

# AGENDA ITEM 6

## APPENDIX 21

2018/0151/DET

# ABSTRACTION RATE & INFILTRATION RATE

### **Abstraction Rate From Quarry**

In the letter sent on 2<sup>nd</sup> July by JPB with respect to the queries SEPA raised over Revision 1 of The Ground Water & Surface Water Management Plan the operation of the pump is detailed.

This quotes a maximum theoretical volume of 950.5m<sup>3</sup> over a 24hour period is if the pump runs continually over this period. The letter describes this as the maximum theoretical volume because of the use of a float switch controlling pump operation.

The maximum abstraction rate for a 24hour period is 950.5m<sup>3</sup>

This is equivalent to a maximum hourly abstraction rate of 39.6m<sup>3</sup>.

### **Discharge / Infiltration Rate**

The 2<sup>nd</sup> July letter details the use of a second float switch within the settlement pond to control flow of water from the pump into the ponds with the switch stopping the pump when water gets to a set level.

The Ground Water & Surface Water Management Plan states that the settlement ponds will cover a total area of approximately 45m by 25m, an area of 1125m<sup>2</sup>.

Since the pump abstracts a maximum volume of 39.6m<sup>3</sup> per hour, the infiltration rate can be calculated using the excavated pond area of 1125m<sup>2</sup>.

Discharging 39.6m<sup>3</sup> of water into the 1125m<sup>2</sup> excavated pond area is equivalent to a water depth in the pond of 0.035m.

Over a 24hour period the maximum the pump can discharge into the excavated pond is 950.5m<sup>3</sup>.

Discharging 950.5m<sup>3</sup> of water into the 1125m<sup>2</sup> excavated pond area is equivalent to a water depth in the pond of 0.84m.

The 24 hour water depth of 0.84m in the pond is close to the level that the float switch will operate, allowing between 15 and 20% freeboard within the pond (a maximum water depth of between 0.8 and 0.85m in the pond) with the pond excavated to a depth of 1m in the permeable overburden.

The calculations above confirm that the maximum infiltration rate is governed by the maximum abstraction rate of the pump.

The maximum infiltration rate per hour is 0.035m/hr

This is equivalent to infiltration of 35.2litres of water over every square metre of the pond floor each hour.

The maximum infiltration rate for a 24hour period is 0.84m/24hrs

A substrate which was a poor infiltration media would allow the maximum infiltration rates calculated to be achieved with an infiltration coefficient of  $9.78 \times 10^{-6}$  m/s or greater required.

## **Ground Conditions**

The submitted Ground Water and Surface Water Management Plan contains details of the ground conditions at the site following site investigation work undertaken by Leiths Geologist using a 360° excavator. The overburden was assessed as a free draining granular glacial material.

The relevant sections from the Ground Water and Surface Water Management Plan Revision 2 are copied below.

### **2.3 Ground Conditions**

*As part of the initial site investigation for re-opening and expanding Dalwhinnie Quarry several trial pits were excavated within the proposed extension area to assess the soil and overburden depths and to allow the proposed quarry design to be accurately modelled.*

*All trial pits had a similar character with a thin topsoil averaging 0.2m. This agrees with the depths recorded in the Peat Probing survey undertaken as part of the EIAr. (Hydrology, hydrogeology and peat assessments MNV Consulting Ltd).*

*The top soil directly overlay a granular overburden with a high percentage of angular rock fragments. This overburden is identical to the exposures visible above the bedrock within the existing quarry.*

*The trial pits were excavated using a 360° tracked excavator and all were excavated to bedrock level. No groundwater was encountered in any of the trial pits although two had a trace of water at the soil / overburden interface. No aquitards or impermeable layers were identified within any of the trial pits.*

*The results of the trial pits confirmed that the overburden in the area was a free draining granular material of glacial origin and the groundwater table was below the overburden / bedrock interface.*

### **2.4 Infiltration Rate**

*The trial pits encountered a granular glacial overburden which is assessed as a very good infiltration media with no evidence of silt or clay identified within the overburden.*

*Typical infiltration rates for this material are the range of  $3 \times 10^{-4}$  to  $3 \times 10^{-2}$  m/s<sub>(1)</sub>.*

*No infiltration tests were undertaken during the site investigation excavations since the uniform geological nature of the overburden, along with the lack of any water in the trial pits confirmed the overburden was a permeable material.*

(1) Table 25.1 Typical Infiltration coefficients based on soil texture, C753 CIRIA SuDS Manual 2015

## **2.5 Settlement Ponds**

*A tracked excavator will be used to excavate a sequence of temporary shallow settlement ponds to the north of the existing quarry, within the application boundary. The ponds will cover a total area of approximately 45m by 25m, as indicated in Drawing RG547/SWMP/F/01A.*

*Top soil will initially be removed prior to excavating the overburden to a depth of approximately 1m to form the ponds. The overburden will be used to form an edge protection bund around the pond and the soil and vegetation will be placed on the outer face of the bund.*

*The discharge pipe from the submersible pump will flow into the first pond in the sequence. Water in the settlement pond will infiltrate through the permeable overburden at the base of the pond. No pollutants will be introduced into the groundwater regime by this method of indirect discharge.*

*The average overburden depth in this area is approximately 2.25m and leaving an average of 1.25m of overburden undisturbed will ensure that infiltration can take place through the overburden.*

*Paragraph 25.2.2 in C753 CIRIA SuDS Manual 2015 states  
'Groundwater level*

*Groundwater levels should be investigated to ensure that the base of the proposed infiltration component is at least 1m above the maximum anticipated groundwater level (taking account of seasonal variations in levels and any underlying trends).'*

*and*

*'A 1m separation distance ensures a depth of unsaturated soils to help ensure the infiltration performance of the component and protect underlying groundwater from contamination.'*

*While there is a low silt content in the water in the quarry, the use of settlement ponds will minimise the potential for pollution. A second float switch within the settlement ponds connected to the pump will manage water level in the ponds, if the settlement ponds are full of water then the pump will not switch on. When the water level in the ponds drops due to infiltration, the float switch triggers the pump, re-filling the pond until the water level rises to trigger the float switch when the pump is switched off again.*