MORPHUM ENVIRONMENTAL LTD
Engineers & Consultants

Far North District Council

Kaitaia Wastewater Overflow Reduction Study

Presented by: Jan Heijs

Other Authors: Greer Lees and Dean Watts (Morphum Environmental Ltd), Tim Lockie (Hydraulic Analysis Ltd), Barry Somers (Far North District Council).

This presentation

Outline

- Background
- Innovation resulting in scope change
- Need for performance standard
- Use of Long Term Time Series
- Use of Cost Benefit approach
- Outcomes
- Conclusion

Background

- **High frequency of wet weather overflows**

- **Resulting in:**
  - Community concerns
  - Abatement notice by Regional Council
  - Community concerns about costs to fix

- **$13.7 million allowance in 2015-2025 LTP**
  - Based on initial estimate to improve to 1 in 1 year overflow frequency
  - Not a 100% commitment – conditional on further study


2 Northern Advocate

Sewerage system repair cost soars

Continued from p1

With no money set aside for the upgrade, it would have to be included in the council's 2015-25 Long Term Plan, Mr Somers said.

Infrastructure committee chairman John Vujcich said the new councillors only learned of

The Team

Barry Somers

Far North District Council

Dean Watts

Morphum

Greer Lees

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Jan Heijs

Morphum

Tim Lockie

Hydraulic Analyses Ltd

Proposed change in scope was accepted

Initial scope

- **Best solution to meet 1 yr ARI or better**
- **Use design storms**
  - 1yr, 2yr and 5 yr storm events

Changed scope

- **Use Long Term time series**
- **Consider more frequent events**
- **Cost-benefit approach to confirm containment standard**
- **Extensive cost optimisation**

Why is having a network performance standard critical?

- To enable assessment on individual events
- To assess actual network performance
- To provide transparency and objectivity
- To justify capital works and set priorities
- To assist in assessing consent application(s)
- To assess the ability to service growth
- To support a network discharge consent application

Using Long Term Time Series (LTS) is superior to the use of Design Storms

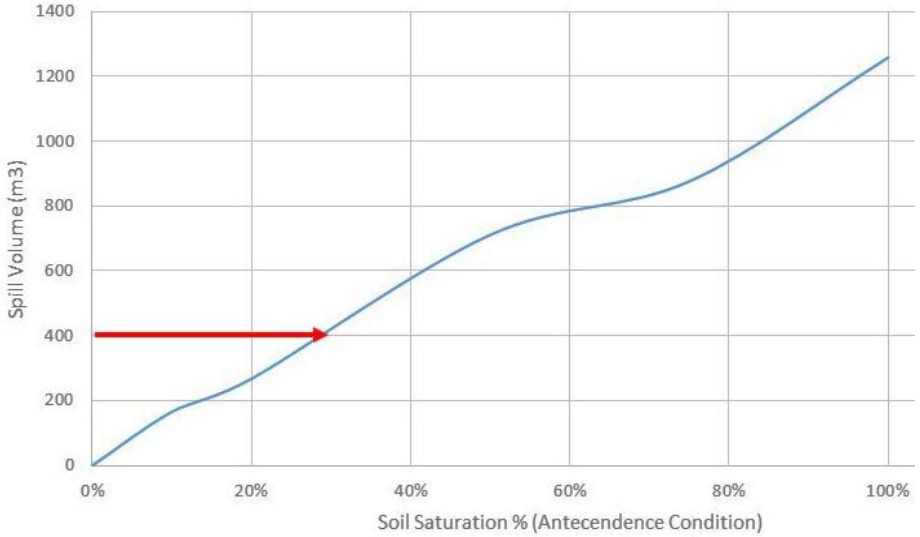
- Need to know what comes out - not what goes in
- LTS is more statistically robust
- Antecedent conditions vary in the real world
- Potential savings
- Because we can

More in the next slide

Using a Long Term Time Series (LTS) is providing a better refection of what is actually happing

Assumed soil saturation affects design storm results

- Example:
  - Use of the Kaitaia model
  - Same 1 year Design Storm
  - Range 0% - 100% soil saturation
  - Red arrow annual average from LTS run



Spill volume using design storm varies significant depending on assumed soil saturation level.

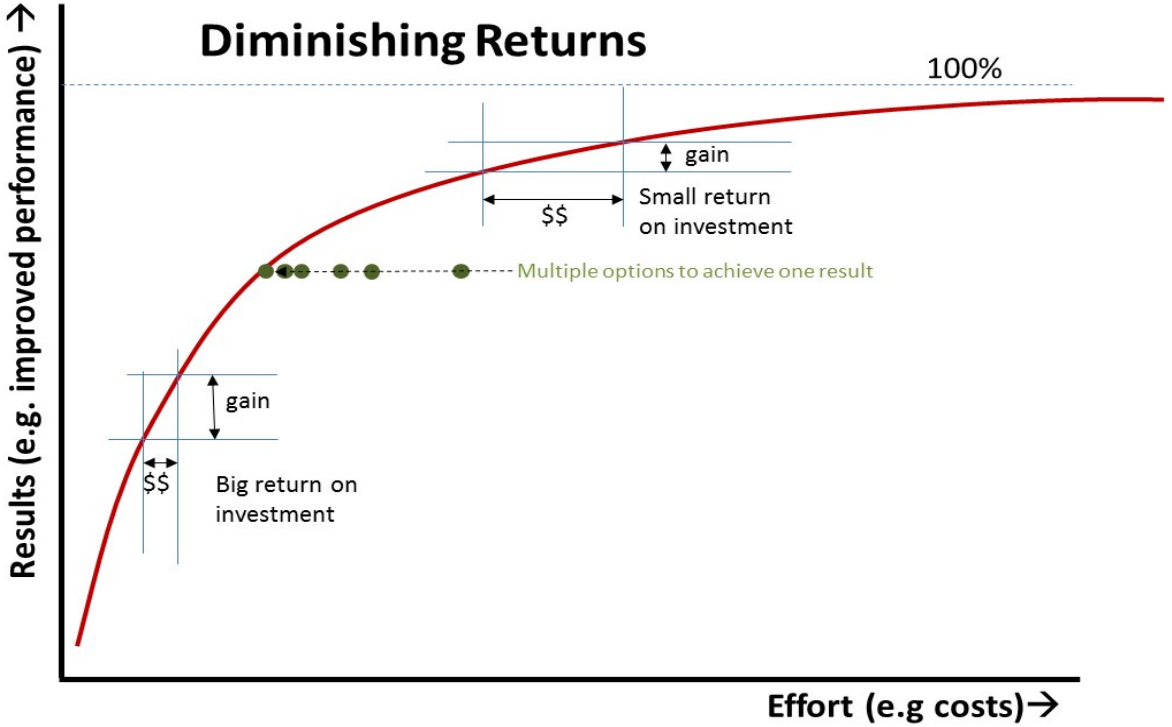
Making an informed decision on a (affordable) Level of Service

- **A cost benefit analyses will show the return on investment**

- **My observations**
  - Very few have gone though this process
  - Many dogmatically applied an industry standard??
  - Or have no (formal) standard at all
  - Many are in a reactive mode

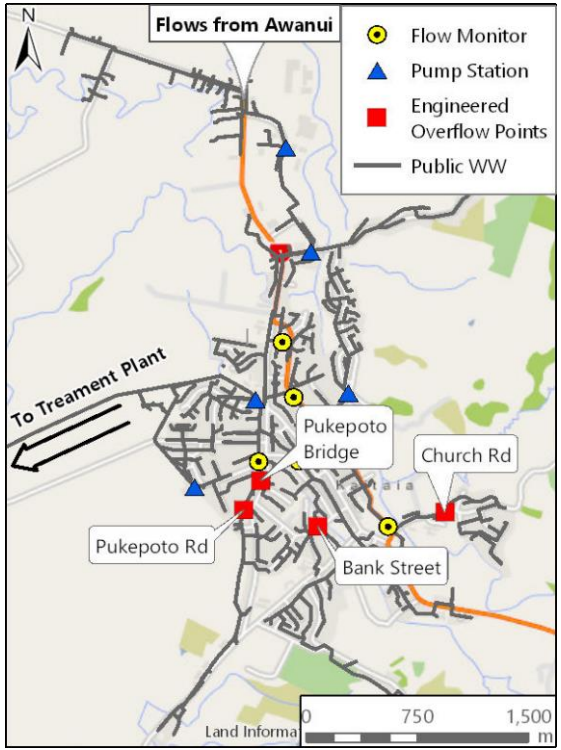
- **The cost-benefit analyses needs to be accompanied by a wider assessment**
  - eg MCA including risks, environmental benefits, etc

Cost-Benefit based on diminishing returns



The union of engineering design and nature.

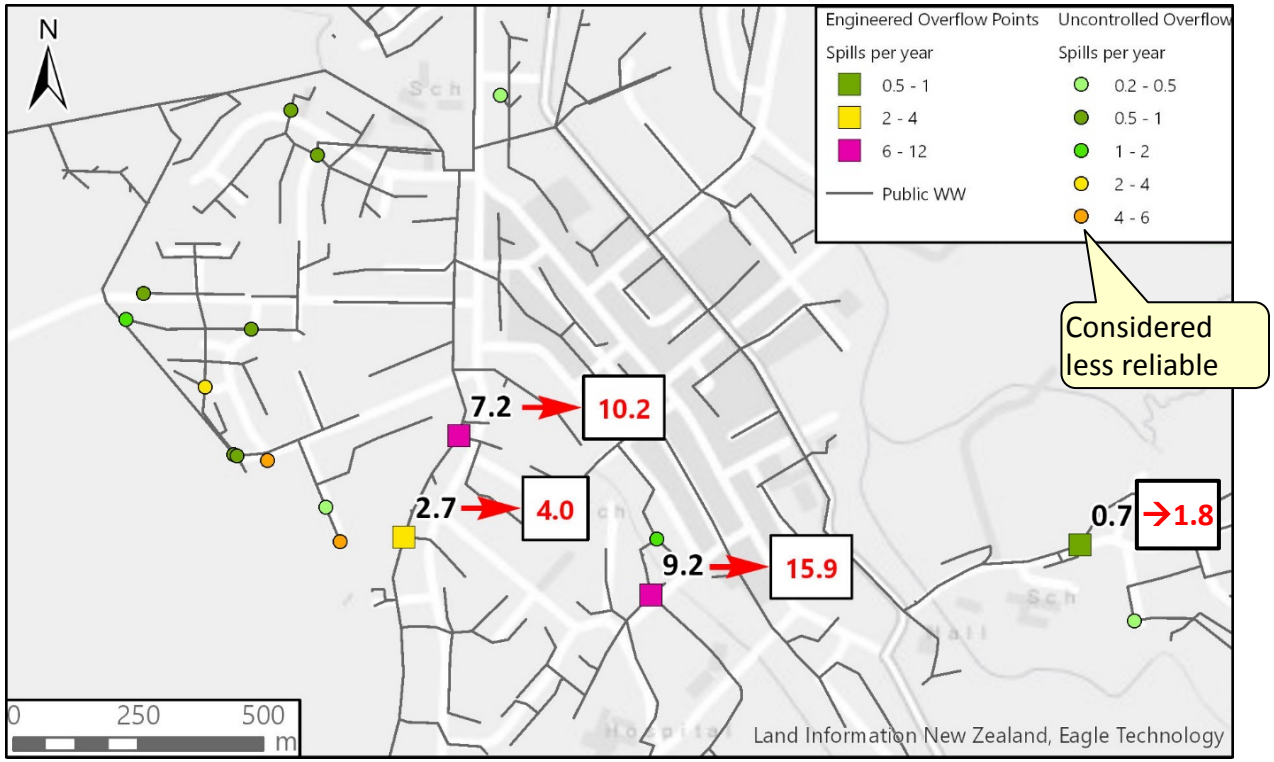
The Kaitaia Network



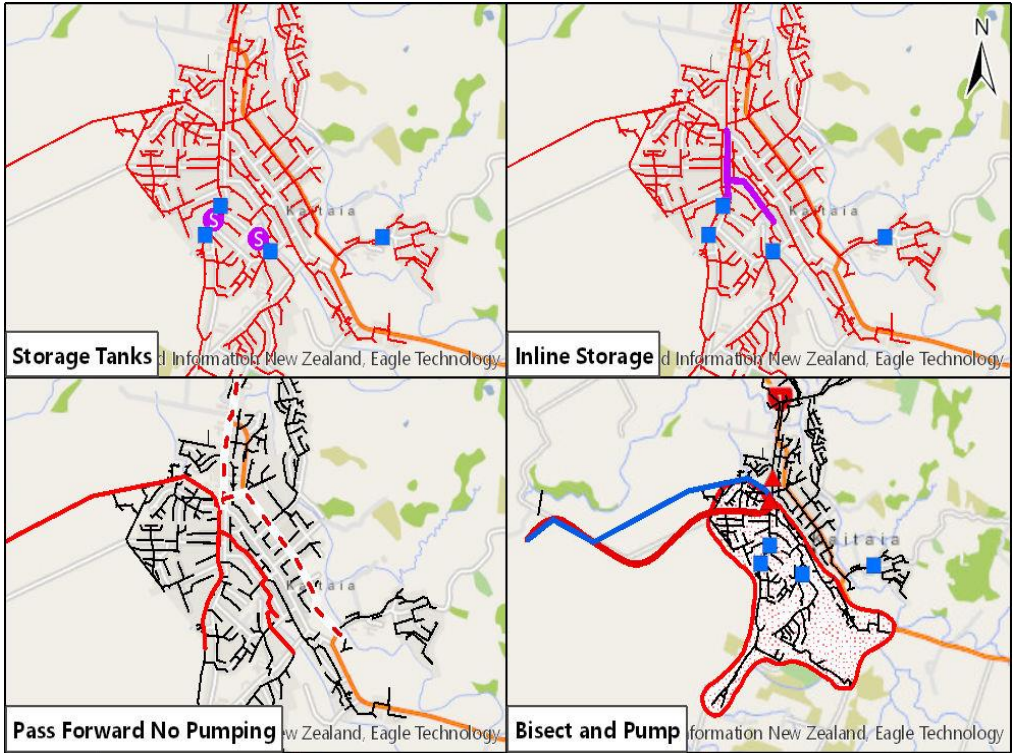
- Length ~44 km
- 18 pumping stations
- Flat
- Local treatment plant ~2 km to the West of the town
- Age: majority from late 50's and early 60's
- Signs of elevated Inflow and Infiltration and deteriorating condition
- 4 Engineered Overflow Points & many uncontrolled overflow locations

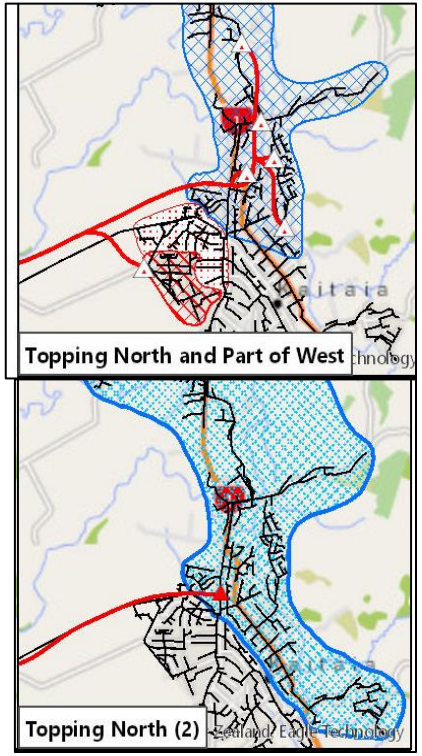
Network performance not good and getting worse

- Two overflow types
- Existing → future
  - Freq: see map
  - Total volume: +86%
- Model reliability varies



Options considered (by type)

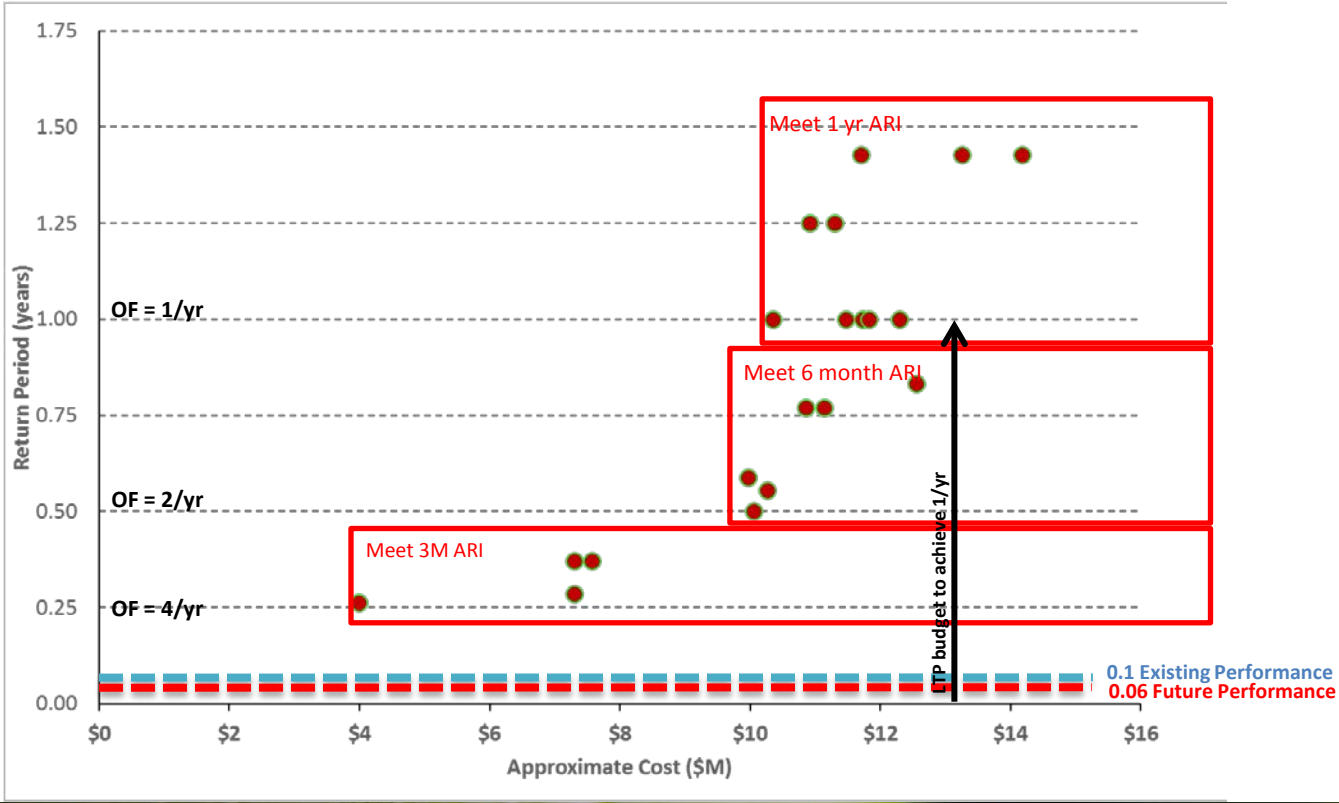




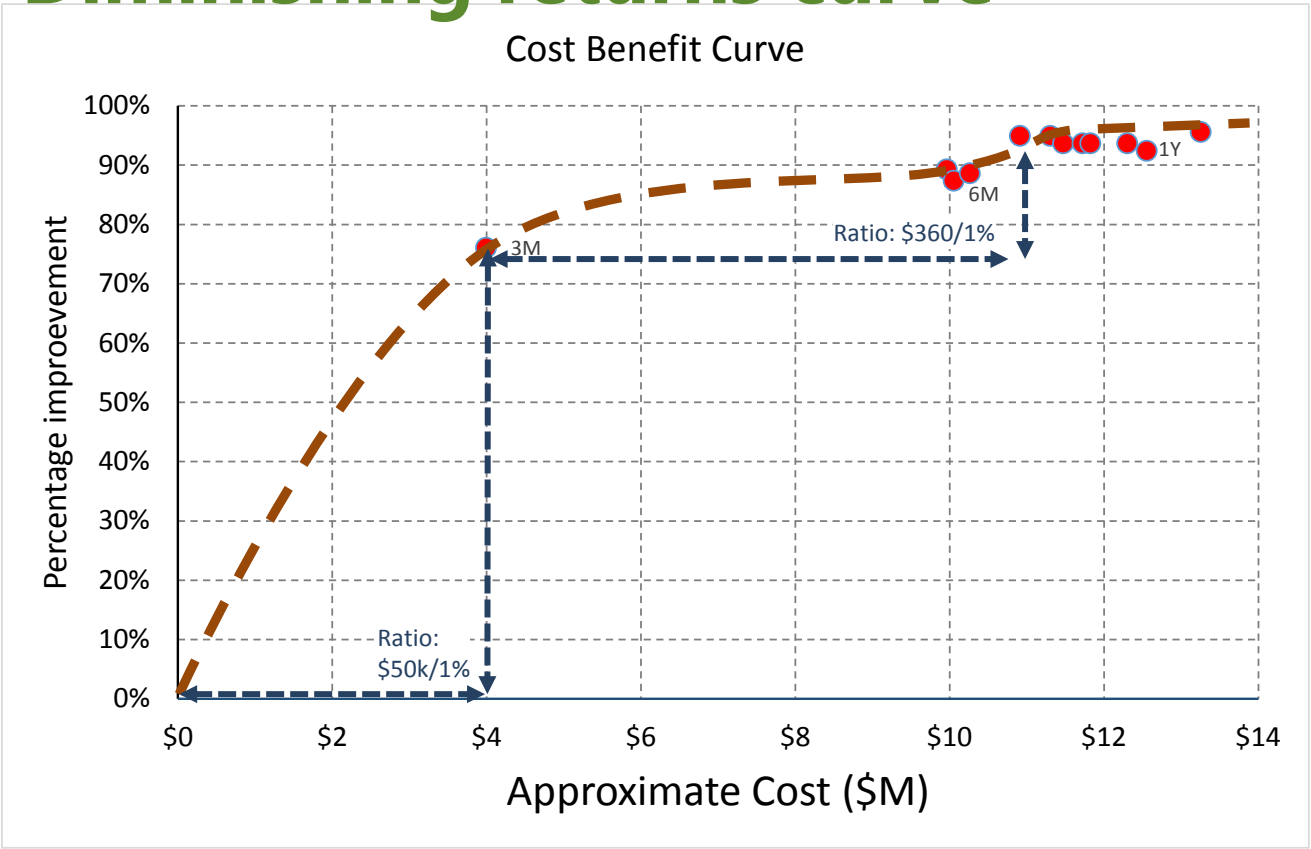
Observations

- **Process**
  - Moved from looking at broad option types to refinement and combination of tools
    - ~70 options scoped, modelled and costed
    - ~ 200 model runs undertaken (mostly LTS)
- **Outcomes**
  - Topping options, and RTC not progressed
  - I/I reduction in isolation not adequate (and high risk)
  - Bank Street is local problem (storage can work)
  - Pukepoto Street is largely caused by backflow (storage limited success – need to improve hydraulic grade)
  - Combination of option types works best

Top Options


1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Return Period (years)
OF = 1/yr
OF = 2/yr
OF = 4/yr
Meet 1 yr ARI
Meet 6 month ARI
Meet 3M ARI
LTP budget to achieve 1/yr
0.1 Existing Performance
0.06 Future Performance
$0
$2
$4
$6
$8
$10
$12
$14
$16
Approximate Cost ($M)

Diminishing returns curve

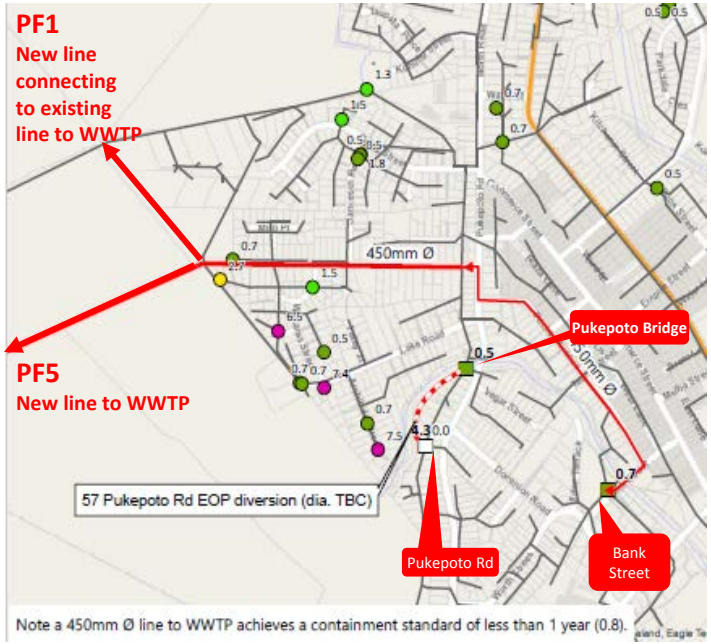


The union of engineering design and nature.

Some detail:

Pass forward has limitations

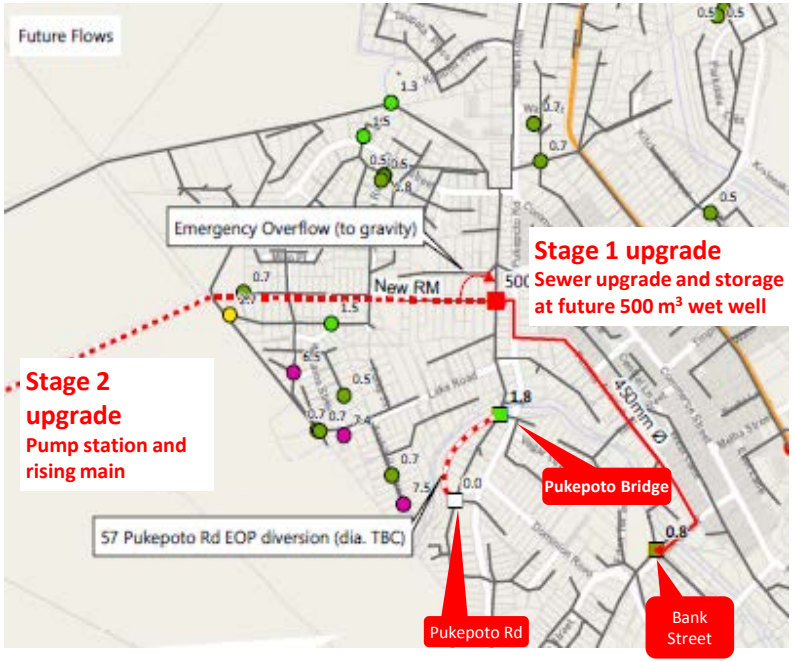
- **PF1**
  - In the knee of the curve
  - only $4million and achieving 3 month ARI
- **PF5**
  - achieve 1 year ARI
  - Expensive: $13.2 million
  - Because of cost to extend to WWTP



Some detail:

Bisect and Pump is more flexible

- **Phase 1:**
  - Sewer upgrade and storage at future (500m3) wet well
  - 3M ARI @ $4.5 million
- **Phase 2:**
  - Pumping station and rising main to WWTP
  - 1 yr ARI for $6 million extra
  - Time to resolve reliability issues in the local retic and review scope of phase 2



Current Status

- **Council to make an informed decision on future Containment Standard**
  - Based on cost/benefit and practicalities, and
  - affordability for this community

- **Other specific considerations are:**
  - The implementation of private I&I programme
  - Applying an effects based approach to selected solution(s)
  - Need for flexibility / future proofing
    - to even out the maintenance spend over the coming generations

Conclusions - outcomes

- **The cost optimisation identified significant cost savings compared to the estimated costs used in the LTP**
  - When sticking with 1 yr ARI: potential savings are $3.3 million
    - Achieved by cost optimisation and use of LTS
  - When reducing to 3 month ARI: savings are $9.7 million
    - Lower LoS → less to improve
  - Cost and benefit, flexibility, stage-ability, risks and uncertainties all to be considered when council makes its decision

Conclusions - process

- **Understanding the reliability of your model is essential**
  - Where less reliable: stop → investigate → decide
- **Long Term Time Series** more reliable than Design Storms
- Detailed cost benefit approach confirmed a clear **diminishing return** relationship

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Thank You

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