

BEFORE COMMISSIONERS APPOINTED BY THE NELSON CITY COUNCIL

IN THE MATTER OF

Applications for resource consent under the Resource Management Act 1991

AND IN THE MATTER OF

The aberrational discharge of sewerage from Nelson Sewerage Business Unit (NSRBU) pump stations and reticulation network

STATEMENT OF EVIDENCE OF PHIL RUFFELL

Dated 24 November 2017

1. INTRODUCTION

- 1.1 My name is Philip Ruffell. I am currently employed by Nelson City Council as a Senior Asset Engineer – Utilities. My role includes the development of Asset Management Plans and provision of technical advice to Council for the water, stormwater and wastewater assets owned and operated by Nelson City Council. My qualifications are a Diploma in Environmental Management (University of Auckland), Bachelor Engineering (Civil) (University of Canterbury) and Masters of Engineering Studies (Fire Engineering) (University of Canterbury).
- 1.2 I have been employed by Council in various roles since 1994 and in the utilities asset management section since 2008.
- 1.3 I have read the Code of Conduct for expert witnesses issued as part of the Environment Court Practice Note. I agree to comply with the Code of Conduct. I am satisfied that the matters addressed in this statement of evidence are within my expertise. I am not aware of any material facts that have either been omitted or might alter or detract from the opinions expressed in this statement of evidence.

2. STORMWATER INFLOW AND INFILTRATION

- 2.1 Nelson City Council (NCC) discharges wastewater to the NRSBU pump stations at four separate locations: Nelson Airport, Songer Street, Saxton Road and Elms Street (Wakatu Industrial Estate). These four locations account for approximately 50% of the wastewater produced by the city each day. The remaining 50% is discharged to the Nelson Wastewater Treatment Plant adjacent the Boulder Bank to the North of the city (See Figure 1).
- 2.2 Nelson City Council has been aware of stormwater inflow and ground water infiltration (I/I) into the wastewater network, leading to wet weather discharges from the wastewater network, for a number of years. Information regarding this comes from a range of sources:
 - (a) Increased flows through NCC sewer pump stations during wet weather, identified by monitoring pump run hours and flow meter readings.
 - (b) Reports from Council's maintenance contractors and service requests from the public during and after wet weather events identifying overflows from the network.
 - (c) Results from Council's computer wastewater network model that identifies flows in the network in dry and wet weather. This model can be used to predict locations of wet weather overflows from the NCC network.

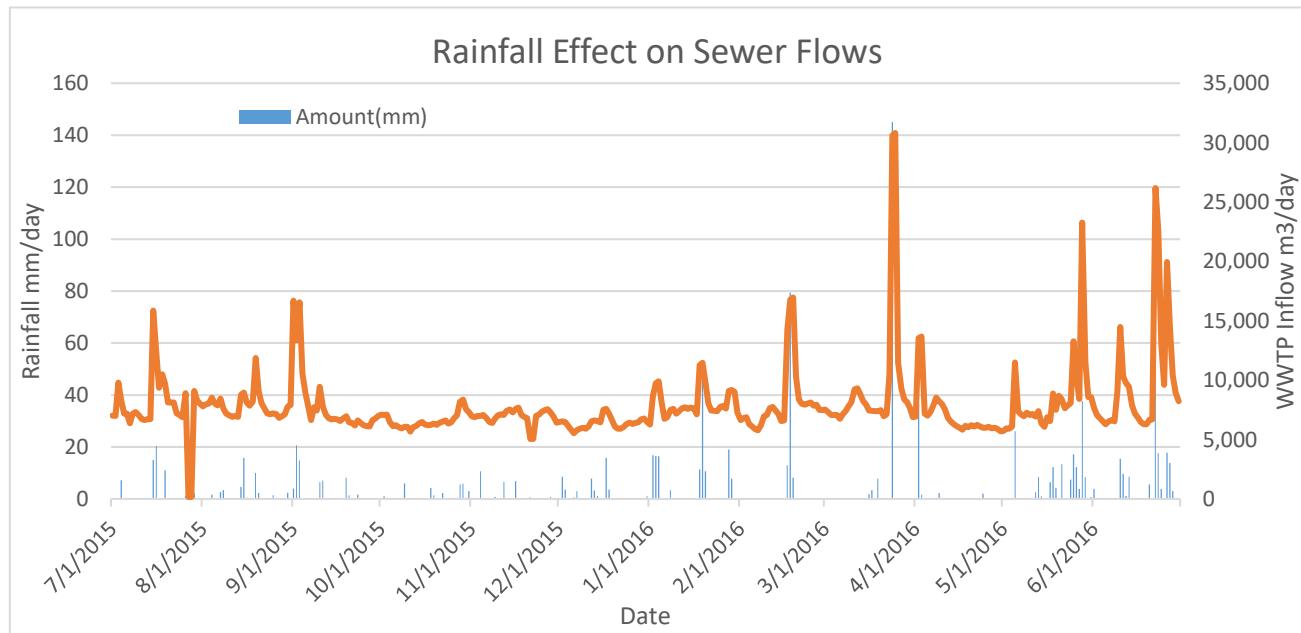
2.3 **Inflow** is considered to be the portion of stormwater that enters the wastewater network as follows:

- (a) directly through cross connections between the stormwater network, both deliberate and accidental, eg stormwater downpipes on buildings directed to discharge into the wastewater network (see photos section 4.0)
- (b) surface water flows being directed to the wastewater network eg through surface manhole lids and or low gully traps

2.4 **Infiltration** is considered to be ground water that enters the network though faults in the subsurface reticulation eg cracked or broken pipes, poor pipe to pipe jointing and connection to manholes.

2.5 Sheet B5 of the Data Bundle shows NRSBU pump station flow volumes and rainfall events and is typical of the results that Nelson City Council also experiences at pump stations within the network during rain events. The following figure 2 details the impact of rainfall on wastewater flows recorded at the Nelson waste water treatment plant during the period July 2015- June 2016 (flows increased from 7,500m³/day to 30,000m³/day following a significant rainfall event).

Figure 2 : Rainfall Effects on Sewer Flows



2.6 It has been Council's experience that older parts of the network experience higher levels of infiltration as particularly earthenware pipes crack and joints fail with age, but inflow volumes can still be elevated in quite recent developments. Connection of stormwater to the wastewater network and ground level gully traps being used for stormwater disposal are not un-common faults in all areas of the city.

2.7 Council considers that the ongoing wet weather overflows from the Nelson City Council public wastewater network are not desirable on public health, cultural and environmental grounds. Council has undertaken a number of initiatives to address the issue:

- (a) Engaging contractors to investigate the network to identify properties where there are connections from the stormwater network to the wastewater network. This has been carried out city-wide on at least two separate occasions in the past.
- (b) Retrofitting of bolts to plug lifting eyes in lids to sewer manholes to prevent stormwater ingress.
- (c) Ongoing programme of renewing sections of the public sewer network with priority given to pipes in poor condition as identified through closed circuit television (cctv) inspections and reports of overflows.
- (d) Construction of a large storage tank adjacent the Neale Park sewer pump station to hold pump station overflows.
- (e) Incorporating limited wet weather storage where possible when upgrading sewer pump stations, and installation of express sewers to cater with growth without overloading existing reticulation.
- (f) Expansion of stormwater reticulation across the city to provide properties with appropriate stormwater disposal options.

2.8 Over the past twenty years Council has carried out a number of street by street inspections to identify points of inflow and maintained an annual renewal programme to replace pipes at the end of their service lives to address infiltration. To date Council would typically renew or reline the public wastewater pipe network in one - two streets each year. The Nelson City Council wastewater network contains approximately 360kms of gravity pipework and 6700 manholes. Of this approximately 48.5kms is of earthenware construction (cctv inspections found numerous pipe defects in this material) and it is expected to take 10-20 years to reline or replace these at the current rate of renewal.

3. CURRENT REDUCTION OF INFLOW AND INFILTRATION PROGRAMME

- 3.1 In 2015 Council developed a more strategic approach to address the issue of inflow and infiltration (I/I). This approach is based on the Inflow and Infiltration Control Manual produced by Water NZ in March 2015. The following summarises the catchment based approach which Council is adopting:

1 - Evaluate Performance

Pump station flow data was analysed to understand the base average flows entering them and how these changed in reaction to rainfall.

2 - Identify Key Performance Indicators

Three of the five key performance indicators recommended in the I/I Control Manual have been assessed for each of the pump stations.

GW_I₁ – a measure of the dry weather groundwater infiltration.

GW_I₂ – a population based flow indicator, a ratio of measured ADWF to estimated population.

SW_I₁ – the ratio of peak flow during a specific rainfall event to the measured ADWF preceding the event.

3 - Prioritise Areas for investigation

Phase 3 of the Strategy is to narrow down the areas to further investigate.

From the pump station analysis detailed above, the catchment feeding that pump station is broken into sub-catchments. Key manholes within each catchment have been identified for lifting in dry weather and during a rain event to measure the depth of flow. By lifting these in a methodical manner during a rain event, starting at the pump station and working up the catchment, high flows can be traced back to a smaller source area or areas. This process will primarily identify sources of inflow, rather than infiltration.

The results of these reasonably high level investigations can then be used to colour code catchment maps for priority based on extent of flows found. This will drive more detailed investigations for future years.

General Steps:

- *Identify key MHs in each catchment*
- *Lift key MHs in dry and wet weather to narrow down worst affected areas*
- *Produce prioritised and colour coded map of city*

The following sub-catchments have been investigated in detail as a priority - Halifax, Trafalgar 1, Trafalgar 2, St. John and Hardy. These sub-catchments have been earmarked for residential intensification in the near future and incorporate the CBD.

4 - Source Detection Activities

Phase 4 is the source detection phase. This consists of work aimed at better understanding the nature and sources of I/I through a programme of physical condition inspection works.

There are many methods of source detection available (these are all detailed in the I/I Control Manual), but at this stage of the programme, the only methods being applied are manhole locates/assessments, visual inspection, smoke testing, dye testing and CCTV.

5 – Prioritise Repairs / Rehabilitation

All defects identified as a result of the investigations will be passed back to Council on a catchment by catchment basis. Repairs or rehabilitation needed will be prioritised for progression within the available budgets.

Minor repairs may be carried out under the reactive maintenance budget, or under this budget. Larger scale renewals or rehabilitation requirements will be prioritised under the sewer renewals funding line [1564] or created as a separate capital project in future Long Term Plans.

6 – Undertake Repairs / Rehabilitation

Repairs or rehabilitation will be carried out as prioritised using the most appropriate solution, budget and time frame.

7 – Assess Rehabilitation Effectiveness

Once all investigations and repairs for an area have been carried out, the pump station flow data will be re-analysed to determine the effectiveness the work has had for reducing I/I.

The strategy is seen as an ongoing programme. Once an area has been subject to repair or rehabilitation, regular flow monitoring and analysis should still be carried out at the pump station. This will allow early notification of further I/I issues developing.

- 3.2 Council has been implementing the strategy since 2015/16. The first priority was identifying critical manholes city wide that can provide flow information to key catchments in the strategy. These have now been identified and in 2016/17 the investigation of dry and wet weather flows at these manholes throughout the city was completed. In tandem, cctv inspections were completed for the sewer network in the Central Business District (CBD).
- 3.3 In the summer of 2016/17 contractors also began visual inspections of properties in the central city catchment to identify property specific I/I issues.
- 3.4 In the second half of the 2016/17 financial year Council has commenced investigations of an additional two catchments: Parkers 2 and Vanguard South. Parkers 2 catchments are within the area discharging to the NRSBU.

4. PROGRESS TO DATE

- 4.1 To date approximately 3890 properties have been visited. The results are set out in table 1.1. In addition pipe defects that impact I/I have been identified through closed circuit television inspection of the Council sewer mains. Twenty-one of these have been repaired and the remainder will be repaired either as part of the I/I project, normal operations and maintenance activities or the annual network renewal programme.
- 4.2 The issues with private properties that can lead to direct inflow of stormwater into the wastewater network will need a separate programme of work to be developed. Council workshops have shown strong support from the Mayor and Councillors for both education and regulation approaches to address the inflow and infiltration issue on private property.
- 4.3 The Nelson City Council Wastewater Asset Management Plan 2015-25 sets out budgets for a programme of work for the next thirty years. For the years 2015-25 a sum of \$100,000 per year is identified specifically for the reduction of stormwater entry into the wastewater network, together with a sum of \$6.4M in total over the same years for pipeline renewal works.
- 4.4 The proposed Long Term Plan 2018-28 will include increases in expenditure in this area for the next ten years as follows:
- (a) \$220,000 per year for the first three years and \$200,000 per year thereafter for investigation, model calibration, policy development, liaison with property owners and possible regulatory enforcement.
 - (b) \$1.28M in the first year for pipeline renewal and \$850,000 per year thereafter.
 - (c) \$10.8M for I/I mitigation over the ten years. This budget is for the investigation of options to address the volume of wet weather inflow and infiltration into the network. Priority will be given to responding to the results of property inspections to seek compliance with the waste water bylaw and address any instances of inflow into the network. A further programme of work will be the investigation of the viability of constructing detention tanks at various locations or upgrading the network in order to cope with wet weather flows.

The proposed Long Term Plan 2018-28 is subject to consultation with the community and final adoption by the Council.

- 4.5 The I/I project will span multiple years. The city has initially been divided into 45 wastewater sub-catchments that will need to be investigated. Each catchment has been given a priority rating based on the first stage of the investigation. Nine of the 45 high and medium priority sub-catchments are in the area of the city that discharges to the NRSBU network.

- 4.6 It is expected that with current resourcing it will take in the order of five years to complete the investigation of the high and medium priority areas. Renewal of the wastewater network will continue at the same time following the priorities identified as a result of the investigation.
- 4.7 It is expected to take five - ten years before significant positive impacts on inflow and infiltration can be identified.

5. RESULTS

- 5.1 The following section contains a table setting out the results of investigations to date together with photos taken as part of the property inspections and cctv investigation.



Phil Ruffell

Inflow and Infiltration Project. Summary of Property

Inspections up to November 2017.

| <i>Sewer Catchment</i> | <i>Number of Properties Inspected</i> | <i>Number of Properties with I & I Issues</i> | <i>% of Properties with I-I issues</i> | <i>Stormwater down pipes connected to gully traps</i> | <i>Low lying / Unsealed traps</i> | <i>Irrigating / Broken gully trap covers</i> |
|--------------------------------|---------------------------------------|---|--|---|-----------------------------------|--|
| NCC Owned buildings in the CBD | 94 | 22 | 23% | 0 | 15 | 16 |
| Halifax | 96 | 23 | 24% | 3 | 15 | 13 |
| Harley | 74 | 21 | 28% | 3 | 16 | 14 |
| St John | 175 | 30 | 17% | 3 | 24 | 26 |
| Trafalgar 1 | 206 | 53 | 26% | 4 | 42 | 31 |
| Trafalgar 2 | 312 | 86 | 28% | 5 | 73 | 70 |
| Parkers 2 | 1793 | 393 | 22% | 13 | 397 | 125 |
| Vanguard South | 1144 | 354 | 31% | 23 | 329 | 172 |
| Total | 3894 | 982 | Average 25% | 54 | 911 | 467 |

Table 1.1 Summary of inspection results up to November 2017



Photo set 1 of pipe network showing elevated dry weather flows in the first photo and root intrusion in the second. The flow from the pipe to the left of the first picture is attributed to sea water infiltration in a low-lying area of the central city.



Photo set 2 showing pipe defects in earthenware pipe.



Photo set 3 of lowlying gully traps highlighting surface water inflow issues.

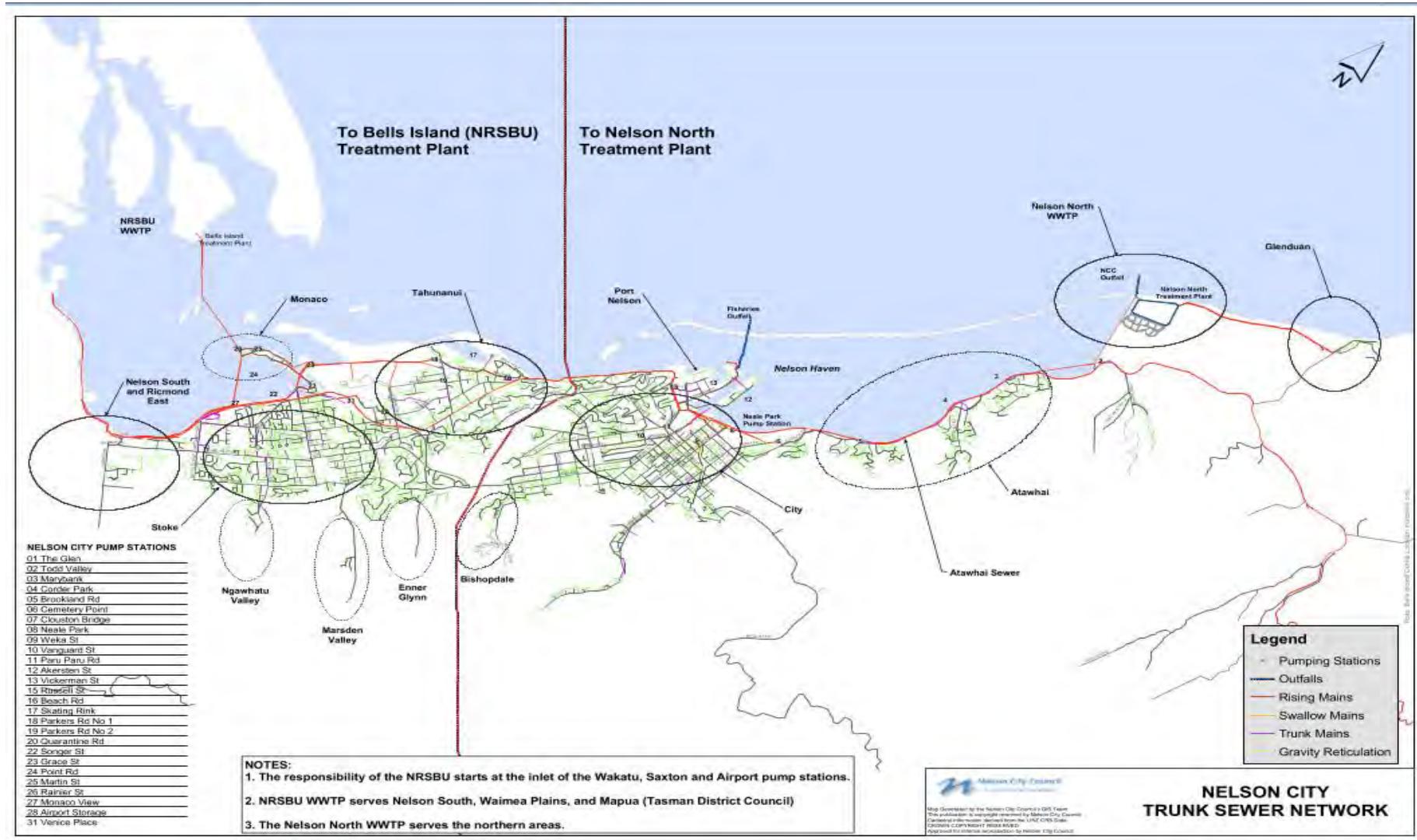


Figure 1. Nelson City Council Wastewater Treatment Catchments