# Wastewater Overflow Continual Improvement Programme

Waikato District Council

## Wastewater Overflow Continual Improvement Plan

| Rev2

18 November 2016

Client Reference

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# Wastewater Overflow Continual Improvement Programme

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# Executive Summary


### Background

Over the last 18 months there has been an increase in community awareness and subsequent response to the number of wastewater overflows that have been occurring within the district. A number of these overflows have occurred in Raglan and have resulted in the harbour being closed to both contact recreation (swimming) and the collection of seafood. Whilst overflows have occurred in other locations they have not generally had the same community reaction as has occurred in Raglan, largely due to their impact on a highly valued marine environment.

In August 2016 Council received a report outlining initial responses to the level of overflows from the network and supported a continual improvement programme (CIP) approach to managing the overflow issues. This is a risk based approach that sets a goal of reducing overflows as much as practicably possible, whilst acknowledging that it is not possible to completely rule them out.

### Current Performance

Waikato District Council currently is the poorest performing provincial district council in the country according to the National Performance Review data (2014/2015) administered by Water New Zealand and a continual improvement programme approach should seek an improvement in performance such the Waikato DC would rank as one of the better performing councils. It should be noted that Council's performance as regards wastewater overflows has been consistently poor over the last five years relative to other water utilities in New Zealand.

### Early Interventions

In order to address the issue Council has commenced a series of early interventions, which are described in this report. Council has also reviewed the adequacy of the current plan and examined opportunities for additional interventions to reduce the risk of overflows and to accelerate the improvement of network performance.

The early interventions are largely complete and are already showing benefits.

### Future Intervention Options

In order to develop improvement options it is first necessary to understand and to determine factors causing wastewater overflows and also to understand what the consequence of overflows are and a summary of the causal factors and high consequence sites are highlighted.

Two suites of high level options for intervention have been developed to move to a higher level of wastewater overflow performance employing both proactive and reactive means using a series of technique types. The **medium** level of intervention seeks to improve the performance to be on a par with the median of peer provincial district councils in the country, whilst the **high** level of intervention seeks to achieve performance to be on a par with the best performing peer provincial councils.

### Uncertainties

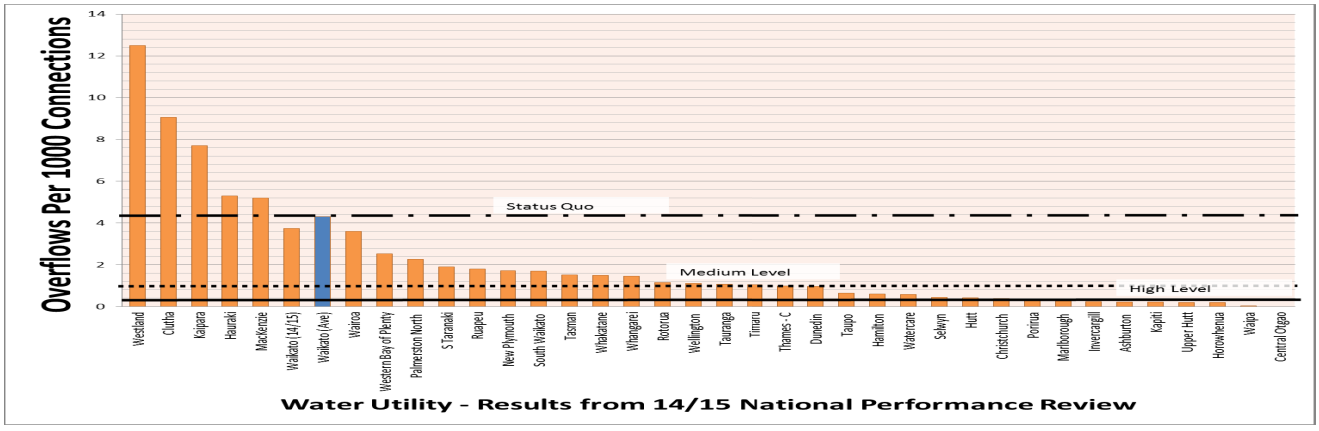
Development of such high level options brings with it significant uncertainties associated with the underlying information and the intervention requirements in terms of dimensions have been developed on the basis of readily available information. It is **essential** that further work be undertaken to confirm these dimensions prior to implementation.

Similarly the budget estimates used for the various methods of implementation have been developed on the basis of readily available information. It is **essential** that further work be carried on the budget estimates prior to the implementation of the interventions. The budget assumptions made for each method of intervention are stated within the report.

## Summary of Options

A summary of the medium and high level interventions and associated high level budgets are provided below. In each case they assume implementation over a ten year period and the totals given are on that basis.

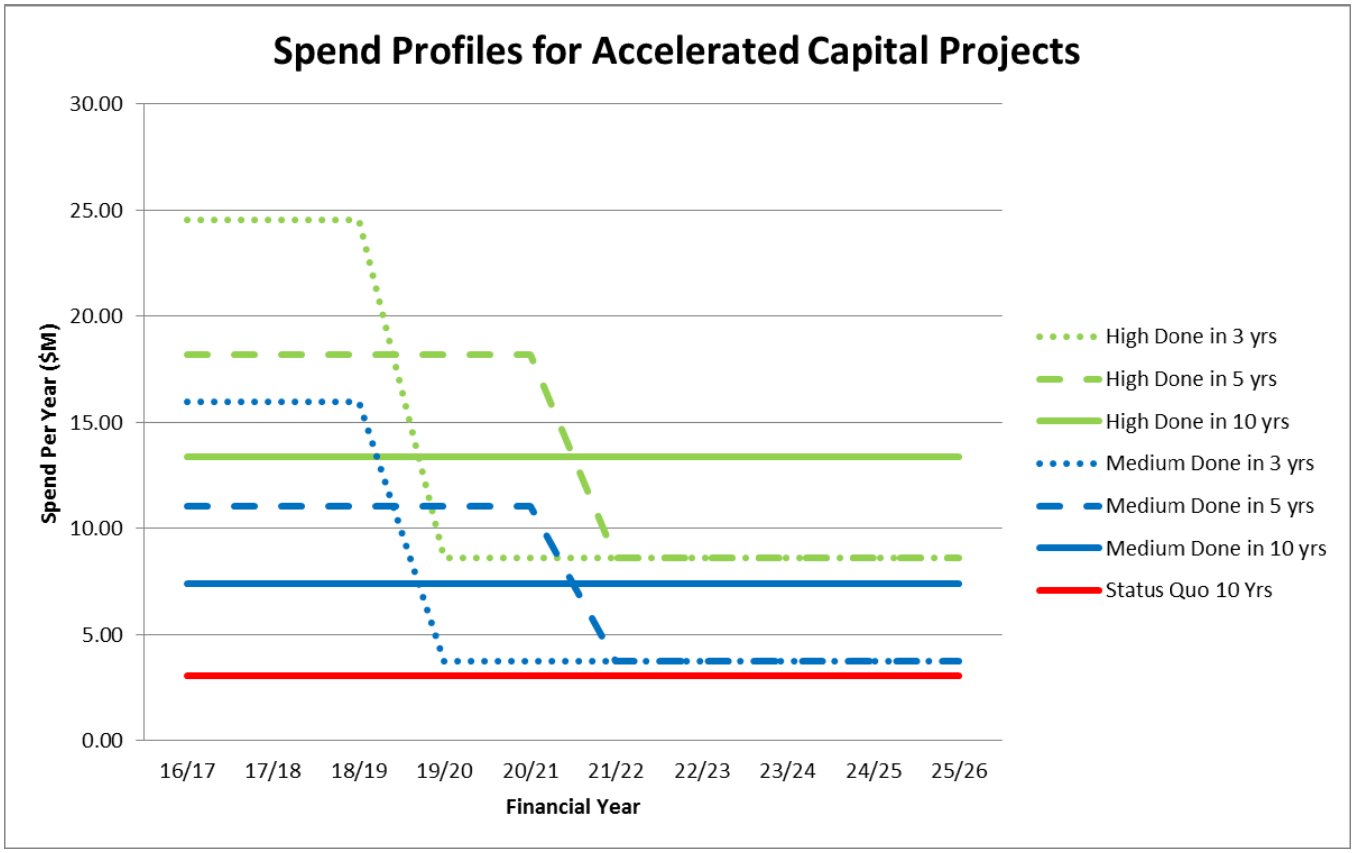
| | Status Quo | | Median Performance | | High Performance | |
|---|---|---|---|---|---|---|
| | Target Number of Overflows / 1000 connections | 4.3 | Target Number of Overflows / 1000 Connections | 1 | Target Number of Overflows / 1000 Connections | 0.25 |
| Intervention | Description | Budget (10 year) $M | Description | Budget (10 year) $M | Description | Budget (10 year) $M |
| Network Maintenance | Maintain Current Level of Jetting / CCTV Condition assessment | 1 | Maintain Current Level of Jetting / CCTV Condition assessment (OPEX) | 1 | Maintain Current Level of Jetting / CCTV Condition assessment (OPEX) | 1 |
| | | | Jetting / CCTV Condition assessment @ 19 problematic sites yearly (OPEX) | 3.4 | Jetting / CCTV Condition assessment @ 19 problematic sites yearly (OPEX) | 3.4 |
| | | | | | Jet/CCTV entire network yearly (OPEX) | 39 |
| Service Delivery | Maintain current level and function | 8.6 | Increase level to industry standard and split function of teams to be SW/WW & Water (OPEX) | 13.4 | Increase level to industry standard and split function of teams to be SW/WW & Water (OPEX) | 13.4 |
| | | | Additional Equipment ( CAPEX) | 0.7 | Additional Equipment ( CAPEX) | 0.7 |
| | | | Running Costs for additional equipment (OPEX) | 1.94 | Running Costs for additional equipment (OPEX) | 1.94 |
| Renewals | Renewal of pipelines on condition /age basis | 9.8 | Renewal of pipelines on condition /age basis (CAPEX) | 9.8 | Renewal of pipelines on condition /age basis (CAPEX) | 9.8 |
| | | | Renewal of pipelines to improve capacity in areas which have been susceptible to overflows ( CAPEX) | 3.8 | Renewal of pipelines to improve capacity in areas which have been susceptible to overflows (CAPEX) | 3.8 |
| | | | | | Renewal of pipelines which are near to capacity (determined by modelling ) (CAPEX) | 3.8 |
| | | | Renewal of pipelines which through CCTV are shown to be leaky (CAPEX) | 1.47 | Renewal of pipelines which through CCTV are shown to be leaky (CAPEX) | 2.94 |
| Inflow and Infiltration Control | Maintain Current level of Inflow / Infiltration Control ( One Township/yr) | 7 | Higher level of Inflow / Infiltration Control ( 2 Townships/yr) (OPEX) | 14 | Highest level of Inflow / Infiltration Control ( 3 Townships/yr) (OPEX) | 21 |
| Pumping Station Storage | Installation of 6 Hours at 2 stations / year | 3.3 | Installation of 12hr storage at high risk stations (CAPEX) | 4.9 | Installation of 24hr storage at high risk stations (CAPEX) | 9.1 |
| | | | Installation of 6hr storage at medium risk stations (CAPEX) | 6.7 | Installation of 6hr storage at medium risk stations (CAPEX) | 6.7 |
| | | | Installation of 6 hr storage at low risk stations (CAPEX) | 2.9 | Installation of 6 hr storage at high risk stations (CAPEX) | 2.9 |
| Power Failure | Provide 2 Standby Generators in Raglan | 0.07 | Provide 2 Standby Generators in Raglan (CAPEX) | 0.07 | Provide 2 Standby Generators in Raglan (CAPEX) | 0.07 |
| | | | Provide 1 Stand By Generator in both Huntly and Ngaruawahia (CAPEX) | 0.08 | Provide 1 Stand By Generator in both Huntly and Ngaruawahia (CAPEX) | 0.08 |
| | | | | | Provide 4 additional generators around the remainder of the District (CAPEX) | 0.15 |
| SCADA / Telemetry | Maintain Current Level of Resilience / Reliability | 1 | Level 1 Improvement (CAPEX) | 6.4 | Level 2 Improvement (CAPEX | 8 |
| | | | Level 1 Improvement (OPEX) | 2.4 | Level 2 Improvement (OPEX) | 5.2 |
| Public Education Process | Prepare Education process | 0.015 | Implement Education Process (OPEX) | 0.5 | Implement Education Process (OPEX) | 0.5 |
| Addition Investigations / master plans | | | Studies to confirm performance and costs of Medium Intervention methods (CAPEX) | 0.5 | Studies to confirm performance and costs of High Intervention methods (CAPEX) | 0.5 |
| **Totals** | | **30.8** | | **74** | | **134.0** |



It is noted that to improve the current level of performance beyond the medium level of performance to the high level of performance, the law of diminishing returns will apply. For that reason it is prudent to consider an interim goal of seeking the medium level of performance.

**Accelerating the Improvement**

Some of the methods of intervention are operational activities and need to be continued year on year to attempt to achieve the level of improvement desired. Some of the intervention methods however are capital expenditure intervention methods are thus 'one off' costs. The assumption made in this plan is these intervention methods are completed gradually over a ten year period on a prioritised basis. Should there be a desire to accelerate either the medium or high level capital expenditure intervention to be delivered over a 3 or a 5 year period the graph below indicates the budgets required.




**Immediate Interventions**

Some of the intervention methods which are described in this report are conditional on further work being carried out to address uncertainties in terms of outcome and budget costs, but some are not and they can be implemented immediately.

To maintain progress the following actions are recommended.

| Action | Budget | Programme |
|---|---|---|
| Studies to confirm performance and budget costs of medium intervention (wastewater overflow improvement plans) | $500,000 (capital) | Nov 16 – June 17 |
| Improve service delivery level industry standard and split function of teams to be SW/WW & Water | $674,000 per annum ( Operating)<br>$700,000 (Equipment) (Capital) | Nov 16 Onwards |

| Action | Budget | Programme |
|---|---|---|
| Provide 4 additional standby generators for district (locations to be determined) | $150,000 (Capital) | Nov 16 |
| Implement SCADA / Telemetry Upgrade for Raglan Only | $1.6M ( Capital)<br>$60,000 per annum (operating) | Nov 16 – June 17 & then onwards |
| Implement Public Education Process | $50,000 per annum (operating) | Dec 16 Onwards |
| Jetting and CCTV Investigations for entire network (district wide) to inform renewals programme | $3.9M (operating) | Dec 16 – Dec 17 |

It is recommended that on completion of the wastewater overflow improvement plans in June 2017 that this report be updated to reflect the outcomes of that work and to give an update on the effectiveness of these interventions.

**Conclusions**

The following can be concluded from this work.

- A description of the cause and effects of wastewater overflows in the district has been provided.
- The early intervention works are underway and largely complete and are already showing benefits.
- Two suites of high level options for intervention have been developed to move to a higher level of wastewater overflow performance employing both proactive and reactive means using a series of technique types. The **medium** level of intervention seeks to improve the performance to be on par with the median of provincial district councils in the country, whilst the **high** level of intervention seeks to achieve a performance in line with the highest performing peer organisations.
- The total budget to be allowed over a ten year period for implementing the suite of medium level interventions is approximately $74M, whilst to implement the suite of high level interventions, the cost is approximately $134M. These budget costs include the work that is essential to refine these estimates.
- Different spend profiles for the capital expenditure elements of this work to be implemented over 3 and 5 year periods have been provided.
- Some of the intervention methods which are described in this report are conditional on further work being carried out to address uncertainties in terms of outcome and budget costs, but some are not; these address some high risk issues and they can be implemented immediately.

**Recommendations**

It is recommended that

- Council consider what level of intervention they wish to adopt and over what period of time. It is noted that to improve the current level of performance beyond the medium level of performance to the high level of performance, the law of diminishing returns will apply. For that reason it is prudent to consider an interim goal of seeking the medium level of performance.
- Some of the intervention methods which are described in this report are conditional on further work being carried out to address uncertainties in terms of outcome and budget costs, but some are not; these address some high consequence issues and should be implemented immediately.
- It is essential that detailed investigations are commenced immediately to address uncertainties in terms of outcome, budget costs and to confirm the details of the interventions including required dimensions.

# 1. Introduction & Background

Over the last 18 months there has been an increase in community awareness and subsequent response to the number of wastewater overflows that have been occurring within the district. A number of these overflows have occurred in Raglan and have resulted in the harbour being closed to both contact recreation (swimming) and the collection of seafood. Whilst overflows have occurred in other locations they have not generally had the same community reaction as has occurred in Raglan, largely due to their impact on the marine environment.

On 25 March this year a spill occurred at the Marine Parade pump station which was investigated by the Waikato Regional Council (WRC). On the 29th July Council received a Formal Warning for this event. Since the March event, a further two spills have occurred in Raglan, one at Whitley Street Pump Station and most recently, one at the Greenslade Road pump station .

Whilst the number of overflow events has not changed significantly over the last 5 years the view of the communities has. This results in the approved programmes and resources that are in place to manage these events needing to be updated to reflect these views.

## 1.1 Objectives & Performance Measures

The performance targets, as stated in the 2015 – 2025 Long Term Plan (LTP) are that for the entire 10 year period that there should be 5 or less dry weather overflows per 1,000 sewage connections, per year. Council, until 2015/2016 met this target but 6.2 dry and wet weather overflows per 1,000 sewage connections was achieved in 2015/2016.

Furthermore the LTP states that the performance target for the entire 10 year period is that the median response time for attending to a sewage overflow should be equal or less than 1 hour. The median resolution time should be equal to or less than 4 hours. According to 2014/2015 data, Council currently meets the response time, but not the resolution time with a median of 8 hours.

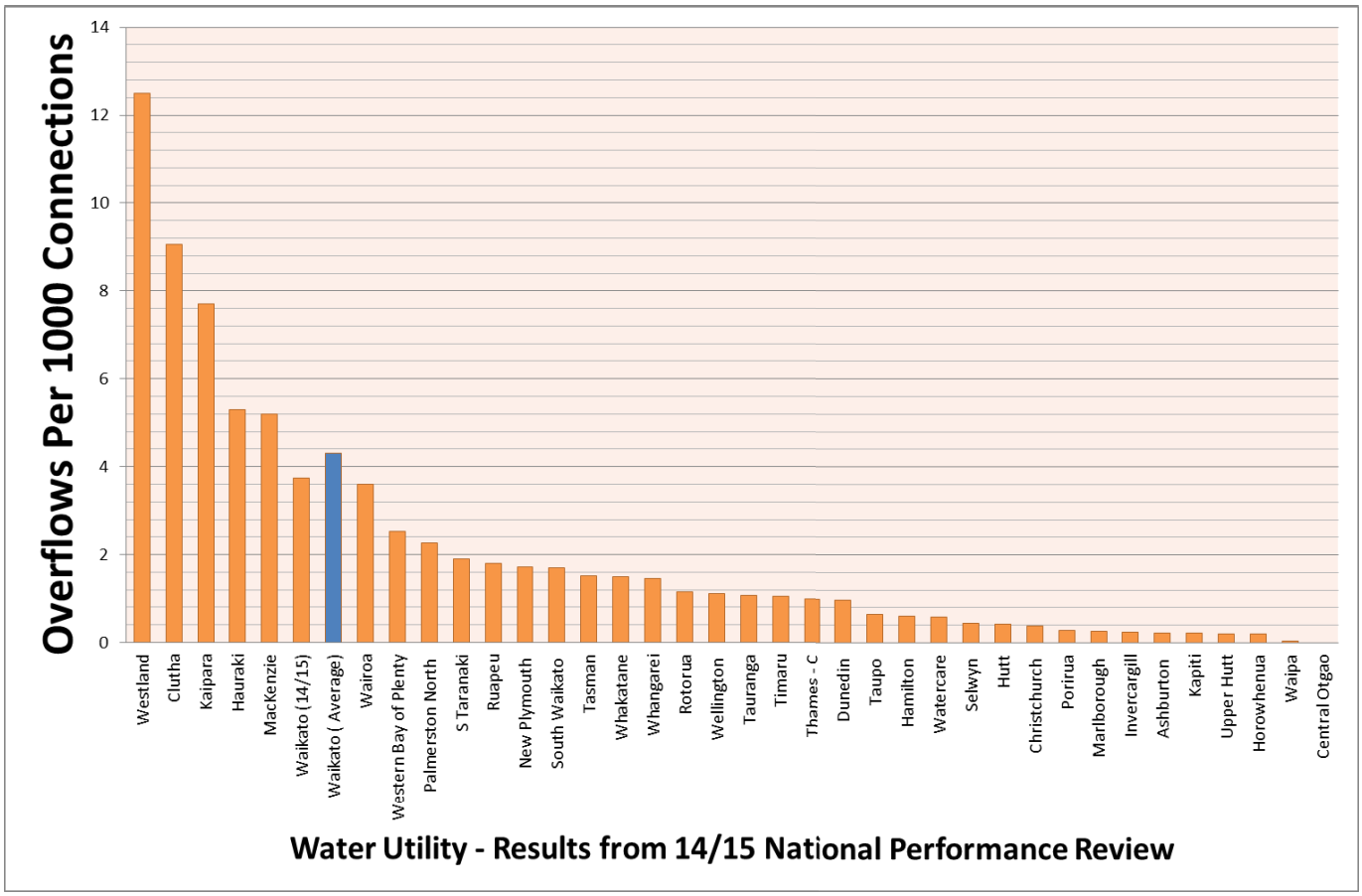
Finally the LTP states that the target for the level of compliance for discharges from its wastewater network is that throughout the ten year periods Council receives 2 or less abatement notices, infringement notices, and enforcement orders per year and zero convictions.

In August 2016 Council received a report outlining initial responses to the level of overflows from the network and supported a continual improvement programme (CIP) approach to managing the overflow issues. This is a risk based approach that sets a goal of reducing overflows as much as practicably possible, whilst acknowledging that it is not possible to completely rule them out.

The following table illustrates the number of wastewater overflows (in both dry and weather) which have occurred in the district and have been reported in the last five years.

| Financial Year | Number of Wastewater Overflows | Overflows per 1000 connections |
|---|---|---|
| 15/16 | 59 | 6.2 |
| 14/15 | 35 | 3.75 |
| 13/14 | 35 | 4 |
| 12/13 | 30 | 3.5 |
| 11/12 | 35 | 4.2 |
| **Average** | **39** | **4.3** |

Waikato District Council has participated in the National Performance Review administered by Water New Zealand over the last 5 years. A graph indicating the relative performance against other utilities for the 14/15 National Performance Review is presented below for both dry and wet weather overflows. Waikato District council's average performance (blue) for the last 5 years of records is also presented on the graph.




Waikato District Council currently is the poorest performing provincial council, and amongst the poorest performing of all councils in the country according to the most recently National Performance Review data from financial year 14/15.

It should be noted that Council's performance in all cases when it has participated in the National Performance Review it has been amongst the poorest performing in terms of wastewater overflows relative to other water utilities in New Zealand.

Due, to the relative infancy of the National Performance Review, it is known that there have been some inconsistencies in the methods of recording overflows between utilities. Waikato District Council record and report each overflow, irrespective of its size or effect. Other utilities are understood to report differently. Water New Zealand are understood to be addressing this issue and it is likely that consistency will improve as the review matures.

## 1.2 Scope of this report

The scope of this report is to

- Review the adequacy of the current plan to reduce wastewater overflows
- To provide options to enhance the current plan to achieve higher levels of overflow performance

- To provide options for acceleration of the enhanced plan &
- To provide recommendations on the way forward

## 1.3 Contents of this report

In order to address the issue Council has commenced a series of early interventions, which are described in this report as well as reviewing the adequacy of the current plan and examined opportunities more additional interventions to reduce the risk of overflows and also to accelerate the improvement of network performance.

The remainder of this report is in the following parts and describes

- The causes and effects of wastewater overflows
- Adequacy of the current plan & improvement options
- Summary of overall options
- Options for acceleration of capital intervention methods
- Opportunities for continued improvement whilst uncertainties are resolved
- Conclusions and Recommendations

# 2. Description of Cause and Effects of Wastewater Overflows

In order to develop improvement options it is first necessary to understand and to determine factors causing wastewater overflows and also to understand the consequence of overflows.

Wastewater overflows are caused by

- Blockages within the network or at pumping stations either in wet or dry weather
- Inadequate Capacity within the network, relative to the flow being transported – this is normally an issue in wet weather.
- Failure of key equipment (e.g. Pumping Stations) or power at key installations (e.g. Pumping Stations).

The effects or consequences of wastewater overflows are that

- They result in the pollution of waterway (streams, rivers and harbour)
- Give rise to public health issues, if adjacent to habitation.
- They cause a loss of utility for sanitary services for customers

Wastewater overflows sometimes occur in remote places and at all hours of the day and therefore understanding that overflows have occurred is important in facilitating a quick response to that event so that its effects can be reduced.

Understanding the cause of overflows and the effect those overflows may cause permits a method and level of intervention to be developed appropriate to reduce the effects.

## 2.1 Causal Analysis

A review of the reports of repeat (more than 1) wastewater overflows in the same location districtwide over the last 4 years has been undertaken to determine effective intervention methods. To determine whether these overflows occurred in dry or wet weather analysis of rainfall at the time or just before the overflow was undertaken as part of this review.

The review concluded that the wastewater overflows were caused by one of the following reasons

- Pumping station capacity issues (wet weather)
- Private property issues (wet or dry weather)
- Blockages caused by local issues which were resolved (normally dry weather)
- Repeat blockages at the same locations, indicating that that part of the network was prone to blockages (normally dry weather)
- A combination of blockage issues and capacity constraints. The primary cause was not conclusive in these cases. (wet weather)
- Inappropriate use of caravan / trade waste dump sites. (wet or dry weather)

The maps from this causal analysis are presented in Appendix A. A suggested intervention strategy for each of these causes, and the programme which should be used as a vehicle for the intervention is presented below;

| Issue | Number of Locations | Intervention | Programme |
|---|---|---|---|
| Pumping Station Capacity issues | 5 | Increase pumping station capacity / storage | Pumping Station storage / Inflow / Infiltration Programme |
| Private Property issues | 6 | Education / Penalties. | Education programme |
| Blockages caused by local issues which were resolved | 21 | Reactive operations Education programme. | Reactive operations, education programme. |
| Repeat blockages at the same locations, indicating that that part of the network was prone to blockages | 5 | Proactive CCTV survey and Jetting – targeting renewals programme in these areas. | Proactive CCTV / Jetting Programme<br><br>Renewals Programme |
| A combination of blockage issues and capacity constraints. The primary cause was not conclusive in these cases. | 14 | Proactive CCTV survey and Jetting – targeting renewals programme in these areas. | Proactive CCTV / Jetting Programme<br>Renewals Programme<br>I / I Programme |
| Inappropriate use of caravan / trade waste dump sites. | 3 | Education / Penalties. | Education programme |

## 2.2 Consequence Assessment

A consequence assessment was carried out by WDC staff on major wastewater pumping stations to determine the consequence of failure of power or key equipment. Each Pumping station was assessed on a five point scale based on the consequence of overflow in terms of proximity to the receiving environment, be it a stream, river or harbour.

These results showed that of the 84 pumping stations that council owns and operates there are

- Eighteen (18) Pumping Stations with the highest consequence score of 5.
- Thirty Six (36) pumping stations with a moderate consequence score of 3 or 4.
- Twenty three (30) pumping stations with a low consequence score of 1 or 2.

Locations of each of the pumping stations with highest and medium consequence scores in each of the categories are provided in Appendix B.

# 3. Adequacy of Current Plan & Improvement Options

As has been noted within this report, it is clear that the current LTP measure for wastewater network overflows are no longer considered appropriate by the wider community. To see a marked improvement in overflow levels Council has supported the CIP approach as previously described. This approach will see an increase in investment in the area of controlling overflows which will support a reduction in the number occurring.

## 3.1 Early Intervention Works

Immediately after the events of early 2016, a series of early works were implemented, these were mainly aimed at early warning of overflows, by the installation of additional alarming mechanisms and the provision of additional power in the event of power failures at high risk sites. The current status of these early works is summarised below.

| Project Description | Outcome Sought | Budget | Completion programme | % Complete |
|---|---|---|---|---|
| SMS Units | Installation of 18 SMS units for Pumping Stations for early warning. | $55,000 | Mid Sept 16 | 100% |
| Generator Plugs | Install generator plugs at 18 pumping stations to permit connection of Backup Generator(s) | $55,000 | End Sept | 100% |
| Backup Generator - Greenslade | Obtain backup generator - for locating at Greenslade PS | $35,000 | End Oct | 100% |
| Downer Support | To provide additional resources to be mobilised if required for a period of 2 years | $1,000,000 | Two year contract period. | 5% |
| City Care Support | To provide immediate additional resources | $55,000 | End Sept | 100% |
| Public Education Programme | | $15,000 | Dec – 16 | 5% |

The benefits of having these early intervention works in place is hard to quantify as to date there have been limited circumstances where the arrangements were required. An exception was a power failure in Raglan which occurred on the 13th September 2016 which triggered the SMS units to alarm. Shortly after the power failed it was restored with no further intervention necessary. In addition to this the SMS units provided backup alarms when there was a 13 hour failure of the Spark network on 7th October 2016, a 4 hour failure of the Spark network on the 9th October and there have been minor communications failures on the SCADA system, but at all times alarm functionality was maintained. There have not yet been power failures which have required the generators to be deployed.

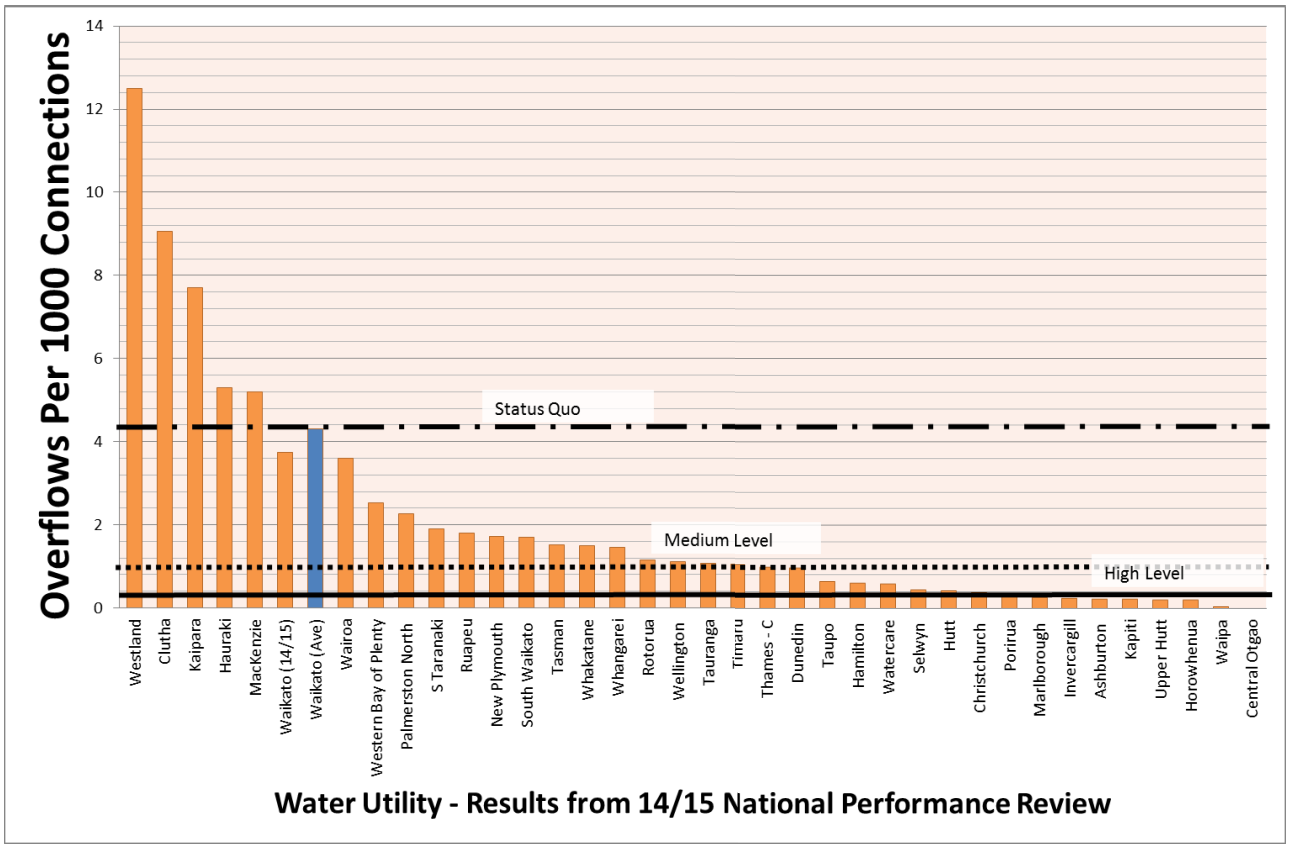
## 3.2 Continual Improvement Intervention Works

### 3.2.1 Methodology

In developing options for improvement, intervention methods have been considered which firstly seek to avoid the overflows happening and secondly to improve knowledge of the overflow occurring and thirdly to improve the reaction to the overflow happening.

For each method of intervention, medium and high level options are provided. In all cases the high level of intervention provides the least risk of overflow occurring relative to the medium level of intervention, but at a higher cost. It should be noted that the amount of residual risk after intervention is relative, not absolute.

The **medium** level of intervention seeks to improve the performance to be on a par with the median of peer provincial district councils in the country with a goal of achieving a performance of 1 overflow per 1000 connections. The **high** level of intervention seeks to achieve performance to be on a par with the best performing peer provincial councils with a goal of a performance of 0.25 overflows per 1000 connections. Both performance goals for the **medium** and **high** level interventions are illustrated on the graph below.




### 3.2.2 Uncertainties

There are uncertainties in the quantum of the interventions proposed as the intervention plan has been developed at a high level, rapidly and using readily available information to inform each intervention and associated budget costs.

In addition to this there are uncertainties associated with the link between the intervention proposed and the outcome (goals) desired. These uncertainties relate to both weather and lack of detailed information on the precise cause of overflows and it is essential that these uncertainties are reduced prior to the implementation of capital intensive interventions.

**Basis of Intervention Requirements**

In developing the intervention requirement in terms of dimensions, such as pumping station volumes, lengths of pipe to be jetted, pipe lengths and diameters for renewal and so on, have been developed on the basis of readily available information to develop a high level strategy. It is recognised that further work will be required to confirm these dimensions prior to concept, preliminary and detailed design is carried out and the intervention implemented.

**Basis of Budget Cost Estimates**

Similarly the budget cost estimates used for the various methods of implementation have been developed on the basis of readily available information to develop a high level strategy. Further work will be required on the cost estimates prior to the implementation of the intervention. The cost assumptions made for each method of intervention are stated in the following sections.

### 3.2.3 Network Maintenance

Improving the maintenance of the network through cleaning and jetting can greatly reduce the number of blockages experienced. In addition to this CCTV inspections, which are carried out at the same time can identify where broken pipes located and can assist in renewals programme.

Analysis of spend on CCTV investigations and Jetting operations for Council using outside contractors indicate that the following has been spent in the last few financial years.

| Financial Year | Spend |
|---|---|
| 2013/2014 | $ 149,410 |
| 2014/2015 | $ 205,770 |
| 2015/2016 | $ 230,457 |

It should be noted that the network maintenance has been carried out generally on a reactive and informal basis and has average cost of nearly $200,000 per year has exceeded the LTP allowance of $100,000 per year.

It is recommended, to achieve the **medium** level of performance for the areas of repeat blockage that these areas are proactively jetted. Further work is required to determine the precise locations and dimensions for this jetting, but on the basis of each of the 19 sites requiring 200 metres of jetting/CCTV at $80 per metre a total of $340,000 should be budgeted for.

It is recommended, to achieve the **high** level of performance that the entire wastewater network is subject to CCTV inspection and jetting every year. The budget allowance to provide this level of intervention is approximately $4M each time it is done, less the budget currently allowed in the LTP of (approximately $100,000 per annum), so $3.9M each time it is done.

It should be noted that a similar budget to that allowed for in the LTP (approximately $100,000 per annum) for reactive work should be retained. Should the medium and high level of intervention be implemented less reactive work is likely to be required, particularly if the high level of intervention is implemented.

CCTV and jetting work has been carried out using specialised contractors on an ‘ad hoc’ basis and it is recommended that a dedicated contract be set up over a long period so that the CCTV / Jetting work might be better programmed and economies of scale accrued. A clause should be written in the contract to ensure attendance within 30 minutes of an incident in Raglan, Huntly and Ngaruawahia. There will be a premium to be paid for having the quicker response times and the premium will be determined at the time of tendering

A summary of the recommended CCTV / Jetting budgets to be allowed is provided below

| Element | Annual Budget to be allowed |
|---|---|
| Reactive Element | $100,000 |
| Proactive element ( repeat blockages) (**Medium Level of Intervention**) | $340,000 |
| Thirty Minute Response premium | To be determined |
| Proactive Element ( Entire Network) **( High Level of Intervention**) | $ 3,900,000 |

### 3.2.4 Service Delivery Improvements

Waikato DC has a reticulation maintenance establishment size which compares unfavourably with a nearby district council with similar geographical challenges.

In addition to this Waikato DC use water reticulation trained staff on wastewater reticulation activities and vice versa. Whilst appropriate procedures are in place and are used to decontaminate equipment between jobs, there remains a very high residual risk of cross contamination. It is now industry standard for servicemen to focus on either water or wastewater and for those that work on wastewater to have a three week stand down period before working on water reticulation.

It is recommended that WDC increase their reticulation maintenance equipment and establishment such that they are capable of manning dedicated wastewater and water reticulation maintenance teams and are thus on a par with industry standard. It should be noted that demand for these skills in the market outstrips supply and finding suitable skilled individuals is and will be a challenge.

Council should allow a budget of $480,000 per annum to increase the establishment size to be capable of undertaking these functions. In addition to this a further $700,000 should be budgeted for capital additions to purchase equipment and vehicles to support this establishment and running costs for these vehicles and equipment of $194,000 per annum be budgeted.

There are many means of delivering the functions undertaken by the reticulation establishment and the options should be considered by Council.

### 3.2.5 Policies and Procedures

The current procedures for network maintenance are being reviewed by both Council staff and contractor Downer to ensure that appropriate and in line with industry best practice. The revised procedures will be implemented as soon as the review is completed. This is expected to be complete by December and should be implemented immediately.

### 3.2.6 Education

A large number of network blockages are caused by disposal of a large number of items such as baby wipes, sanitary items, disposable nappies, cleaning wipes and the like via toilets into the wastewater system. These items become stuck within the network and pumping stations and don't allow the network to operate as it is designed to do. An education process to seek a reduction in the disposal of these items has commenced as part of the early implementation works, and it is logical that the education process become a permanent component of the improvement programme. A budget allowance of $50,000 per annum should be allowed and this estimate should be refined on the completion of the early intervention works in December 2016.

### 3.2.7 Network Renewals

Additional network capacity can be provided by increasing the pipe sizes of existing pipes when they are renewed as part of the wastewater reticulation renewals programme at marginal additional cost ( per metre of pipe replaced).

The current LTP spend profile for wastewater reticulation renewals is as follows

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|
| $000's | 858 | 879 | 930 | 928 | 954 | 984 | 1,015 | 1,050 | 1,086 | 1,125 |

Wastewater pipe renewals are currently prioritised on the basis of age and condition and do not consider capacity at this stage. It should be noted that a report issued in August 2016, (Pipe Data Management, Stages 1 & 3 Pipe Data Cleansing, Condition Assessment and Pipeline Renewal Planning 2016-17) advocated the reprioritisation of water, wastewater & stormwater renewals on the basis of a more rigorous methodology, which did not include consideration of wastewater overflows or capacity. It is unclear as to whether the report's recommendations have yet been acted upon.

In addition to the planed renewal programme and In order to achieve the **medium** level of improvement in terms of wastewater overflows it is recommended that renewals are also provided such that those 19 areas of the networks highlighted as suffering from repeat blockages and / or capacity constraints from the causal analysis are carried out to increase capacity and therefore to reduce overflows. Further work is required to determine the precise locations and dimensions for these renewals (which are likely to be larger than current asset sizes) , but on the basis that each of the 19 sites requires 200 metres of new pipeline at $1,000 per metre a total of $3.8m should be budgeted.

In addition to this and In order to achieve the **high** level of improvement in terms of wastewater overflows it is recommended that a similar quantum of renewal works (as for the medium level of improvement ) are identified for assets which are under capacity but not giving rise to overflow presently. Further work is required to determine the precise locations and dimensions for these renewals (which are likely to be larger than current asset sizes), but on the basis of a similar quantum of work a further $3.8m should be budgeted.

It should be noted that no detail work has been carried out to determine required pipe diameters and no detailed consideration of site specific conditions have made in determining unit costs.

Because more proactive CCTV and jetting will be carried out if either level of improvement is carried out it is likely that further leaky pipes will be identified. In light of this an allowance for replacing these pipes has been made by increasing the current renewal budget by an estimated 15% for the **medium** level of improvement and by 30% for the **high** level of improvement. This will result an increase in the planed 10 year renewal programme of $1.47M for the **medium** level intervention and $2.94M for the **high** level of intervention.

### 3.2.8 Inflow and Infiltration control programme

Reducing the amount of rain related flow entering the wastewater network can reduce the number of wastewater overflows occurring.

The inflow and infiltration programme for the current year (16/17) is committed to Raglan with flow gauging and modelling being carried out. This work will inform both the optimisation of pumping station storage requirements and prioritisation of renewals. Smoke testing to determine the nature and extent of poorly made connections to the wastewater network will be carried out in summer 16/17. This current LTP spend budget is for a similar spend of $700k per year for the full ten year period. This is believed to be predicated on the basis of completing inflow and infiltration control in Huntly and Ngaruawahia in the following years.

In order to achieve the **medium** level of improvement in terms of wastewater overflows it is recommended that a rolling programme of inflow and infiltration control be carried out in two townships each year be budgeted at $1.4M per annum

In order to achieve the **High** level of improvement in terms of wastewater overflows it is recommended that a rolling programme of inflow and infiltration control be carried out in three townships each year be budgeted at $2.1M per annum.

### 3.2.9 Pump Station Storage

Councils' adopted Engineering Infrastructure Technical Specifications (RITS) states that new pumping stations must be constructed with emergency storage of 6 hours average dry weather flow. This storage essentially allows for pump station or power failure and a reasonable response time to react. It is acknowledged that this storage level is a balance between risk mitigation and cost and may or may not be appropriate for all pump stations.

An additional benefit of having storage available is that it can be used to buffer flows in wet weather. Many of the current pumping stations do not have emergency storage.

The current approved LTP works programme states that emergency storage (6 hours dry weather flow) will be provided at two pumping stations in the current year as part of the $3.3m allocation in the LTP.

The current LTP spend profile for the installation of pumping station storage is as follows

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|
| $000's | 79 | 263 | 473 | 263 | 473 | 263 | 473 | 263 | 473 | 263 |

Many of the wastewater overflows occur at pumping stations either in wet or dry weather. Continuing with this plan will improve level of service provided. This improvement will be offset by increased flow in growth areas.

There are a series of high level options which have be examined to provide 6, 12 & 24 hours of emergency storage for each of the high, moderate and low risk pumping stations.

In order to achieve the **Medium** level of improvement in terms of wastewater overflows it is recommended that 12 hour storage is installed (where possible) at high consequence stations and 6 hours storage at the moderate and low consequence sites (where possible) and council should budget $14.5M for this.

In order to achieve the **High** level of improvement in terms of wastewater overflows it is recommended that 12 hour storage is installed (where possible) at high consequence stations and 6 hours storage at the moderate and low consequence sites (where possible) and council should budget $18.7M for this.

As this is a high level exercise, the dimensions calculated are on the basis of desk top calculations and that unit costs to determine budgets have been determined as follows.

| Range of Storage Tank Sizes | Cost per $M^3$ ($) |
|---|---|
| 0-10 m3 | 10,000 |
| 11-50 m3 | 7,000 |
| 50m3 + | 5,000 |

Furthermore these unit costs have not been validated against the history of unit costs for recently installed emergency pumping stations in the district.

It is known that some of the pumping stations have emergency storage already installed (although dimensions are yet to be confirmed). This analysis assumes that no storage is available at any of the sites and is therefore conservative.

### 3.2.10 Power Failure

As stated above, one of the causes of overflows is that of failure of key equipment or power failure. One way of mitigating the effects of network power failure is the provision of either mobile or permanently located standby generators.

As part of the early works, 2 generators have been provided for use in Raglan. Plugs have been fitted to all high and medium risk pumping stations to permit direct connection to these generators.

It is recommended that to achieve the **medium** level of improvement, additional generators are purchased and are available for pumping stations in Huntly and Ngaruawahia. The additional budget for providing these two generators is a total of $80,000, based on the cost for providing an additional generator for Raglan, which was implemented during the early works described earlier in this report, and allowing for the higher power requirements for pumping stations in Huntly & Ngaruawahia.

It is recommended that to achieve the **high** level of improvement, that in addition to the generators for Huntly and Ngaruawahia, a further 4 mobile generators are provided for the remainder of the district. The additional budget to be allowed for providing these generators is $150,000, again based on the cost for providing an additional generator for Raglan.

### 3.2.11 SCADA / Telemetry

The reliability of the SCADA / Telemetry system is important to understand when an overflow is about to occur or has occurred at pumping stations. Control functionality and the reliability of it can permit remote control of pumping stations to avoid overflows remotely.

A review of the current Scada / telemetry system has been carried out and the current SCADA system employed by the council can be described in three layers:

- Layer 1 is the high end architecture of SCADA and includes the SCADA servers, HMI, data historians and user interfaces. Layer 1 is generally of a high standard and the approach the council and its contractors have taken in implementing this layer is consistent with industry best practices.

- Layer 2 can be characterised as the WAN communications layer. The use of a 3rd party supplied network (Spark) to provide this is generally consistent with industry best practices but it is noted that the service provision does not appear to be provided under a defined Service Level Agreement and restoration of services is under a “best efforts” basis. This is not consistent with industry best practices and represents a risk to the council’s SCADA operations. No built in redundancy in the form of specific regional level communications links exists in this layer 2, except for the recently installed SMS units installed as part of the early intervention works.

- Layer 3 is the remote end of SCADA consisting of the field instrumentation, last mile communications links and RTU’s. This is implemented as a series of ad-hoc solutions with multiple components from varying manufacturers. This layer appears to have developed organically and lacks commonality and governance leading to reduced reliability, limited planning and poor maintainability.

The design and implementation of the higher levels of the SCADA network are generally appropriate and fit for purpose and no major recommendations are made regarding these layers. This infrastructure is well designed and fit for purpose for both the current standard of SCADA and also to support the ongoing drive to improve SCADA. The notable exception being the service levels around communications (arguably the most important component of SCADA) for the managed WAN / VPN service from Spark.

The implementation of the field elements of SCADA needs significant improvements if this component is to support the council’s ongoing desire to eliminate wastewater overflows. Recommendations to address these issues at the remote end of SCADA are as follows;

| Layer | Current Projects | Moving to Medium Performance | Moving to High Performance |
|---|---|---|---|
| 0 – Control philosophy | • No modification to the sites fundamental operation.<br>• Add generator connection points to all switchboards.<br>• Add back-up SMS alarming system for critical alarms. | • Implement WWPS 2.0 Standard<br>• Add additional level sensors to critical sites.<br>• Install relays on high and low level floats to run the pumps during RTU failures. | • Review all pump stations in the district.<br>• Develop a complete new control philosophy which takes into account the hydrologic network design and storage. |

| Layer | Current Projects | Moving to Medium Performance | Moving to High Performance |
|---|---|---|---|
| | | | • Create a disaster recovery plan.<br>• Add inter-station control to block stations to maximise system storage. |
| 1 – SCADA software | • Continuous improvements as issues are identified.<br>• Add a back-up alarming system to increase redundancy. | • Reverse engineer missing source code | • Software Registry for all functional blocks and configurations |
| 2 – Backbone network | • No change | • Install communications routers at selected WWPS sites | • Install microwave links between Ngaruawahia and all base stations.<br>• Negotiate new Service Level Agreements with Spark |
| 3 – Radio network | • Undertake a radio survey / Audit to check radio frequencies are correct and broadcasting with the limits of their licences. | • Replace Radio network<br>• Review and possibly replace all site antennas to ensure they have the best chance of successful communication with the repeater.<br>• Implement 4G VPN connections for selected high risk WWPS sites | • Update all existing 1200bps analogue radios with new Ethernet based radios (same as HCC).<br>• Where 4G coverage available install to allow independent communication with critical sites during WAN failure. |
| 4 – Control hardware & code within RTU's | • Replace old broken RTU's with newer models.<br>• Where available install standard pump station code. | • Replace all old Datran units with new units.<br>• Implement standard code at each site. | • Update all existing Datran units to a more advanced and more widely supported RTU.<br>• Implement standard code in each site.<br>• Implement onsite storage or store forward ability for data.<br>• Add onsite SMS alarming or allowance for alternative communication paths (4G). |
| 5 – Equipment and wiring within switchboards | • Fix problems as they are discovered. | • Undertake a detailed review of all the sites to discover any wiring faults.<br>• Replace, repair, standardise equipment wherever possible.<br>• Audit battery backup capacity and age – program of upgrades / replacements | • Undertake a detailed review of all the sites.<br>• Replace all old battery chargers and batteries with modem No-break type units.<br>• Standardise all equipment and instrumentation onsite allowing the correct implementation of standard code. |
| 6 – Operator procedures | • See policies and procedures. | • See policies and procedures. | • See policies and procedures. |
| 7 – Documentation | • Maintenance contractor to verify current drawing status as part of maintenance contract. | • Commission a third party for the verification or creation of complete as-built drawings for each site. | • Create FD's and P&IDs for each site.<br>• Implement a document management structure within the councils ECM system. |
| 8 – Scada Management | | • Appoint SCADA manager<br>• Develop change management policy / design approval processes | • Implement Governance structure<br>• Implement Data standards<br>• Apply policy of retrofitting new RTUs<br>• Functional Need Documents |

Districtwide, the budget to be allowed to move to a medium performance is approximately $ 8.8m over a ten year period and the budget to be allowed to the high performance is $ 13.2m. These costs include Capital and

Operational Expenditure and in the case of the SCADA / Telemetry upgrade a significant proportion, especially for the high level of intervention is the operating component. The operating component for the medium level intervention is $2.4M and for the High level intervention is $5.2M.

As with all other budget estimates these are high level estimates and will be subject to verification during feasibility, concept and detailed design.

### 3.2.12 Additional Option Considered

An additional, alternative option would be to install a leak proof new network, similar to the low pressure system which is installed on the Whaanga coast scheme with pumping stations at individual properties.

On the basis of the history of costs for these pumping stations at approximately $30,000 per property, the cost for Raglan with approximately 1,800 properties, to implement this solution council would need to budget in the order of $54M. Such a system could be installed in only the higher risk catchments and a breakdown of budgets is provided for each of the 18 pumping station catchments in Raglan below.

| Pump Station | Properties | Cost ($) |
|---|---|---|
| Camping Ground PS | 2 | 60,000 |
| Daisy Street PS | 41 | 1,230,000 |
| East St PS | 66 | 1,980,000 |
| Greenslade Rd PS | 5 | 150,000 |
| Hideaway PS | 67 | 2,010,000 |
| Kaitoke St PS | 35 | 1,050,000 |
| LorenzenBay PS | 263 | 7,890,000 |
| Marae PS | 26 | 780,000 |
| Marine Parade PS | 79 | 2,370,000 |
| Nero St PS | 221 | 6,630,000 |
| Nihinihi Avenue PS | 91 | 2,730,000 |
| Riria Kereopa Memorial Dr PS | 28 | 840,000 |
| Robertson St PS | 54 | 1,620,000 |
| Smith Street PS | 76 | 2,280,000 |
| Tutchen Avenue PS | 66 | 1,980,000 |
| Wainui Rd PS | 27 | 810,000 |
| Wallis street PS | 644 | 19,320,000 |
| Whitley Street PS | 22 | 660,000 |
| **Totals** | **1813** | **54,390,000** |

### 3.2.13 Additional work required

There is extra work that is required to confirm both the performance that will accrue from some of these interventions and the cost estimates stated in this report. It is essential that this work is carried out prior to their implementation

This is best carried out on a township by township basis and will consolidate all work streams underway for the following interventions

- Network Maintenance
- Renewals
- Inflow and Infiltration
- Pumping Storage

It is recommended that the following wastewater overflow improvement plans are developed which will provide this information

- Huntly wastewater overflow improvement plan
- Ngaruawahia wastewater overflow improvement plan
- Raglan wastewater overflow improvement plan
- Remaining District wastewater overflow improvement plan

These should be developed to refine the budgets, costs and effectiveness of the chosen level of intervention.

In addition to this further work is required to confirm the feasibility design of the upgrade of the SCADA / Telemetry system and to confirm levels of staffing / equipment, which are district wide issues.

It is expected that these work streams will define preferred methods of procurement of these services.

Council should allow a high level budget for these investigations is in the vicinity of $500,000.

# 4. Summary of Options

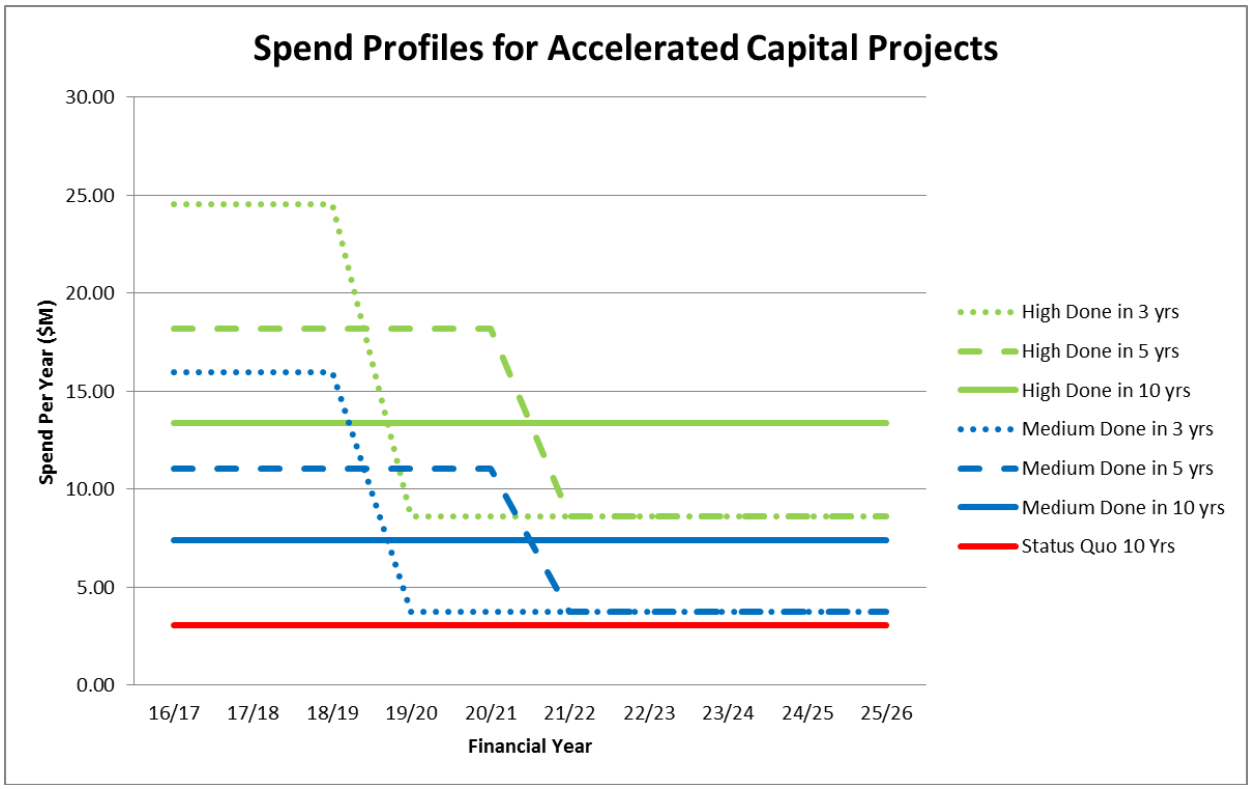
A summary of the medium and high level interventions and associated high level budgets are provided below. In each case they assume implementation over a ten year period and the totals given are on that basis. As the budgets indicated include both Capital and Operating expenditure elements, this will need to be considered in potential acceleration of the Capital elements.

It is noted that to improve the current level of performance beyond the medium level of performance to the high level of performance, the law of diminishing returns will apply. For that reason it is prudent to consider an interim goal of seeking the medium level of performance.

| | **Status Quo** | | **Median Performance** | | **High Performance** | |
|---|---|---|---|---|---|---|
| | **Target Number of Overflows / 1000 connections** | **4.3** | **Target Number of Overflows / 1000 Connections** | **1** | **Target Number of Overflows / 1000 Connections** | **0.25** |
| **Intervention** | **Description** | **Budget (10 year) $M** | **Description** | **Budget (10 year) $M** | **Description** | **Budget (10 year) $M** |
| Network Maintenance | Maintain Current Level of Jetting / CCTV Condition assessment | 1 | Maintain Current Level of Jetting / CCTV Condition assessment (OPEX) | 1 | Maintain Current Level of Jetting / CCTV Condition assessment (OPEX) | 1 |
| | | | Jetting / CCTV Condition assessment @ 19 problematic sites yearly (OPEX) | 3.4 | Jetting / CCTV Condition assessment @ 19 problematic sites yearly (OPEX) | 3.4 |
| | | | | | Jet/CCTV entire network yearly (OPEX) | 39 |
| Service Delivery | Maintain current level and function | 8.6 | Increase level to industry standard and split function of teams to be SW/WW & Water (OPEX) | 13.4 | Increase level to industry standard and split function of teams to be SW/WW & Water (OPEX) | 13.4 |
| | | | Additional Equipment ( CAPEX) | 0.7 | Additional Equipment ( CAPEX) | 0.7 |
| | | | Running Costs for additional equipment (OPEX) | 1.94 | Running Costs for additional equipment (OPEX) | 1.94 |
| Renewals | Renewal of pipelines on condition /age basis | 9.8 | Renewal of pipelines on condition /age basis (CAPEX) | 9.8 | Renewal of pipelines on condition /age basis (CAPEX) | 9.8 |
| | | | Renewal of pipelines to improve capacity in areas which have been susceptible to overflows ( CAPEX) | 3.8 | Renewal of pipelines to improve capacity in areas which have been susceptible to overflows (CAPEX) | 3.8 |
| | | | | | Renewal of pipelines which are near to capacity (determined by modelling ) (CAPEX) | 3.8 |
| | | | Renewal of pipelines which through CCTV are shown to be leaky (CAPEX) | 1.47 | Renewal of pipelines which through CCTV are shown to be leaky (CAPEX) | 2.94 |
| Inflow and Infiltration Control | Maintain Current level of Inflow / Infiltration Control ( One Township/yr) | 7 | Higher level of Inflow / Infiltration Control ( 2 Townships/yr) (OPEX) | 14 | Highest level of Inflow / Infiltration Control ( 3 Townships/yr) (OPEX) | 21 |
| Pumping Station Storage | Installation of 6 Hours at 2 stations / year | 3.3 | Installation of 12hr storage at high risk stations (CAPEX) | 4.9 | Installation of 24hr storage at high risk stations (CAPEX) | 9.1 |
| | | | Installation of 6hr storage at medium risk stations (CAPEX) | 6.7 | Installation of 6hr storage at medium risk stations (CAPEX) | 6.7 |
| | | | Installation of 6 hr storage at low risk stations (CAPEX) | 2.9 | Installation of 6 hr storage at high risk stations (CAPEX) | 2.9 |
| Power Failure | Provide 2 Standby Generators in Raglan | 0.07 | Provide 2 Standby Generators in Raglan (CAPEX) | 0.07 | Provide 2 Standby Generators in Raglan (CAPEX) | 0.07 |
| | | | Provide 1 Stand By Generator in both Huntly and Ngaruawahia (CAPEX) | 0.08 | Provide 1 Stand By Generator in both Huntly and Ngaruawahia (CAPEX) | 0.08 |
| | | | | | Provide 4 additional generators around the remainder of the District (CAPEX) | 0.15 |
| SCADA / Telemetry | Maintain Current Level of Resilience / Reliability | 1 | Level 1 Improvement (CAPEX) | 6.4 | Level 2 Improvement (CAPEX | 8 |
| | | | Level 1 Improvement (OPEX) | 2.4 | Level 2 Improvement (OPEX) | 5.2 |
| Public Education Process | Prepare Education process | 0.015 | Implement Education Process (OPEX) | 0.5 | Implement Education Process (OPEX) | 0.5 |
| Addition Investigations / master plans | | | Studies to confirm performance and costs of Medium Intervention methods (CAPEX) | 0.5 | Studies to confirm performance and costs of High Intervention methods (CAPEX) | 0.5 |
| **Totals** | | **30.8** | | **74** | | **134.0** |

# 5. Acceleration of Capital Intervention Methods

As is noted in the previous section, some of the methods of intervention are operating expenditure costs and need to be continued each year to attempt to achieve the level of improvement desired. Some of the intervention methods however are capital expenditure intervention methods which are 'one off' costs. The assumption made in this plan is these intervention methods are completed gradually over a ten year period on a prioritised basis. Should there be a desire to accelerate either the medium or high level capital expenditure intervention to be delivered over a 3 or a 5 year period the graph below indicates the spend required. The spend profiles below include both capital and operating expenditure.



# 6. Continual Improvement Programme

Some of the intervention methods which are described in this report are conditional on further work being carried out to address uncertainties in terms of outcome and costs, but some are not and they can be implemented immediately.

To maintain progress the following actions are recommended.

| Action | Budget | Programme |
|---|---|---|
| Studies to confirm performance and budget costs of medium intervention (wastewater overflow improvement plans) | $500,000 (capital) | Nov 16 – June 17 |
| Improve service delivery level industry standard and split function of teams to be SW/WW & Water | $674,000 per annum ( Operating)<br>$700,000 (Equipment) (Capital) | Nov 16 Onwards |
| Provide 4 additional standby generators for district (locations to be determined) | $150,000 (Capital) | Nov 16 |
| Implement SCADA / Telemetry Upgrade for Raglan Only | $1.6M ( Capital)<br>$60,000 per annum (operating) | Nov 16 – June 17 & then onwards |
| Implement Public Education Process | $50,000 per annum (operating) | Dec 16 Onwards |
| Jetting and CCTV Investigations for entire network (district wide) to inform renewals programme | $3.9M (operating) | Dec 16 – Dec 17 |

It is recommended that on completion of the wastewater overflow improvement plans in June 2017 that this report be updated to reflect the outcomes of that work and to give an update on the effectiveness of these interventions.

# 7. Conclusions and Recommendations

## 7.1 Conclusions

The following can be concluded from this work.

- A description of the cause and effects of wastewater overflows in the district has been provided.
- The early intervention works are underway and largely complete and are already showing benefits.
- Two suites of high level options for intervention have been developed to move to a higher level of wastewater overflow performance employing both proactive and reactive means using a series of technique types. The **medium** level of intervention seeks to improve the performance to be on par with the median of provincial district councils in the country, whilst the **high** level of intervention seeks to achieve a performance in line with the highest performing peer organisations.
- The total budget to be allowed over a ten year period for implementing the suite of medium level interventions is approximately $74M, whilst to implement the suite of high level interventions, the cost is approximately $134M. These budget costs include the work that is essential to refine these estimates.
- Different spend profiles for the capital expenditure elements of this work to be implemented over 3 and 5 year periods have been provided.
- Some of the intervention methods which are described in this report are conditional on further work being carried out to address uncertainties in terms of outcome and budget costs, but some are not; these address some high risk issues and they can be implemented immediately.

## 7.2 Recommendations

It is recommended that

- Council consider what level of intervention they wish to adopt and over what period of time. It is noted that to improve the current level of performance beyond the medium level of performance to the high level of performance, the law of diminishing returns will apply. For that reason it is prudent to consider an interim goal of seeking the medium level of performance.
- Some of the intervention methods which are described in this report are conditional on further work being carried out to address uncertainties in terms of outcome and budget costs, but some are not; these address some high consequence issues and should be implemented immediately.
- It is essential that detailed investigations are commenced immediately to address uncertainties in terms of outcome, budget costs and to confirm the details of the interventions including required dimensions.

# Appendix A. Causal Analysis Maps

# Appendix B. Location of High, Moderate and Low Consequence Pumping Stations

| WDC Asset Name | Township | Consequence Category |
|---|---|---|
| Wallis Street Pump Station | Raglan | 5 |
| Russell Road Pump Station | Huntly | 5 |
| Lorenzen Bay Pump Station | Raglan | 5 |
| Hartis Avenue Pump Station | Huntly | 5 |
| Nero Street Pump Station | Raglan | 5 |
| Thomas Street Pump Station | Ngaruawahia | 5 |
| Marae Pump Station | Raglan | 5 |
| Blunt Road Pump Station | Te Kauwhata | 5 |
| Nihinihi Avenue Pump Station | Raglan | 5 |
| Smith Street Pump Station | Raglan | 5 |
| East Street Pump Station | Raglan | 5 |
| Marine Parade Pump Station | Raglan | 5 |
| Great South Road Pump Station | Taupiri | 5 |
| Greenslade Road Pump Station | Raglan | 5 |
| Daisy Street Pump Station | Raglan | 5 |
| Whitley Street Pump Station | Raglan | 5 |
| Wainui Road Pump Station | Raglan | 5 |
| Bridge Street Pump Station | Huntly | 4 |
| Waipa Esplanade Pump Station | Ngaruawahia | 4 |
| Regent Street Pump Station | Ngaruawahia | 4 |
| Baker Street Pump Station | Huntly | 4 |
| East Mine Road Pump Station | Huntly | 4 |
| Ngaere Street Pump Station | Ngaruawahia | 4 |

| WDC Asset Name | Township | Consequence Category |
|---|---|---|
| Ashwell Crescent Pump Station | Taupiri | 4 |
| Fairfield Avenue Pump Station | Huntly | 4 |
| Te Putu Street Pump Station | Taupiri | 4 |
| Couch Street Pump Station | Ngaruawahia | 4 |
| Tutchen Avenue Pump Station | Raglan | 4 |
| Horotiu Road Pump Station | Horotiu | 4 |
| Reserve Pump Station (Hopuhopu) | Hopuhopu | 4 |
| Robertson Street Pump Station | Raglan | 4 |
| Kaitoke Street Pump Station | Raglan | 4 |
| Duke Street 2 (Herangi) Pump Station | Ngaruawahia | 4 |
| Ready Mix Pump Station | Huntly | 4 |
| Hideaway Pump Station | Raglan | 4 |
| Lignite Street Pump Station | Huntly | 3 |
| Springhill No.2 Pump Station | Te Kauwhata | 3 |
| Tainui Bridge Pump Station | Huntly | 3 |
| Helenslee Road Pump Station (PSC) | Pokeno | 3 |
| Tuakau Interceptor Pump Station | Tuakau | 3 |
| Duke Street Pump Station | Ngaruawahia | 3 |
| Meremere Lane Pump Station | Meremere | 3 |
| Waingaro Road Pump Station | Ngaruawahia | 3 |
| Washer Road Pump Station | Horotiu | 3 |
| Hitchen Road Pump Station (PSB) | Pokeno | 3 |
| Bob Byrne Park Pump Station | Taupiri | 3 |
| King Street Pump Station | Ngaruawahia | 3 |
| Wright Street Pump Station | Taupiri | 3 |

| WDC Asset Name | Township | Consequence Category |
|---|---|---|
| Main Street Pump Station | Huntly | 3 |
| Jackson Street Pump Station | Ngaruawahia | 3 |
| Eccles Avenue Pump Station | Te Kauwhata | 3 |
| Porritt Avenue Pump Station | Huntly | 3 |
| Travers Road Pump Station | Te Kauwhata | 3 |

**Location -** 56 Harrisville Road
**Frequency of overflows -** 2
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** No

**Location -** 37 Dominion Road
**Frequency of overflows -** 2
**Cause -** Blockage
**Rain on day > 1mm -** No

**Location -** 11 Martindale Lane
**Frequency of overflows -** 2
**Cause -** Blockage
**Rain on day > 1mm -** No

**Location -** 52 Harrisville Road
**Frequency of overflows -** 3
**Cause -** Fat Blockage - Resolved
**Rain on day > 1mm -** Yes

**Location -** 19 West Street
**Frequency of overflows -** 2
**Cause -** Repeat Blockage
**Rain on day > 1mm -** No

**Location -** 5 Park Avenue
**Frequency of overflows -** 4
**Cause -** Blockage / Tree Roots
**Rain on day > 1mm -** Yes

**Location -** 5C Dominion Road
**Frequency of overflows -** 3
**Cause -** Repeat Blockage
**Rain on day > 1mm -** No

**Location -** 8 St Stephens Avenue
**Frequency of overflows -** 2
**Cause -** Dump Station
**Rain on day > 1mm -** Yes

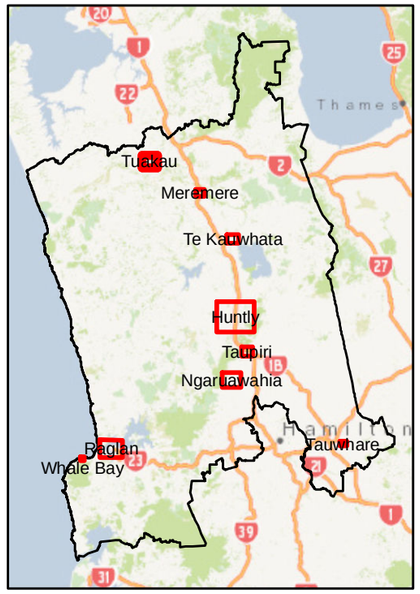
**Location -** 9 Geraghtys Road
**Frequency of overflows -** 2
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** No

**Location -** 21A Matipo Drive
**Frequency of overflows -** 2
**Cause -** Pump Station failure-Repaired
**Rain on day > 1mm -** No

0 80 160 320 480 640 800 Meters

## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Tuakau

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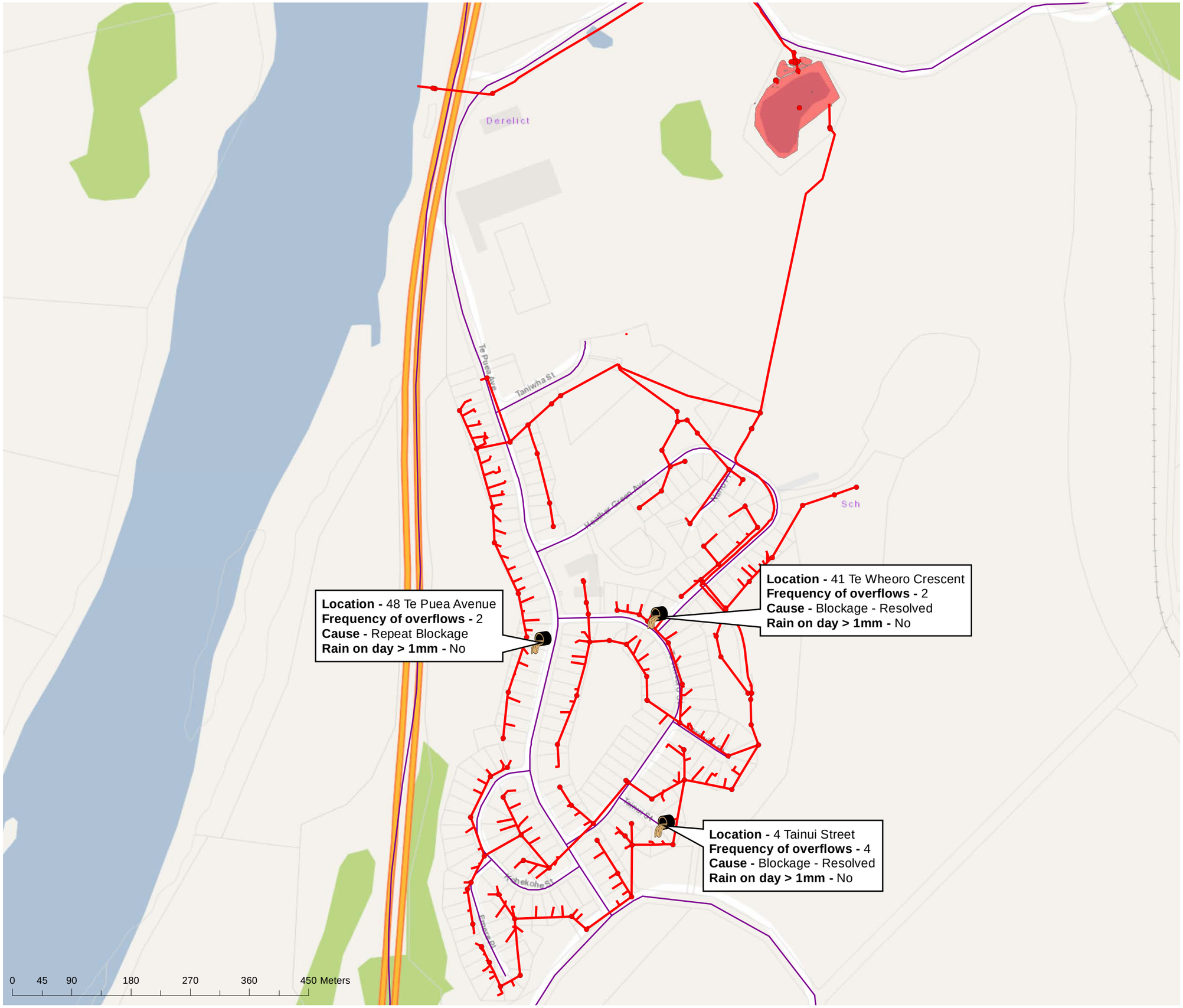
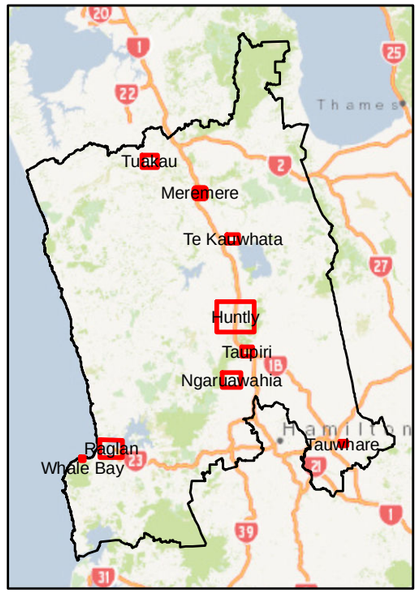



## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Meremere

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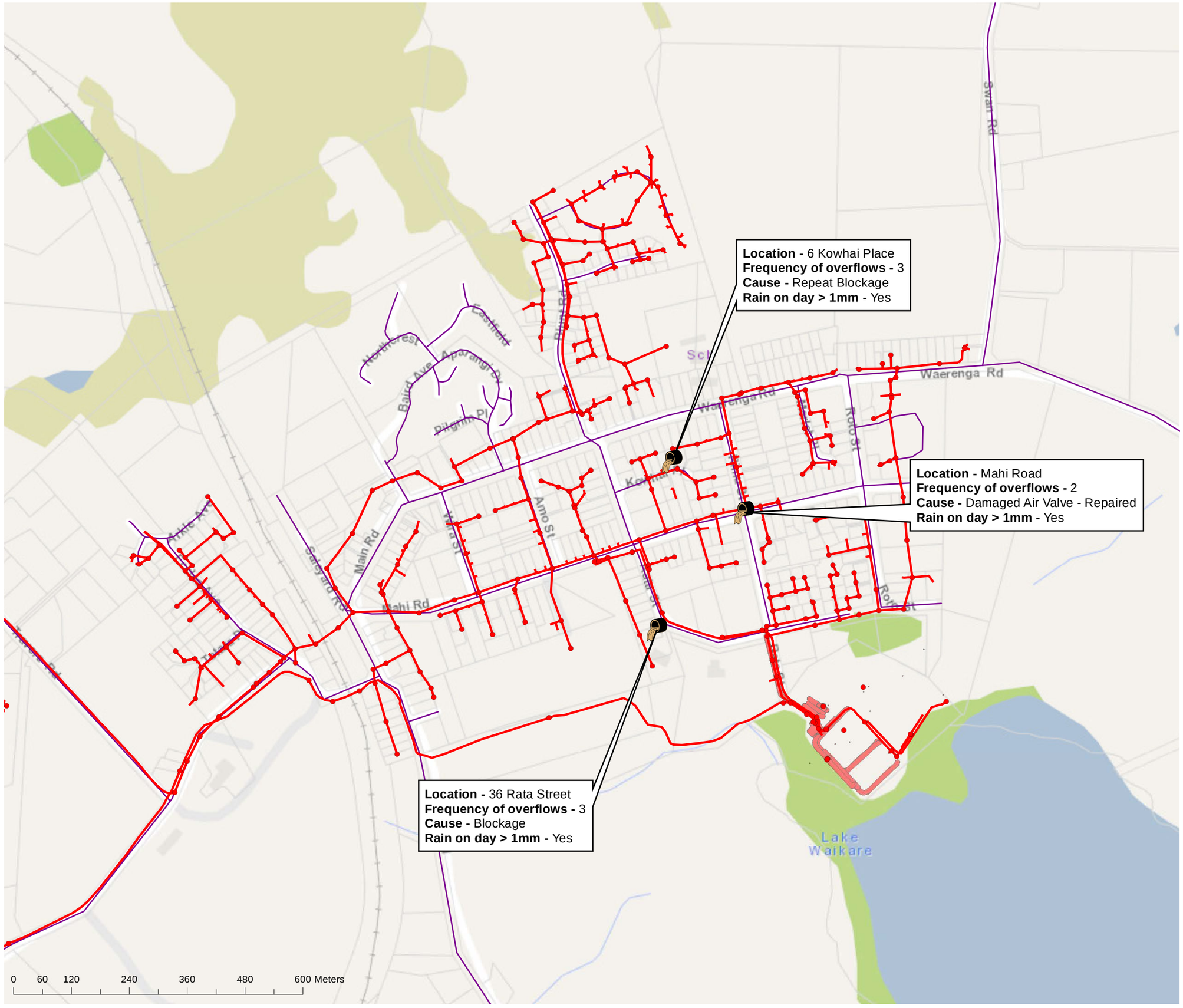
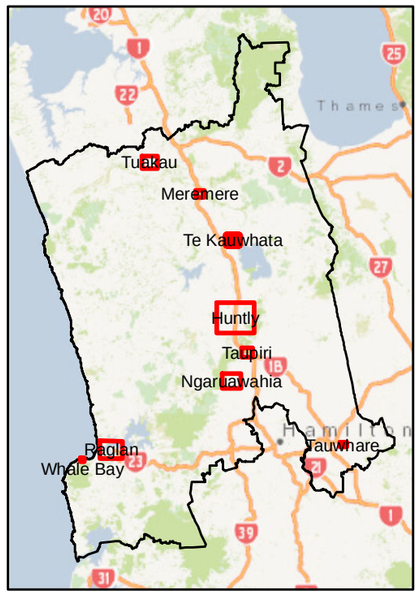



## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Te Kauwhata

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**Location -** 212 Te Ohaki Road
**Frequency of overflows -** 2
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** Yes

**Location -** East Mine Road
**Frequency of overflows -** 3
**Cause -** WWTP Pump Issue
**Rain on day > 1mm -** No

**Location -** 173 Te Ohaki Road
**Frequency of overflows -** 2
**Cause -** Private property issue
**Rain on day > 1mm -** No

**Location -** 82 Great South Road
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** 132 Kimihia Road
**Frequency of overflows -** 4
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** No

**Location -** Te Ohaki Road
**Frequency of overflows -** 3
**Cause -** Private property issue
**Rain on day > 1mm -** No

**Location -** 6 Berrymans Access Road
**Frequency of overflows -** 2
**Cause -** Private property issue
**Rain on day > 1mm -** No

**Location -** 132 Kimihia Road
**Frequency of overflows -** 3
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** 20 Main Street
**Frequency of overflows -** 3
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** McVie Road
**Frequency of overflows -** 2
**Cause -** WWTP Pump Issue
**Rain on day > 1mm -** No

**Location -** 32 Berrymans Access Road
**Frequency of overflows -** 3
**Cause -** Pump / Septic Tank - Resolved
**Rain on day > 1mm -** No

**Location -** 34 Taniwharau Street
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** 18 Lakeview Terrace
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location - Frequency of overflows -** 2
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** Yes

**Location -** 36 Lakeview Terrace
**Frequency of overflows -** 2
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** No

**Location -** 44 Onslow Street
**Frequency of overflows -** 2
**Cause -** Private property issue
**Rain on day > 1mm -** Yes

**Location -** 10 Starr Street
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** No

**Location -** 82 Paki Street
**Frequency of overflows -** 3
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** No

**Location -** 60A Riverview Road
**Frequency of overflows -** 2
**Cause -** Repeat Blockage
**Rain on day > 1mm -** Yes

**Location -** 9 Chisholm Street
**Frequency of overflows -** 3
**Cause -** Private property issue
**Rain on day > 1mm -** Yes

**Location -** 41 Harris Street
**Frequency of overflows -** 2
**Cause -** Blockage
**Rain on day > 1mm -** No

0 195 390 780 1,170 1,560 1,950 Meters

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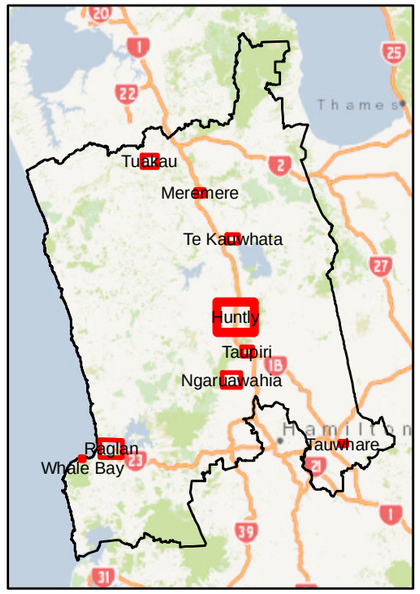
## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Huntly

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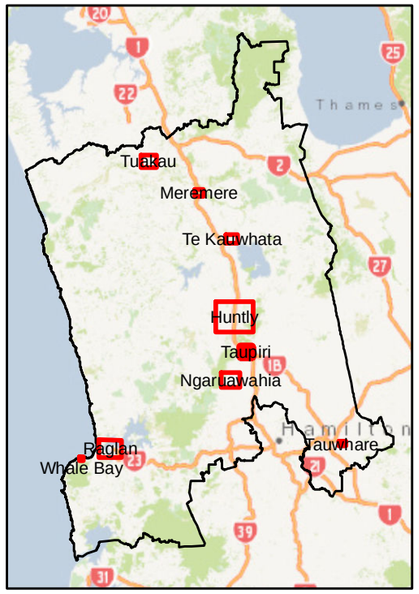


## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

N

# Waikato District Wasterwater Overflows Taupiri

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**Location -** 16 Hakarimata Road
**Frequency of overflows -** 4
**Cause -** Pump Station Capacity
**Rain on day > 1mm -** No

**Location -** 15 Brownlee Avenue
**Frequency of overflows -** 3
**Cause -** Blockage
**Rain on day > 1mm -** Yes

**Location -** 15 Brownlee Avenue
**Frequency of overflows -** 4
**Cause -** Blockage
**Rain on day > 1mm -** Yes

**Location -** 16 Hakarimata Road
**Frequency of overflows -** 3
**Cause -** Pump Station Capacity
**Rain on day > 1mm -** Yes

**Location -** 4 Galbraith Street
**Frequency of overflows -** 2
**Cause -** Blockage
**Rain on day > 1mm -** No

**Location -** 1 Ngaere Street
**Frequency of overflows -** 3
**Cause -** Pump Station Capacity
**Rain on day > 1mm -** No

**Location -** 12C Kent Street
**Frequency of overflows -** 4
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** No

**Location -** 14 Kent Street
**Frequency of overflows -** 2
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** No

**Location -** 1 River Road
**Frequency of overflows -** 3
**Cause -** Pump Station Operation
**Rain on day > 1mm -** Yes

**Location -** Lower Waikato Esplanade
**Frequency of overflows -** 5
**Cause -** Caravan Dump Station
**Rain on day > 1mm -** No

**Location -** 7A Havelock Road
**Frequency of overflows -** 3
**Cause -** Blockage - Resolved
**Rain on day > 1mm -** No

**Location -** 10 Pharo Place
**Frequency of overflows -** 4
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** 20 Croall Crescent
**Frequency of overflows -** 3
**Cause -** Pump Station Operation
**Rain on day > 1mm -** No

0 100 200 400 600 800 1,000 Meters

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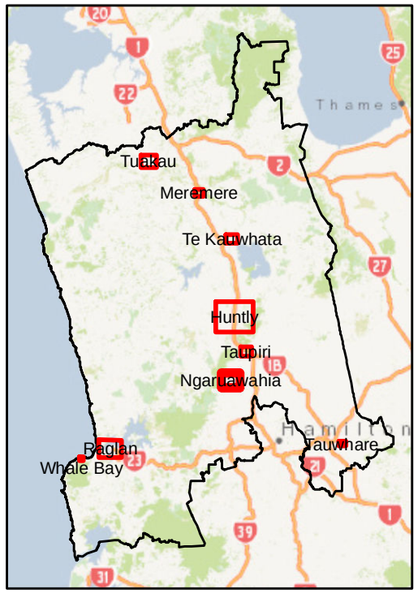
## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Ngaruawahia

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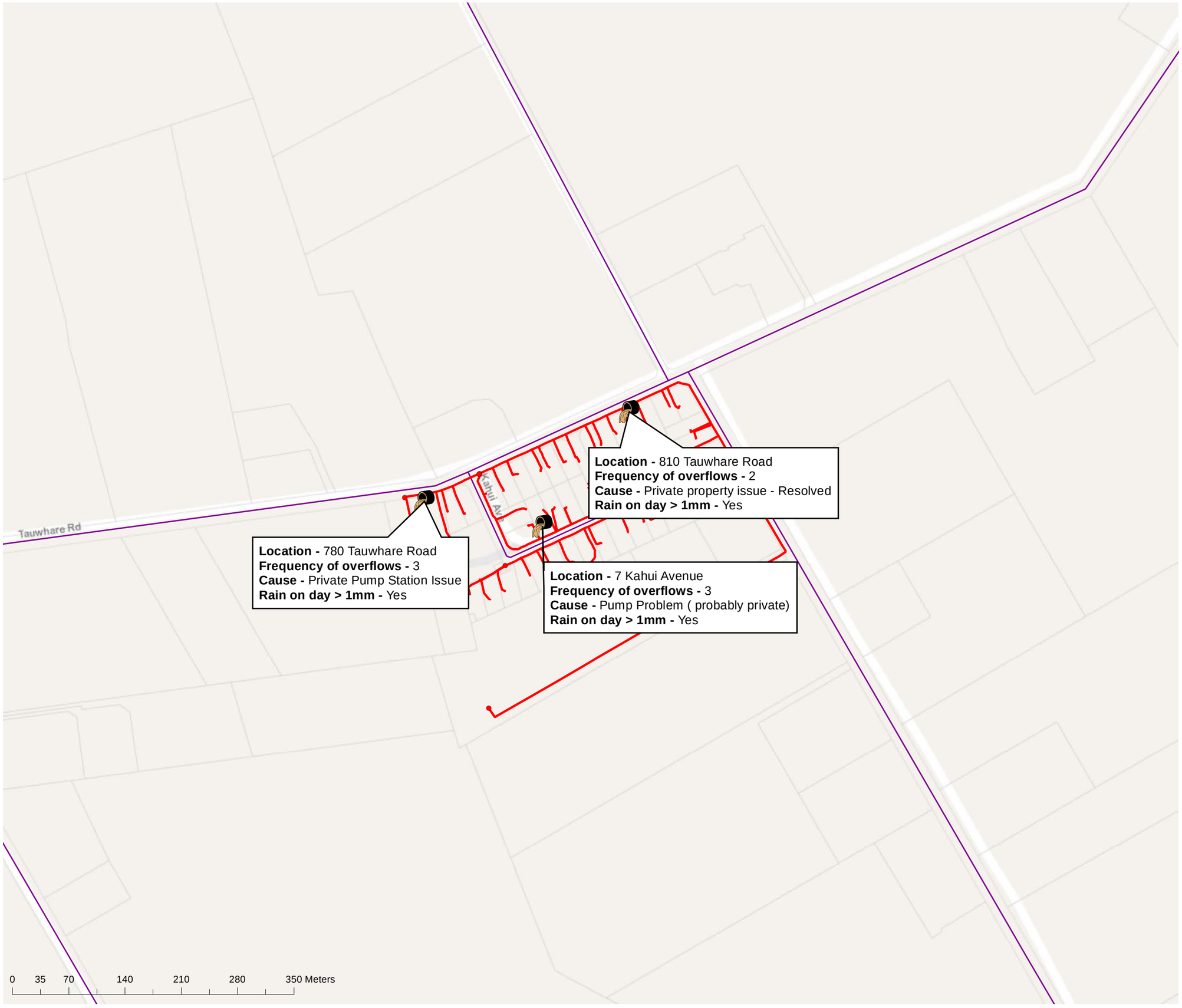
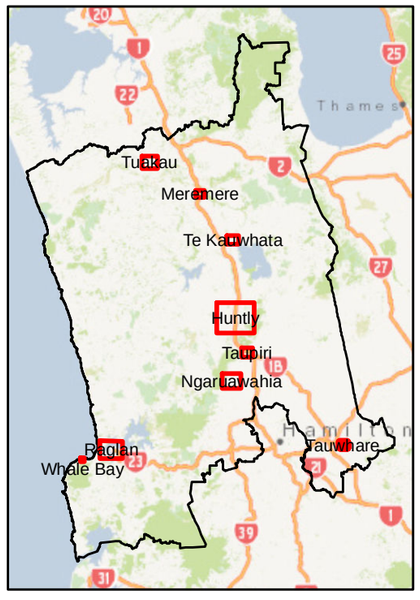



## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Tauwhare

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**Location -** 5 John Street
**Frequency of overflows -** 5
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** 11 Park Drive
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** No

**Location -** 45A Bay View Road
**Frequency of overflows -** 3
**Cause -** Leaking Pipe
**Rain on day > 1mm -** No

**Location -** 17 Cliff Street
**Frequency of overflows -** 3
**Cause -** Pump Station Capacity
**Rain on day > 1mm -** Yes

**Location -** 39 Bay View Road
**Frequency of overflows -** 3
**Cause -** Pump Station Capacity
**Rain on day > 1mm -** No

**Location -** 61 Marine Parade
**Frequency of overflows -** 6
**Cause -** Blockage ( Camping Ground)
**Rain on day > 1mm -** No

**Location -** Marine Parade
**Frequency of overflows -** 2
**Cause -** Blockage
**Rain on day > 1mm -** Yes

**Location -** 104C Greenslade Road
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

**Location -** 10 Pokohui Avenue
**Frequency of overflows -** 2
**Cause -** Capacity
**Rain on day > 1mm -** Yes

**Location -** 102B Greenslade Road
**Frequency of overflows -** 2
**Cause -** Blockage / Capacity
**Rain on day > 1mm -** Yes

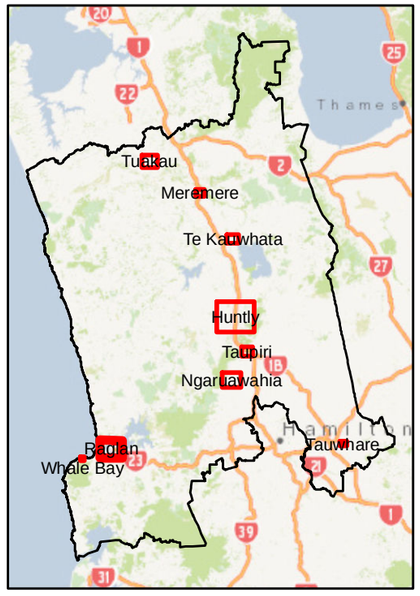
**Location -** 4 Gilmour Street
**Frequency of overflows -** 2
**Cause -** Groundwater
**Rain on day > 1mm -** Yes

**Location -** Wainui Road
**Frequency of overflows -** 2
**Cause -** Pump station commissioning
**Rain on day > 1mm -** Yes

0 115 230 460 690 920 1,150 Meters

## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Raglan

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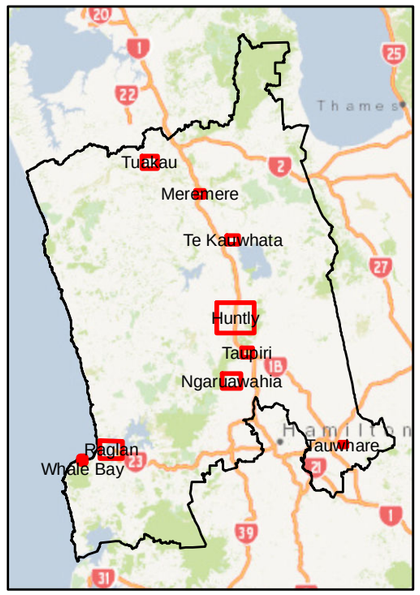
## Legend

- Overflow location
- WW point
- WW pump station
- WW pipe
- WW treatment plant

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# Waikato District Wasterwater Overflows Whale Bay

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