

BEFORE THE COMMISSIONERS

IN THE MATTER of an application to Dunedin City Council for Resource
Consent comprising:
SUB-2017-49, and LUC-2017-255

BETWEEN

BALMORAL DEVELOPMENTS (OUTRAM) LIMITED

AND

DUNEDIN CITY COUNCIL

BRIEF OF EVIDENCE OF GARY MAURICE DENT

INTRODUCTION

1. My name is Gary Dent. I have a Bachelor of Engineering (Civil) and a Diploma in Hydraulic Engineering and I am a member of the Institution of Professional Engineers of New Zealand. Currently I am a Director and Principal Water Resources Engineer for Fluent Infrastructure Solutions Limited in Dunedin.
2. My qualifications and professional associations are:
 - a. Qualifications
 - Bachelor of Engineering (Civil), New Zealand
 - Diploma in Hydraulic Engineering, Delft, The Netherlands
 - CPEng and IntPE (pending approval December 2013)
 - b. Professional Memberships
 - Member - Institution of Professional Engineers New Zealand
 - Member - New Zealand Hydrological Society
 - Member - Water New Zealand (NZ Water & Wastes Association Waioara Aotearoa).
3. I have practiced as a professional engineer since 1982 in the fields of irrigation engineering, flood hydrology, river engineering, urban stormwater and wastewater reticulation engineering, infrastructure asset management and environmental effects assessment.

BACKGROUND

4. The proposed subdivision site is located between Holyhead Street and Mountford Street (SH 87) in Outram. To the west of the site, and west of SH87, is an Otago Regional Council (ORC) Scheduled Drain network which conveys water to the West Taieri drainage network. The ORC Schedule Drain network that discharges via the Taieri Flood and Drainage Scheme to the Taieri River via Lake Waihola.
5. On the south-eastern boundary of the site an Otago Regional Council (ORC) flood bank separates the proposed development from the Taieri River.
6. We have based our proposed stormwater management planning on the lot layout Paterson Pitts Group (PPG) drawing (PPG Ref. D15829 / Sheet 1, Rev C) entitled 'Proposed Post Development Ground Surface Drainage' dated 27/10/2017. The proposed Balmoral Developments (Outram) Limited development on Lot 2 DP 20759 provides for a total of approximately 42 residential lots plus road access lots off Holyhead Street and a detention pond lot, Lot 31, at the south-eastern corner of the site.

7. With reference to the 2nd Schedule plan of Lower Taieri Defences Against Water included in the ORC "Flood Protection Management Bylaw 2012"(Bylaw), refers to an excavation sensitive area being a 20m wide strip at the toe of the Taieri River flood bank (stop bank). This is provided for in the layout plan for the proposed subdivision as a "Building Restriction Area."
8. Currently, stormwater drainage from the eastern half of the site drains to a natural depression adjacent to the flood bank at the southeast corner of the site. Stormwater that enters the depression infiltrates the ground surface and eventually flows under the flood bank to the Taieri River. The natural depression is in Lot 31 of the PPG subdivision layout plan. The natural detention pond area would be retained, enlarged and used as an important part of the stormwater management infrastructure for the proposed development of the site. Provision for construction the enlarged detention pond, referred to further as the detention pond, has been consented.
9. The soils on the site are well drained silty loam soils that vary in depth, but in many areas, exceeds 3 metres. Gravels at depth underlie the silty loams.

PROPOSED STORMWATER MANAGEMENT PLAN

Stormwater Collection

10. A conventional piped stormwater collection system with overland flow paths for secondary flows on roads is proposed as shown on the attached PPG drawing. The collection system would direct all stormwater to the detention pond.
11. The area of the new lots would vary from 1000m² to 1550m². With the construction of residential roofs, pavements and the access roads, the direct stormwater runoff volume would be increased. Currently, the soils on the site absorb a major proportion of the rainfall. With the proposed addition of the western side of the site to the existing detention pond sub-catchment and the increase in impermeable area within the site, the stormwater disposal capacity of the detention pond is adequate to take the 100 year Average Recurrence Interval (ARI) runoff volume with appropriate freeboard.

Detention Pond and Disposal to the Taieri River

12. The capacity of the detention pond would be increased by increasing the base area of the natural pond and an increase in depth outside the Building Restriction Area, but more specifically through the use of a pump station in the consented detention pond to discharge stormwater from the whole site to the Taieri River. Stormwater disposal by soakage through the base of the detention pond would continue in a similar way to that from the existing natural pond. Stormwater from the site would no longer be discharged to the Scheduled Drain network to the west of Mountford Street.
13. Stormwater disposal would be via pump and rising main pipeline from the detention pond to the Taieri River at one of two possible locations. One location that has been explored is to discharge over the ORC flood bank to the Taieri River at the eastern end of Holyhead Street. The other possible stormwater discharge location would be to discharge stormwater to the Taieri River at the Outram - Mosgiel Road Taieri River

bridge abutment. The Taieri River stormwater disposal options are described in more detail in the attached Fluent Solutions letter dated 27 October 2017.

14. The detention pond and pump station would be designed to contain and dispose of stormwater to the Taieri River for a 100year ARI storm event with an appropriate freeboard in the detention pond.
15. From hydrological calculations, the pump capacity for the discharge from the whole site would be up to 15 litres per second (l/s) delivering stormwater to a 100 millimetre (mm) or similar diameter rising main.
16. If the pumped discharge over the flood bank at Holyhead Street was considered to be the best stormwater disposal option the rising main would be encased in a second pipe, such that if the rising main failed under pressure, then the water would be contained and either discharged at the river or back to the pump station at the detention pond. The additional protection for the rising main over the flood bank is to mitigate any risk of erosion damage to the flood bank batters.
17. The discharge to the Taieri River bridge abutment is less likely to create an erosion risk and would be simpler to maintain but requires a significantly longer rising main.
18. The pump station would be a critical item of infrastructure for flood water management in the locality and therefore the pumps would have a dual power supply. It is anticipated that the pumps would be powered off the local electric power supply grid but would also be provided with a back-up power supply that would typically be a diesel electric generator set.
19. The proposed stormwater management system for the Balmoral site would reduce the stormwater discharge from the locality to the existing ORC schedule drains to the west of the site. The urban area between Mountford Road and Holyhead Street southwest of the site and from the Mountford Street carriageway would continue to drain to the existing Schedule Drains to the west via the pipe under Mountford Street adjacent to Lot 6 on the attached plan.
20. Construction of the consented detention pond would not lower the ground level within Building Restriction Area but would utilise the existing natural capacity of the existing pond. Enlargement of the capacity of the natural pond to create the consented detention pond would include excavation of the ground outside the Building Restriction Area by up to 2m below the existing minimum natural pond invert level. Enlargement of the natural pond would include further geotechnical assessment to ensure that the integrity of the ORC flood bank is not adversely affected.

Surface Flooding and Finished Floor Levels

21. Land on the western side of the site (Lots 6 and 7, 39 to 42 and 46) has been shown by analysis and through experience during the 22 July 2017 storm event to be subject to surface flooding. The proposed Ground Surface Drainage plan addresses this by filling areas A and B and through local filling and shaping to promote drainage to the access road that is set below the final ground levels. Surface water would therefore be

directed to the detention pond either via the piped collector network or the access road as a secondary flow path.

22. A final land grading plan would provide the information required to set minimum finished flood levels for Building Consent for individual lots.

Submission Responses

23. Stagnant water and pump station noise was a concern. The invert of the detention pond would be shaped such that it positively drains to the pump station inlet sump thus avoiding standing water. The detention pond would not be a *ówet pond*
24. Given the proximity of the detention pond to existing and proposed residential lots specific attention is required to manage noise from the pump station. Sound proofing of pump stations is common practice. Wastewater pump stations located in urban streets are a part of many urban wastewater collection system networks. The frequency of operation of the pump station for stormwater disposal is significantly less than that for a wastewater network. The pump station would be set into the banks of the detention pond to minimise any adverse visual effects - and to assist with noise control.
25. Comment in the DCC planning report suggested that further analysis of catchments to the west was required. The proposed land grading would isolate the site from the local flood effects to the west of Mountford Street. All surface water for up to at least a 100year ARI event would be contained within the site and pumped to the Taieri River. This component of the stormwater management plan would be of benefit to all the local areas served by the Scheduled Drain and would not have any adverse effect on the stormwater network in adjacent areas to the south of the site within Outram.
26. References in the previous CPG report and the Fluent Solutions report dated 29 May 2017 to limiting the discharge to the Schedule Drains to the west of Mountford Street to the predevelopment flow to avoid adverse effects downstream are no longer relevant since all the stormwater would be discharged slowly to the Taieri River via infiltration or the pumping system.
27. To clarify a point in the planning report, the effect of individual wastewater disposal areas on runoff from the site is not significant. Based on the daily wastewater loading on the pervious areas on lots, being between 650m² to 1250m² per lot, the maximum wastewater load is equivalent to 1.5mm depth over the minimum pervious area, compared to the design 100year ARI 24 hour rainfall depth of 188mm.

CONCLUSIONS

28. Based on further investigation and refinement of the stormwater management plan as presented in my evidence the key points are as follows:
 - A conventional stormwater collection system and the proposed land grading will direct all stormwater from the site to the consented stormwater detention pond in

Lot 31. From the detention pond, all the stormwater from the site would infiltrate the ground under the pond and be pumped to the Taieri River.

- The choice of the stormwater disposal point to the Taieri River, being either adjacent to Holyhead Street or to the Taieri River bridge, is a matter for detailed design and assessment of the relative advantages and disadvantages.
- Redirecting the discharge from the western half of the site to the detention pond with infiltration to ground and disposal to the Taieri River means the pumped discharge to the Taieri River would be of the order of 15l/s.
- Redirecting the stormwater that currently flows from the western half of the site to the Scheduled Drains to the west would reduce flooding to adjacent areas in Outram.
- In terms of effects on flooding, infiltration to ground and the proposed discharge to the Taieri River means the site would no longer discharge to the Scheduled Drains to the west and hence there is a drainage benefit to local areas.

Gary Maurice Dent
Water Resources Engineer
Fluent Solutions
3 November 2017

ATTACHMENTS

- Paterson Pitts Group (PPG) drawing (PPG Ref. D15829 / Sheet 1, Rev C) entitled 'Proposed Post Development Ground Surface Drainage' dated 27/10/2017.
- Fluent Solutions letter dated 27 October 2017.



KEY:

- Proposed stormwater pump station and discharge main.
- Existing stormwater pipe.
- Existing stormwater open drain.
- Proposed stormwater pipe and structure.
- Proposed road / ROW centreline.
- Road chainage and/or finished level.
- Major contours (1.0m intervals).
- Minor contours (0.2m intervals).
- Anticipated earth fill areas (indicative).
- FL 10.00 Proposed minimum floor levels for sites.
- Proposed / possible overland flow path.

SWM PROVISIONS:

- 1a. Full piped reticulation to enable all new sites to drain roof and hardstand run-off to the Lot 31 pond.
- 1b. New sites to be prevented from discharging piped water onto Mountford Street.
- 1c. The above provisions will result in a reduction of the Existing water flows into the Mountford St catchment.
2. New stormwater reticulation intake facilities will be installed in Mountford Street to capture any surplus flows that exceed the capacity of the existing infrastructure at this location. These flows will be piped to the Lot 31 pond.
- 3a. The new road will be recessed into the existing ground to provide a stormwater collection corridor for surface runoff. Water captured by the road formation will be piped to the Lot 31 pond.
- 3b. Minimum floor levels will be established on relevant new sites to ensure that surface water runoff can occur effectively and will not damage property.
- 3c. Earthworks will be undertaken in Fill Areas A and B to raise the level of the ground by up to 0.6m so that the minimum floor levels are within a sensible proximity to the post-earthworks ground levels.
- 3d. Overland flows paths will be installed during earthworks to provide emergency escape routes for surface water in the event of i) blockage in the new piped network, and/or ii) an extreme rainfall event that exceeds the design standard and contingency.
4. Proposed facilities described under 1b, 3b and 3d can be protected through application of suitable consent notices.

Ref:GL-17-10-26-GMD-000356.DOCX

27 October 2017

Email: Kurt Bowen (kurt.bowen@ppgroup.co.nz)

PPG Dunedin

Attention: Kurt Bowen
Principal

Dear Kurt

**Balmoral - 94 Holyhead Street, Outram
Pumped Stormwater Disposal to the Taieri River**

1.0 Introduction

The stormwater management plan for the proposed subdivision development at 94 Holyhead Street provides for pumping stormwater from a proposed detention pond to the Taieri River as shown in Figure 1 below. We have reviewed the options for pumped disposal to the Taieri River and suggest that there are two options that have benefits for a similar order of cost. The options are outlined below.

2.0 Background

The stormwater disposal option illustrated in Figure 1 below, the "Direct" option, is a direct rising main pipeline from the proposed pump station location in the detention pond to the flood plain on the river side of the Taieri River flood bank.

The flood bank protects Outram urban areas and the rural areas within the Lower Taieri River Flood Protection Scheme from flooding and is therefore a critical piece of infrastructure. The Otago Regional Council has reviewed this river disposal pipeline concept and has suggested that the presence of the rising main would present a geotechnical stability risk to the flood bank.

3.0 Pumped Stormwater Disposal Options

3.1 Option 1 - Protective Sheath Direct Rising Main Option

To mitigate the potential geotechnical risk posed by the rising main pipeline we propose that the rising main be fitted inside a second larger diameter pipe that, in the event of a pressure failure of the rising main, the water that is released would either flow back to the detention pond or to the river without affecting the surface, and potentially the core of the flood bank.

Balmoral - 94 Holyhead Street, Outram
Pumped Stormwater Disposal to the Taieri River

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The larger pipe would have a diameter of approximately 200 millimetres and would be laid in a shallow trench of approximately the same depth as the pipe diameter, and where there was a risk of damage to the protective sleeve, such as across the road and at the crown of the flood bank, it would be concrete encased.

3.2 Option 2 - Bridge Site Disposal Location

An alternative stormwater disposal location is the Outram - Mosgiel Road bridge abutment. This option is illustrated in Figure 2. This option would see the 100 millimetre (approximately) rising main installed from the pump station in the detention pond to the Outram - Mosgiel Road reserve and on to the bridge abutment site where the rising main pipe would discharge to river. The bridge abutment is stable and the pipe to the normal river water level would be protected with the existing abutment scour protection modified to suit the chosen pipe alignment.

Figure 1: Subdivision Layout - Direct Stormwater Disposal Option 1

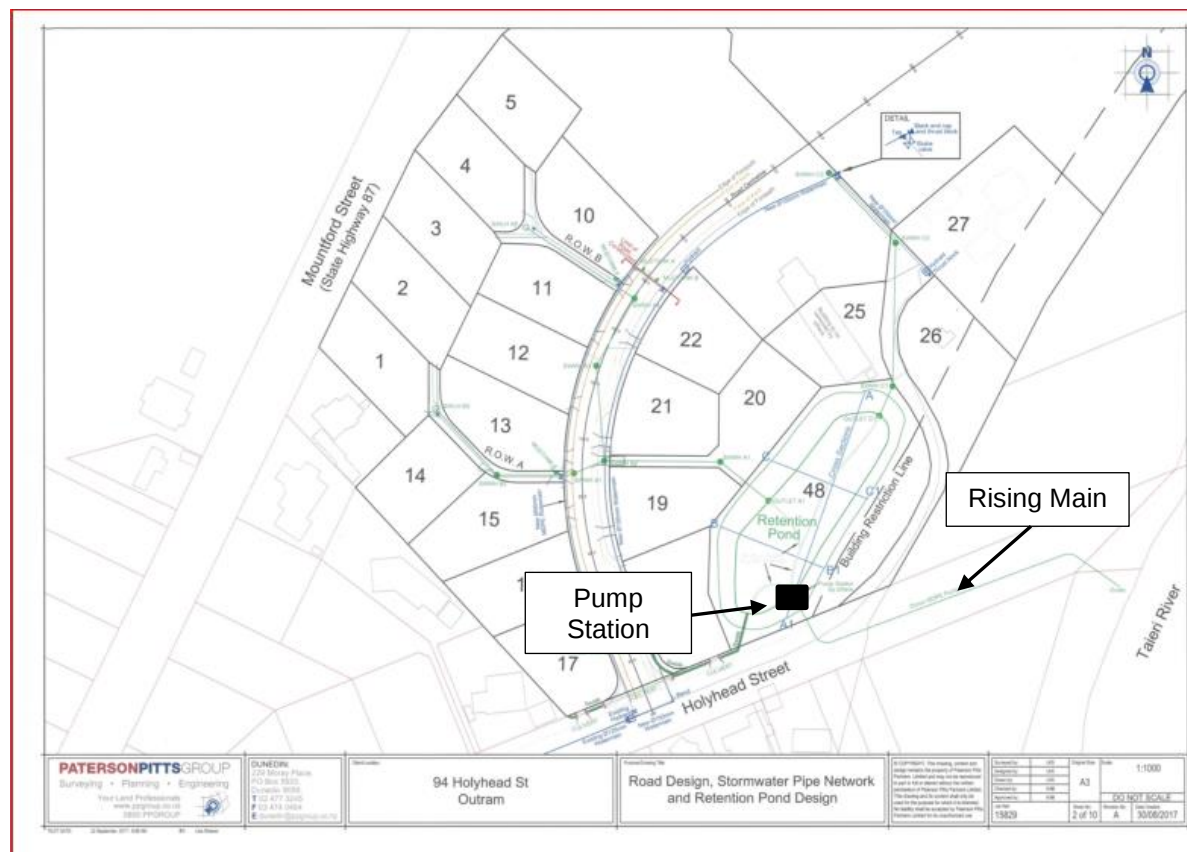
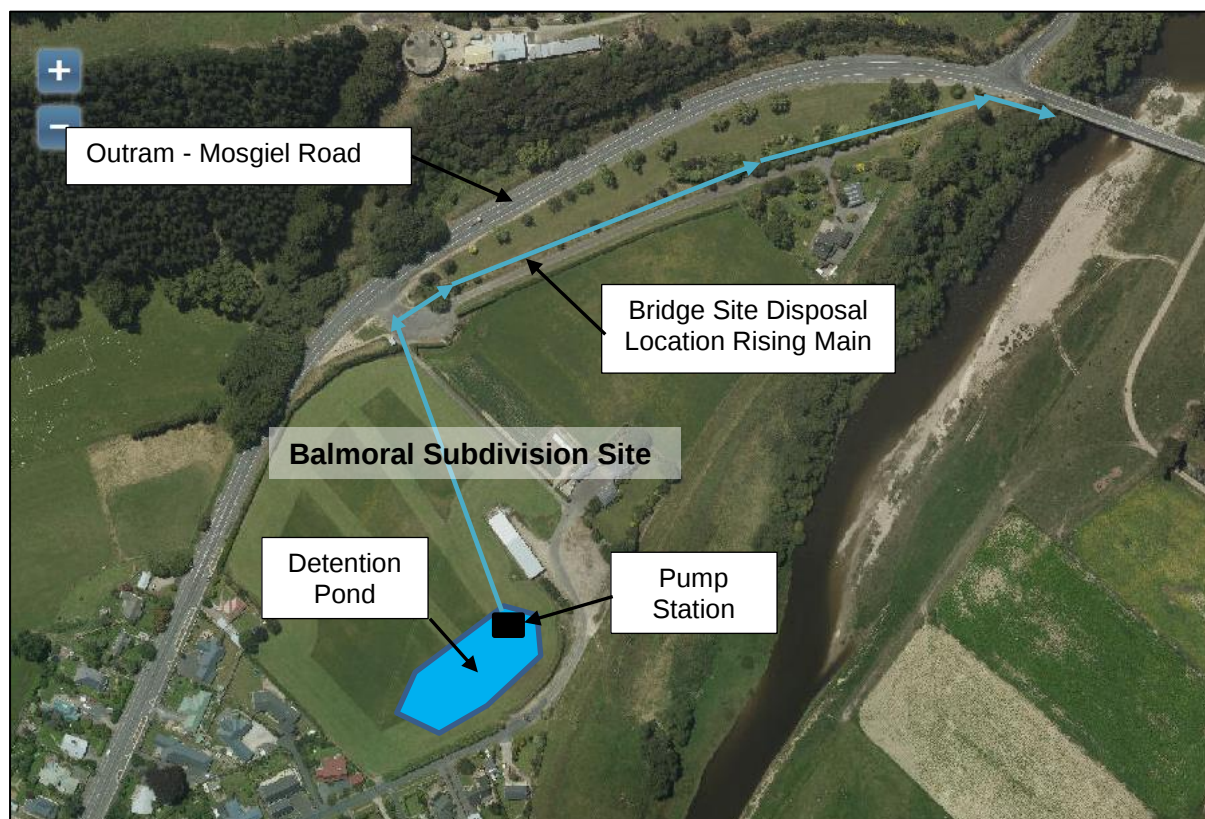


Figure 2: Option 2 - Bridge Site Disposal Location



4.0 Commentary

Option 1 is a direct line to the river but is potentially more complex to construct and maintain with regard the transition from the pipe to the river. The main channel bank location at the river adjusts from time to time and hence work would be required to maintain the outfall location accordingly.

Option 2 would utilise an existing stabilised channel edge.

The options are similar in terms of initial and operating cost and both are well placed for access for maintenance.

For further comment please refer to the undersigned.

Yours faithfully

FLUENT INFRASTRUCTURE SOLUTIONS LTD

Per:

Gary Dent
Water Resources Engineer