potential alignment of the a tidal creek avoiding existing pohutukawa

















Redevelopment of the Tank Farm will connect the coastline to Victoria Park
Google Earth, accessed 23 March 2007



Formal entrance to the Viaduct near the coastal outlet for a stormwater catchment

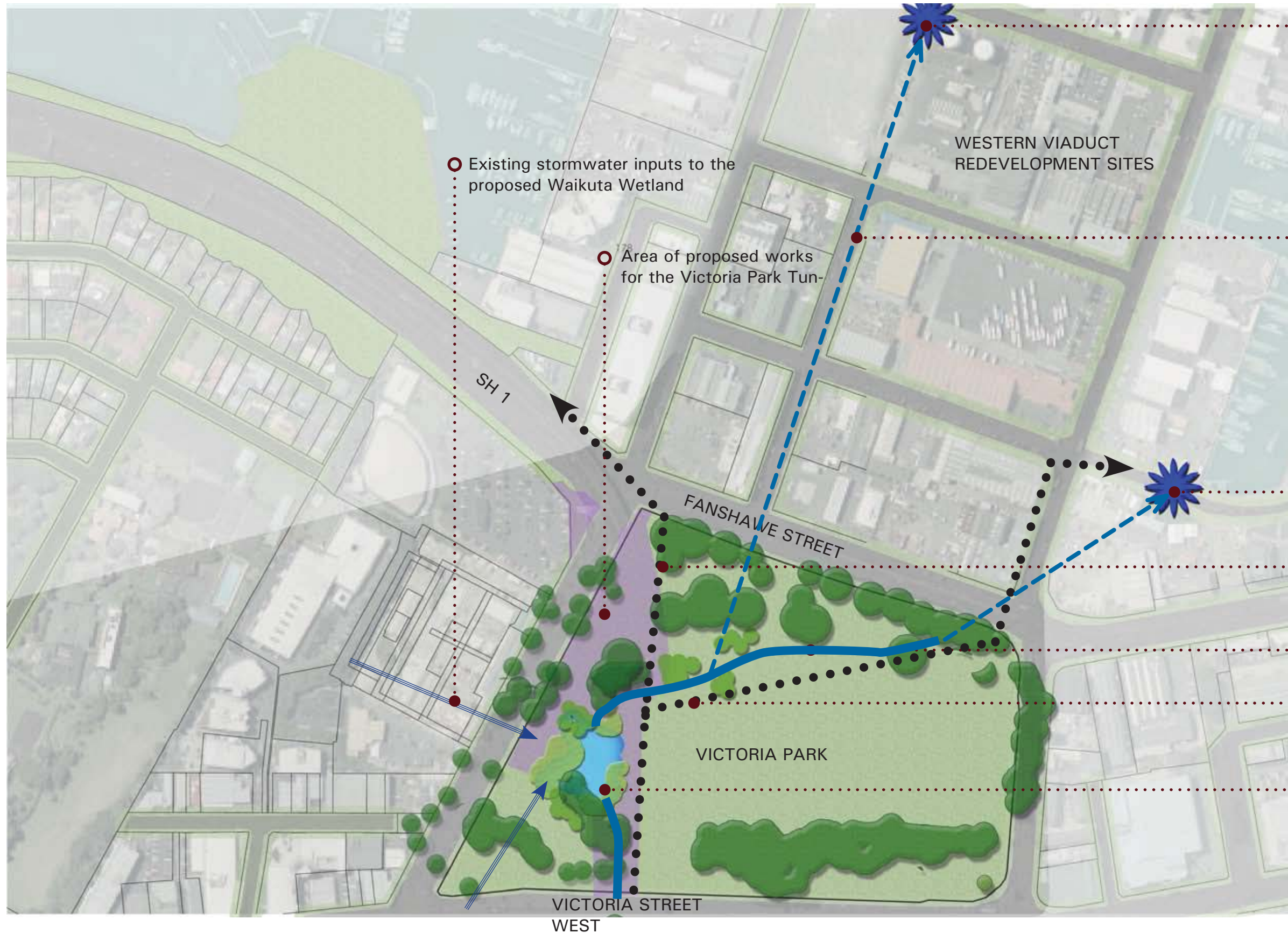
Lower Tunamau Stream Daylighting Constraints

KEY

-  Historic stream
-  Gravity stormwater pipe
-  Gravity wastewater pipe
-  Gravity combined storm and waste
-  100-year flood plain
-  Manholes
-  Catchpits
-  Significant protected feature
-  Significant trees
-  Treatment device
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-  Cadastral boundaries
-  Public open space
-  Land to be potentially affected by Victoria Park Tunnel works



Lower Tunamau Stream Daylighting Opportunities



- A potential location to celebrate the Tunamau/Waikuta outlet in association with Western Viaduct proposals of coastal public open space and stormwater treatment.
- Existing stormwater inputs to the proposed Waikuta Wetland
- Area of proposed works for the Victoria Park Tun-
- Potential daylighted stream channel in association with connected open spaces and wide boulevards proposed for the Western Viaduct redevelopment.
- A potential location to celebrate the Tunamau/Waikuta outlet at the entrance to the Viaduct.
- Pedestrian/bike connection between Ponsonby, the western viaduct and proposed future harbour bridge connections.
- Stream channel or tidal creek within Victoria Park.
- Pedestrian/bike Connection between Ponsonby and the CBD.
- Stormwater wetland receiving the Tunamau and Waikuta catchments.