CLARK FORTUNE MCDONALD & ASSOCIATES
REGISTERED LAND SURVEYORS, LAND DEVELOPMENT & PLANNING CONSULTANTS

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M E M O R A N D U M

TO: Tim Allan – Laurel Hills Ltd

FROM: Chris Hansen
Clark Fortune McDonald & Associates

DATE: 18th January 2019

SUBJECT: Laurel Hills Ltd – Proposed Residential Development – WSP Opus response to Second Review dated 8 Jan 2019.

Background

The second review identifies correctly that there is use of either non-Code of Practice Figures or figures that do not exist in the Code of Practice and that these figures are a matter for QLDC to determine using their discretion.

Wastewater

To assist in evaluating the actual wastewater demands across a wider period of time, updated flow readings have been requested by QLDC maintenance contractors. This data will more accurately show trends and demands so that decisions are not based on a 'snap shot' in time.

We'll analyse the data received in due course and forward for consideration.

QLDC Code of Practice does not specify a requirement for pipes to operate part full. This is a further matter for QLDC determine whether or not possible surcharge is an acceptable risk. Furthermore, calculated capacity for pipe full scenario is 200 dwellings, Laurel Hills proposal is 156 dwellings therefore pipes will not be full.

Although QLDC Code of Practice does not specify storage requirements, 8 hours emergency storage was previously accepted by QLDC for the Shotover Country SHA given the WWPS has a standby generator on site.

Stormwater

As the catchments are relatively small our view is Rational formula is appropriate for calculating peak run-off. Modified Rational formula is appropriate for calculating volume.

Updated volume calculations are shown below.

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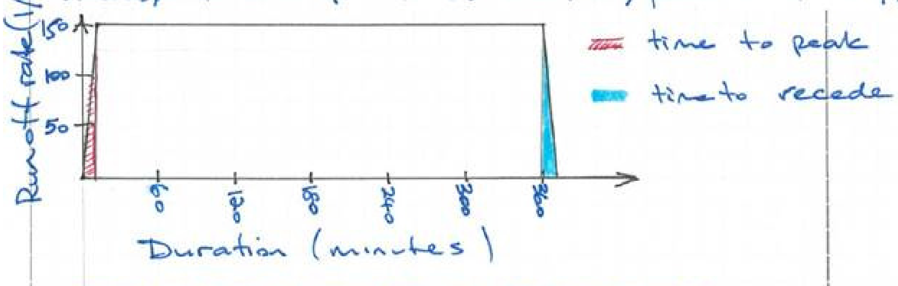
Client: Laurel Hills Ltd		Date: 17/1/2018
Project/Job: Laurel Hills	Job No. 13496	Sheet No: 1 /
Subject: Stormwater runoff volumes		By: TS

Example : 20 year ARI storm*, 6hr duration

* HIRDS V4 RCP 8.5 2081 – 2100

Rainfall depth = 60.3 mm, C = 0.60, A = 9.4ha, Tc = 10min

Average intensity = 10.05 mm/hr, peak runoff 158 l/s



STORMWATER RUNOFF IN PIPE NETWORK

Runoff volume = area under hyrograph
= peak runoff rate x storm duration
= 3,400m3

Can also be calculated as rainfall depth x catchment area x runoff coefficient.
= 3,400 m³

Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h
1.58	0.633	21.6	17.1	14.7	11.3	8.29	4.74
2	0.500	24.4	19.3	16.6	12.6	9.29	5.26
5	0.200	35.1	27.3	23.4	17.6	12.7	7.08
10	0.100	44.1	34.0	28.9	21.5	15.5	8.50
20	0.050	54.3	41.5	35.2	26.0	18.5	10.0
30	0.033	61.0	46.4	39.2	28.8	20.4	11.0
40	0.025	66.0	50.0	42.1	30.9	21.8	11.7
50	0.020	70.2	53.1	44.6	32.6	23.0	12.3
60	0.017	73.6	55.6	46.7	34.0	23.9	12.7
80	0.012	79.5	59.8	50.1	36.4	25.5	13.5
100	0.010	84.2	63.2	52.9	38.3	26.8	14.1

Rainfall depths (mm) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h
1.58	0.633	3.59	5.69	7.37	11.3	16.6	28.4
2	0.500	4.07	6.42	8.30	12.6	18.6	31.6
5	0.200	5.85	9.11	11.7	17.6	25.5	42.5
10	0.100	7.35	11.3	14.5	21.5	31.0	51.0
20	0.050	9.05	13.8	17.6	26.0	37.0	60.2
30	0.033	10.2	15.5	19.6	28.8	40.8	65.9
40	0.025	11.0	16.7	21.1	30.9	43.7	70.2
50	0.020	11.7	17.7	22.3	32.6	46.0	73.5
60	0.017	12.3	18.5	23.3	34.0	47.9	76.5
80	0.012	13.3	19.9	25.1	36.4	51.1	81.0
100	0.010	14.0	21.1	26.4	38.3	53.6	84.7

Infiltration requirements are calculated for multiple storms: 0.25hr, 1 hr, 2 hr, 6 hr, and 12 hr.

Iterations have been carried out to illustrate the duration / infiltration / storage relationship. In the example below, it was determined that the 2hr storm required the greatest amount of storage.

Laurel Hills Limited							
Laurel Hills Residential Development							
Infiltration routing computations							
20 year ARI storm							
14-Dec-18							
Catchment area - impervious (ha)							
Catchment area - impervious (ha)	9.400						
Runoff coefficient	0.60						
CA (ha)	5.640						
Infiltration nominal dimensions							
W (m) (effective width available for soakage)	20						
L (m)	41						
Depth (m)	1.5						
Total Net Volume (m3)	1230						
Total Area (m2)	820.000						
Infiltration rate (m/hr)*	0.54						
			Infiltration and storage requirements				
			Duration (hr)				
			0.25	1	2	6	12
		Rainfall (mm)	11.4	26.0	37.0	60.3	78.1
		Runoff (m3)	643.0	1466.4	2086.8	3400.9	4404.8
		Infiltration (m3)	110.7	442.8	885.6	2656.8	5313.6
Storage (m3)	1230	Required storage (m3)	532.3	1023.6	1201.2	744.1	-908.8
Infiltration (m3/hr)	442.8	Total storage (m3)	1230.0	1230.0	1230.0	1230.0	1230.0
Area (m2)	820.0	Surplus storage (m3)	697.7	206.4	28.8	485.9	2138.8

* includes reduction factor of 0.5 to allow for loss of performance over time

Pre-development run-off calculation below confirming run-off baseline. We note a typo was made in the initial calculation of 20l/s. Calculations have been checked and added below. The peak 20yr ARI is 2**9**0l/s.

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Client: Laurel Hills Ltd		Date: 17/1/2019
Project/Job: Laurel Hills	Job No. 13496	Sheet No: 2(
Subject: Stormwater – predevelopment peak runoff		By: TPS

$A = 9.4ha$

Medium soakage soil type w pasture cover

$C = 0.30$

Time of overland flow:

$L_o \simeq 300m$ @ 1%

$T_o = 25min$

Rainfall intensity – HIRDS V4
RCP 8.5 2081–2100

20 year ARI → $i = 37$ mm/hr

100 year ARI → $i = 56$ mm/hr

Q_{peak} 20yr ARI = 290 l/s
100yr ARI = 440 l/s

Water Supply

How council ultimately choose to connect current and future water supply infrastructure will be at the discretion of council and will be an operational consideration.

By way of background the Lake Hayes scheme was originally developed to service the wider Lake Hayes area and the Lake Hayes Estate subdivision.

The Lake Hayes Estate scheme was added as stand-alone infrastructure for an additional 95 houses that were not anticipated by the original development. This was due to the Lake Hayes scheme being at capacity.

The Hayes Creek subdivision (within Lake Hayes Estate) developed further sections and at that time the Lake Hayes and Lake Hayes Estate systems were joined to achieve firefighting flows in emergencies.

The first four stages of Shotover Country utilised the Lake Hayes Estate system while new infrastructure for Shotover Country was constructed.

QLDC contributed to additional capacity for the Shotover Country system and new reticulation to connect Lake Hayes Estate to Shotover Country. Once Shotover Country was commissioned, Lake Hayes Estate was disconnected (except in emergencies) from Lake Hayes system alleviating existing capacity issues with the original Lake Hayes scheme. These amendments also enabled the Bridesdale SHA to be serviced.

More recently the Lake Hayes Estate system was augmented to service the added demand from the Queenstown Country Club SHA.

Although these schemes are physically connected, they may be operated independently but can be connected in the event of emergencies.

As you can see the existing water infrastructure is managed and operated by QLDC in a manner that provides an optimum outcome for providing level of service and security of supply. Therefore, the name of the scheme referred to in the report may be a semantic argument.

The reporting to date also anticipates the development of new water supply infrastructure to service the greater Ladies Mile catchment as detailed in Ladies Mile HIF concept design.

It is our view that connectivity between Shotover Country, Lake Hayes Estate, Lake Hayes scheme and any HIF infrastructure provides for redundancy and security of supply and overall a more robust network.

In regards to fire fighting pressure, we do not anticipate any problems meeting the dynamic or running minimum pressures once the minimum domestic pressures are achieved.

The original report identified the need either for booster pumping, or connection to future HIF infrastructure. This will be dependent on development timing.

The report also recommends detailed water modelling to determine reticulation sizing and levels of service. This will ensure firefighting standards are met.

Conclusion

The proposed development can be serviced with existing infrastructure. Some minor improvements may be needed to the infrastructure or connection to proposed HIF infrastructure to meet QLDC levels of service. The final solution is at the discretion of QLDC.

- The QLDC have different options available to service the development and as network owner they will be able to determine the most efficient option.
- The QLDC can impose suitable conditions to ensure the development is appropriately serviced.

- The development will generate development contributions sufficient to mitigate any wider network effects.
- Wastewater flows can be further analysed with current flow data from QLDC maintenance contractor to ensure no underestimation of flows.
- QLDC to determine if part full flow in pipes and appropriate volume of emergency wastewater storage which is not currently in COP.
- Stormwater run-off and volume has been conservatively calculated.
- Pre-development flow determination now clarified.
- Infiltration rates have been determined by Geosolve to be favourable.
- Clarification on existing QLDC water infrastructure provided.
- Water supply network configuration subject to detailed modelling.
- Modelling to confirm minimum firefighting standards can be met.