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MEMO

To: Jonathan Smith

From: Tim Lockie; Manu Ward

CC:

Subject: WILLIAMSON ROAD STORMWATER ASSESSMENT

Date: 9 May 2018 **File number**: J000056.01

1. Introduction

This memo report outlines the hydraulic relationship between Williamson Golf Course and Williamson Park Pond in Whangamata, based on the 2007 model of the stormwater network.

2. Background

We understand that in April 2017, Williamson Golf Course and some adjacent properties experienced ponding for an extended period. During the same period, the Williamson Park Pond remained full, at a water level that was partly elevated by prior build-up of grass and sand on the overflow spillway, reportedly raising the spillway level by about 500 – 600 mm over the original level.

The period was marked by significant rainfall, king tides, and elevated groundwater table throughout the catchment. TCDC have since cleaned the Williamson Park Pond spillway, installed a new 375mm diameter pipe and inlet in the low point of the Williamson Golf Course and bunds to protect several properties bordering the course.

A detailed hydrological and hydraulic model was developed of the Whitianga SW catchment by Hydraulic Analysis Ltd (HAL) in June 2007. HAL has been commissioned to use this model to clarify the mechanism of flooding in these areas and indicate the suitability of the concept used for the improvement works.

3. Analysis

The 2007 model of Whangamata is a 1D US EPASWMM model. The following analysis is based on the model named "WHA_5YREX", which uses 2007 catchment land use scenario under a 5-year ARI design storm.

3.1 "Normal" Conditions

The Williamson Park Pond geometry has been modified to represent the surface shown in recent LiDAR capture. The corresponding stage-area curve of the basin is shown in Figure 1 below. The spillway geometry was also modified according to the cross-section of the LiDAR surface at the overflow level, shown in Figure 2 below.

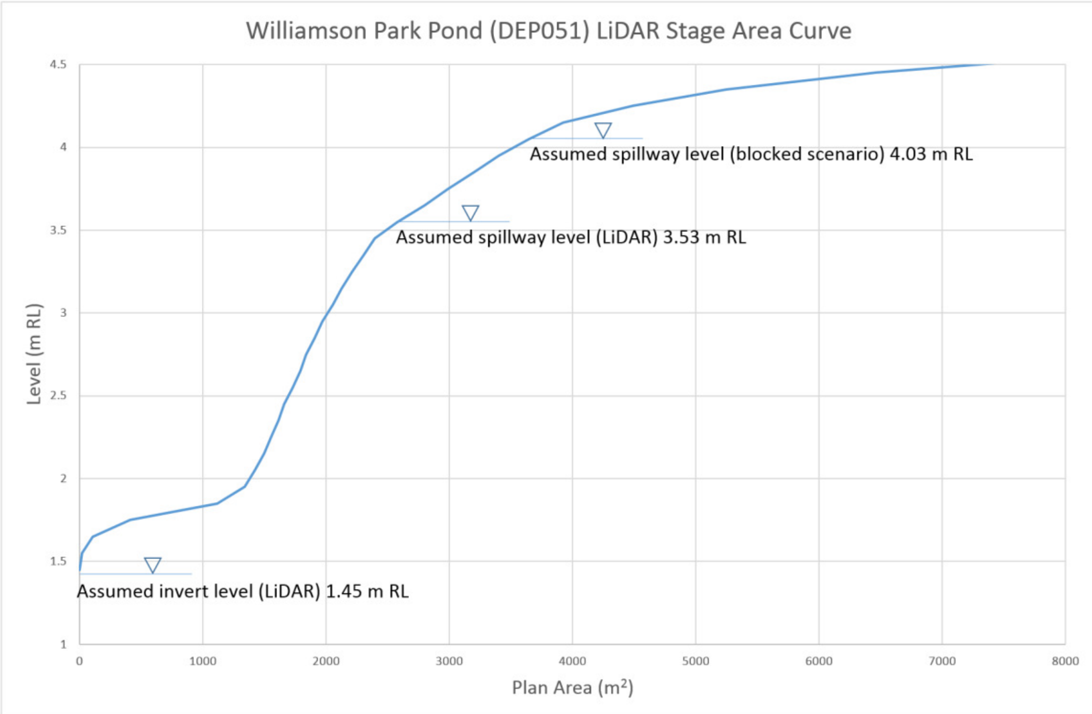

Figure 1 Williamson Park Pond Stage-Area Curve based on LiDAR surface

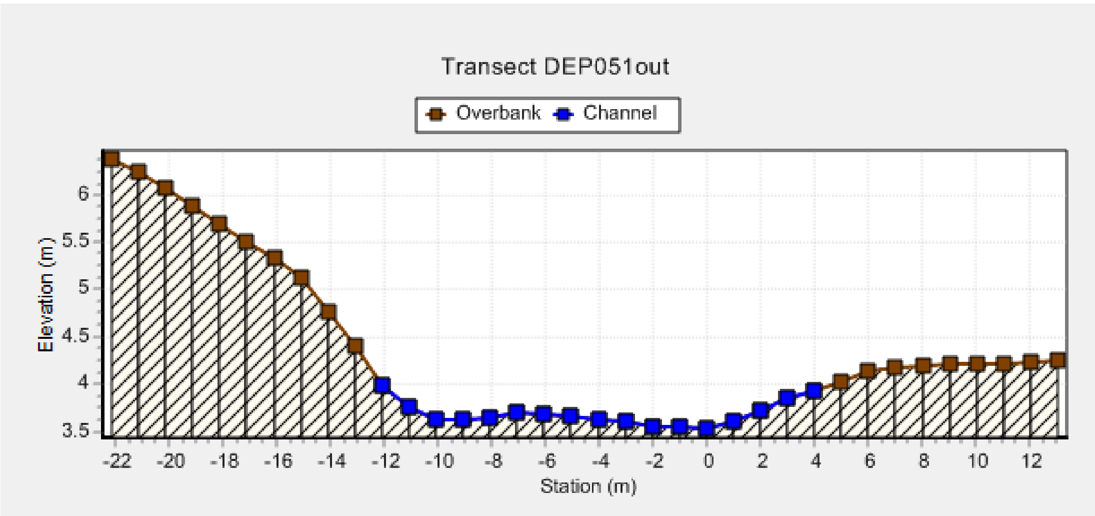

Figure 2 Williamson Park Pond Spillway Cross-Section based on LiDAR surface

Apart from the overflow spillway, Williamson Park Pond drainage is primarily by soakage, with ground flow percolating towards the coast downstream of the spillway. A very approximate estimate of soakage outflow capacity of 50 L/s in good conditions has been made based on photographs of flow appearing downstream of the spillway. This corresponds to infiltration rates of about 90 mm/hr over a surface of 2000 m2 (if the pond level is at about 3.0 m RL). According to TP10, this corresponds to expected infiltration for conditions better than loamy sand (61 mm/hr), but not as good as sand (210 mm/hr).

3.2 "Blocked" Conditions

A second scenario was created to observe the effects of:

a) Pond spillway level raised by 0.5 m RL to represent increased sediment and vegetation.
b) Pond soakage outflow capacity reduced to 7 L/s, which corresponds to infiltration rates of 13 mm/hr ("loam" according to TP10), to approximate the silt and sludge that would line the pond after a long period of non-maintenance.

Note that under this scenario, the spillway level is at 4.03 m RL. According to design drawings for the spillway, overflow levels at the time of weir construction appear to be at a maximum of 3.0 m RL (Riley Consultants Drawing 05284-1, Nov 2005, appended to this report). Based on this, and comparing photos of spillway clean-out on 5 April 2017 (figure 3), a spillway level of 4.03 m RL seems conservatively high above the spillway design level. Further survey is needed to verify the actual spillway as-built level and the level at the time of flooding. However, the levels as stated here are sufficient for this sensitivity analysis.

Figure 3 Williamson Park Pond Spillway with sediment build-up, overflowing 5 April 2017.

3.3 Modelled Results

The model was run for the above conditions to determine the sensitivity of top water levels throughout the upstream network under both "normal" and "blocked" conditions.

Note that surface depressions within the golf course area have not been explicitly represented in the model, so for the purposes of this study water levels have been examined at the manhole adjacent 312 Williamson St and the access corridor between the road and the golf course. The location of this manhole (SWMH_302014) and the Williamson Park Pond (DEP051) are indicated in the attached map (Figure 4).

Water levels at these locations are plotted in the attached chart (Figure 5).

The locations are differentiated by colour: orange representing water levels at the Williamson Park Pond, and green representing water levels in the network adjacent the Williamson Golf Course.

The scenarios are differentiated by tone: dark/bold lines indicating "normal" conditions, and light lines indicating "blocked" conditions as described above.

The resulting top water levels (TWL) for both scenarios (5-year ARI) are shown in the following table:

	Modelled 5-year TWL	
	"Normal" conditions	"Blocked" conditions
Manhole near Williamson Golf Course (SWMH_302014)	4.70 m RL	4.70 m RL
Williamson Park Pond (DEP051)	3.72 m RL	4.26 m RL

3.4 Results Discussion

The results indicate that the actual peak water levels in the upstream network in the area of Williamson Golf Course are not affected by the spillway blockage and reduced soakage at Williamson Park Pond.

However, spillway blockage and reduced soakage at the pond does appear to affect the length of time that water levels are raised within in the upstream network. At the manhole near Williamson Golf Course, water levels are higher than 4.4 m RL for 17.1 hours under "normal" conditions, but 45.8 hours under "blocked" conditions (compare the dark and light green lines in Figure 4 attached). According to LiDAR information, low points in the golf course surface are at about 4.4 m RL, so flooding is expected when TWLs are above that level.

This longer period of elevated water levels near the golf course correlates to the experience of the ponding in April 2017. Interestingly, however, the model shows that when rainfall ceases (after timestep 4/01/2006 00:00), water levels in the network quickly drop to levels equivalent to the Williamson Park Pond, which in the "blocked" scenario are held at about the assumed spillway level just above 4.0 m RL.

In the case of ponding at the golf course in April 2017, ponding remained for several weeks, held up by the elevated groundwater table. Modelling the groundwater table is outside the scope of this study, but the 1D model of the pipe network indicates that a piped connection between the golf course and the network in Williamson Road would allow the surface depressions to drain reasonably efficiently following rainfall events, even if the Williamson Park Pond remains excessively full.

4. Conclusions

This analysis indicates that the formal stormwater network drains relatively efficiently following the end of the storm, even if the Williamson Park Pond remains very full. This suggests that the network is still able to drain post-event flows and that with subsoil drainage and piped connections to the network, the depressions in the golf course can be drained and avoid the extended period of waterlogging of April 2017.

The network will perform better if the pond is well maintained, including regular removal of sludge to ensure good infiltration rates, and shaping/levelling the overflow path for extreme events.

4.1 Limitations

The conclusions of this study are based on our professional estimate using the tools and information available. However please note this study is subject to the following limitations:

- This analysis is based on the 2007 1D SWMM model for Whangamata. Apart from the modifications at Williamson Park Pond, no other updates have been made to represent asset survey, network upgrades or landuse changes since the initial model build.
- The modelling results are for the synthetic 5-year ARI design storm for the purposes of indicative hydraulic behaviour. Actual rainfall during the period of flooding in April 2017 has not been modelled.
- 1D modelling is limited in its ability to accurately represent surface flooding, and the depressions in Williamson Golf Course have not been explicitly modelled. The conclusions of this study are based on insights gained from modelled water levels in nearby manholes.
- The geometry of Williamson Park Pond and the overflow spillway are based on LiDAR information and has not been verified by site survey.
- Site investigations of the actual soil conditions and testing to establish expected soakage rates have not been undertaken.
- Groundwater modelling has not been carried out.

4.2 Recommendations

- Regular maintenance of the pond is recommended, including removal of sludge and periodically clearing sediment and vegetation from the spillway.
- If Council wish to carry out options analysis for additional work to address wider flood issues in the Williamson Road area, it is recommended that the 1D model is updated to a coupled 1D/2D model. Better efficiencies and economies of scale can be achieved if this is carried out for the entire Whangamata Catchment as part of a wider strategy to develop a Catchment Management Plan.

5. Attachments

Figure 4: Williamson Road, Whangamata, Stormwater Assessment
Figure 5: SWMM 5YR Modelled Levels
Riley Consultants Drawing 05284-1, Nov 2005

Figure 4: Williamson Road, Whangamata Stormwater Assessment

Drwn: MRW
Checked: TAL
Date: 8 May 2018

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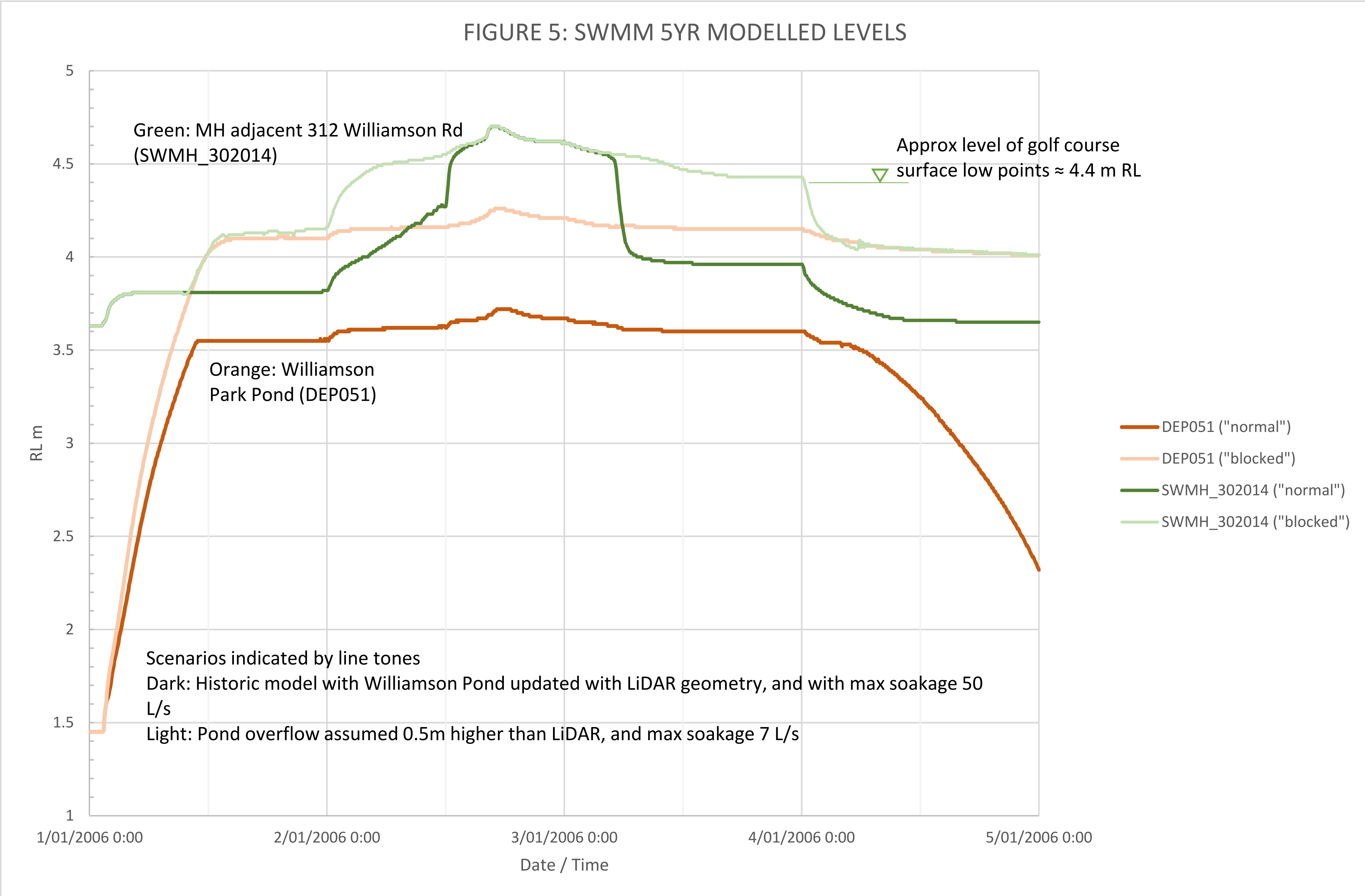
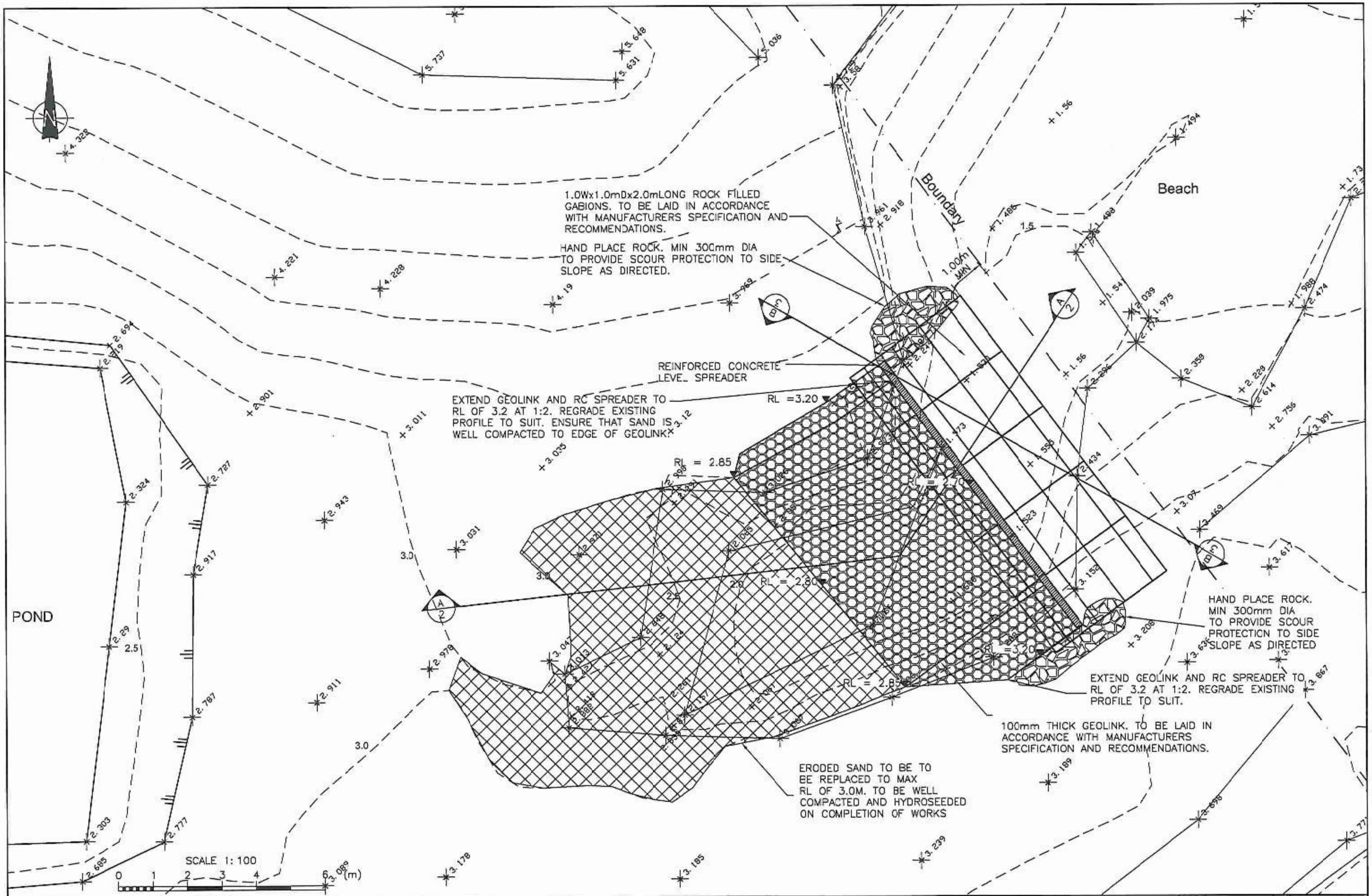


FIGURE 5: SWMM 5YR MODELLED LEVELS
Green: MH adjacent 312 Williamson Rd
(SWMH_302014)
Approx level of golf course
surface low points ≈ 4.4 m RL
Orange: Williamson
Park Pond (DEP051)
Scenarios indicated by line tones
Dark: Historic model with Williamson Pond updated with LiDAR geometry, and with max soakage 50 L/s
Light: Pond overflow assumed 0.5m higher than LiDAR, and max soakage 7 L/s
RL m
5
4.5
4
3.5
3
2.5
2
1.5
1
1/01/2006 0:00
2/01/2006 0:00
3/01/2006 0:00
4/01/2006 0:00
5/01/2006 0:00
Date / Time
DEP051 ("normal")
DEP051 ("blocked")
SWMH_302014 ("normal")
SWMH_302014 ("blocked")



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WHANGAMATA STORMWATER
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DATE NOV 2005
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