



memorandum



TO	Bruce Van Duyn	FROM	Eoghan O'Neill
	Carter Group Ltd	DATE	9 September 2026
RE	Wastewater – Beca Review Questions		

1.0 Introduction

This memorandum provides comments on questions raised by the Waimakariri DC (WDC) peer reviewer regarding the wastewater system for the proposed Carter Group residential subdivision at 531 and 535 Mill Road, Ohoka. A meeting was held on 14 August 2026 between Carter Group, Inovo and Pattle Delamore Partners Limited (PDP) to discuss a number of questions posed by Beca, assisting WDC. PDP's responses to those questions are provided in the sections below.

1.1 How will the existing Ohoka connections be altered under your current proposal? It is likely that the high pressure proposed in the line would impact the existing on-site pumps or even prevent them from running.

It is not proposed that the existing Ohoka connections are physically altered in any way. These connections are serviced by individual low-pressure sewer (LPS) pumps, located in a tank on each property. These LPS pumps currently discharge directly into the WDC pressure main on Mill Rd via a collective pressure pipe network. The new pump station within the Ohoka development is anticipated to operate between 3 and 6 hours per day. This allows for a significant time window when the individual property pumps in Ohoka can operate unimpeded. The existing LPS pumps are anticipated to run for approximately 10 to 20 minutes per day per pump.

The existing LPS pumps are E/One pump installations fitted with pressure switches that prevent the pumps from dead-heading or operating against a closed head. When an LPS pump enters its start sequence and the pressure switch senses a downstream pressure greater than 55 m, the pump enters a dormant phase for a set period before attempting to restart. Each LPS pump tank has sufficient storage to buffer short periods when system pressure is higher than 55 m and the pump is in dormant mode. This pressure switch function is a built-in mechanism that helps manage LPS pump restarting following an extended power outage by limiting the number of pumps that can operate concurrently through the LPS pressure network.

Once the downstream pressure is less than 55 m, any existing LPS pumps that have been in dormant mode then operate and pump out their chamber. A typical existing LPS pump run cycle is approximately 1 minute. It is not anticipated that the operation of the proposed Ohoka pump station would impact on the existing LPS pumps in a way that would be noticeable to the individual householders.

1.2 Please provide hydraulic calculations for your current proposal, including fatigue calculations

A hydraulic model of the existing rising main and Bradleys Road pump station (BRPS) was constructed in the Bentley Hammer software. The model construction was based on the alignment and pipe parameter information as available in the WDC GIS system. Levels for key components of the pipeline were interpolated from the design drawings and long sections contained in the CPG Ltd design report (CPG, 2012). The BRPS was modelled as per the WDC GIS information as well as the design plans, pump details and fittings information contained within the CPG Ltd design report. The proposed Ohoka Development Pump Station (OPS) has been connected to the existing BRPS rising main approximately opposite 544 Mill Rd in Ohoka.

The design flow for the OPS of 30 L/s has been selected primarily based on the hydraulic analysis outlined in the PDP Fast Track Application Wastewater Report. This analysis assessed a range of flows from 25 L/s to 35 L/s. The design flow of 30 L/s was selected because the analysis indicated that it met the requirements of the Waimakariri DC Engineering Code of Practice with respect to the existing pipeline. This is consistent with the original CPG design report for the Bradleys Road pump station and pressure main, which indicated that the future system envisaged a new pump station in Ohoka operating in conjunction with the Bradleys Road pump station. The total design flow for the rising main, as stipulated in Table 2 of the CPG design report and reproduced below, is 30.3 L/s. This flow would be achieved when both the Bradleys Road pump station and the previously envisaged Ohoka pump station operate concurrently, as described in the control logic for the two pump stations in Section 5.2 of the design report. As noted in the PDP wastewater report, the proposed OPS control logic is such that it would not operate simultaneously with Bradleys Road pump station, thereby ensuring that the flow in the rising main does not exceed 30 L/s.

	Bradleys Pump Station	Ohoka Pump Station	Total to WWTP
Properties Connected	625	250	875
Average Daily Flow (m ³ /day)	312.5	125	437.5
Average Daily Flow (L/s)	3.6	1.5	5.1
Peak Daily Flow (m ³ /day)	437.5	175	612.5
Peak Daily Flow (L/s)	18.1	7.2	25.3
Contingency (20%)	3.6	1.4	5.0
Design Flow (L/s)	21.7	8.6	30.3

Figure 1 Reproduction of Table 2 from CPG Design Report for Bradleys Rd PS

Fatigue calculations undertaken for the operation of both Bradleys Rd PS and the OPS over the remaining life of the pump station indicate as follows:

- ✧ Average pump starts per day from Bradleys Rd PS over 100-year life is approximately 3.7 cycles /day or 135,000 total cycles.
- ✧ A conservative average number of pump cycles for the proposed OPS is 6.2 cycles/day or 188,000 cycles over the remaining life of the pressure main following connection.
- ✧ Conservatively assuming a total of 350,000 pump cycles over the lifetime of the pipeline, an appropriate Fatigue Load Factor for PVC-U is 0.715.
- ✧ For a Cyclic Pressure Range of 667 kPa, the equivalent operating pressure (P_{eo}) for the pipeline is therefore 933 kPa, which is less than the 1200 kPa pressure class of the pipeline.

- ✧ The above analysis also conservatively assumes that the cyclic pressure range for all pump cycles over the course of 100 years is 667 kPa, although this will represent only approximately 58% of the total cycles. The balance of pump cycles will have a much lower cyclic pressure range.

1.3 What water hammer calculations have been completed for a fast valve closure on the pumping main?

Four valve closing scenarios were undertaken using the Bentley Hammer model software for the OPS operating at a flow of 30 L/s. These scenarios were:

- ✧ Instant Valve Closure (0.1 s) and Opening (0.1 s) at time of 10 s and 150 s. Pump Remains on.
- ✧ Fast Valve Closure and Opening (10 s). Pump remains on.
- ✧ Fast Valve Closure and Slow Opening (10 s / 150 s) - with pump ramping down in parallel
- ✧ Fast Valve Closing and Opening (10 s) - with pump ramping down slowly after closure/open of valve.

The pressure profile results generated for these scenarios are appended in Appendix A. For all modelled scenarios, the maximum pressure remained within the pressure class of the pipeline. The scenarios are not exhaustive, and additional transient modelling will be completed at detailed design stage to confirm any positive or negative pressure mitigation measures required for the final pump station and rising main configuration.

1.4 Please provide further information on how the 251m³ storage has been calculated

The storage requirement at the proposed pump station was calculated using available raw SCADA data from the 2022 groundwater resurgence period, including pump on/off data and instantaneous flow data. The SCADA data had a one-minute timestep, which was adopted for the volume analysis. A mass balance was then carried out at one-minute intervals over a two-week period spanning the high-inflow event. The analysis first identified periods when the BRPS was not operating. These BRPS OFF windows, which represent the potential periods when the OPS could operate, were then reduced to allow for:

- ✧ An allowance of 2 minutes for the communication interval between the BRPS and OPS.
- ✧ An allowance to account for the reduced gravity flows out of the BRPS during the OPS operating cycle, which will in turn reduce the time until BRPS tank level signals BRPS to turn on again. This allowance was calculated based on an average gravity flow of 5.5 L/s from the BRPS, which was calculated from the SCADA data and represents the additional time the BRPS would need to pump this volume at the BPRS pump flow.

These allowances reduced each available time window by an average of 27% and provided a series of OPS ON pumping intervals across the analysis period within which the OPS could operate. Within these time intervals, the following parameters were also calculated:

- ✧ an accumulated wastewater volume was calculated for the OPS (“OPS Inflow Volume”) based on an average inflow of 27 m³/hr across the “BPRS OFF” period; and
- ✧ a maximum wastewater volume the OPS could pump in the available window, based on a flow of 30 L/s (“OPS Pump Volume”) over the “OPS ON” period.

This calculation was carried out for each time interval across the two-week period. For each interval where the OPS Pump Volume exceeded the OPS Inflow Volume, a negative wastewater storage balance was recorded for that pump interval. Where the OPS Pump Volume was less than the OPS Inflow Volume, a positive wastewater storage balance was recorded. The mass balance then added or subtracted the storage requirement for each interval from the Wastewater Storage Required balance. For any given

interval, the Wastewater Storage Required volume was not allowed to drop below zero and was only reduced by a negative wastewater storage balance where a positive storage balance existed in the preceding interval.

The analysis deliberately focussed on the period when very extreme flows were generated within the Mandeville wastewater network. These flows were driven by extended periods of surface flooding and ponding in the Mandeville area due to very high groundwater levels induced by successive large rainfall events. As the area relies on stormwater discharge via infiltration, the high groundwater levels impeded discharge to ground and resulted in ponding across the area. This ponding directly affected the Mandeville STEP (Septic Tank Effluent Pumping) network, with septic tanks on properties receiving direct inflows of surface water and high rates of groundwater infiltration which were then pumped through to the BRPS. The analysed period is therefore considered to represent a worst-case scenario and includes the largest inflows to the Bradleys Road pump station since at least 2018, and likely since the June 2014 storm event that caused extensive flooding in the area. Figure 2 below is sourced from the Waimakariri DC report entitled Mandeville Area Wastewater Network Model, dated 13 August 2021, and indicates inflows to BRPS from 2018 to 2020.

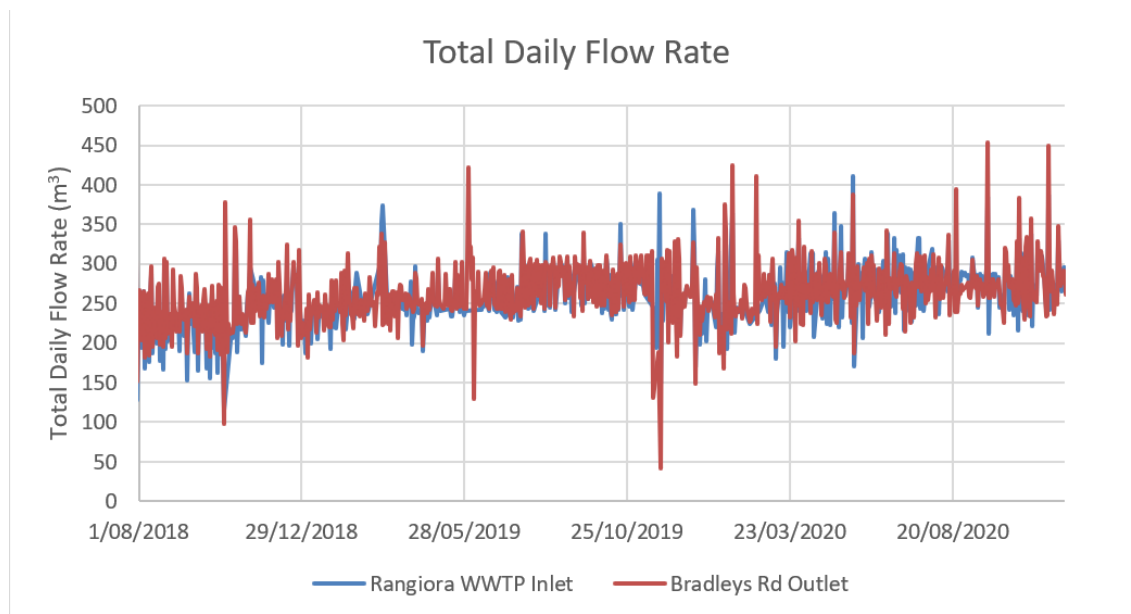


Figure 2: Total Daily flows at Rangiora WWTP and Bradleys Rd.

For context, the peak inflow to the Bradleys Rd PS during the two-week focus period of analysis was 1,720 m³/day. The storage proposed would only be needed during an event of similar magnitude and would be unused for the balance of the time. Over the two-week period analysed, wastewater was only accumulating and being stored within the tank for a consecutive period of 89 hours (3.7 days) during the peak of the inflow event at Bradleys Rd PS. During this time, the wastewater was also regularly pumped out of the storage tank, which greatly limited the residence time of the wastewater in the tank. Over the 89-hour period during which the peak wastewater volume of 251 m³ accumulated within the storage tank, a total volume of 2,406 m³ was pumped out of the same tank. The peak hydraulic retention time calculated for wastewater within the storage tank over the 89-hour accumulation and discharge period was 15.5 hours, and the average hydraulic retention time over that period was 6.75 hours.

As noted in the PDP wastewater report, a significant programme of drainage work is being undertaken by WDC to divert both surface and groundwater flows from the Mandeville area to the Eyre River in order to mitigate the flooding issues which have periodically occurred. Any mitigation of this flooding is expected to have a significant impact on the magnitude of the inflow and infiltration impacted inflows to the Bradleys Rd PS during and following extreme weather events.

1.5 Please provide justification for the wastewater flows from the retirement village lots

The flows generated from the development were calculated by Ecoflow Ltd and reported in its Preliminary Design Report, which is included in the Fast Track Consent Application. Section 3.1 details the sewer loading calculations and apportions 60 m³/day to the retirement village. This volume appears to be derived for a proposed 300-unit development (now reduced to 250 units), with 200 L/day/unit allowed for wastewater generation and five units sharing an LPS pump station. A source for the 200 L/day/unit wastewater generation rate is not provided.

The WDC Engineering Code of Practice does not specifically prescribe a wastewater generation basis for retirement villages. The Watercare Code of Practice for Land Development and Subdivision specifies 180 L/person/day for residential wastewater, while Table 5.1.2 states that, for a residential retirement village without a hospital facility and with single-bedroom units, an occupancy of 1.5 persons/unit may be adopted. This equates to 67.5 m³/day for a similar development in the Auckland region, which is not materially different from the 60 m³/day value adopted by Ecoflow. It is also noted that the Retirement Villages Association, a membership association representing operators, developers and managers of retirement villages throughout New Zealand, advocates for a wastewater figure of 208 L/day/unit¹. If WDC has a preferred methodology for calculating this load, that methodology can be incorporated into the wastewater design.

1.6 Please confirm what allowance has been made for I/I for the new wastewater connections

Discussions with pressure sewer suppliers indicate that conventional practice is not to apply significant I/I allowances on top of average flows for pressure sewer systems. The Watercare Code of Practice, Section 5.3.12.3.3, specifies that for pressure sewer system design, peak flows will be based on average dry weather flow (ADWF) with an added capacity safety factor of 1.2 per dwelling unit.

Monitoring of installed Christchurch pressure sewer systems indicates average per property flows of approximately 350 L/property/day. Monitoring of other mature pressure sewer systems in the Auckland area indicates average per-property flows of a similar magnitude with little statistical impact on flows during storm events.

For the storage analysis reported above the flows were based on average flows of 27 m³/hr which works out to approximately 585 L/property/day based on 859 residential lots and 250 retirement units.

1.7 Please provide information on the option of a dedicated pipeline to Rangiora or downhill to Kaiapoi

A pipeline to Kaiapoi has not been considered or discussed as a servicing option with WDC. During the previous Plan Change and District Plan Review processes, WDC indicated and agreed, through Joint Witness Statements, that connection of the development to Rangiora WWTP was an acceptable solution. A dedicated pipeline to Rangiora had previously been discussed with WDC and was a connection option that had been agreed in principle. However, the cost of installing such a pipeline would be considerable, and it is considered reasonable to utilise available capacity in the existing pressure main rather than constructing a separate pipeline.

¹ [Retirement Villages Association Submission to CCC Development Contributions Policy Review 2025](#)

1.8 Is the intention for all on-site pumps to be connected through a central control system like Iota for EOne?

This is a potential option available to Carter Group, and Carter Group is open to discussing the potential operational advantages it could provide. However, none of the analysis undertaken to date has relied on a central control system being installed.

1.9 What consideration has been given to a gravity sewer network rather than a low pressure sewer system?

A gravity sewer has previously been considered, and a concept was developed that involved four to five internal wastewater pump stations with conventional gravity sewers. The overall operational, maintenance and asset depreciation costs that such a system would generate for WDC, in comparison with a privately owned pressure sewer network, are considerable. The construction of a gravity sewer network would also have additional potential construction-related effects associated with the extent of dewatering that would be required to facilitate construction of the deep pipelines, manholes and deep wet wells for pump stations. Given the high groundwater levels at the site, the benefits of a pressure sewer system with shallow, small-diameter pipelines are considered to significantly outweigh those of a conventional gravity system in this location.

1.10 What would be the consequence of an overflow at the proposed Ohoka Pump Station

It is standard practice to construct an engineered overflow at terminal wastewater pump stations. This public health measure ensures that any potential overflow from the wastewater system is directed away from direct public contact, public roads and private properties. Such overflows are typically associated with inflow and infiltration into wastewater networks. Pressure systems are specifically engineered to minimise inflow and infiltration when compared with conventional gravity sewers. Storage at the pump station, together with significant storage on each individual lot, increases the robustness of the network to manage outages and unforeseen events. Additional design measures, such as standby generators and camlock fittings at the pump station tank to facilitate sucker truck access if necessary, would also reduce the risk of overflows. These additional design measures are all items that will be considered for inclusion at detailed design stage.

If an overflow did occur, it is likely that a constructed overflow would discharge to a nearby waterway. The potential consequence would depend on the overflow volume, duration, receiving environment, weather conditions at the time, and the response actions implemented by the operator.

2.0 Concluding Statement

Based on the analysis undertaken to date, the proposed wastewater servicing approach is considered technically feasible, subject to confirmation and refinement of the control logic, transient mitigation measures, storage assumptions and operational requirements during detailed design. The responses above address the matters raised by Beca and identify where further modelling or design development will be completed as the project progresses.

3.0 References

CPG Ltd, 2012; Mandeville and Ohoka Wastewater Scheme Design Report for Waimakariri District Council, April 2012.

4.0 Limitations

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Carter Group, Waimakariri District Council, Beca, Ecoflow Ltd and other parties involved in the project. PDP has not independently verified all provided information and has relied upon it being accurate and sufficient for use in preparing this memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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APPENDIX A – VALVE CLOSURE TRANSIENT SIMULATIONS

Legend for below Graphs:

Maximum Pressure: _____

Operating Pressure: _____ or _____

Minimum Pressure: _____

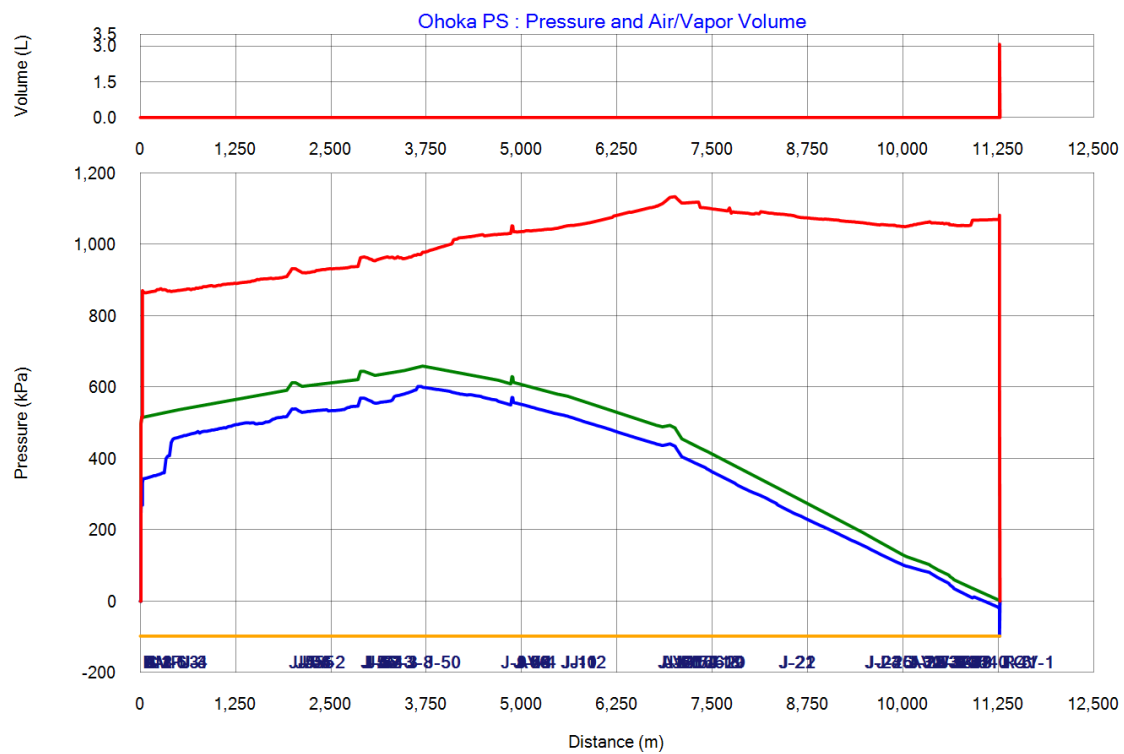


Figure A1 Instant Valve Closure (0.1 s) and Opening (0.1 s) at time of 10 s and 150 s. Pump Remains on.

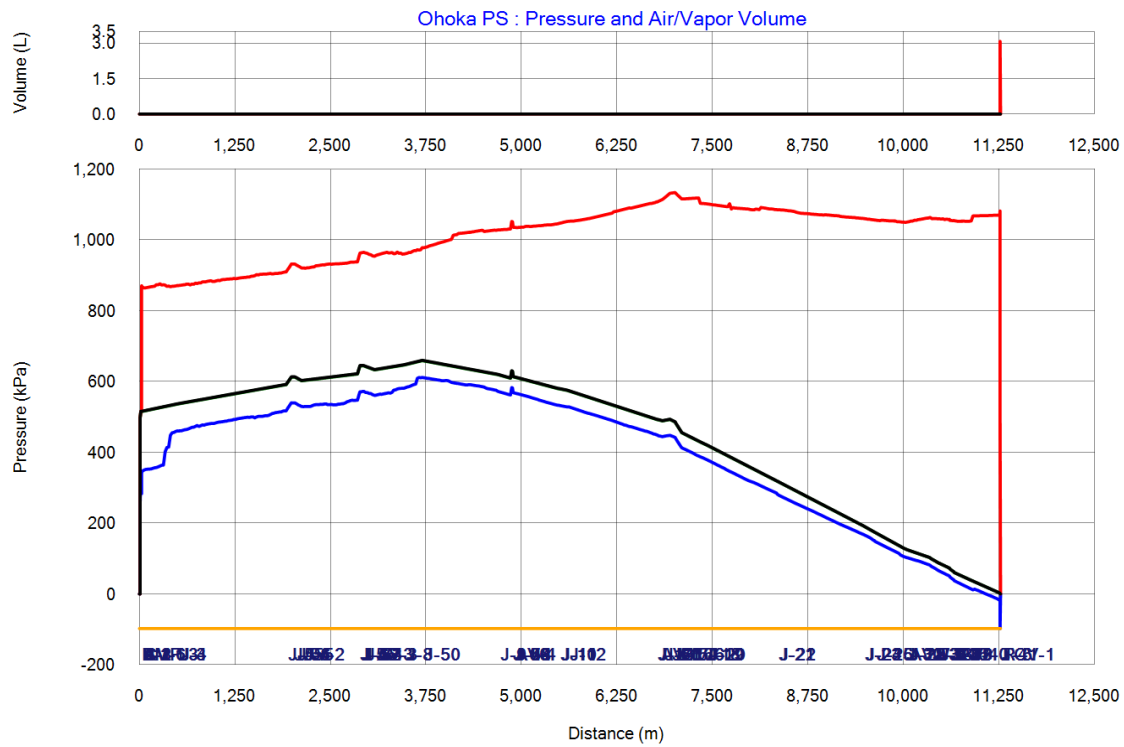


Figure A2 Fast Valve Closure and Opening (10 s). Pump remains on.

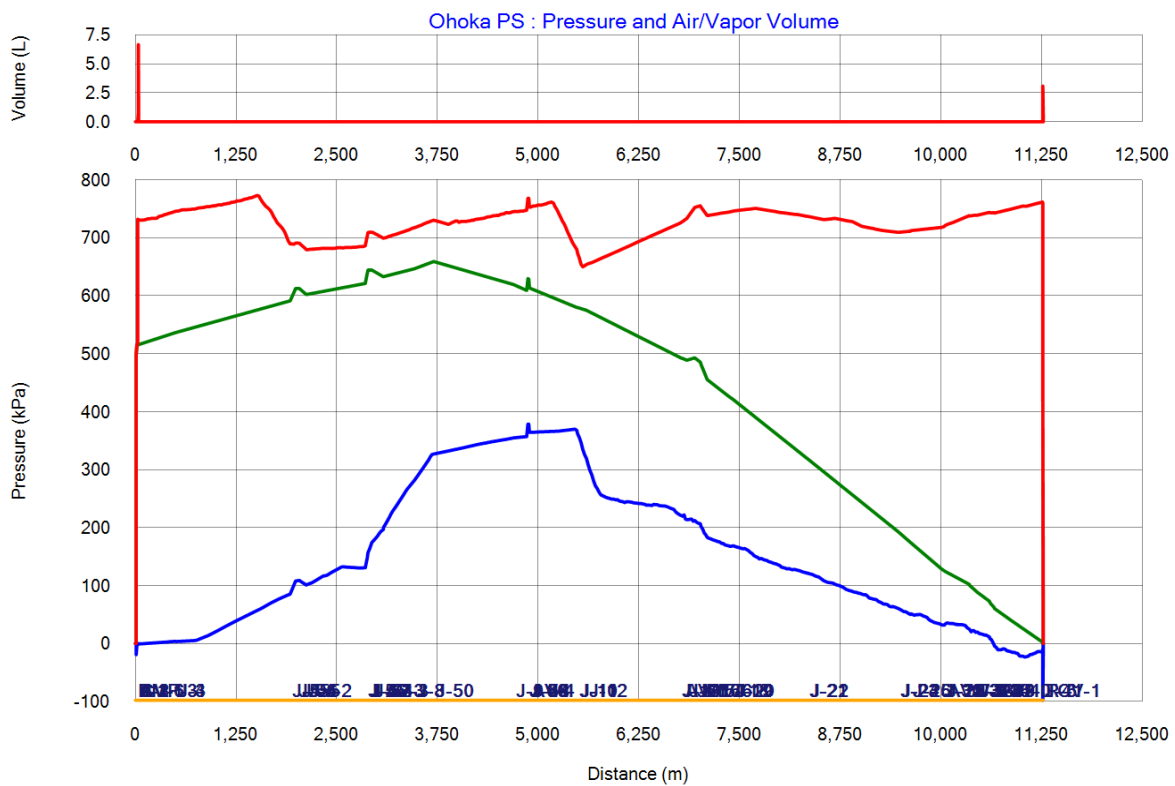


Figure A3 Fast Valve Closure and Slow Opening (10 s / 150 s) - with pump ramping down in parallel

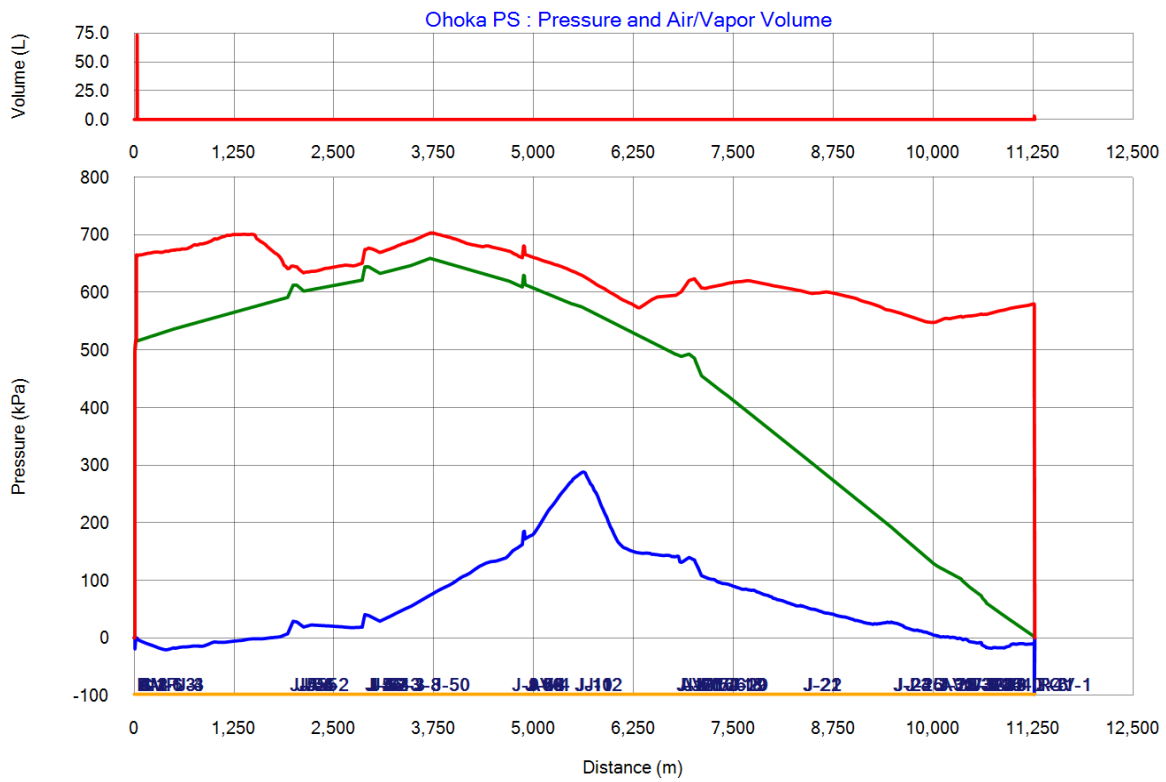


Figure A4 Fast Valve Closing and Opening (10 s) - with pump ramping down slowly after closure/open of valve.