



Eastern Selwyn Sewerage Scheme Resilience Master Plan

Water New Zealand Modelling Symposium 2021



Presentation Outline

- Introduction
- Overview of Eastern Selwyn Sewerage Scheme (ESSS)
- Study Objectives
- Defining Critical Infrastructure
- Modelling Assessment
- Results (the interesting ones!)
- Study Conclusions
- Value Added Through Hydraulic Modelling Conclusions

Project Contributors

- WSP - Failure Scenarios Development and Hydraulic Modelling Assessment
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- Stantec - Failure Scenarios Development and Response Planning
 - Shane Bishop
 - Rico Parkinson
- Selwyn District Council
 - Murray England

A Resilience Master Plan?

- A Master Plan?
- An Infrastructure Master Plan?
- An Infrastructure Resilience Master Plan?

Eastern Selwyn Sewerage Scheme Overview

- ESSS provides wastewater servicing to the communities of Rolleston, Lincoln, Prebbleton, West Melton and Springston
- Local servicing provided through gravity sewers and local pumping stations
- Local schemes connected through terminal pumping stations and rising mains, all discharging to Pines Wastewater Treatment Plant
- As new assets have been constructed, selected redundant assets have been maintained for operation under emergency/ failure scenarios

Eastern Selwyn Sewerage Scheme Overview



Objectives of this Study

- Assess and improve ESSS resilience by:
 - Applying a hydraulic model to evaluate a range of operational scenarios including failure of critical wastewater pipelines, pumping stations and the wastewater treatment plant.
 - Review implications of failure of critical infrastructure and how outages can be managed.
 - Develop a list of recommendations to increase system resilience.

Defining Key Components of the Network

- **Primary Assets**
 - Critical infrastructure used on a daily basis under normal operation
 - Terminal pumping stations and pipelines connecting communities to greater scheme
- **Secondary Assets**
 - Used either intermittently due to high flows or in emergency operations
 - Typically redundant assets that have been maintained

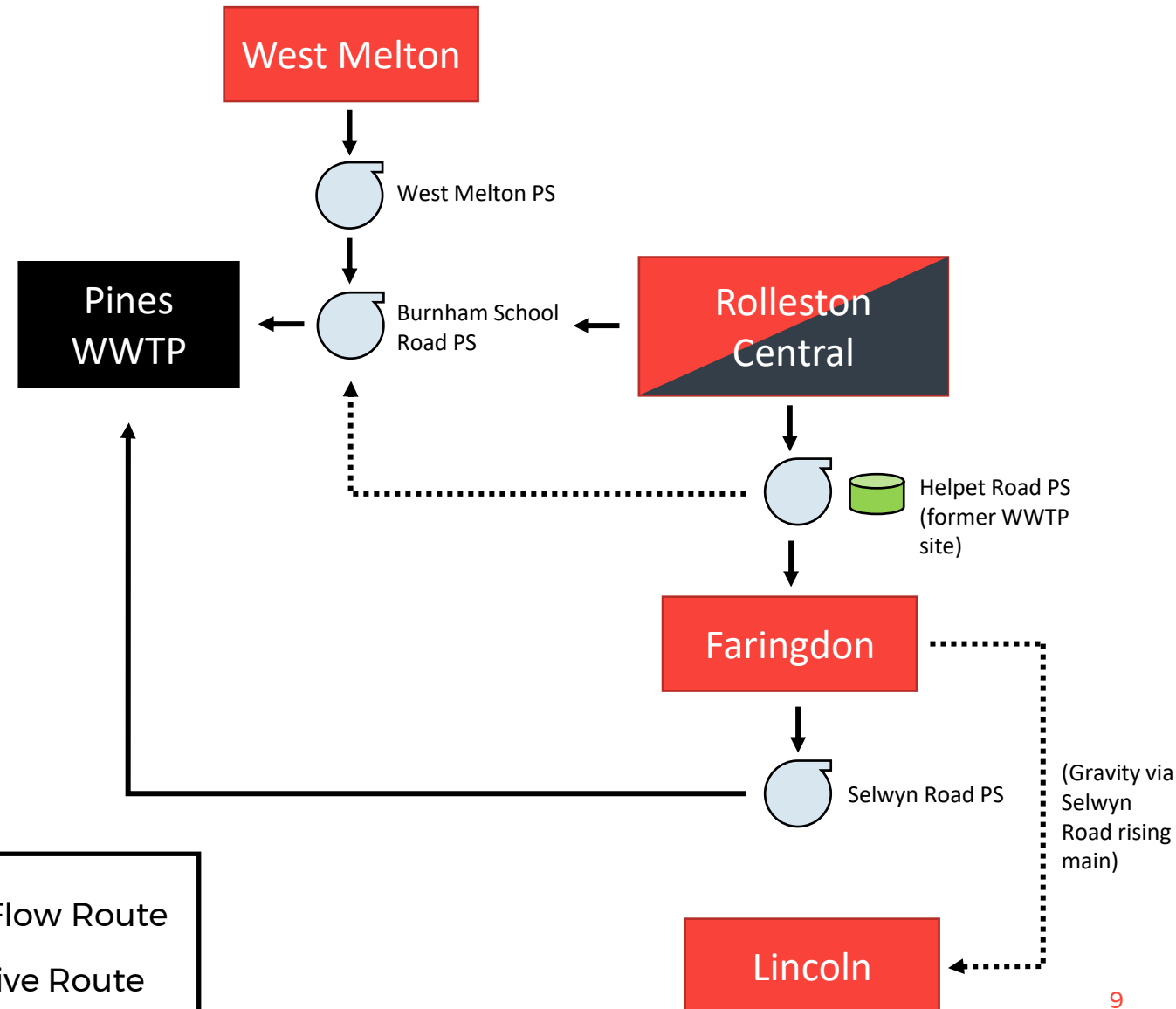
Network Overview – Rolleston

Primary Assets:

- Pines WWTP
- Selwyn Road PS
- Rolleston PSs (George Holmes, Burnham School and Helpet) PSs
- West Melton Terminal PS

Secondary Assets:

- Helpet emergency storage tanks (repurposed WWTP)
- Helpet PS old RM



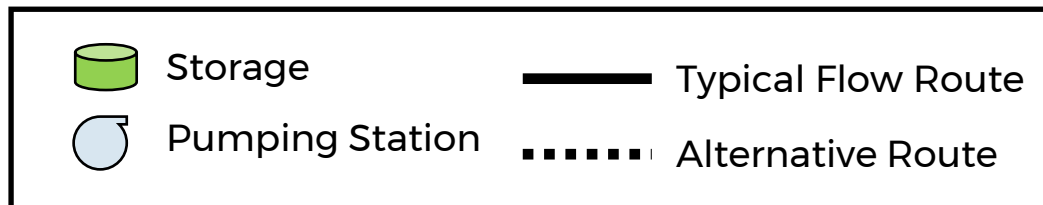
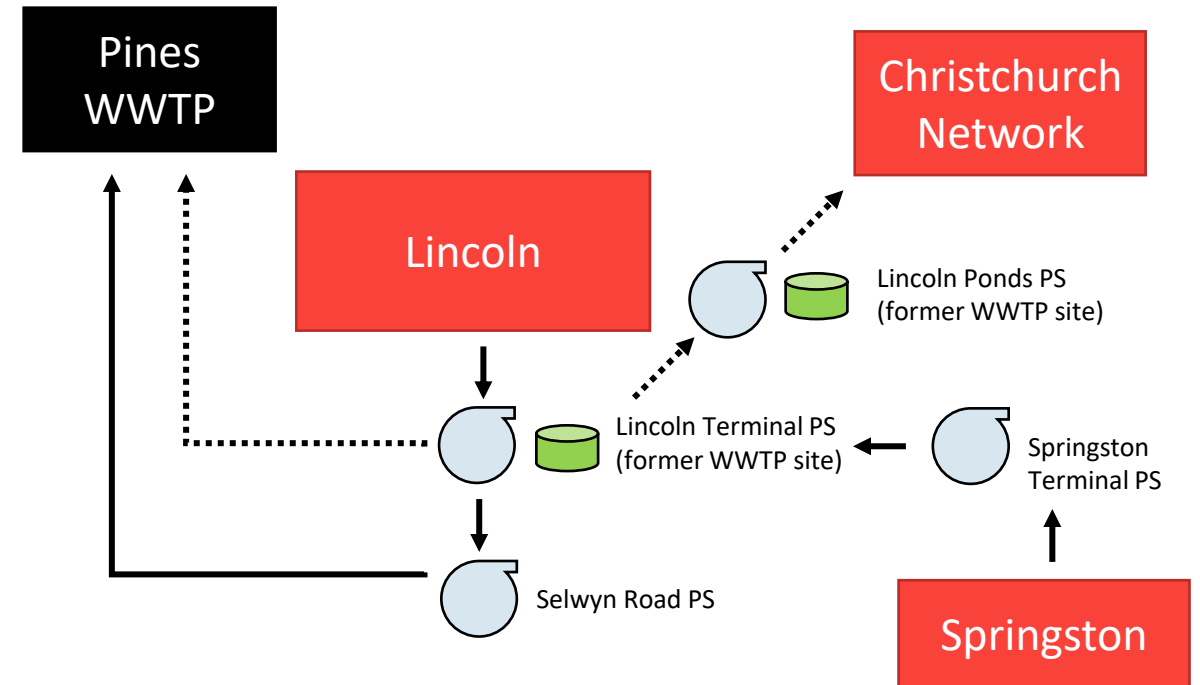
Network Overview – Lincoln

Primary Assets:

- Pines WWTP
- Lincoln Terminal PS and rising main

Secondary Assets:

- Lincoln Storage (repurposed WWTP, SBRs tanks and oxidations ponds)
- Lincoln Ponds PS and pressure mains to Christchurch network



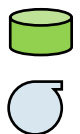
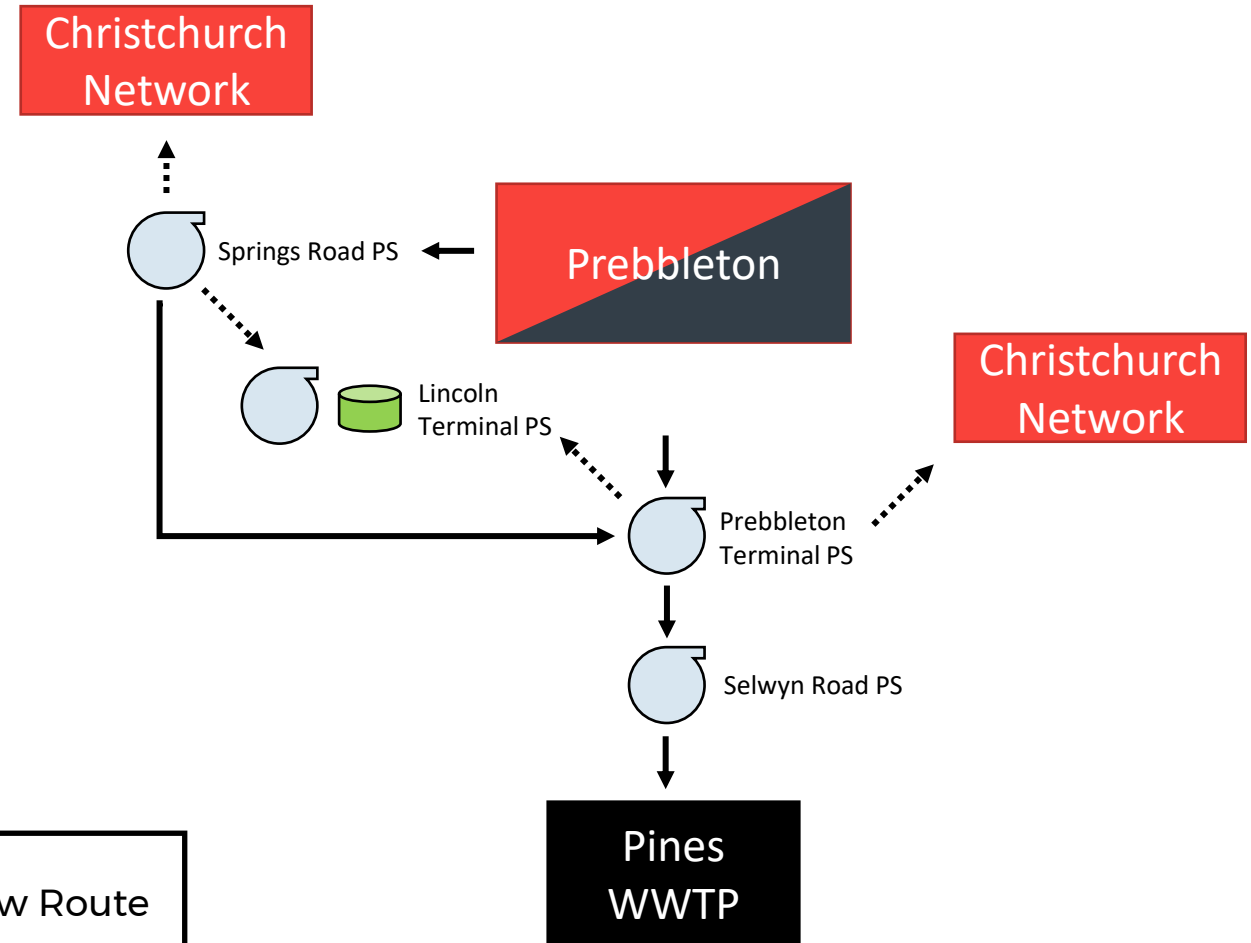
Network Overview – Prebbleton

Primary Assets:

- Pines WWTP
- Prebbleton Terminal PS

Secondary Assets:

- Springs Road PS and rising main (to Lincoln)
- Springs Road PS and rising main (to Christchurch network)



Storage



Pumping Station



Typical Flow Route



Alternative Route

Failure Scenarios

- Now lets break it!
- Eight scenarios defined to assess system resilience, including failure of:
 1. Selwyn Road PS
 2. Selwyn Road rising main, and storage at Lincoln Ponds
 3. Selwyn Road rising main, and storage at Lincoln Ponds / pump to Christchurch
 4. Lincoln Terminal RM, and storage at Lincoln Ponds
 5. Prebbleton Terminal rising main on Springs Road
 6. Prebbleton Terminal rising main on Selwyn Road
 7. Burnham School Road rising main
 8. Helpet rising main to Faringdon Subdivision
- Results for select scenarios presented today

Modelling Assessment

- Modelling completed using a calibrated InfoWorks ICM all-pipes network model
- All assessments completed under calibrated dry weather flow conditions
 - Calibration completed by WSP in 2016, updated to 2019/2020 population
- Assessment criteria:
 - 8 hours of emergency storage
 - 30 minutes operational response
- Real time controls (RTCs) used to represent delayed operation response to infrastructure failures

Sc. 1: Selwyn Road Pump Station Failure

Operational Response:

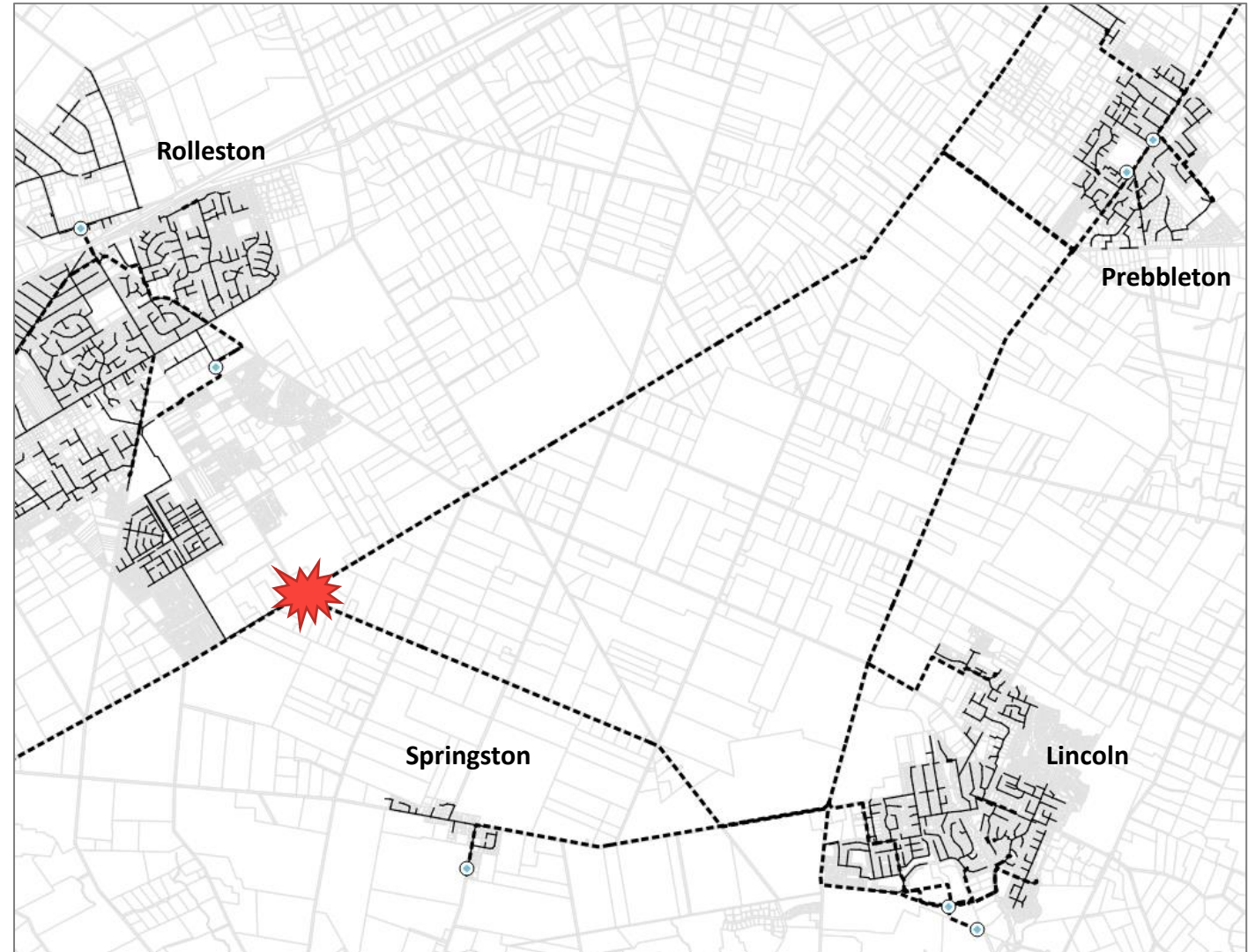
- Selwyn PS bypassed, with Lincoln PS discharging to WWTP
- Prebbleton PS shutdown and flows pumped to Lincoln via Springs Road PS
- Helpet PS diverted north

Unresolved:

- Faringdon subdivision continues to discharge to Selwyn PS wet well by gravity

Model Results:

- Spilling predicted from a manhole within the Selwyn PS site 7:30 after failure



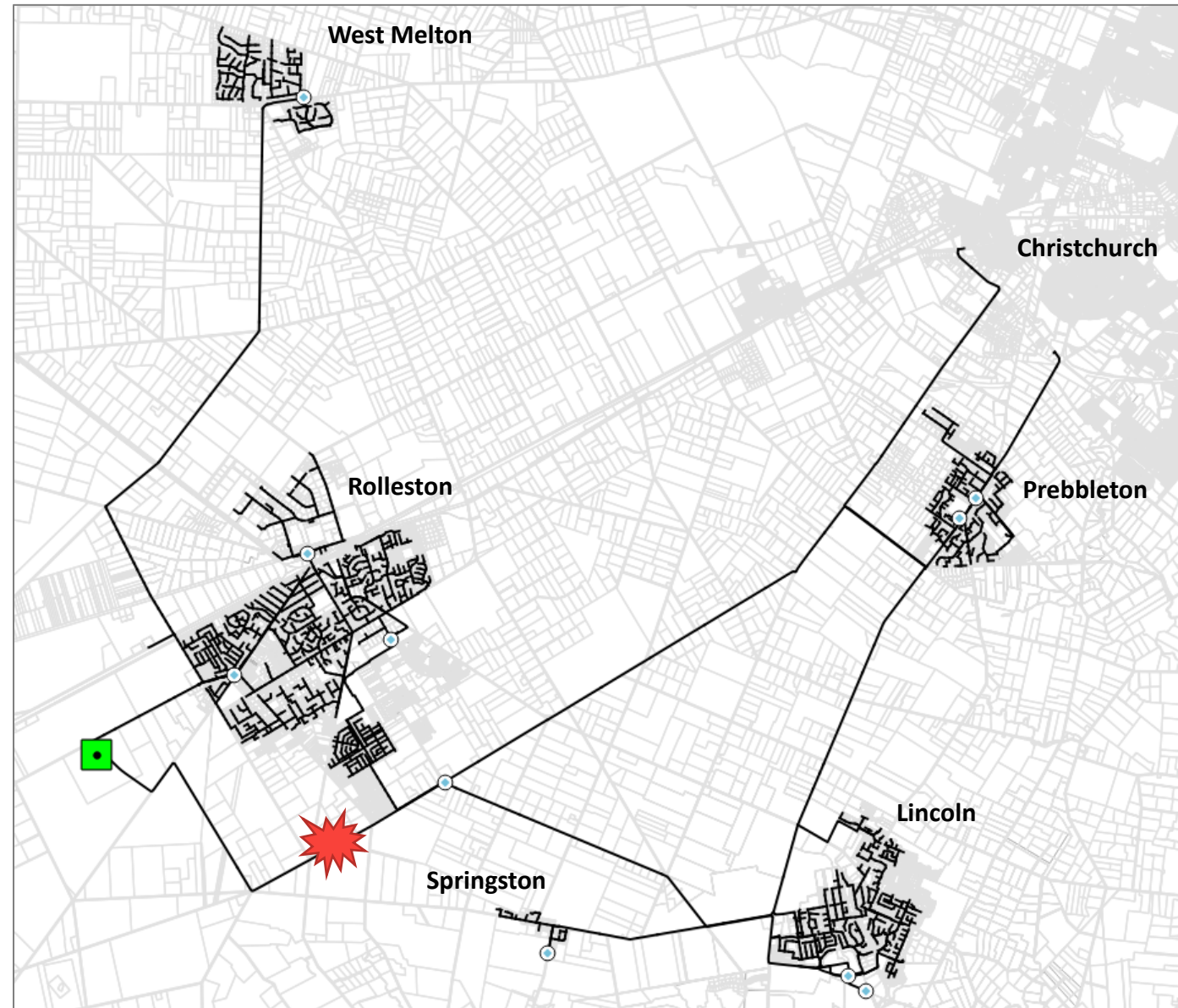
Sc. 2: Selwyn Road Rising Main Failure (Storage)

Operational Response:

- Prebbleton PS shutdown and flows pumped to Lincoln via Springs Road PS
- Helpet PS diverted north
- Lincoln Terminal PS shutdown, flows discharging to storage
- Faringdon discharges to Selwyn PS wet well, backflow through Lincoln Terminal rising main to storage in Lincoln

Model Results:

- Backflow to SBR tanks and then to Lincoln ponds
- Sufficient storage for 8 hour response time (21% of pond storage used)
- No network overflows predicted



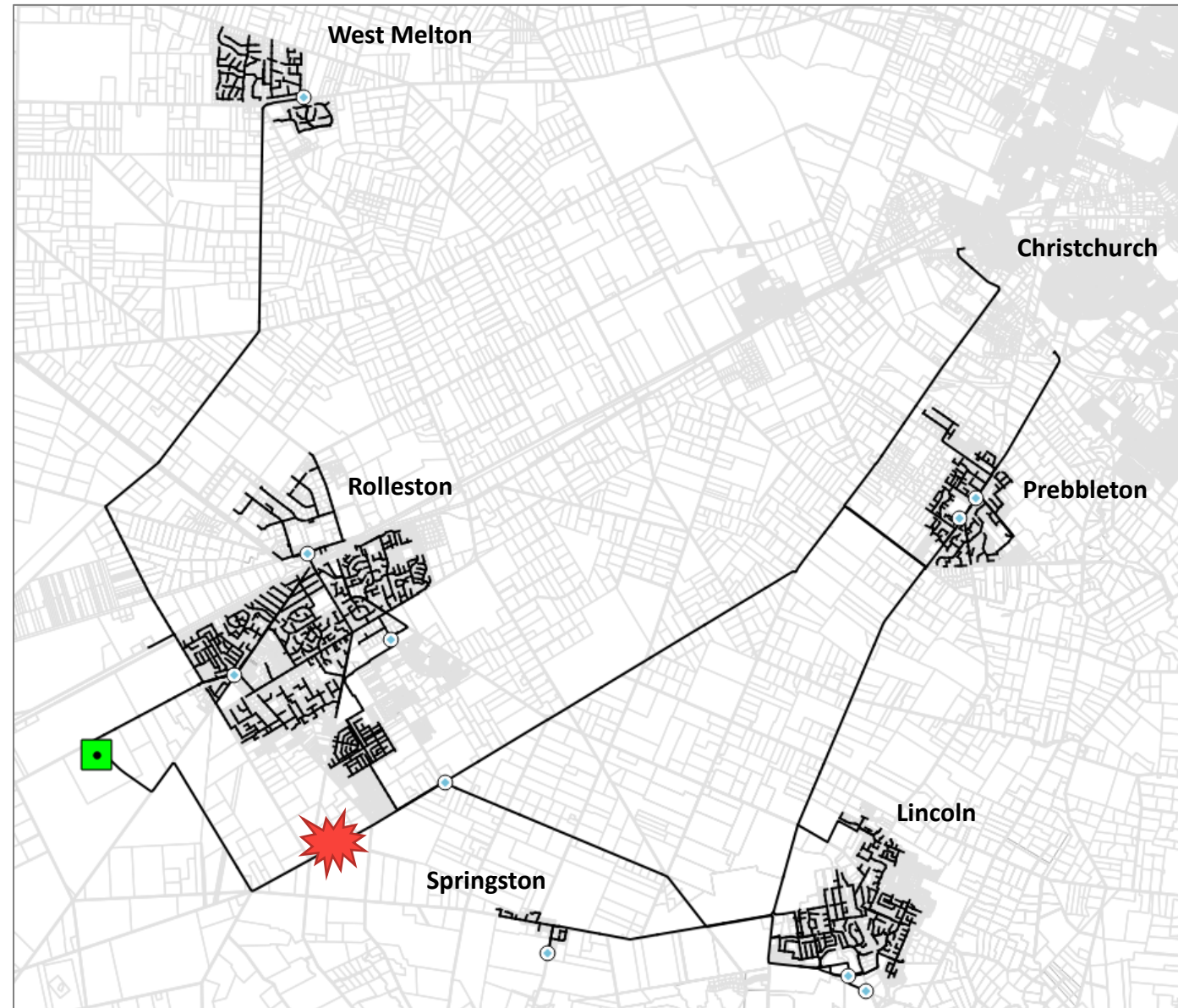
Sc. 3: Selwyn Road Rising Main Failure (Pump)

Operational Response:

- Helpet PS diverted north
- Lincoln Terminal PS shutdown, flows discharging to storage
- Faringdon discharges to Selwyn PS wet well, backflow through Lincoln Terminal rising main to storage in Lincoln
- Prebbleton PS is shut down and isolated from the Springs Road RM. All flows from Prebbleton discharge to Springs Road PS and pumped to Christchurch
- Lincoln ponds PS is turned on and flows pumped to Christchurch network

Model Results:

- Inflows to the Lincoln storage exceed Ponds PS pump capacity (to Christchurch)
- Sufficient storage at Lincoln
- No network overflows predicted



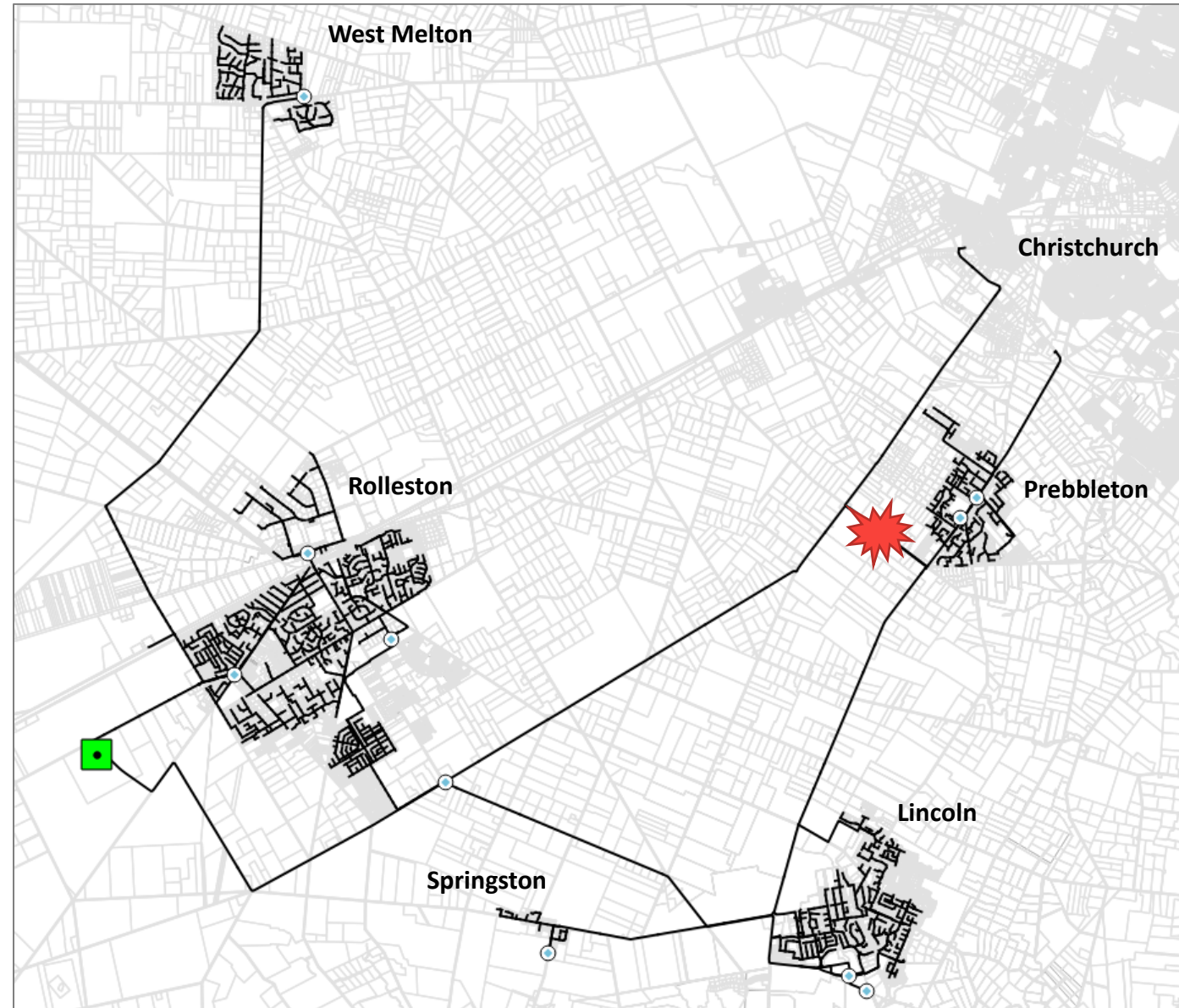
Sc. 6: Prebbleton PS Rising Main Failure

Operational Response:

- Prebbleton Terminal PS is shut down and isolated from the Springs Road RM.
- All Prebbleton flows are conveyed by gravity to Springs Road PS and pumped south to the Lincoln Terminal PS.

Model Results:

- No issues predicted at Lincoln Terminal PS due to increased flow
- No network overflows predicted



Sc. 7: Burnham School Road Rising Main Failure

Operational Response:

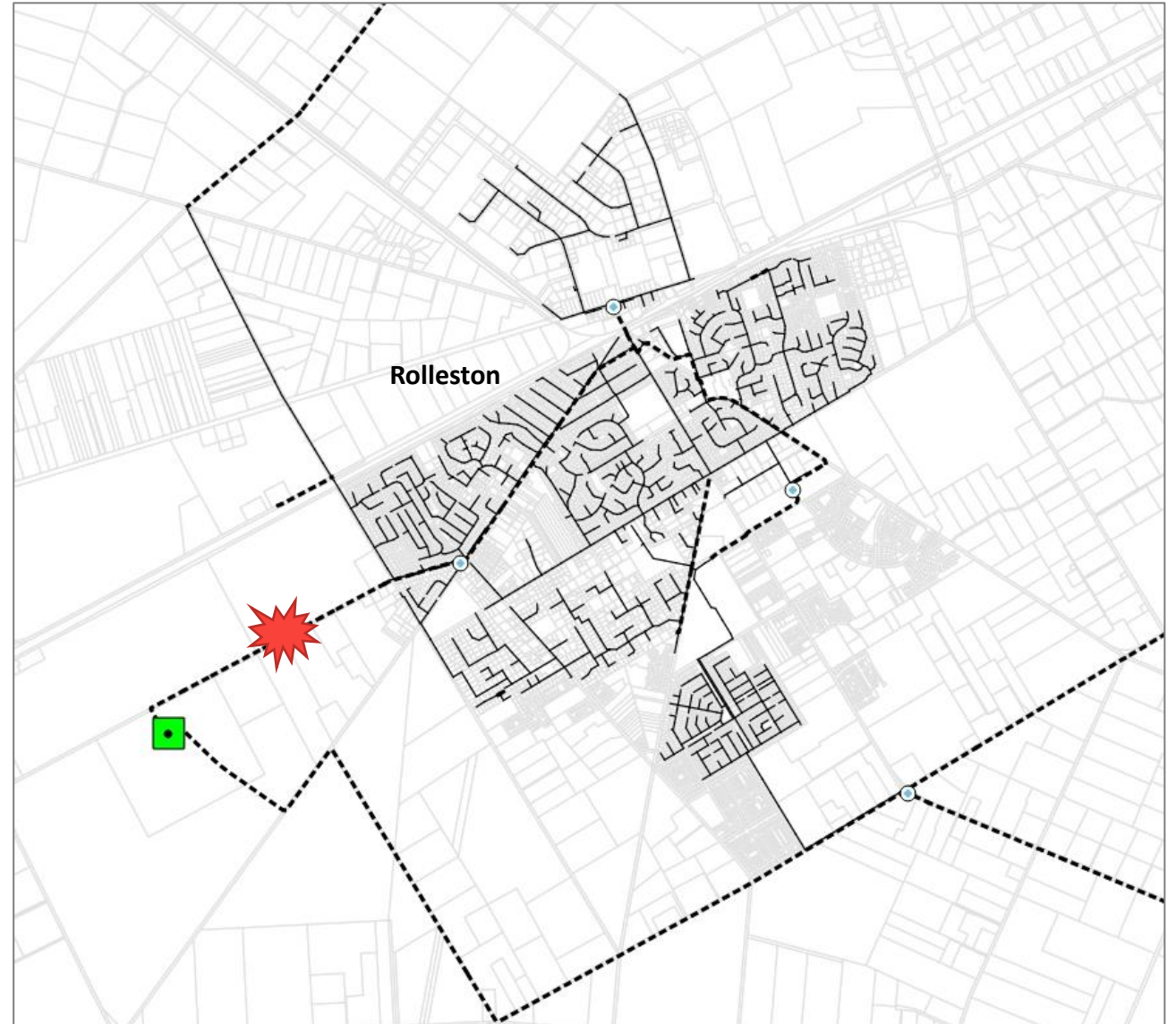
- Burnham School PS shut down, flows stored in wet well.
- George Holmes Road PS (North Rolleston shut down, flows stored in wet well).

Model Results:

- Flooding resulting from PS shutdown
- Burnham School Road – **7hrs storage**
- George Holmes – 8hrs storage
- **Criteria not met!**

Proposed Mitigation:

- Shutdown of additional contributing PSs (West Melton and Runners Road)
- High level gravity overflow from Burnham School Road to Helpet PS catchment
 - 50m of DN 150 pipe



Conclusions

- 8 failures/ operational responses were assessed in real time
- Modelling assessment the has proven robustness of the existing network
 - One recommendation for new infrastructure to improve system reliance (Scenario 8)
- Recommendation to have backup supply of materials for critical assets

Benefits of Hydraulic Model

- Model developed to include base operating conditions and redundant infrastructure:
 - Including detailed (and programmable) valving arrangements for unused pipelines
 - Allows for dynamic representation of outage responses
- Selwyn District continues experience one of the fastest rates of population growth in New Zealand
- Council is proactively maintaining network models to:
 - Assess network capacity for developments
 - Assess future connection of other local schemes to ESSS

Thank you

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