



CASE STUDY TECHNICAL SHEET

Case study 1 – Agricultural processing building, Kelowna, British Columbia

This building, built in 2010, is a two-storey processing building linked to an herb production farm. It is located on the agricultural bench land above Okanagan Lake in southeast Kelowna, British Columbia.

System description

The earth tube system was designed to provide high volumes of passively cooled air to drive the drying process of the medicinal herbs and plants produced by the farm.

The owners were seeking an alternative approach to the energy-intensive conventional drying and cooling machinery because of operating costs and the undesirable operational impact on the farm.

The main drying occurs in the summer, when the outside air temperature is highest – which further exacerbates the amount of energy required to cool the air. The earth tube system provides naturally cool air – perfect for slowly drying the herbs, with no mechanical cooling or complex systems.

In the winter, the system provides freely tempered, minimal outside air linked with the building's HVAC system. The owners are able to increase outdoor air volumes and air quality for no extra energy cost.

Earth tube technical data

Pipes	8
Pipe depth	2.4 m
Pipe length	30.0 m average, each
Pipe internal diameter	100 mm
Material	HDPE
Airflow rate (L/s)	100.0 L/s, total (approx. 12.5 l/s per pipe)
Building type	agricultural, processing
Geographical location	Kelowna, Canada
Maximum heating delta T ¹	16°C
Maximum cooling delta T	-19°C
Distance between pipes	0.2m



Figure 1. The layout of tubes with lower layer already backfilled

Photo courtesy of Trevor Butler

Energy performance

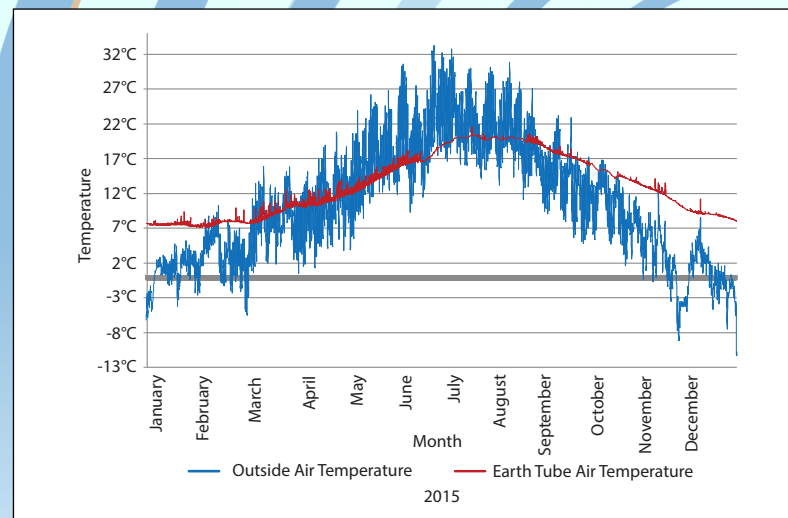


Figure 2. Energy performance of the system, 2015

¹ Delta T is the temperature difference between the pipe inlet and pipe outlet.

Lessons learned

The earth tube system was monitored for more than a year, starting in 2015. The results indicate a well-performing system. The small diameter and depth of the pipes, as well as the low air velocity all contribute to the high-performance output of this system.

The material cost for this system was among the lowest provided, eight 30.0 m lengths of 100-mm diameter pipe. This was a low-risk test case, with no direct contact with HVAC and the ability to monitor air quality.

Acknowledgements

Thank you to Trevor Butler, P.Eng. (Archineers Consulting Ltd.) for contributing to this case study.

Disclaimer

Neither Natural Resources Canada nor any of its employees makes any warranty express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of its contents. Reference in the case study to any specific commercial product, process, service or organization does not necessarily constitute or imply endorsement, recommendation or favouring by Natural Resources Canada. The views and opinions of authors expressed in this case study do not necessarily state or reflect those of Natural Resources Canada.

Aussi disponible en français sous le titre :

Étude de cas 1 – Bâtiment de transformation agricole, Kelowna, Colombie-Britannique

Cat. No. M91-19/1-2021E-PDF

ISBN 978-0-660-40846-0

For information regarding reproduction rights, contact Natural Resources Canada at nrcan.copyrightdroitdauteur.nrcan@Canada.ca.

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources, 2021



Figure 3. Watertight connection of tubes to a building

Photo courtesy of Trevor Butler.

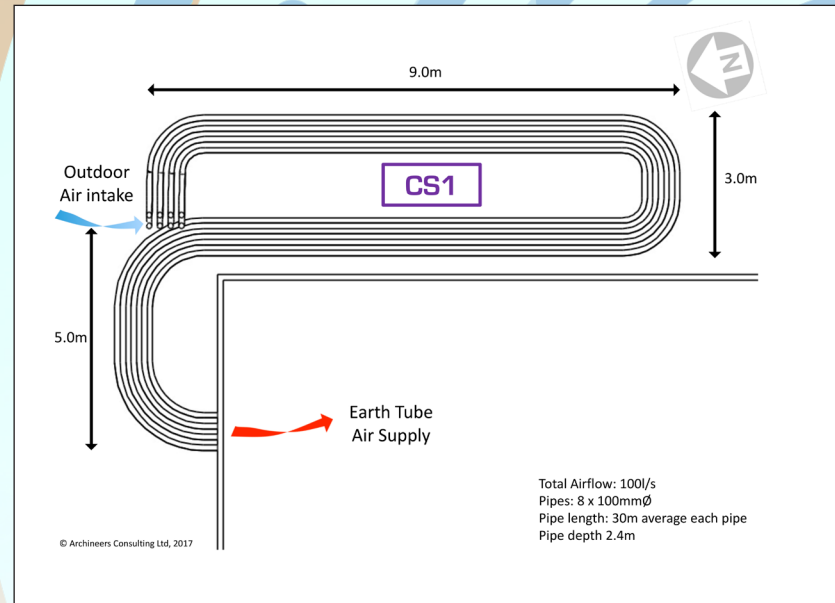


Fig 4. Pipe layout

Figure courtesy of Trevor Butler.