

Your ref
Our ref 224753
File ref

ARUP

Nic Johnston
Senior Consultant
Level 8
16 O'Connell Street
Sydney
NSW 2000

Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia
t +61 2 9320 9320
d +61 2 93209974
f +61 2 9320 9321
claire.moore@arup.com
www.arup.com

18 December 2012

Dear Nic

Bega Hospital - Assessment of Geothermal Impacts on Flooding

Further to your request we have reviewed both the impacts of the proposed geothermal energy storage system on the flood levels for the hospital site, and the impacts of flooding to the geothermal energy system. We have also reviewed the environmental implications for the proposed location and documented our findings below.

Impact of the proposed geothermal energy storage system on flood levels

The thermal bores will be installed so that the top of the bores are between 600mm and 1000mm below the existing ground levels. Once installed the land above the thermal bores will be returned to grass land, which prevents any impact of the bores on the predicted flood levels. The mechanical operations for the geothermal energy storage system will be located within level 03 of the hospital building while the pipe work is located on the ground level at approximately 20.50m AHD. Both of these levels are above the predicted PMF flood level.

Impact of flooding on the geothermal energy storage system

The thermal bores required by the geothermal energy storage system have been located to the East of the hospital building in an area with surface levels that vary from 9m AHD to 12m AHD. Arup has previously estimated the flood levels at the site as being as follows.

ARI Event	Arup Peak Flood Level Estimate (m AHD)
100 year	14.0
500 year	15.0
1000 year	16.75
PMF	18.25

The preferred area for the thermal bores is therefore located within the extents of the 100 year ARI floodplain. This location is intentional for two reasons:

- The thermal bores do not require protection from flooding. The thermal bores are similar to those also installed in harbour situations and will continue to operate when the area is inundated. In fact, from an energy perspective the system could actually perform better in a flood situation.
- The operation of the bores requires that there is no building above them. The installation of the bores within the 100 year ARI floodplain assists in restricting development in this area.

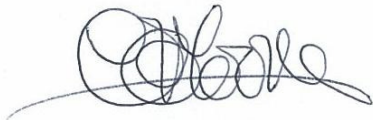
This approach allows critical flood sensitive infrastructure such as the hospital building to be located outside of the flood extents optimising the use of the site by placing resilient and non sensitive infrastructure such as the thermal bores within the floodplain. It is possible (although not currently planned) that the ground area above the geothermal bores could in the future be used for car parking and as a future proofing measure the bores will be designed to withstand vehicular traffic.

The design of the thermal bores and associated pipe works will specify the need to consider the implications of locating the bores and pipe work within the floodplain and require the contractor to address issues such as possible flotation of the pipe work within the design. Flotation is seen as a minor risk as the pipes will be filled with the coolant mixture during operation and not empty.

Environmental implications for the proposed location

The geothermal energy system proposed by Steenson Varming is a closed loop system. The HDPE pipe work is grouted into place to make the pipes crack resistant and impermeable and the system is pressure tested prior to backfill and operation. It is our understanding that these measures mean the risk of flood water entering the pipe network or the mixture of water and antifreeze in the pipes leaking through the pipes is very low.

Yours sincerely



Claire Moore
Associate