rationale LIMITED
PO Box 226, Arrowtown Queenstown New Zealand
t: +64 3 442 1156 f: +64 3 442 1156 e: info@rationale.co.nz

18 November 2015

Ayrburn Farm Developments Limited
Cruickshank Pryde
Unit 23 Gorge Road Retail Centre
159 Gorge Road
Queenstown 9300

To whom it may concern,

RE: Ayrburn Farm, Arrowtown-Lake Hayes Road, Lake Hayes

Further to your e-mail dated 6 November 2015, we have completed the following assessments of the wastewater connection for the proposed Ayrburn Farm development.

Background

The proposed site for the development (indicated in green) is located to the west of Arrowtown-Lake Hayes Road, to the north of Speargrass Flat Road. This location borders the current boundary of the Lake Hayes wastewater scheme, and the provided report (Clarke Fortune McDonald) indicates the preferred option would be to connect by gravity to the Lake Hayes Scheme. As per the report modelling has been undertaken assuming a connection to the manhole at the junction of Speargrass Flat Road and Slope Hill Road (QLDC 'UnitID' SM11800).

The modelling is based on the Wakatipu dynamic wastewater model (2012), calibrated to flow data January 2012 and June 2013. The modelling has been carried out on two scenarios:

1. Current day - used to assess the current impact of the development connecting to the scheme.

2. 2051 growth scenario - used to assess if the development will consume capacity that is required for developments that are compliant with the current district plan and within the scheme boundaries. I.e. to determine if this development would trigger additional upgrades beyond that reflected in the QLDC 30 Year Strategy / Long Term Plan.

It should be noted that Lake Hayes Pump Station 1 is currently under capacity and requires an upgrade. The pump station currently has a duty pump capacity of 2.6 l/s. The model projects the following flows with and without the proposed development:

- Current day maximum inflow, without the proposed development, is 5.0 l/s.

- Future day maximum inflow, without the proposed development is 6.0 l/s.

- Future day maximum inflow, with the proposed development is 14.5 l/s.

To assess future capacity it has been assumed that the pump is upgraded to achieve 16 l/s, this achieves a 10% excess capacity assessed against the projected maximum inflow including the proposed development. It is also assumed that the rising main will require upgrade to avoid high velocities (approximately 2 m/s) and friction losses. An upgrade to a 150 mm diameter rising main has been assumed, reducing velocity to approximately 0.9 m/s.

The objective of this work is to determine if the wastewater network has sufficient capacity with the addition of this development.

We have completed our investigations based on the development containing the following loads:

Load Type	Units	Total Units	Load / Unit / Day (l/d)	PDWF (l/d)	Approx Peaking Factor	Rainfall Catchment Area (Ha)
Residential	units	150	735	110,250	2.1	45.9

All loads (including the above residential load) have been modelled as per the standard load from the calibrated model. Additional rainfall catchment area has been added to the model as per the above table. The same infiltration parameters as per the neighbouring Lake Hayes catchments have been applied.

Assessment of Capacity
The relevant sections of the network have been checked for capacity using the following criteria:

- No overflows allowed at any network element.

- No pump station overflows based on the duty pump capacity.

- As per the infrastructure code (section 2.7.10.6), emergency storage of 8 hours of average daily dry weather flow is required or emergency generation.

It should be noted that the following calculations of emergency storage requirement are calculated assuming that 8 hours' storage of average daily flow over the peak day flow is required. The use of peak day flows in this estimate is likely to be conservative and may overestimate the storage requirement comparted to the intended interpretation. The Infrastructure Code is now superseded by the QLDC Land Development and Subdivision Code of Practice; the Code of Practice does not stipulate any requirements for pump station design. The infrastructure code parameters have been retained as an indicator of emergency storage capacity / emergency management requirements.

Results – SM11800 to Lake Hayes Pump Station 1.

- There are no related network elements overflowing in either scenario. See attached maps.

- Pump station inflow significantly exceeds outflow, generating an overflow of 10 l/s In the current day scenario. This is based on a single duty pump capacity of 2.6 l/s and a total storage volume of 17.0 m^3. An upgrade is assumed for the future day scenario. See Figure 1 and Figure 2.

- There is no dedicated external emergency storage at this pump station. It is believed that emergency generation can be supplied from the water bore site. Without the generator the storage requirements, as per the infrastructure code, are estimated to be as follows:

    - Current Day: 20.7 m^3.
    - Future without proposed development: 31.3 m^3.
    - Future with proposed development: 68.0 m^3.

Results – Lake Hayes Pump Station 1 to Lake Hayes Pump Station 2.

- The current day scenario has sufficient capacity for the current pumped flow. There are two network locations where overflows are projected in the future day scenario. This is due to the upgraded pumped flow exceeding the capacity of localised downstream pipe lengths with a flat grade. See attached maps.

- Pump station inflow does not exceed outflow. This is based on a duty pump capacity of 16 l/s and a total storage volume of 21.2 m^3. See Figure 3 and Figure 4.

- There is no dedicated external emergency storage at this pump station. It is believed that emergency generation can be supplied from the Arrowtown-Lake Hayes Road Pump Station. Without the generator the storage requirements, as per the infrastructure code, are estimated to be as follows:

    - Current Day: 38.0 m^3.
    - Future without proposed development: 87.4 m^3.
    - Future with proposed development: 124.2 m^3.

This does not include any potential upstream or network storage.

Results – Lake Hayes Pump Station 2 to Arrowtown - Lake Hayes Road Pump Station.

- It is noted that this is a rising main construction and cannot overflow under normal operation.

- Pump station inflow does exceed outflow, but does not cause an overflow. This is based on a duty/assist pump capacity of 80 l/s and a total storage volume of 275 m^3. See Figure 5and Figure 6.

- There is dedicated external emergency storage at this pump station of 224 m^3, plus the wet well storage of 50 m^3. Compliance with the infrastructure code is fulfilled by the use of an on-site backup generator. Without the generator the storage requirements, as per the infrastructure code, are estimated to be as follows:

    - Current Day: 456 m^3.
    - Future without proposed development: 713 m^3.
    - Future with proposed development: 750 m^3.

This does not include any potential upstream or network storage.

Results – Arrowtown - Lake Hayes Road Pump Station to Shotover Treatment Plant.

This trunk main has been modelled as a dedicated rising main through to the treatment plant and no overflows can occur. The original plan for the 'Balance Tank' at the junction with Shotover Country was that all downstream reticulation would be designed to convey at least the combined pump capacity of the three pump stations discharging to this point (Arrowtown – Lake Hayes Road Pump Station, Lake Hayes Estate

Pump Station 4 and Shotover Country Pump Station). As the addition of this development would not trigger the requirement of an upgrade to any pump station it is assumed that the original design of the balance tank and downstream reticulation remains valid.

Discussion

Modelling of the network from the proposed development through to the treatment plant indicates that the existing QLDC network, has insufficient capacity to handle the addition of this development, based on the above assumptions. However, it is noted that the model also indicates that the current infrastructure does not have capacity for the current catchment and a portion of the upgrade would be attributable to that shortfall.

The model indicates that a pump upgrade to enable a pumped flow of 16 l/s would be sufficient to manage the risk of overflow at the pump station under the modelled future scenario. However, the proposed pump upgrade will exceed the downstream reticulation capacity. The model projects overflows in gravity reticulation between Lake Hayes Pump Station 1 and Lake Hayes Pump Station 2 at the following locations:

1. Immediately downstream of the Lake Hayes Pump Station 1 discharge manhole, totalling 38.5m^3. As the rising main will require an upgrade, an upgrade of the gravity reticulation starting at this location could be avoided by a realignment/extension to the rising main to discharge to a location further downstream where sufficient downstream capacity exists.

2. A flat section of reticulation approximately 830 m downstream of the discharge manhole, this is projected to be a relatively minor overflow of 0.7m^3. This overflow will be magnified if the upstream overflows are eliminated. It is likely that an upgrade of the remaining reticulation from this location (or other solution) will be required. This is likely to total a minimum of 500 m of reticulation that will require to be upgraded.

If the development did not proceed it is likely that upgrades would be confined to the pumps. An upgrade to provide sufficient capacity for an inflow of 6 l/s would result in a velocity of approximately 0.7 – 0.8 m/s, which would not require an upgrade to the rising main.

The model indicates that the wet well has sufficient operational storage capacity future scenarios:

- A maximum 2 hour period between the pump runs overnight (dry conditions).

- A maximum 40 minute pump run time, at the peak of the modelled 1 in10 year, 6 hour storm.

Assuming that the pump station's wet well and power source would not require upgrade, the following infrastructure is likely to require upgrading to service this catchment with the addition of this development:

- 2 x pumps (associated fittings/controls), upgrading to 16 l/s at a head of 28 m.

- 300 - 750 m of 150 mm rising main, depending on alignment.

- 500 - 1,330 m of 225 mm gravity main, depending on alignment.

A more detailed study of the required reticulation upgrades, and other potential solutions, should be carried out following agreement on the required pump station upgrades and potential reticulation alignments.

Recommendation

It is recommended that the development could connect to the network, following the upgrade of Lake Hayes Pump Station 1 and the downstream reticulation, with no further significant effects on the capacity reserved for developments that currently comply with the district pan / scheme boundaries

Due to the rapid growth occurring in this area, the validity of this letter should be checked any time it is used as supporting evidence in a consent application.

It should be noted that the wastewater models are an attempt to simulate a physical system using hydraulic equations and various assumptions, hence it bears some uncertainty. QLDC's GIS data was used to develop the models and we can offer no guarantee on the accuracy of this information. The sanitary loads and diurnal patterns are an approximation of the patterns in the townships which have been agreed with QLDC.

Yours Sincerely,

Mark Baker
Infrastructure Analyst

Tom Lucas
Director / Infrastructure Analyst

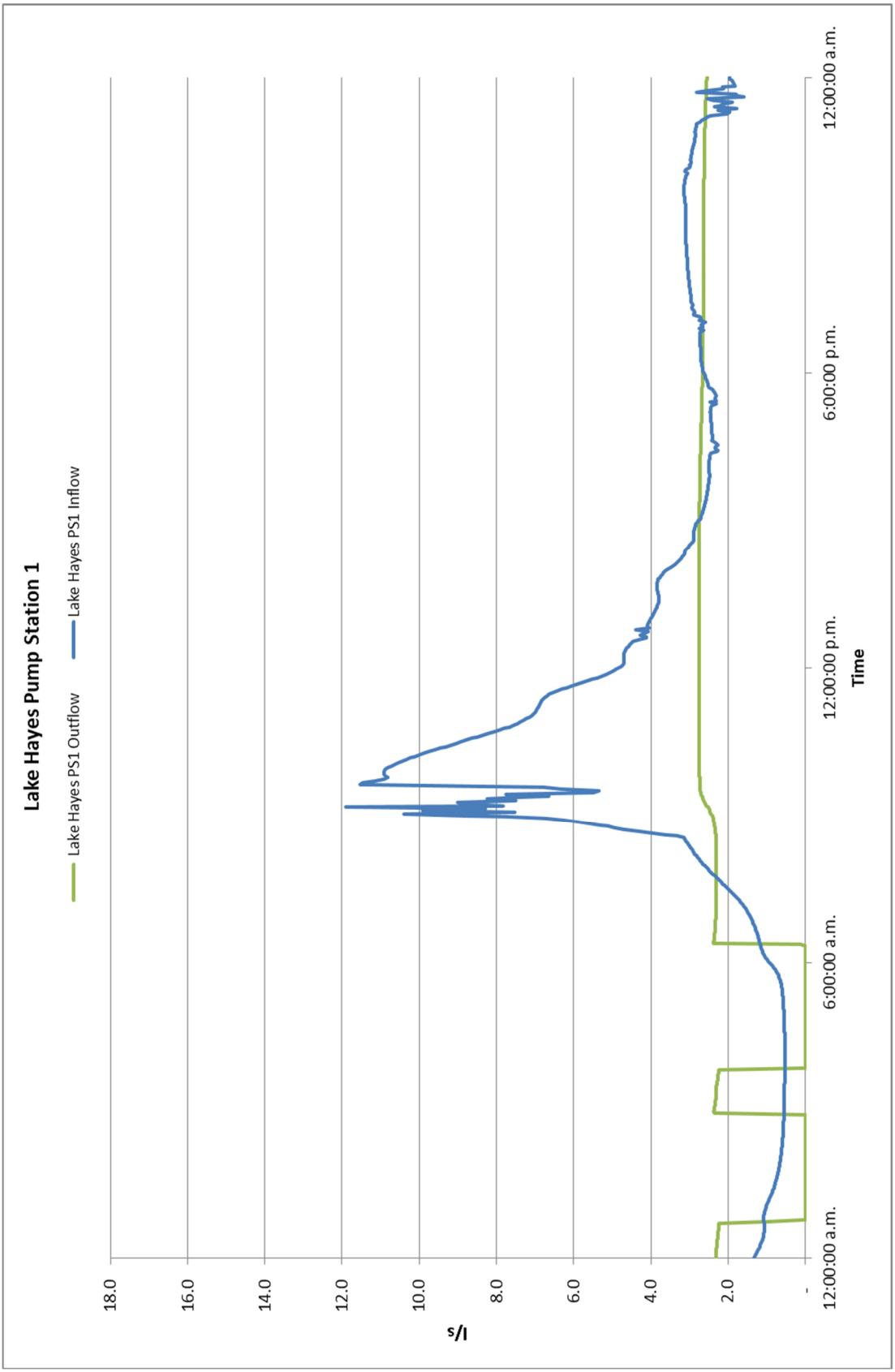

Figure 1 – Lake Hayes Pump Station 1 Inflow/Outflow – Current Day
Note: the instability in the inflow is caused by the overflow in the calculation engine.

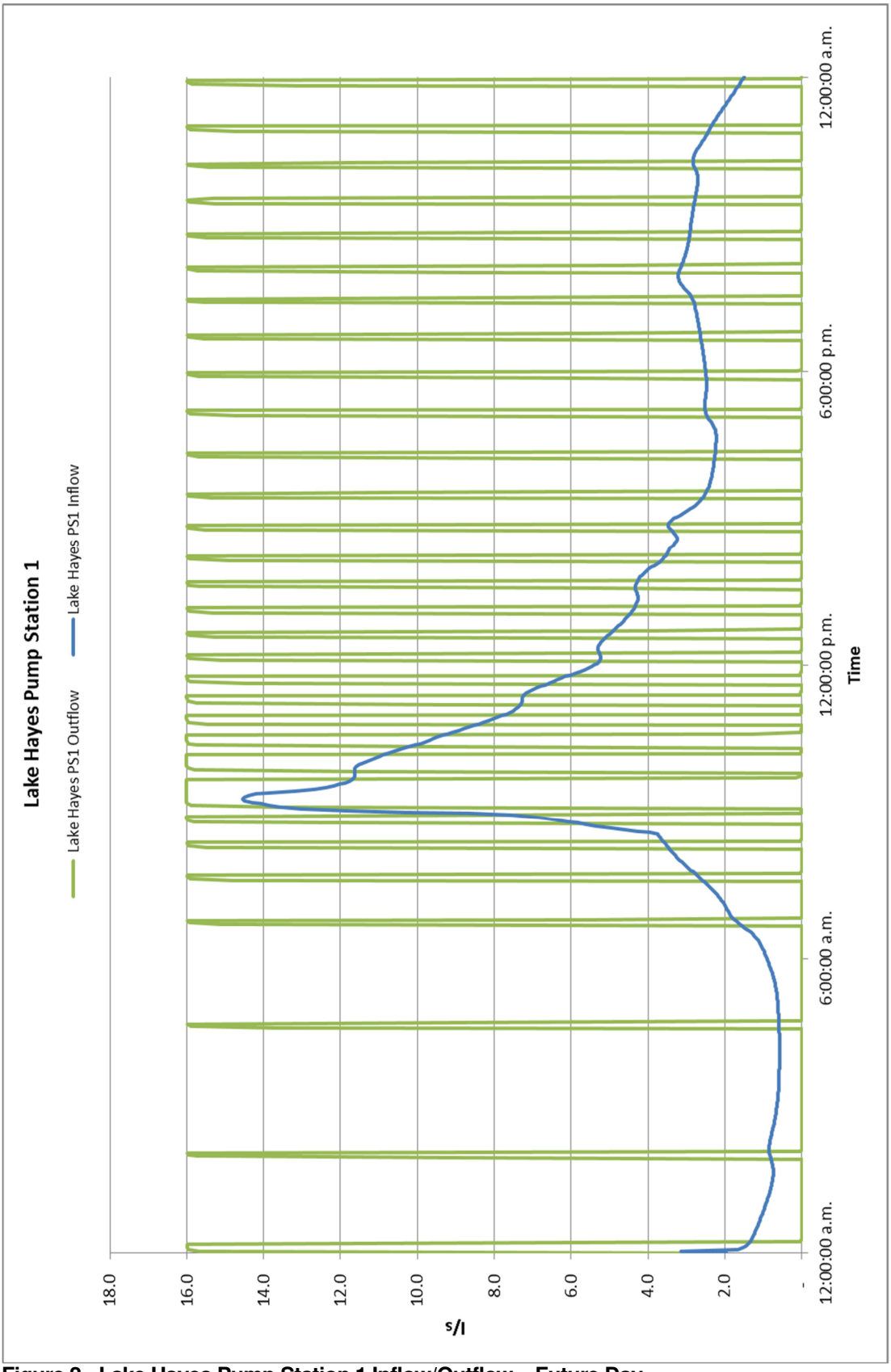

Figure 2 - Lake Hayes Pump Station 1 Inflow/Outflow – Future Day

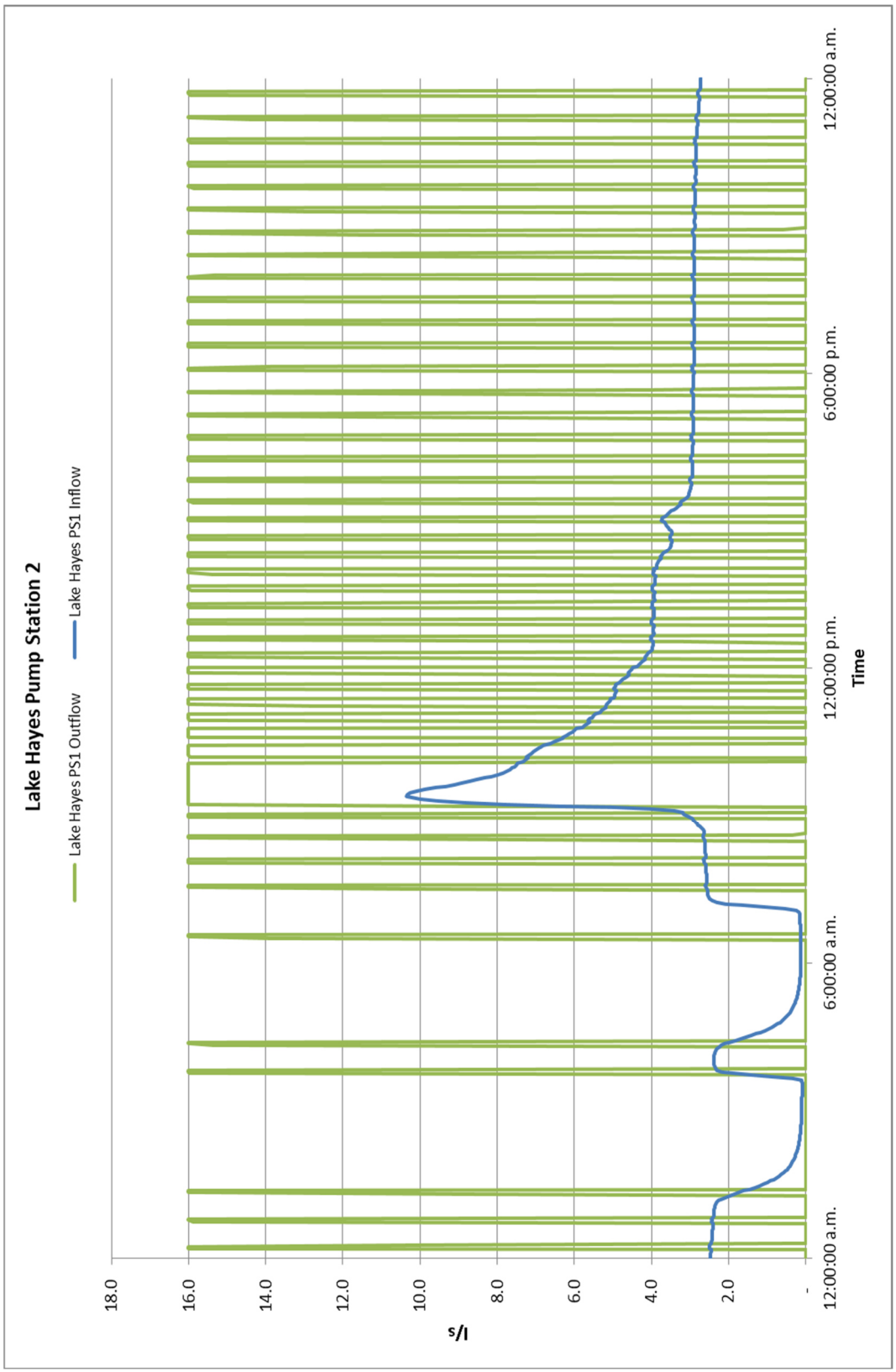

Figure 3 - Lake Hayes Pump Station 2 Inflow/Outflow – Current Day

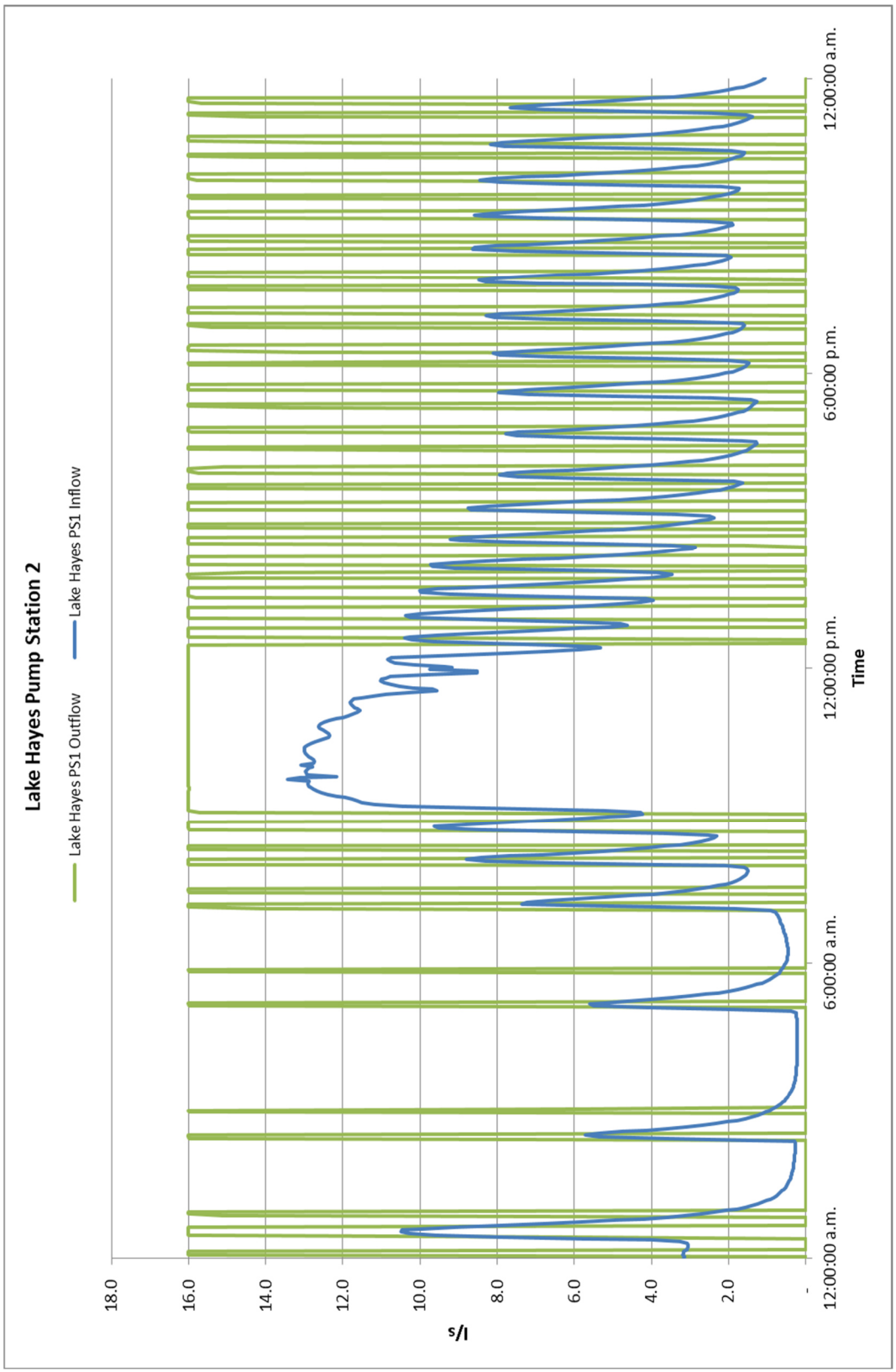

Figure 4 - Lake Hayes Pump Station 2 Inflow/Outflow – Future Day

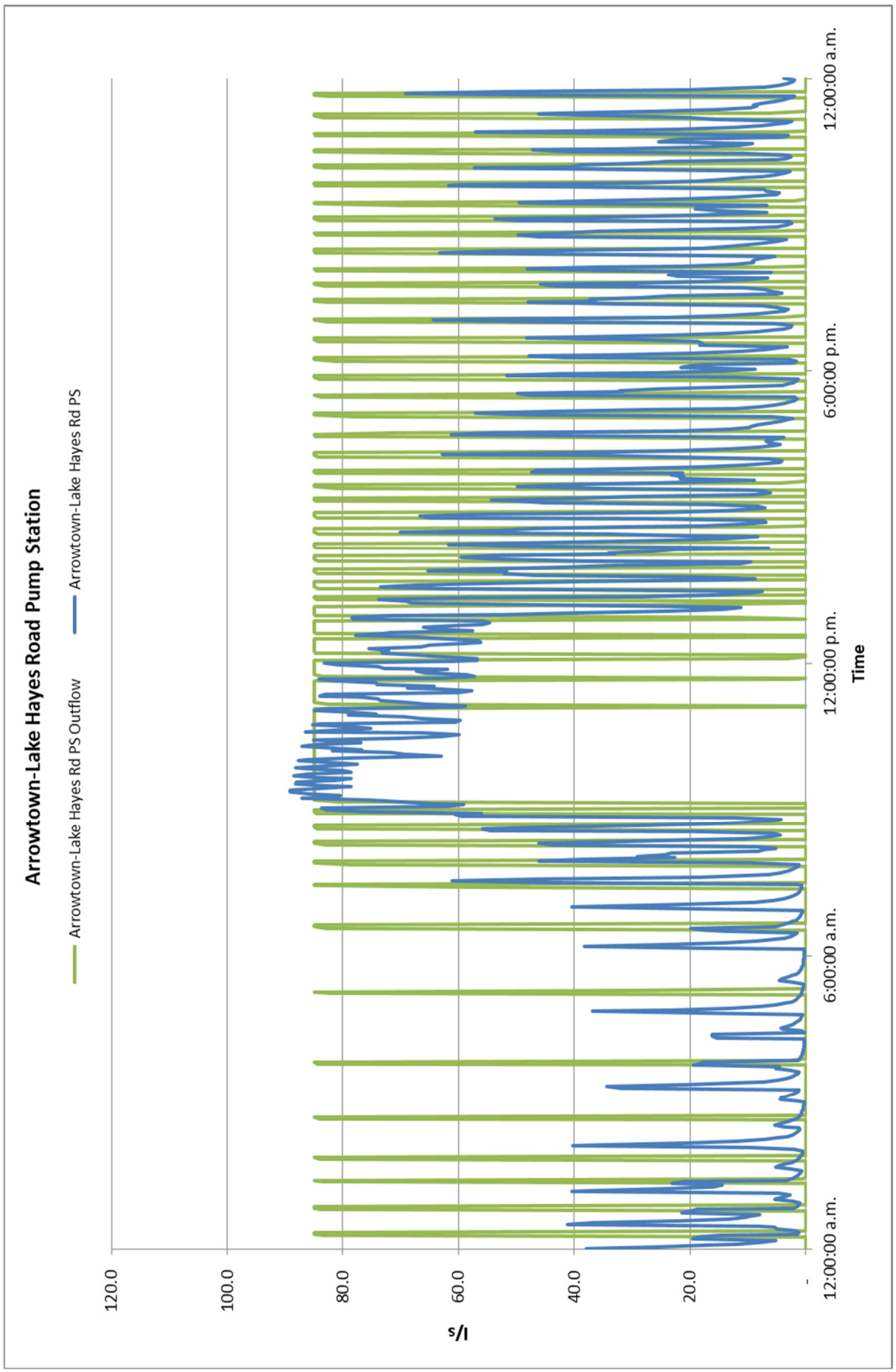

Figure 5 – Arrowtown-Lake Hayes Road Pump Station Inflow/Outflow – Current Day

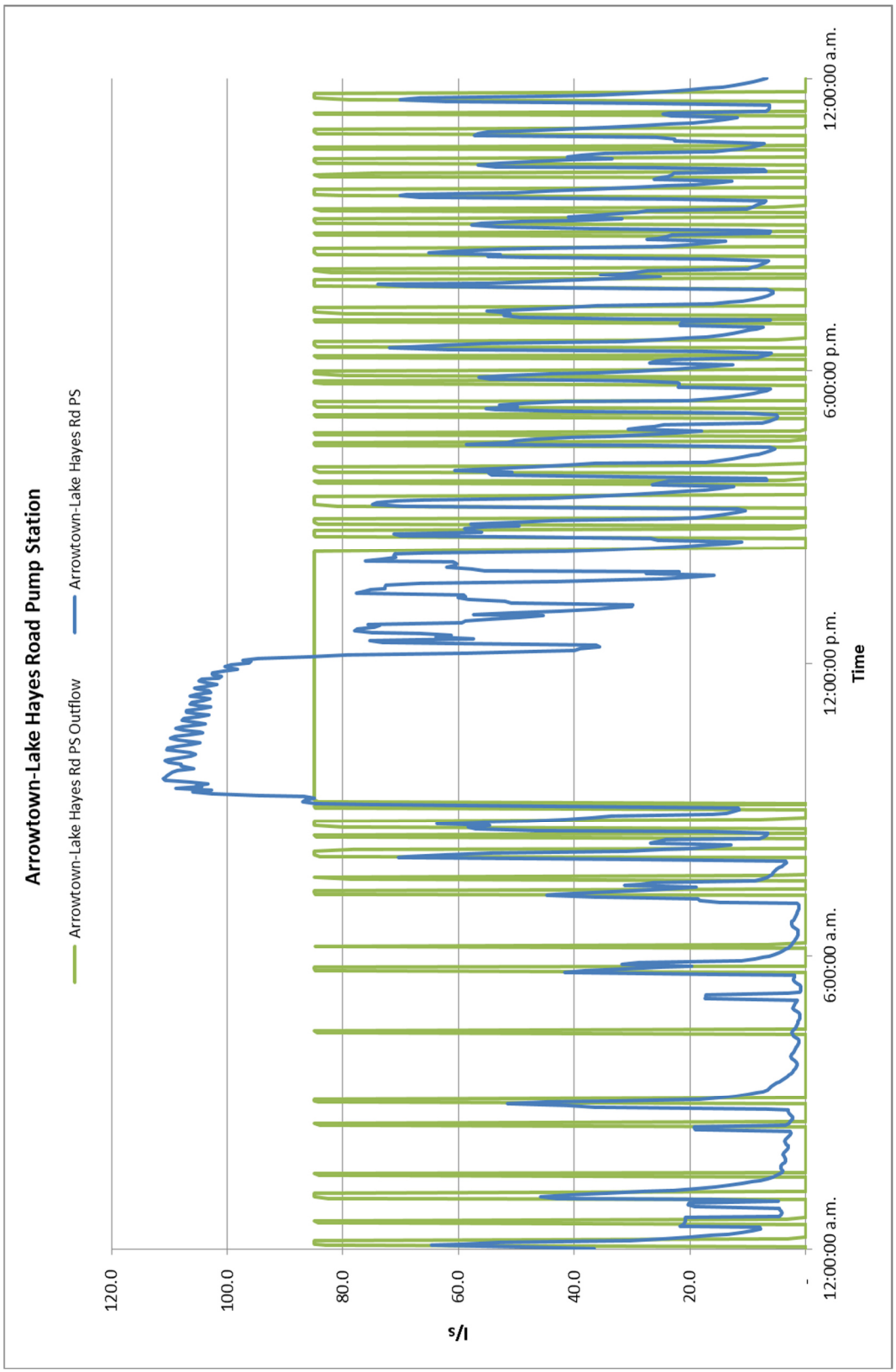

Figure 6 – Arrowtown-Lake Hayes Road Pump Station Inflow/Outflow –Future Day