Thermal Transfer Geothermal System

BULLDOG HEAT PUMP

CGC GROUP

The Clarington Phase 1, 2 & 3 - Brampton, ON

Introduction

For the greatest chance of success for your Geothermal project, choose an HVAC system that offers the most flexibility and the greatest heat reclaiming capabilities.

Most buildings are unbalanced when it comes to the amount of heat rejected to and extracted from the Geothermal field.

Choose an HVAC system that can provide:

- Longevity of the Geo field by mitigating the risk of overheating
- Simplest building piping loop layout
- Greatest ability for heat reclaiming
- Minimize heat rejection
- Most dependable heating delivery method

The Bulldog Thermal Transfer Geothermal system has a positive impact on the design and operation of the Geothermal field. It allows for greater design flexibility that can help bring the Geothermal field back to a balanced mode. This is accomplished by a design that allows for ALL HVAC loads to be placed on one common fluid loop which takes advantage of the diversity in the building and provides greater heat reclaiming capabilities. This reduces the risk of overheating and may result in a smaller Geothermal field with capital cost reductions.

Bulldog Geothermal Q & A

How can heat be extracted from a Geothermal field with a fan coil system?

With a water to water thermal transfer plant located in an equipment room.

Since the Bulldog Geothermal system requires centralized heating, how does the heating cost get allocated to each suite?

The Bulldog suite units have communicating capabilities that can transmit information such as the length of time that the heating valve is open. With this information and a meter on the central plant, a ratio of the energy consumption can be allocated to each suite at a very low cost.

Take Note!

Bulldog Geothermal Q & A

Since a Reversing WSHP system doesn't require this plant, why would anyone want to incur the additional capital cost for this centralized plant?

Some of the possible benefits include:

- Lower capital cost with smaller Geothermal field for cooling dominant buildings.
- Lower capital costs with no need for pipe insulation and vapour barrier.
- Possible reduction in quantity of building fluid loops.
- Lower costs by not oversizing the heating units and better comfort.
- Lower capital costs with smaller pipes.
- No glycol required.
- Lower maintenance expense.
- Lower noise levels.

Bulldog Geothermal Advantages

Lower capital cost with smaller Geothermal field for cooling dominant buildings.

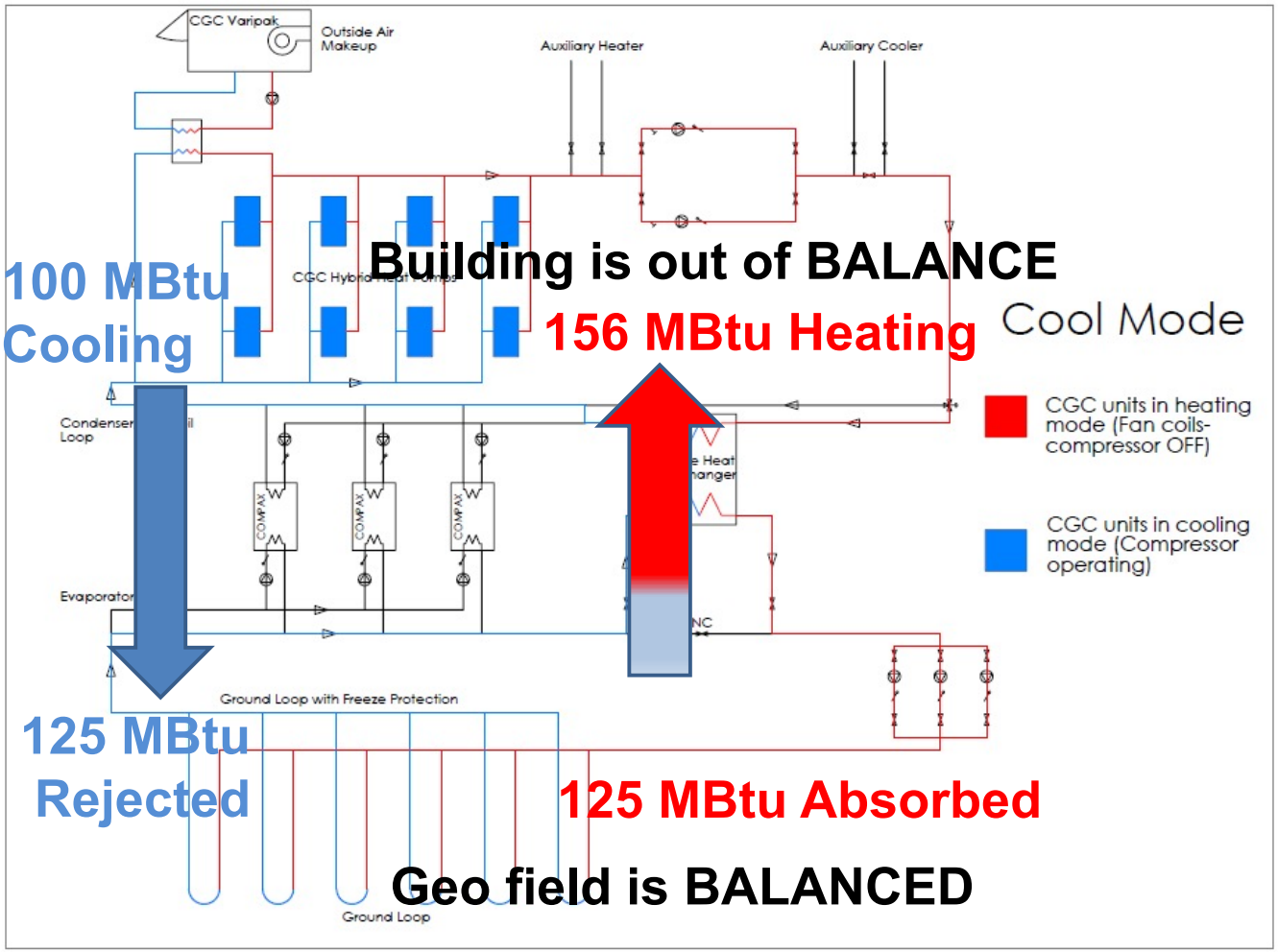
A building heating load would have to be approximately 56% larger than the building cooling load in order for the Geo field to be balanced. A value less than 56% means the Geo field is cooling dominant. Most buildings are cooling dominant with respect to the Geothermal field even in cold climates such as Ottawa, Ontario. The nature of the Bulldog system allows for more heat sharing such as tying in the ventilation load and the AC load onto one common loop. This could result in less heat being rejected and may allow for a smaller Geo field. Also, less compressor operation with passive heat transfer helps balance the Geo loads and may result in a smaller Geo field. This would result in lower capital cost.

Lower capital costs with no need for pipe insulation/vapour barrier.

With a regular WSHP the fluid pipes need to be insulated for condensation with a vapour barrier. Since the Bulldog system doesn't operate with cold fluid temperatures there may be no need for thermal insulation.

Bulldog Geothermal Advantages

Geothermal design engineers have in fact selected smaller Geothermal fields for the Bulldog system since a Bulldog system will reject less heat and extract more heat from the Geothermal field than traditional WSHP's.



In order for the Geothermal field to be considered balanced, the building's aggregate heating load would have to exceed the cooling aggregate load by approximately 56%.

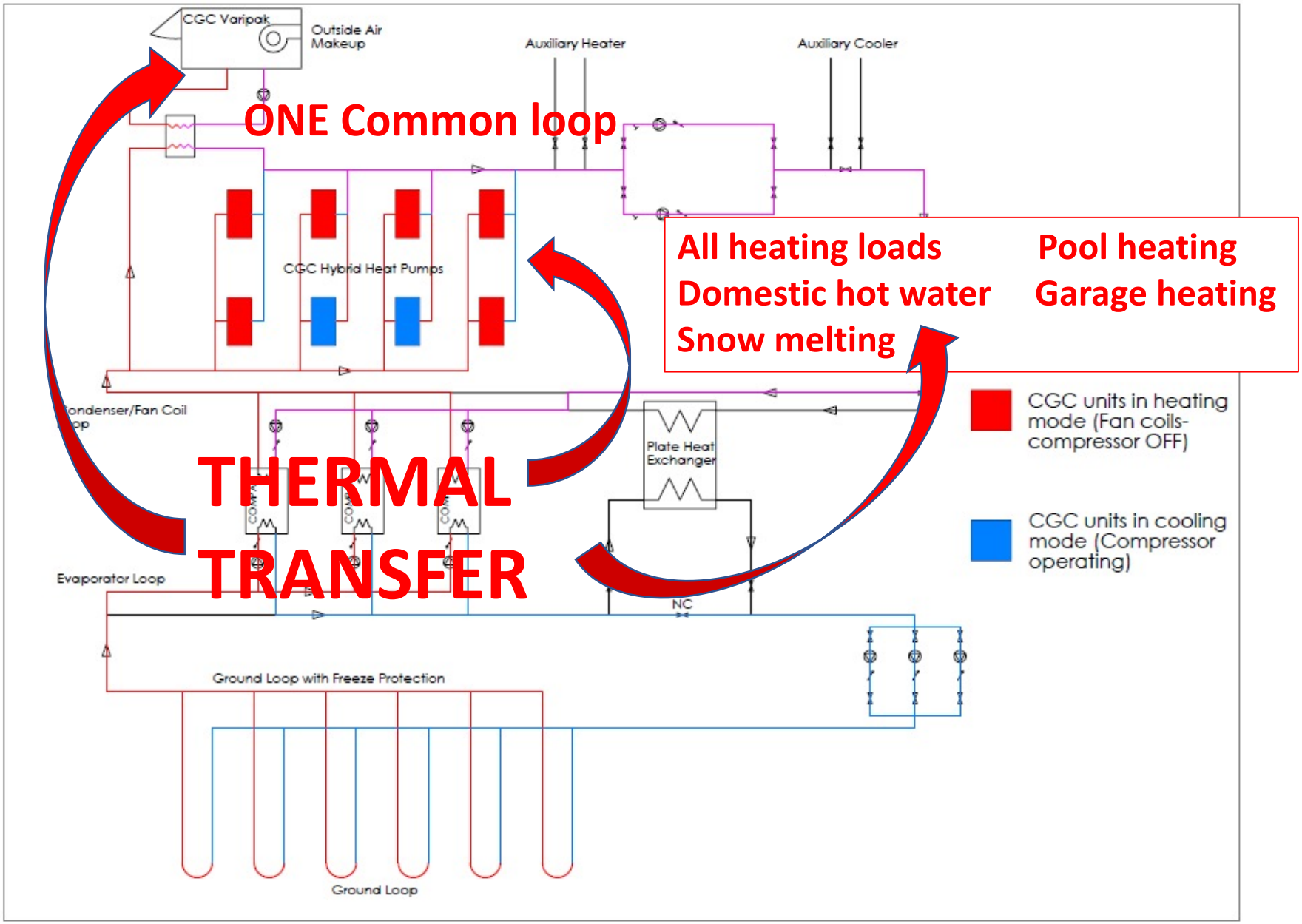
Bulldog Geothermal Advantages

Possible reduction in quantity of building fluid loops with Thermal Transfer capabilities to all heating loads.

Some reversing WSHP systems may require a separate secondary piping loop for the Ventilation load and other ancillary heating systems (snow melt, domestic hot water). This may be the case since Make Up Air units cannot have a low EAT coupled with cold evaporator fluid temperatures. In those cases the building may require a separate piping loop for the MUA's than the suite WSHP. Another option would be to have an Energy Recovery system for the MUA's so that the minimum EAT is sufficiently high. Although this is a good idea, it can also be expensive. Yet another option would be to place the Ventilation load onto a Gas Fired MUA.* With a Bulldog system the Varipak MUA's can be placed on the exact same loop as the suite units, thereby reducing the piping costs and increasing the heat sharing capability of the system. This may also result in less heat being rejected and may allow for a smaller Geo field.

*Note: Gas fired MUA's would add to the problem of potentially over heating the Geothermal field, or require more bore holes.

Bulldog Geothermal Advantages



Bulldog Geothermal Advantages

Lower costs by not oversizing the heating units and better comfort.

Regular WSHP may need to be oversized for the heating mode in cold climates. This is due to the need for the highest heating capacity requirement when faced with cold evaporator fluid temperatures. An oversized unit is not a good idea for excessive compressor cycling and dehumidification during the cooling season. A Bulldog unit never has to be oversized for heating, which should result in a lower cost and better cooling comfort.

A reversing WSHP will deliver approximately 26% less heating capacity at 50°F fluid temperatures than at 75°F fluid temperatures.

Lower capital costs with smaller pipes.

A Bulldog system still only requires a design of only 2gpm/ton, which may mean lower costs due to smaller pipes and smaller pumps. This is due to the high efficient nature of our tube in shell condenser.

Bulldog Geothermal Advantages

No glycol required in the building.

The Bulldog system is separated from the Geo field by heat exchangers and therefore doesn't require glycol in the building loop, unlike a reversing WSHP system.

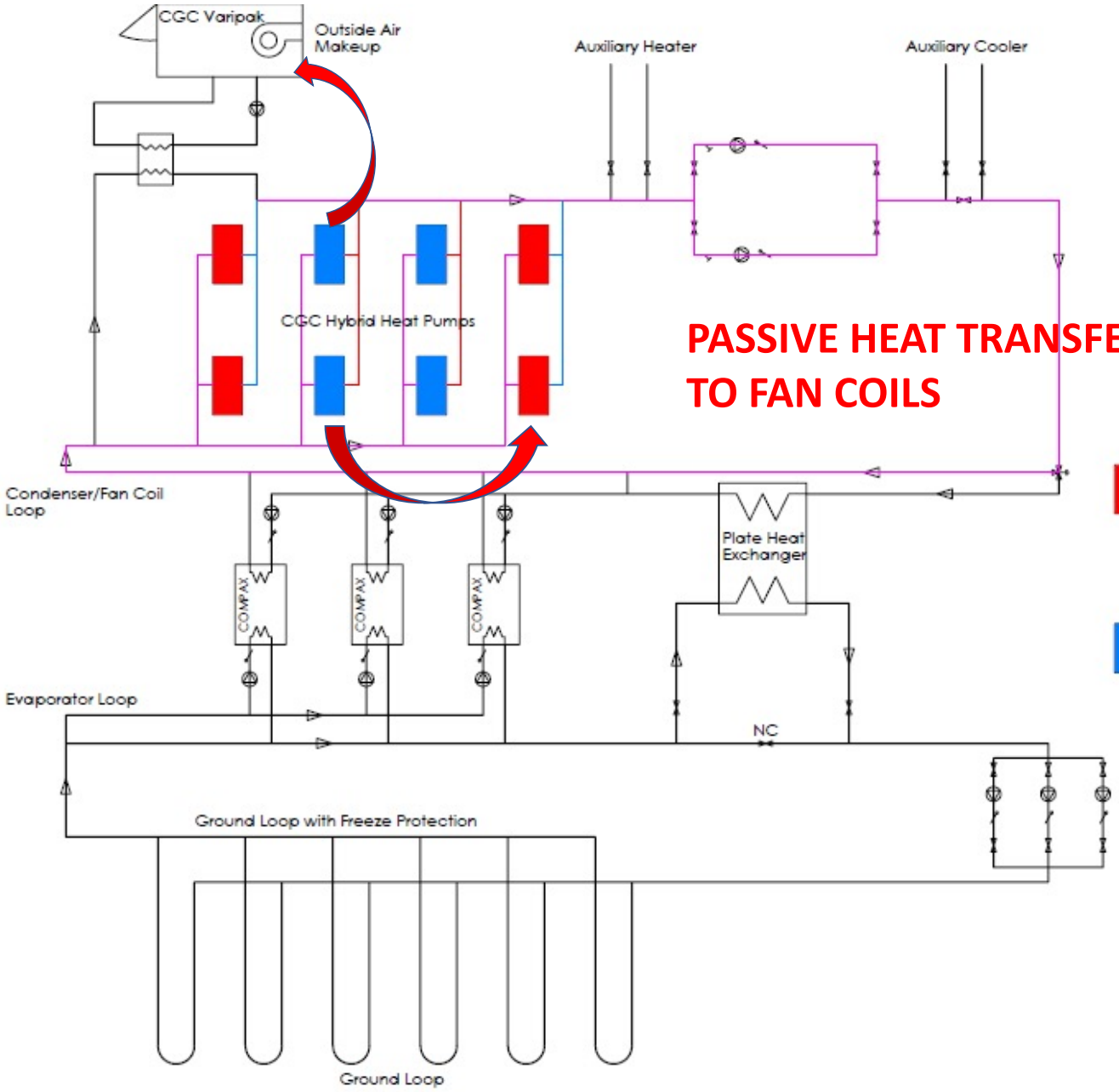
Lower maintenance expense.

Bulldog units are going to be more reliable with fewer run time hours on the compressor and no reversing valve to ever repair resulting in lower maintenance costs. The Bulldog units are guaranteed to never experience a refrigeration failure while in the heating mode.

Lower noise levels.

It is a fact that traditional WSHP's are noisier while in the heating mode than in the cooling mode. The Bulldog unit has eliminated this noisiest mode of operation by silencing the compressors while in the heating mode (they are turned off). So the Bulldog unit has fan coil noise levels while in heating.

Bulldog Geothermal Advantages



Balance Mode

CGC units in heating mode (Fan coils-compressor OFF)

CGC units in cooling mode (Compressor operating)

Less compressor operation with passive heat transfer helps balance the Geo loads and may result in a smaller Geo field.

Geothermal Sample Installations

Davis Elementary School - Carbonear, NFLD

Elizabeth Parks School - Paradise, NFLD

Ironstone - Burlington, ON

Le Vistal Condominiums Phase I & II - Montreal, QC

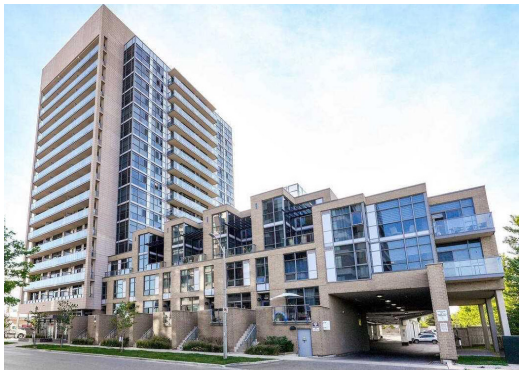
Sparkling Hill Wellness Resort - Vernon, BC

Springdale Professional Office Building - Brampton, ON

Strata Condominiums - Burlington, ON

The Brock Condominiums - Burlington, ON

The Clarington Phase 1, 2 & 3 - Brampton, ON



Ironstone - Burlington, ON

Le Vistal I & II - Montreal, QC

Elizabeth Park Elementary - Paradise, NFLD

Geothermal Springdale Professional Building - Brampton, ON

CGC is 23.8% more efficient!

Caneta Energy has completed a comparative modeling analysis of the Bulldog Heat Pump system concept and a conventional water-to-air heat pump system. Both systems were modeled as ground coupled.

The Results

The HVAC and whole building results for the Bulldog Heat Pump system are compared to the conventional ground source results for the Springdale Office Building in the table below.

The Bulldog Heat Pump system had annual operating savings of $11,858 compared to the conventional GSHP system, and it has electricity savings in both heating and cooling. Unlike the conventional GSHP system, the heat rejected to the heat pump loop during simultaneous heating and cooling reduces the heating load experienced by the central water-to-water heat pump. This heat recovery accounted for a 38% reduction in heating load.

Because of the improved efficiency in heating, the Bulldog Heat Pump system extracts approximately 33% more heat from the ground than the conventional GSHP system. However, due to the improved cooling efficiency, the Bulldog system rejects approximately 11% less heat to the ground than the conventional system.

The heat recovery benefit of the Bulldog system is significant.
"Caneta Energy has modeled heat pump systems in a significant number of buildings over the past number of years. We have seldom seen a concept as promising as the Bulldog system, particularly when used in a ground coupled system with water-to-water heat pumps between the building loop and ground heat exchanger. When the building is balanced thermally, the ground heat exchanger can be bypassed to maximize heat recovery and minimize pumping. This provides the benefits of conventional water-loop and ground source concepts in one system."

- Caneta Research Inc.
R.L. Douglas Cane, P. Eng
Principal

Geothermal Springdale Professional Building - Brampton, ON

Other benefits of the Bulldog Geothermal System:

- Higher COP with water to water heat pumps
- Lower flow rates with only 2 GPM vs. 3 GPM
- Quieter in the heating mode with compressors turned off
- More reliable operation in the heating mode with fan coil function and no reliance on unit compressors
- Better heating comfort
- Longer unit compressor life with cooling mode operation only

System Type	HVAC Only (Annually)		Whole Building (Annually)	
	Energy Use (kWh)	Operating Cost ($)	Energy Use (kWh)	Operating Cost ($)
Conventional GSHP	619,963	55,169	1,577,827	143,056
Bulldog Heat Pump	472,309	43,311	1,430,280	131,198
Savings	147,654 (23.8%)	11,858 (21.5%)	147,547 (9.4%)	11,858 (8.3%)

Conclusion

Caneta Energy has completed a comparitive analysis of the Bulldog Heat Pump system and a conventional ground source heat pump. Annual operating savings are 21.5% compared to the baseline ground source system proposed for the Springdale office building.

BULLDOG HEAT PUMP

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