The Strategic Planning Approach of the Central Auckland Stormwater Initiative

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ABSTRACT

The Central Auckland Stormwater Initiative (CASI) is a regionally-significant programme initiated by Auckland Council to deliver improved stormwater services in the problematic and strategically-important central area of Auckland. Sub-catchments include the western part of the Auckland Isthmus, including the Central Business District (CBD) and covers an area from St Heliers in the east to the Whau Estuary in the west. CASI sub-catchments generally discharge stormwater into the southern part of Waitemata Harbour.

CASI used a strategic planning process to identify conceptual solutions across a number of stormwater sub-catchments that previously had proven difficult to resolve due to a variety of complexities. Taking a top-down rather than a detailed approach has proved successful in setting the high level budget requirements and identifying a set of practical solutions, the most promising of which continue to be refined.

Potential benefits of integrating Auckland Council stormwater initiatives with Watercare's wastewater initiatives include identification of an optimised solution which represents the overall Best Practicable Option for both stormwater and wastewater. The provision of stormwater solutions in these catchments may provide additional opportunities and benefits to be delivered by close co-ordination with Watercares proposed Central Interceptor. This will enable the best community outcome for the management of stormwater contaminants and the reduction of combined sewer overflows to receiving environments at less overall cost.

KEYWORDS

Stormwater, wastewater, flood, drainage, integrated catchment management

PRESENTER PROFILE

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Xeno Captain
Xeno Captain, an Associate Director at AECOM, started his career in 1979 at Auckland City in the Drainage Design Office and when Metrowater was formed in 1997, Xeno took over the management of the drainage networks across the city. He is presently involved with a number of stormwater management projects.

1 INTRODUCTION

The Central Auckland Stormwater Initiative (CASI) is a regionally significant planning study that seeks to identify cost effective improvements to the stormwater services for the central area of Auckland, including the CBD. CASI covers the area from St Heliers to the Whau Estuary that discharges stormwater into the southern part of the Waitemata Harbour.

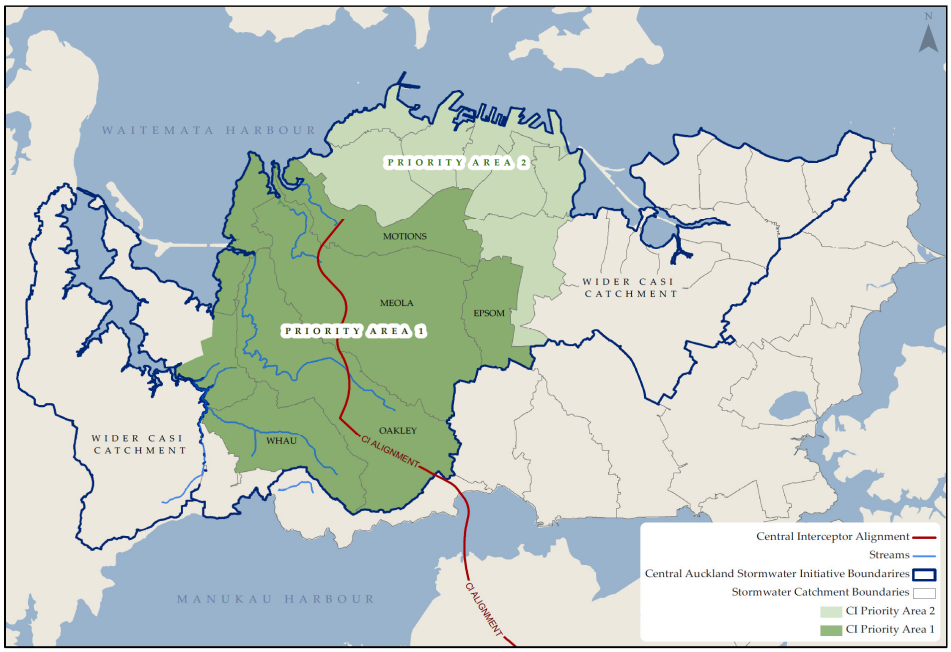
The priority of this area / stormwater management zone in relation to the overall regional priorities has yet to be established (Figure 1). However, it is well recognized that there are significant drainage issues in this area that need to be addressed over time. Two priority areas have been identified within this area / stormwater management zone:

CASI Priority Area 1: Sub-catchments within the Watercare Services Ltd (WSL) Central Interceptor (CI) Project Stage 1 zone of influence.

CASI Priority Area 2: Sub-catchments within the Waterfront / CBD revitalisation area.

This paper concentrates on CASI Priority Area 1.

Figure 1: CASI Priority Areas



2 OVERVIEW OF THE PROBLEMS IN PRIORITY AREA 1

- On average, over 3.5 million m^3 of combined sewage overflows into the Whau, Oakley, Motions and Meola Creeks annually. This flows into the southwestern part of the Waitemata Harbour. As well as producing ecological damage in the receiving environments, this also creates a public health risk through contact recreation in the streams and at bathing beaches along the Waitemata Harbour.
- Over 1,000 properties are at risk of habitable floor flooding in a 100 year average recurrence interval (ARI) storm and a further 2,000 properties are at risk of flooding to within 500mm of their floors.

- Stormwater that discharges to the Motions, Meola, Oakley and Whau Creeks contain contaminants which have an adverse effect on the health and ecology of these streams. Many reaches of these streams are also highly modified and do not provide the community with the amenity opportunities and values expected of a city which aims to be the world's most liveable. The contaminants are transported along the streams and accumulate in the coastal estuaries and adversely impact stream and harbour ecology.
- The effects of climate change and property intensification and growth will exacerbate these problems over the coming years.

3 Timelines

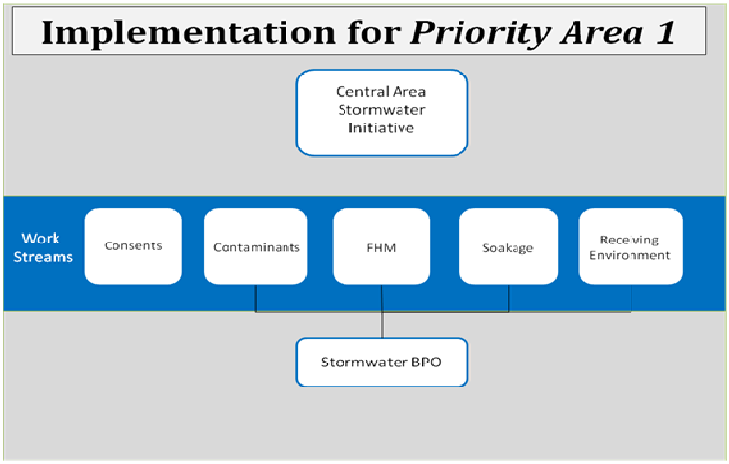
The following milestone deadlines were identified for the first phase of the CASI programme (Auckland Council, 2011). These are concentrated on Priority Area 1, where co-ordination with WSL is particularly time dependent. At the time of the workshop, WSL were planning to complete their final draft design of the Central Interceptor by the end of October 2011 to feed into the development of their assessment of environmental effects (AEE) and consent applications, which are now planned for August 2012.

1. Conceptual stormwater options and costs for the priority one catchments to be identified by the end of July 2011. – *Completed on time*
2. Investment Proposal and annual expenditure profile for recommended priority area one options input to the 2012 Stormwater Asset Management Plan (SWAMP) and Auckland Council Long Term Plan (LTP) by Mid August 2011 – *Completed on time*
3. Ensure the preferred options are feasible by mid December 2011 to enable further optimisation to be undertaken with WSL by the end of December 2011 in time for completion of their draft design. – *Completed on time*
4. Further refinement of preferred option and exploration of optimisation of the stormwater solution with the WSL Central Interceptor preliminary design by the end of June 2012. - *Underway*

4 The Methodology Adopted

The specific areas or workstreams to be covered were identified to enable stormwater Best Practicable Options (BPO) to be defined. (Figure 2)

Figure 2: CASI Workstream Overview



The basic Methodology adopted was as follows:

1. Identify and employ critical team members / subject matter experts with the required knowledge and experience in the area under consideration
2. Hold initial meetings to agree approach and identify available information / sources
3. Identify project constraints
4. Develop work plan and necessary resources
5. Collate and review existing information
6. Hold first workshop to brainstorm and agree conceptual solutions
7. Identify further information and analysis needs
8. Hold second workshop to review and build on initial conceptual solutions and agree recommended options and costs for use in the stormwater AMP (SWAMP) and LTP
9. Post workshops - undertake high level feasibility analysis and cost review of recommended options for taking forward for further optimisation.

Prior to the CASI initiative, Auckland City Council / Metrowater had undertaken a number of separate studies to identify solutions to the flooding problems on an individual sub-catchment basis eg. Meola Catchment Management Plan – SKM 1999. These studies were unable to identify viable sub-catchment based solutions to the main flooding and combined sewer overflow problems.

It was not until the Auckland City Council / Metrowater Integrated Catchment Study (ICS), 1991-1995, Global Options Study was undertaken, that a possible cross-catchment trunk sewer based solution was identified as the most promising option. This possibility has since been identified, developed and enhanced further by WSL, who now own the combined sewer system, and is reflected in their Central Interceptor project.

It was decided to assemble those subject matter experts who had previous experience of the stormwater related matters in the CASI priority one area sub-catchments. We invited them to put forward and test both in-catchment and cross-catchment solutions to the stormwater problems in this area. The CASI panel which was formed is shown in Table 1 below.

Table 1: The CASI Stormwater Panel

Affiliation	Expertise / knowledge
Auckland Council	Project Manager; International experience Stormwater Planning for Central Auckland Consenting requirements Coastal receiving environments
Watercare Services	Integration with CI project
AECOM	Technical Support; Local knowledge Flood hazard modeling / mapping Optioneering in Meola and Oakley
PDP	Auckland aquifers and soakage Stormwater contaminant management
GHD	Flood hazard modeling / mapping Optioneering in Motions
Morphum	Freshwater receiving environments Watercourse management plans

At the first meetings of the assembled expert panel the task and milestone deadlines were defined and all known sources of information were identified.

The information received by Auckland Council was made available to the expert panel members through the development of a hosting website and TeamView system administered by AECOM.

Two, 2-day workshops were held one week apart to give time for further information collection and analysis in the time in between.

4.1 CASI WORKSHOPS

The objectives of the workshops were agreed as:

- Identify and agree conceptual BPOs for the management of flooding and environmental impacts of stormwater discharges on receiving environments for the priority stormwater sub-catchments in the WSL CI zone of influence.
- Identify representative capital investment requirements for the preferred conceptual options to input into the Stormwater 2012 AMP and the AC LTP.
- Identify preferred conceptual solutions to use as the basis for further optimisation in conjunction with WSL to leverage off the opportunities which may be provided by the Central Interceptor.

Following the workshops, further detailed investigations were undertaken, initially targeted at those sub-catchments which interact with the WSL CI. The objective of this was to confirm preferred stormwater solutions to WSL by mid-January 2012, in time to feed into their final concept design and ensure consistency of information in their supporting consent applications.

5 OPTIONS INVESTIGATED

5.1 OAKLEY CATCHMENT

Three high level options were identified in the workshop as follows:

1. Increase the capacity of Oakley Creek to pass-forward all flood flows, including the resolution of independent flooding problems.

   Cost = $45 million

2. Diversion/beheading of Oakley Creek excess flows to the Manukau Harbour

   Cost = $118 million

3. Diversion of excess flows from the upper Oakley Creek to the Meola sub-catchment.

   Cost = $70 million

Preferred option at workshop: Option 1 at $45 million

5.2 EPSOM CATCHMENT

Three potential options were identified to alleviate flooding in the Epsom catchment:

1. Convey stormwater flows from areas at risk of flooding to good soakage areas. Construct soakage facilities to manage the flows.

   Cost = $18 million

   *Concern was expressed about the ability of private soakage to effectively manage flows from storm events greater than 1 in 2 years and public soakage to manage flows from storm events greater than 1 in 10 years. This was therefore not regarded as a long term solution, as the required level of service for flood protection of habitable floors was 1 in 100 years.

2. Convey stormwater flows from areas at risk of flooding to Manukau Road and convey along Manukau Road to Newmarket. Allow for pumping if falls do not allow gravity connection. Provide soakage facilities at the Drive/Onslow area.

   Cost = $66 million

3. Diversion of stormwater flows from areas at risk of flooding and where no soakage exists to the top of the Meola sub-catchment.

   Cost = $73 million

Preferred option at workshop: Option 2 at $66 million. This was the cheapest long term full solution option.

5.3 MEOLA CATCHMENT

Four options were identified to alleviate flooding in the Meola catchment:

1. Conveyance to soakage across the catchment

   Cost = $220 million

   Note: Concern was expressed about the ability of private soakage to effectively manage flows from storm events greater than 1 in 2 years and public soakage to manage flows from storm events greater than 1 in 10 years. This was therefore not regarded as a long

term solution, as the required level of service for flood protection of habitable floors was 1 in 100 years

2. Detention and attenuation using Low Impact Design (LID) principles, property purchase and house raising and overland flow path management.

   Cost = $187 - $247 million

   Note: The retrofitting of LID devices do not in themselves provide a solution to flooding during large events. Their use may contribute to solutions and be considered in specific circumstances and consideration should be made compulsory for all new development.

3a. Full conveyance including stream widening and naturalization

   Cost = $Unknown, as not enough information available

3b. Full conveyance taking the north collector tunnel to the Motions sub-catchment, stream widening + naturalization.

   This option was regarded as impractical due to cross catchment impacts.

4. Full conveyance with discharge tunnel and stream naturalisation.

   Cost = $230 million

Preferred option at workshop: Options 3a and 4 were regarded as the most promising with Option 4 at $230 million being used as the initial input to the LTP.

5.4 MOTIONS CATCHMENT

Investment of more than $30 million had already occurred in this catchment on increasing trunk stormwater capacity. Sewer separation works costing more than $40 million had also been implemented to reduce combined sewer overflows covering half of the existing catchment. The remaining flooding issues were generally concentrated in close proximity to the trunk stormwater system and creek.

Only one viable option was identified at the workshop, as follows:

1. Complete sewer separation works that have been started to date, undertake targeted upgrades and re-configuration of the stormwater and combined drainage system in the area to make better use of the existing system.
   Cost = $10 million

   Preferred option at workshop: Option 1 at $10 million

6 CAPITAL INVESTMENT NEEDS

The following estimated capital investment requirements were included in the Stormwater Asset Management Plan and submitted for consideration in the 2012-2022 LTP in July 2011. In addition, an assessment was undertaken on whether the stormwater solutions could be implemented on their own and whether there is significant benefit to interact with Watercare's Central Interceptor Project:

Meola: $230 million + Design and Consenting costs – *Interacts with WSL CI*

Motions: $10 million + Design and consenting costs – *Interacts with WSL CI*

Epsom: $66 million + Design and consenting costs – *Independent of WSL CI*

Oakley: $45 million + Design and consenting costs – *Mainly independent of WSL CI*

It is important to note that the above estimated catchment costs are a summation of many individual projects.

7 COORDINATION WITH WSL CI STAGE 1 PROJECT

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The combined stormwater and wastewater sewer system in CASI Priority Area 1, owned and operated by Watercare, was originally designed to serve a much smaller population and lower density housing than now exists. Consequently, the system, which was initially designed to spill at specific overflow points into local streams, is now greatly undersized and is inundated during small rainfall events.

This inundation results in large and frequent overflows to streams, backing up and popping of manholes and gully traps around houses and combines with surface water which is unable to enter the system. This produces contaminated flooding in residential areas. The effects of climate change, allowable property intensification and growth will exacerbate these problems over the coming years.

The provision of stormwater flooding solutions in this area provides additional opportunities and benefits to be delivered by close co-ordination with Watercares proposed Central Interceptor.

7.1 BENEFITS OF COORDINATED PLANNING

The benefit of co-ordinated Council and WSL planning to identify the Best Practicable Option for the community are highlighted below. This work is being funded from the current stormwater planning budgets.

7.1.1 BENEFITS ARISING FROM STORMWATER INVESTMENT ASSOCIATED WITH THE PROPOSED WSL CI

The resolution of stormwater flooding will reduce the volume of surface runoff entering the combined system, with the following benefits:

1. Reduction of contaminated flooding from the combined system in the Meola sub-catchment upstream of Lyon Ave and Haverstock Road combined sewer overflows (CSO).
2. Reduction in the volume and frequency of combined sewer overflows at Lyon Ave and Haverstock CSOs.

   Potential reduction in peak flow by up to 45% and volume by up to 40%.
3. Reduction in the volume of stormwater discharged to the CI tunnel.

   Potential reduction in Lyons and Haverstock Road CSOs equivalent to up to 10% of the total storage volume of the CI, leading to improved levels of service for all CSOs and extending the capacity life of both the CI tunnel and the Mangere wastewater treatment works.

It would appear, through CASI investigations to date, that the only viable option to protect properties from the risk of flooding in the Meola sub-catchment during extreme storm events may involve the construction of a tunnel to take stormwater flows to the Waterview Inlet. This option would also have the following benefits:

1. It enables Watercare to utilise the stormwater tunnel to discharge the remaining overflows from Lyon Ave and Haverstock Road CSOs directly to the coastal area where there is less direct exposure to the public. This would remove wastewater

contaminated flows from Meola Creek resulting in improved stream ecology and reduction in public health risk.

2. It potentially enables Watercare to remove the Lyons Ave and Haverstock Road overflow outfall structures. Associated opportunities to daylight / naturalise the upper reaches of Meola Creek will result in improved stream ecology, community amenity and recreational opportunities.

7.1.2 BENEFITS ARISING FROM THE CENTRAL INTERCEPTOR PROJECT ON STORMWATER INVESTMENT

1. Reduced overflow contamination will result in stream water quality improvements and provide greater opportunities for rehabilitation and naturalisation of Meola, Oakley, Motions and Whau streams.
2. The utilisation of the CI itself to receive targeted first flush capture of stormwater contaminants for treatment at the Mangere wastewater treatment plant will result in savings to Council when compared to the cost and practicalities of retrofitting standard methods of stormwater quality treatment dispersed across the sub-catchments. The targeted first flush capture can be designed such that the overall volume of stormwater directed to Mangere wastewater treatment plant remains at existing levels.
3. The need for wholesale sewer separation in Meola as the main method of combined sewer overflow reduction is avoided, although the separation of specific targeted areas may still provide the preferred local solution. This approach reduces the requirement to construct a full stormwater network across the area. This will potentially save the Stormwater Unit up to $375 million which would have been expended undertaking traditional separation (assuming 50% share of the cost of separation 15,000 properties x $50,000 / property).

8 REFINEMENT OF WORKSHOP OPTIONS

Following the initial workshops work has continued on refining the options and costs identified and optimizing the solutions.

The findings of this analysis have resulted in little change to the initial recommendations:

8.1 OAKLEY CATCHMENT

The preferred option of deepening and widening the Oakley Creek to resolve much of the flooding is still the most viable solution. The cost remains unchanged at $45 million.

8.2 EPSOM CATCHMENT

Although the preferred long term solution remains Option 2 at $66 million, it has been decided to progress Option 1 at $18 million to provide relief for pressing flooding issues, accepting that a lower level of service will be provided in the interim period.

8.3 MEOLA CATCHMENT

It has been found that Option 3a - Full conveyance including stream widening and naturalization will cost $430 million due to the cost of stream widening in rock and the number of houses which will have to be purchased.

The cost of Option 4 - Full conveyance with discharge tunnel and stream naturalization has risen slightly to $238 million, due to the cost of working in rock. A preferred tunnel route to outfall at Waterview Inlet has also been identified. This remains the preferred solution (AECOM, Morphum).

8.4 MOTIONS CATCHMENT

Work in identifying the re-configuration requirements is continuing. Currently the only option identified remains the preferred solution at $10 million.

9 OPPORTUNITIES OF INTEGRATED IMPLEMENTATION BETWEEN THE STORMWATER UNIT AND WATERCARE

9.3 LTP INVESTMENT TIMING

The initial LTP proposal was for the full programme of investment across the four CASI sub-catchments to be completed over a 20 year period. This was not supported by the council. Consequently, all resulting capital projects will be subject to a regional prioritization process and delivered as stormwater funding allows in accordance with the confirmed 2012-2022 LTP. This will result in a longer timeframe to achieve the overall improvements than the original investment proposal advocated.

It was therefore important to identify those particular elements of the programme which interact with the CI project and which would be beneficial to implement in a co-ordinated timeframe to take advantage of the opportunities available. These are described in the following sections.

9.1 MOTIONS CATCHMENT

Total stormwater investment $10 million

The preferred solution is to undertake targeted upgrades and re-configuration of the stormwater and combined drainage system in the area. This will enable better utilisation of the stormwater system and concentrate combined flows to a single pipe which would connect directly to the CI.

Opportunity investment $10 million

This will enable Watercare to manage the remaining combined flows from the sub-catchment without requiring further sewer separation works and provide flood mitigation benefits. This opportunity was investigated by Watercare through the CI project and is seen as the most cost effective solution to this area. Timing of the stormwater investment would ideally be integrated with the timing of the CI implementation but must be subject to a regional prioritization process consistent with the draft LTP.

9.2 MEOLA CATCHMENT

Total stormwater investment $238 million

The preferred solution for Meola is currently as follows:

- Maximise all best practice opportunities for stormwater management
  - The investigation of soakage and LID to be made compulsory for all new developments
- Optimise flows to enhance stream ecology and amenity
  - Maximise the use of the existing soakage
  - Stream naturalisation, planting and daylighting
- Install small pipe network to transfer local flooding to a collector system
- Install pipe collector tunnels below basalt
- Direct first flush stormwater contaminants from the collector system to CI
- Install a discharge tunnel to Waterview Inlet

Opportunity investment $75 million

Although the benefits of stormwater investment on reducing combined sewer overflow volume and frequency will be gained gradually as the full programme of works is implemented, initial benefits will be gained by removing all overflow spills from the Meola Creek through installing a stormwater outfall tunnel. Although this investment will not in itself reduce flooding, it is the key enabling project for the Meola sub-catchment. To maximize benefit, completion of the stormwater tunnel would ideally occur prior to 2023 when Stage 1 of the CI tunnel will be complete but must be subject to a regional prioritization process consistent with the draft LTP.

10 CONCLUSIONS

Taking a fresh wider high level look at old problems, with no traditional pre-conceived constraints and an ability to look beyond the normal catchment scale, can provide robust solutions to long standing complex issues in a short time.

It is important to use recognized experts with local knowledge and experience in a structured environment with a common purpose.

Avoid getting lost in local detail and complexities and addressing issues sub-catchment by sub-catchment. This had stymied previous attempts to find viable solutions to the problems.

Coordinating planning between organizations can provide greater community benefits than working in isolation.

ACKNOWLEDGEMENTS

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