

<b>ATTENTION</b>	Expert Consenting Panel - Ashbourne
<b>SUBJECT</b>	Response to Minute 14 (Points 3, 4, 5 and 6)
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### 1. INTRODUCTION

This memorandum provides a response to Minute 14, the Ashbourne Development.

The panel have requested a response to queries on the mounding assessment for proposed Stormwater Basin A.

#### Point 3

*In the mounding assessment, input data provided in the WGA Technical Memorandum of 29 January 2026 (which was provided in response to Panel Minute 13), the input hydraulic conductivity units are shown as m/s. This appears to be an error and should be m/day. Please comment on this.*

Correct, this is a typo error in the document. The units are in m/day as shown in the screen capture from the results shown in Figure 1.

### MOUNDSOLV GROUNDWATER MOUNDING ANALYSIS FOR A SLOPING WATER-TABLE AQUIFER ZLOTNIK ET AL. (2017) SOLUTION

#### Site Description

##### Aquifer Data

Horizontal hydraulic conductivity, $K$	1.53 m/d
Specific yield, $S_y$	0.22
Initial saturated thickness, $h_0$	8.55 m
Maximum allowable water-table rise, $\sigma$	6 m
Dip, $i$	-0.002 m/m
Slope rotation from x axis, $\gamma$	30°

**Figure 1: Input Data Report for Basin A Mounding**

#### Point 4

*In Figure 2 of the 29 January memorandum, the maximum mounding depth arising from a three day 100 year ARI rain event is shown as 6 m. The Panel's review of the available information on likely groundwater depth at the location indicates that the maximum mounding water level would be approximately RL 67.2 m, which is above the design 100 yr WL in the basin per drawing C440-2 and above the ground level adjacent to the basin. This gives the Panel significant concerns about the robustness of the stormwater assessment for disposal from Basin A and the ability to develop consent conditions that adequately deal with the uncertainties of future groundwater levels at the basin location, together with uncertainties inherent in the mounding assessment.*

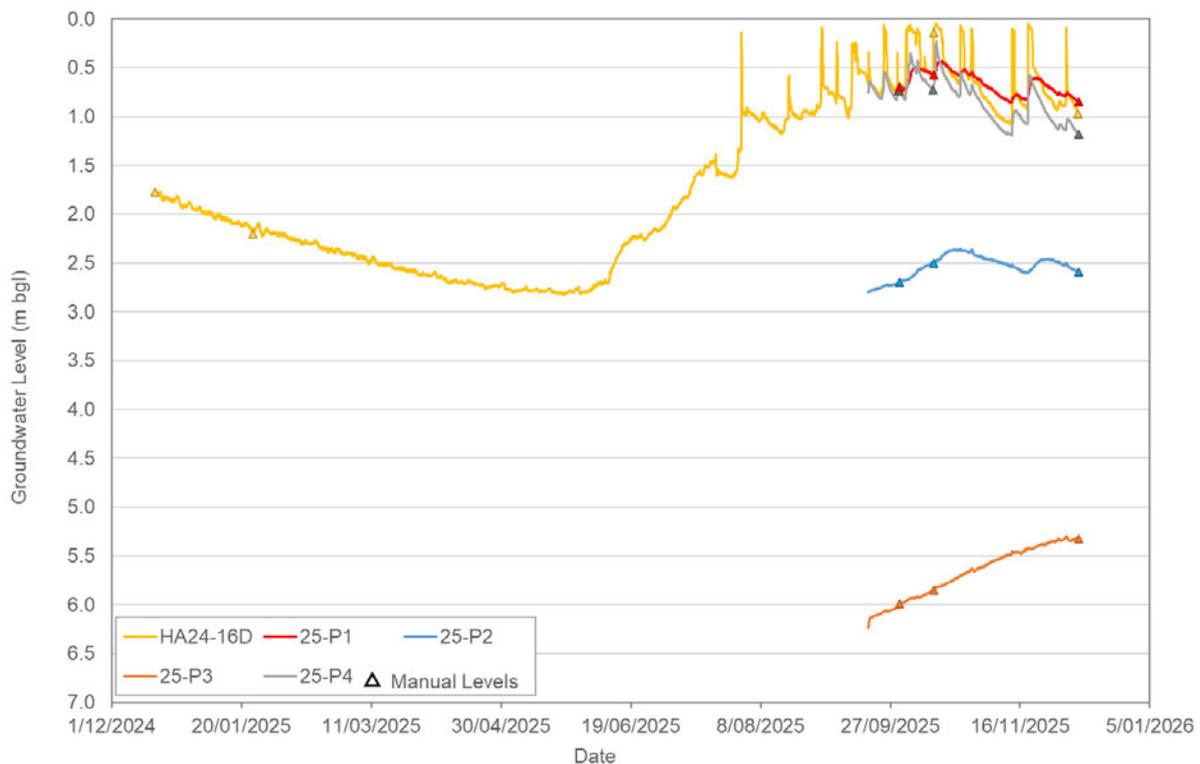
The maximum allowable groundwater level rise is an input parameter for the model.

WGA notes that the October mounding modelling included a lower groundwater level (6.0 m below the top of basin) than used in the original assessment (3.5 m below the top of basin). Therefore, although the mounding increases due to increased “head room” under the basin, the depth to groundwater at nearby structures is greater due to the lower groundwater level starting point. WGA understands that it is the depth to groundwater level which is considered in the liquefaction assessment by CMW. Therefore, all updated results are effectively improved from the original modelling reported in June 2025.

In the modelling carried out October 2025, a groundwater level of 60.5 m RL was used to calculate the available mounding. This level was derived from measurements in piezometer 25-P3 in October 2025 of 6.1 m below ground level (bgl). The ground level at the piezometer 25-P3 is 66.6 m RL based on 1 m lidar elevation data. Therefore, based on a groundwater level of 6.1 bgl the groundwater level is 60.5 m RL. The top of basin is at an elevation of 66.5 m RL. Therefore, the maximum allowable mounding was set to **6.0 m**.

In the initial mounding modelling detailed in the WGA June 2025 report, the maximum allowable mounding was based on a groundwater level of **3.5 m** below top of basin. The additional modelling in October 2025 was carried out to check the potential increased infiltration from Basin A based on lower groundwater levels than the conservative original assessment.

Additional groundwater monitoring conducted since October 2025 has indicated water levels at piezometer 25-P3 have risen to 5.3 m bgl (61.3 m RL) in December 2025 and appear to be plateauing at this higher level (Figure 2).



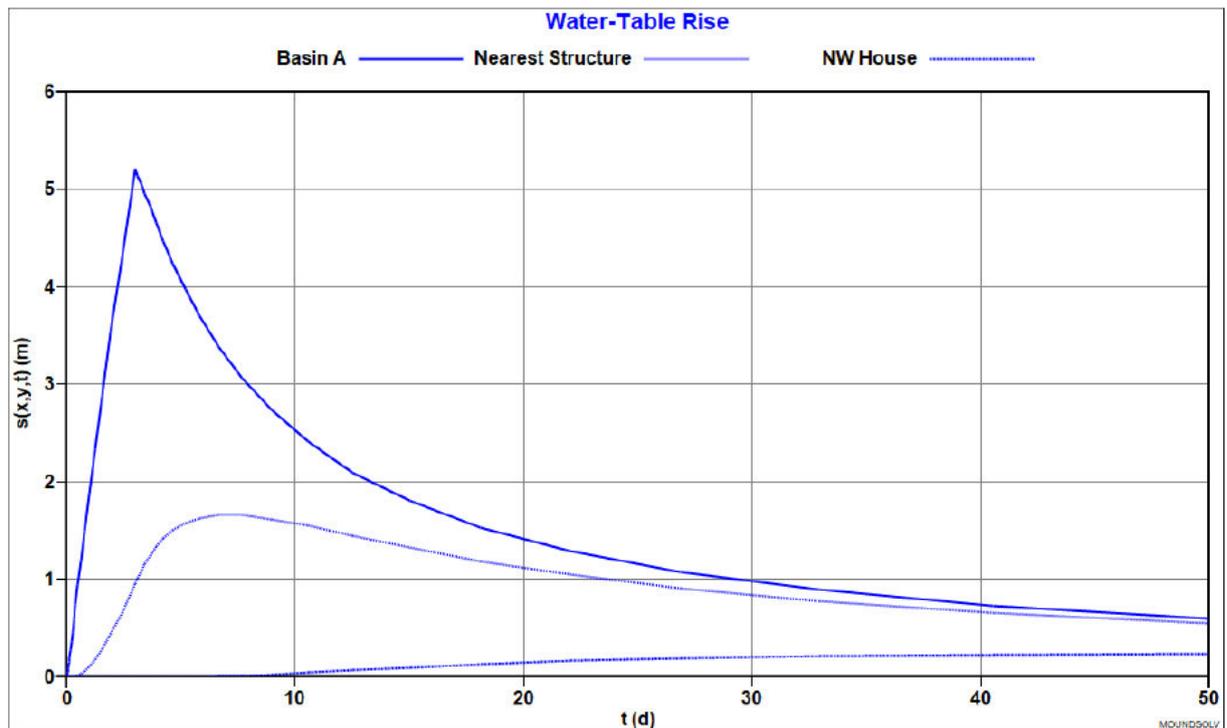
**Figure 2: Groundwater Levels at the Ashbourne Site**

WGA has re-run the three-day and 36-day groundwater mounding model based on groundwater levels at 5.3 m bgl, based on the 25-P3 dataset presented in Figure 2. Due to the higher groundwater level compared to the October assessment, the allowable mounding has been set to **5.2 m**, which equates to the top of the basin in the latest model. The results of the three-day modelling (Table 1) indicate that an infiltration rate of 0.43 m/day is achievable, which equates to 1,890 m<sup>3</sup>/day infiltration through the basin floor.

At that recharge rate, the maximum mounding at the nearest structure would be approximately 1.66 m (Figure 3, Table 2). The ground level at the nearest structure is approximately 68 m RL, 1.4 m higher in elevation than at 25-P3. Therefore, the starting groundwater level at that structure would be approximately 6.7 m bgl. An increase in groundwater level of 1.66 m would result in a groundwater level at that structure of 63 m RL (5.0 m bgl).

**Table 1: Input Parameter and Results from Updated 3 Day Mounding Modelling**

Model Input Parameter		Value	Information source	Unit Conversion		
Length (m)		100	Taken from Maven plans			
Width (m)		43.5				
Duration (days)		1 and 3				
Initial Aquifer Saturated Thickness		9.35	Average aquifer thickness from CPT24-08 and SCPT24-04			
Aquifer Specific Yield		5.3 m bgl				
Aquifer Gradient		-0.0022				
Aquifer Dip Direction	Cardinal	60°E	From winter piezometric surface			
	Moundsolv (°)	30				
Rotation of infiltration Basin Length	Cardinal	23.7°E	Taken from Maven plans			
	Moundsolv (°)	36.3				
Hydraulic Conductivity (m/d)	CMW k (k <sup>1</sup> )	6.27	Taken from CMW sokage tests (CIRIA 113 method), in pit, SOA24-23/24			
	Conservative k (k <sup>2</sup> )	1.53	Last 4 values averaged of CMW tests (CIRIA 113 method), SOA24-23/24			
Allowable Mounding		5.2	Distance from water table to top of basin. High water table height taken from 25-P3 on 8 Dec 2025 at 61.3 m RL.			
Recharge Rate (Q) (m <sup>3</sup> /d)	Target (1 day, k <sup>2</sup> )		13650	Estimated with model based on the target infiltration rate		
	adjusted	1 Day	k <sup>1</sup>		Model Output	
			k <sup>2</sup>			
		3 Days	k <sup>1</sup>			
			k <sup>2</sup>	1890		
	36 day with recovery (k <sup>1</sup> )					
Infiltration Rate (q) (m/d)	Target		3.138	Design rate from Maven	130.75	
	adjusted	1 Day	k <sup>1</sup>	0.00	Model Output	0.0
			k <sup>2</sup>	0.00		0.0
		3 Days	k <sup>1</sup>	0.00		0.0
			k <sup>2</sup>	0.43		18.1
			36 day with recovery (k1)			



**Figure 3: Time Series of Mounding at Basin A and Nearby Structures Following 3 Day Event**

**Table 2: Results from 3 Day Mounding Modelling December Groundwater Levels at Nearby Structures**

SITE	GROUND LEVEL (m RL)	STARTING GW LEVEL (m bgl)	STARTING GW LEVEL (m RL)	EXPECTED MOUNDING (m)	MOUNDED GW LEVEL (m bgl)	MOUNDED GW LEVEL (m RL)
Basin A	66.6	5.3	61.3	5.2	0.1	66.5
Nearest Structure	68	6.7	61.3	1.7	5.0	63.0
NW House	69	7.7	61.3	0.2	7.5	61.5

## Point 5

*In addition, the Panel understands that the runoff to Basin A in a three day 100 year storm used for the mounding assessment excludes the disposal of stormwater by soakage devices other than Basin A. Please comment on how the infiltration of stormwater to ground from this mechanism might affect the mounding assessment for Basin A.*

In terms of the stormwater soakage by other devices at the site, the other devices referred to in the question are generally located within the footprint of the hydrogeological basin underlying the western half of the site, where Basin B is shown in Figure 4. The groundwater levels in this area are represented by the data from Piezometer 25-P1 (Figure 2). In contrast, the groundwater levels within the footprint of the hydrogeological basin underlying the eastern section of the site, where Basin A is situated (Figure 4), are much deeper. The groundwater levels in this area are represented by the data from Piezometer 25-P3 (Figure 2). The groundwater levels recorded from Piezometer 25-P3 and rise slowly in response to recharge compared to the shallow groundwater in the area to the west.

The depth to groundwater under the eastern section of the Site is also evidenced through:

1. Our observations of a deep stormwater device on Peakdale Drive that had no observed groundwater inflow seepage during spring.
2. An absence of drainage systems on farmland in this area.

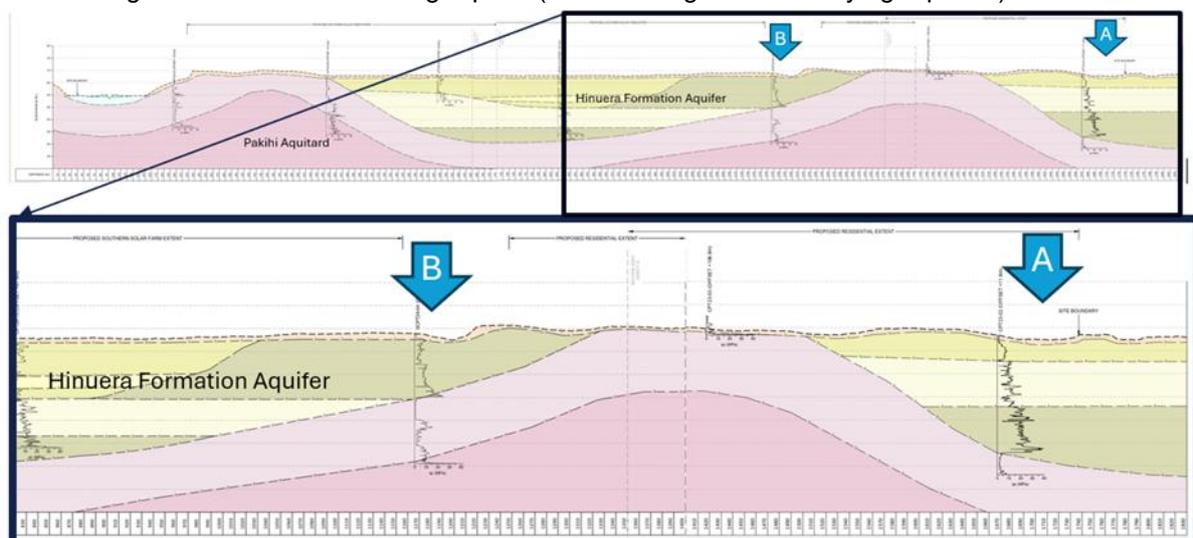
Some stormwater soakage is planned in the area to the east of the low permeability outcrop. However, WGA understands this will not be greater than the current recharge to this area.

The conservative groundwater level used in our original assessment was based on a starting groundwater level at 3.5 m below the top of the stormwater basin. The resulting maximum groundwater level rise following winter was calculated as 2.0 m (WGA Hydrogeological Effects Assessment, Appendix C Section C1.1.2), which results in a groundwater level of approximately 2.9 m below the ground surface at the nearest structure. All other updated modelling results in mounded groundwater levels lower than this original assessment.

WGA understands that Basin A can still operate at higher background groundwater levels (3.5 m below top of basin) as shown in our original June 2025 assessment. Our original assessment therefore represents a conservative assessment for both basin operations and potential mounding.

The following conservative parameters have been used in the mounding assessment:

- Lower hydraulic conductivity than derived from soakage testing.
- Using top of basin as a maximum level for mounding rather than the 100-year basin level.
- Continuous filling of the basin in the Winter (36-day rainfall) scenario results in mounding extending out over a continuous period.
- The modelling software (MoundSolv) is also conservative in that it assumes a no flow boundary along the base of the receiving aquifer (i.e no leakage into underlying aquifers).



**Figure 4: Underlying Hydrogeological Structures with the Position of Stormwater Basin A and Basin B (Blue Arrows)**

## Point 6

The Panel considers it to be imperative that a mounding assessment for Basin A include a winter season scenario as modelled previously and reported in the Hydrogeological Effects Assessment of June 2025.

This modelling has been carried out for the winter season based on 36 days for both the October 2025 water levels and the higher December water levels measured at 25-P3.

The winter scenario based on the October groundwater starting levels is included below to address the question from the panel. In addition, a corresponding mounding assessment based on December starting groundwater levels is included in Table 5 and Table 3.

Results of the modelling based on best knowledge to date (December 2025 groundwater levels) indicate that at an infiltration rate of 0.43 m/day the maximum mounding at the nearest structure will be approximately 3.0 m. As detailed above, the nearest structure is approximately 1.4 m higher in ground elevation than piezometer 25-P3 at 68 m RL, therefore the starting groundwater level at the structure is 6.7 m bgl (61.3 m RL). An increase of groundwater level of 3.0 m would result in a groundwater level at the structure of 3.7 m bgl (63 m RL) at the nearest structure.

**Table 3: Input Parameter and Results from 36-day Mounding Modelling October Groundwater Levels**

Model Input Parameter		Value	Information source	Unit Conversion	
Length (m)		100	Taken from Maven plans		
Width (m)		43.5			
Duration (days)		1 and 3			
Initial Aquifer Saturated Thickness		8.55	Average aquifer thickness from CPT24-06 and SCPT24-04		
Aquifer Specific Yield		0.22			
Aquifer Gradient		-0.0022			
Aquifer Dip Direction	Cardinal	60°E	From winter piezometric surface		
	Moundsolv (°)	30			
Rotation of infiltration Basin Length	Cardinal	23.7°E	Taken from Maven plans		
	Moundsolv (°)	36.3			
Hydraulic Conductivity (m/d)	CMW k (k <sup>1</sup> )	6.27	Taken from CMW soakage tests (CIRIA 113 method), in pit, SOA24-23/24		
	Conservative k (k <sup>2</sup> )	1.53	Last 4 values averaged of CMW tests (CIRIA 113 method), SOA24-23/24		
Allowable Mounding		6	Distance from water table to top of pit. Winter water table height taken from piezometric surface at 25-P3 in Sep 2025 at 60.5 m RL.		
Recharge Rate (Q) (m <sup>3</sup> /d)	Target (1 day, k <sup>2</sup> )		13650	Estimated with model based on the target infiltration rate	
	adjusted	1 Day	k <sup>1</sup>	Model Output	
			k <sup>2</sup>		
		3 Days	k <sup>1</sup>		
	k <sup>2</sup>	2145			
	36 day with recovery (k <sup>1</sup> )	460			
Infiltration Rate (q) (m/d)	Target		3.138	Design rate from Maven	
	adjusted	1 Day	k <sup>1</sup>	0.00	Model Output
			k <sup>2</sup>	0.00	
			k <sup>1</sup>	0.00	
		3 Days	k <sup>2</sup>	0.49	
			k <sup>1</sup>	0.11	
	36 day with recovery (k1)	0.11			
				130.75	
				0.0	
				0.0	
				0.0	
				20.5	
				4.4	

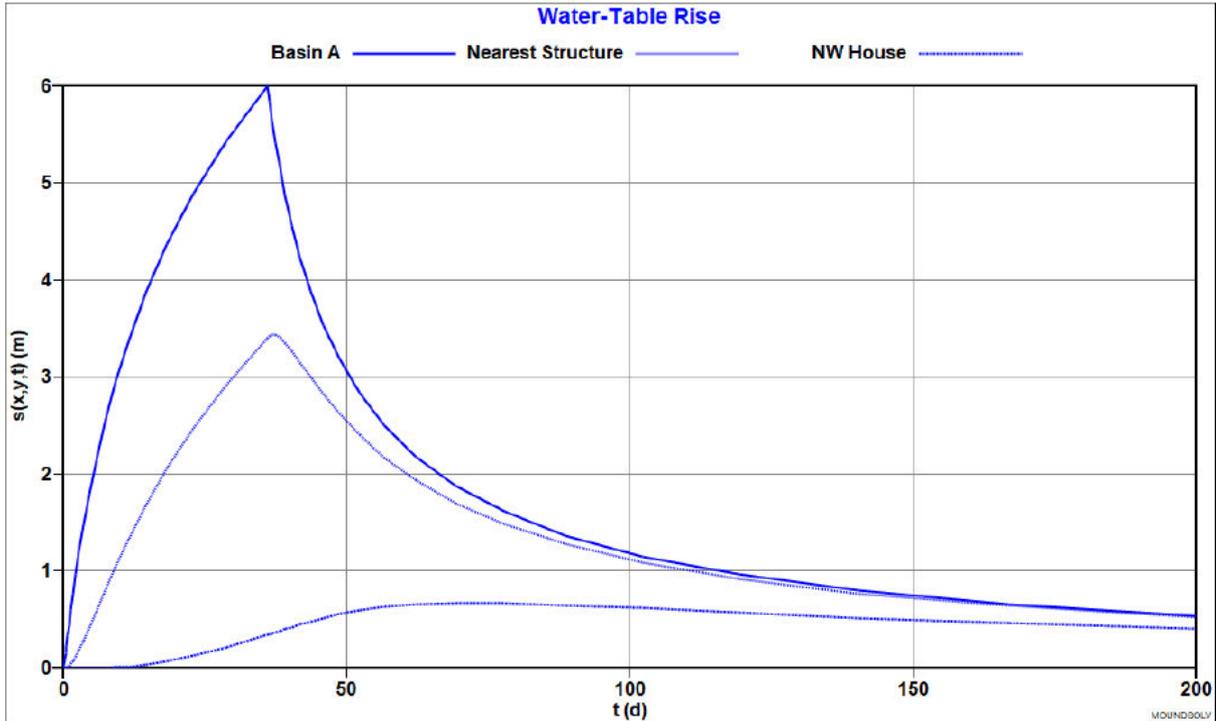


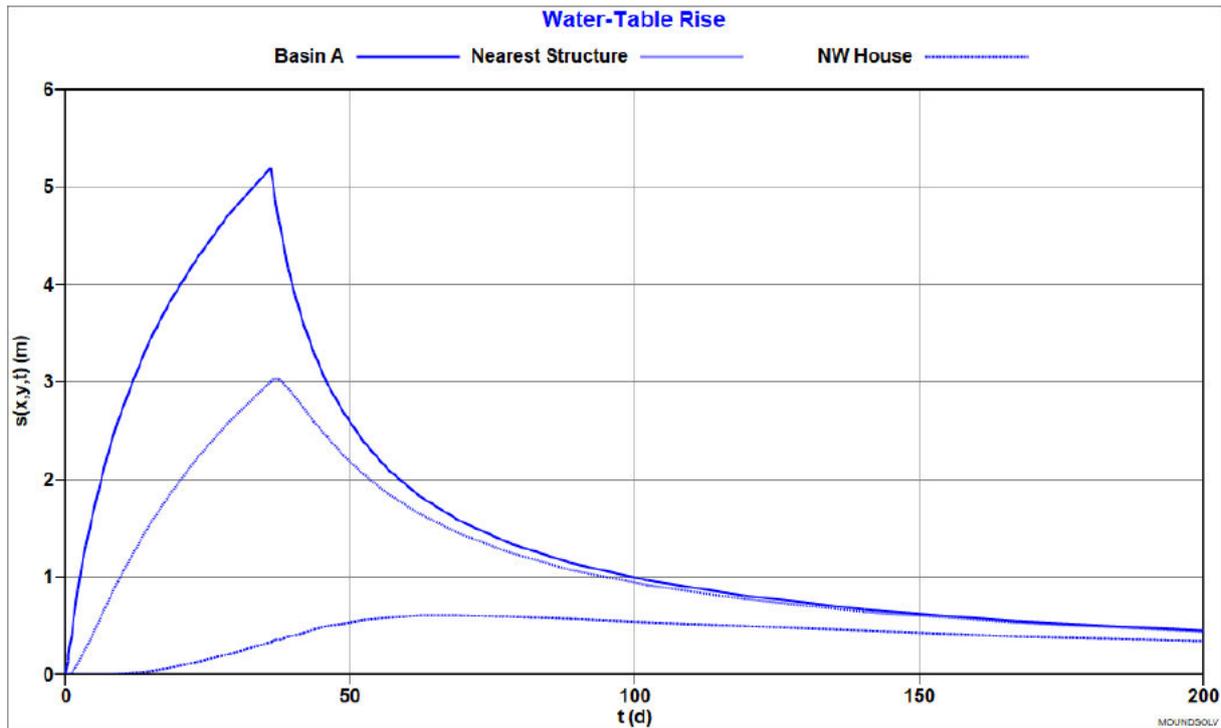
Figure 5: Time series of Mounding at Basin A and Nearby Structures Following 36 day Winter Season (October 2025 Groundwater Levels)

Table 4: Results From 36-Day Mounding Modelling October Groundwater Levels at Nearby Structures

SITE	GROUND LEVEL (m RL)	STARTING GW LEVEL (m bgl)	STARTING GW LEVEL (m RL)	EXPECTED MOUNDING (m)	MOUNDED GW LEVEL (m bgl)	MOUNDED GW LEVEL (m RL)
Basin A	66.6	6.1	60.5	6	0.1	66.5
Nearest Structure	68	7.5	60.5	3.4	4.1	63.9
NW House	69	8.5	60.5	0.7	7.8	61.2

Table 5: Input Parameter and Results from Updated 36-Day Mounding Modelling (December Groundwater Levels)

Model Input Parameter		Value	Information source	Unit Conversion	
Length (m)		100	Taken from Maven plans		
Width (m)		43.5			
Duration (days)		1 and 3			
Initial Aquifer Saturated Thickness		9.35	Average aquifer thickness from CPT24-06 and SCPT24-04		
Aquifer Specific Yield		5.3 m bgl			
Aquifer Gradient		-0.0022	From winter piezometric surface		
Aquifer Dip Direction	Cardinal	80°E			
	Moundsolv (°)	30			
Rotation of infiltration Basin Length	Cardinal	23.7°E	Taken from Maven plans		
	Moundsolv (°)	38.3			
Hydraulic Conductivity (m/d)	CMW k (k <sup>1</sup> )	6.27	Taken from CMW soakage tests (CIRIA 113 method), in pit, SOA24-23/24		
	Conservative k (k <sup>2</sup> )	1.53	Last 4 values averaged of CMW tests (CIRIA 113 method), SOA24-23/24		
Allowable Mounding		5.2	Distance from water table to top of basin. High water table height taken from 25-P3 on 8 Dec 2025 at 61.3 m RL.		
Recharge Rate (Q) (m <sup>3</sup> /d)	Target (1 day, k <sup>2</sup> )		13850	Estimated with model based on the target infiltration rate	
	adjusted	1 Day	k <sup>1</sup>		
			k <sup>2</sup>		
		3 Days	k <sup>1</sup>		
			k <sup>2</sup>	1890	
36 day with recovery (k <sup>1</sup> )		420			
Infiltration Rate (q) (m/d)	Target		3.138	Design rate from Maven	
	adjusted	1 Day	k <sup>1</sup>	0.00	
			k <sup>2</sup>	0.00	
		3 Days	k <sup>1</sup>	0.00	
			k <sup>2</sup>	0.43	
		36 day with recovery (k <sup>1</sup> )		0.10	
					mm/hr
				0.0	
				0.0	
				0.0	
				18.1	
				4.0	



**Figure 6: Time Series of Mounding at Basin A and Nearby Structures Following 36 Day Winter Season (December 2025 Water Levels)**

**Table 6: Results from 36-Day Mounding Modelling December Groundwater Levels at Nearby Structures**

SITE	GROUND LEVEL (m RL)	STARTING GW LEVEL (m bgl)	STARTING GW LEVEL (m RL)	EXPECTED MOUNDING (m)	MOUNDED GW LEVEL (m bgl)	MOUNDED GW LEVEL (m RL)
Basin A	66.6	5.3	61.3	5.2	0.1	66.5
Nearest Structure	68	6.7	61.3	3.0	3.7	64.3
NW House	69	7.7	61.3	0.6	7.1	61.9

Yours sincerely,



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**WALLBRIDGE GILBERT AZTEC**