

LOOK I MADE A HAT – EFFECTIVE USE OF DETAILED DESIGN DOCUMENTS

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ABSTRACT (300 WORDS MAXIMUM)

Stormwater design like any other engineering design requires that the rules and standards of various local authorities are followed. Specifically stormwater design pipe sizing, spacing and material choices are dictated by standards for a good reason.

We have observed a worrying trend towards designs that rely solely on local authority parameters and inaccurate dimensions. One report that recently crossed our desks stated that Google Earth had been used to determine catchment boundaries. On another project no potholing or service location was undertaken prior to the design drawings becoming construction drawings, the contract being let and the contractor arriving on-site.

The contractor commenced service location and potholing, and found 4 fibre ducts, a 200mm AC watermain, a 150 PVC watermain, telecom cables, and an unspecified earthenware pipe. These services were obstructing the path of a 375mm pipeline proposed to be laid at 0.12%.

It was at this point that we decided to make a hat, from the construction drawings because that is all they were good for.

This experience led me to ask the question: how critical is detailed design on a basic stormwater project? Charts exist to assist with pipe capacity calculations, and if it is a matter of getting water from A to B, on-site design may be the best option. We compiled a portfolio of stormwater design projects (hats) and looked for common faults and errors; compared the outcomes and ruminated upon ways to do things better.

We concluded that once those actual problems were accurately identified, packaged together and let as 'design and build' contracts with defined outcomes, life become simpler. Whilst this "we don't care how you get there, just get there and meet the standards" approach is not necessarily limited to stormwater, we find poor outcomes following detail design to be most prevalent in this area.

KEYWORDS

LOS – Level of Service, Growth, Expenditure, Design and Build Contracts

PRESENTER PROFILE

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1 BACKGROUND

1.1 EXPENDITURE

A review of the last 5 years (2010/11 to 2014/15) of Waikato District Council's (WDC's) stormwater expenditure including capital expenditure for Growth, LOS (Level of Service) improvements and asset replacement identified a number of pertinent points:

- In the 2010/11 financial year Franklin District Council (part of) became part of the District.
- This paper covers urban stormwater (exclusive of rural drainage which falls under roading).
- The "Growth" expenditure was approximately \$3.9 million. Growth expenditure is not considered further as generally design and construction of these assets is managed by Developers then vested to Council.
- LOS expenditure was \$1.3 million.
- Asset replacement was \$160k.
- Emergency works was \$800k, again this is not considered further as pre-design is not generally required.

The year on year expenditure for LOS and asset replacement only is shown in Figure 1. The projected expenditure for the following 5 years (2015/16 to 2020/21) is also shown on the graph for completeness.

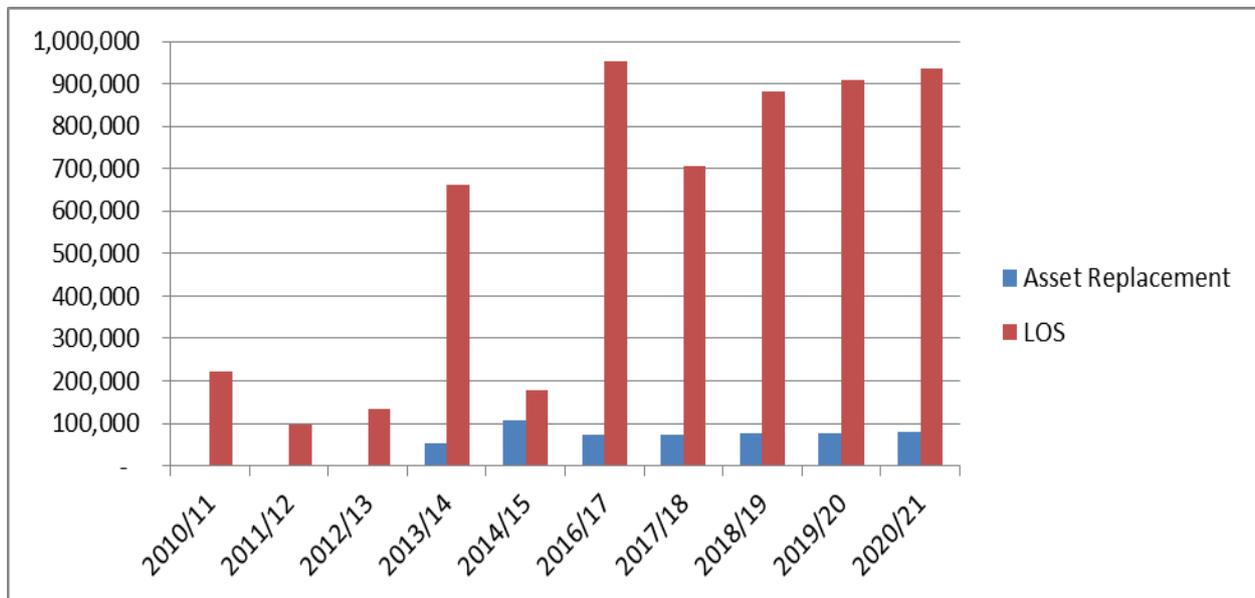


Figure 1: Year on Year Actual and Predicted Expenditure for Stormwater

The graph above shows that comparatively little money has been spent over the last 5 years on Asset replacement. This is due to the large gaps in the asset information of WDC's stormwater assets (their age, condition and the number of). The number of renewals is based on the assets that are in the system (assetFinda) which have an

assumption of the condition being good and that in theory they should last for 100 years, hence the low expenditure. WDC has a large asset data collection project underway at present to understand its assets conditions and criticality to improve the asset renewal programme.

The graph also indicates a large increase in expenditure in LOS over the next 5 years. In the past no planned improvements to the network have been undertaken, reactive works have historically dictated spend here (so if a pipe breaks you go fix it), little proactive works were being done (fixing or increasing capacity before it becomes an issue).

As part of the current LTP (2015-2025), the council plan is to start doing in-depth planning and implementing Catchment Management plans to understand:

- Where the issues are in the system
- Begin to address capacity before it becomes an issue
- Undertake condition assessment, and modelling.

In addition there is also a list of 'problem' areas from Operations detailing flooding, which needs to be investigated, designed and built.

1.2 PROJECT DEFINITION

The type of stormwater project addressed in this paper is very specific, namely a project that falls somewhere between an Operational fix (emergency works) and a large Growth project. These projects are either asset replacement or LOS upgrades, and WDC has spent approximately \$1.4 million on these over the last 5 years (See Figure 1).

By focusing mainly on LOS projects and making the assumptions that asset replacement design is reasonably straightforward we have defined these projects as: the upgrade of primary stormwater network capacity so that they meet the 10 year ARI for Commercial areas, 5 year ARI for Industrial areas and 2 year ARI for Residential areas.

1.3 CASE STUDIES

To date WDC has followed the traditional route for stormwater LOS projects, namely design by a consultant (concept and detailed) followed by tendering, award, and construction. The case studies shown in Table 1 are stormwater projects completed over the last few years, all of which have had problems in construction, due to design, leading to large unexpected costs and delays.

Project Description	Issues
Filling of Council site, stormwater included swales, scruffy dome and connection to existing river outlet	Design didn't consider effects on neighboring properties from filling. Re-work after completion was required to ensure flooding didn't occur.
Installation of new 375mm pipeline to reduce flooding, connection to existing network (LOS)	Flat existing stormwater system, several existing services in the way (fibre, water, telecom, sewer). No potholing at design stage, redesign on-site including introducing a U-bend in the watermain to go over the new stormwater line.

Installation of drainage to divert runoff from upstream catchment around existing skate park	Design was overcomplicated, didn't fit existing surface profiles. Modified design on-site to work.
Installation of pipework through private property to reduce flooding and connect to existing stream outlet (LOS)	No site visit during design. No property owner consultation. Re-design on site to accommodate owner requests for location of stormwater manholes through private property.
Installation of 300mm pipeline to reduce flooding, connect to existing lake outfall (LOS)	Flat existing stormwater system, WEL stacked ducts in the way of alignment, no alternative route. Outcome – pipes abandoned. Cause – no potholing done during design phase. Relocation of the cabling ended up being expensive.

Table 1: Waikato District Council - Case Studies



Photo 1: Abandoned Pipes due to infeasibility of Project

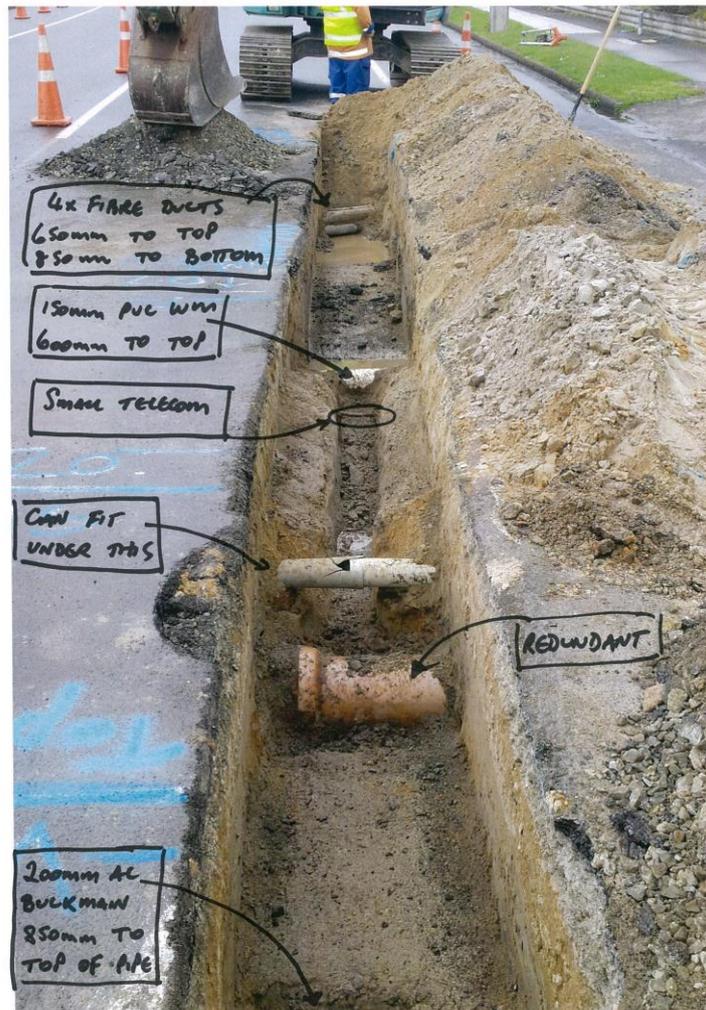


Photo 2: Services in the path of proposed stormwater pipeline

1.4 COMMON FAILINGS

The detailed design in all of the case studies needed to be considerably altered once works commenced on-site (future learnings – singled sided printing to allow drawing of new design on the back?).

Common mistakes seemed to be:

- No potholing of services during design phase leading to downtime on site during construction. Resulting in redesign on-site.
- Flat existing stormwater systems with little thought given to alternative options to deal with stormwater other than a piped system.
- In some cases overly complicated design which was 'turned into a hat' and couldn't work with the actual layout/use of the space.

In all case studies delay costs or re-work costs had to be paid to the contractor and the design costs appear to be unwarranted, as they were ultimately disregarded.

2 RECOMMENDATIONS/SOLUTIONS

2.1 WHAT OTHERS DO

Other councils (including Auckland Council and Hamilton City Council) have Stormwater "Renewals" Contracts that are issued to cover all these types of projects and allow for the design and build type methodology with early contractor involvement. The contractors are given a high level scope of what is required and a background of the flooding issue. Contractors then undertake potholing, survey, site investigations in advance of the main works which guide the "design" of what is installed where.

2.2 WAIKATO DISTRICT COUNCIL - PAST

Over the past 5 years (with the exception of 2013/14) WDC has spent very little on these type of projects (less than \$200k per year) so the approach to design and procurement has been on an ad-hoc basis and has resulted in some of the issues outlined in Section 2.4. It would not have been possible (given the low budgets and un-even expenditure year on year) for a Renewals type contract to be put in place.

2.3 WHAT WE HAVE TRIED MORE RECENTLY

Recently-Lately we have adjusted our approach to be more in line with the 'design and build' type methodologies.

We recently completed a contract which involved replacement of an existing stormwater outfall into the Waikato River. This outfall followed a very steep incline and was required to be laid over the ground. Access to the bottom of the site was very restricted – only helicopter or barge access was available. The contractor was brought on board early, visited the site and came up with some innovative solutions to install and secure the pipeline appropriately. The project was very successful, timely and cost effective (and we got to use a helicopter!).

2.4 FUTURE

In the future we will be recommending that Council pursue the Design and Build type contracts, with early contractor involvement, including involvement with operations staff, and up front discussions with property owners who have knowledge of the area.

Looking at the next 5 years of stormwater budget for LOS and Asset Replacement, the year on year expenditure is much higher – more than \$700k per year. This is now in the realm of making a Design and Build renewals type contract feasible. Another option to consider is to approach other District Councils nearby with similar smaller budgets and look to put together a combined Design and Build Renewals Contract.

3 CONCLUSIONS

Due to the low expenditure to date on LOS and asset replacement for stormwater over the last 5 years, WDC have relied on traditional design and procurement methods. This has resulted in inefficiencies, delays, high costs and use of detailed design drawings as Hats. Budgeted expenditure for the next 5 years is much higher and warrants a different approach.

It is recommended that a Design and Build Contract is investigated, either as a WDC specific contract or combined with other District Councils. This contract could more effectively deliver stormwater projects within the district.

Figure 1: "Year on Year Actual and Predicted Expenditure for Stormwater"

Table 1: "Waikato District Council - Case Studies"

Photograph 1: "Abandoned Pipes due to Unfeasibility of Project"

Photograph 2: "Services in the path of Proposed Stormwater Pipeline"

ACKNOWLEDGEMENTS

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