

Technical design note

Project name	Weldale Street, Reading		
Design note title	Alternative Heating Source Option Appraisal		
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1. Introduction

The Technical note has been prepared to review potential heat source options, addressing potential advantages, restrictions and complications.

The previous consented scheme design was developed on the proposal of a centralised boiler and CHP led system with heat metering in each apartment.

As an alternative, the strategy was developed to include the use of local ducted air source heat pumps in each property. Whilst air source heat pumps seasonal efficiency is reduced compared to ground source heat pumps, the lack of need for central pumps, pipework and transmission heat and pressure losses gives similar levels of overall system efficiency, and along with high performance building fabric, retains the approach of decarbonisation.

The systems proposed have deviated from this proposal to develop a solution that is better aligned to low carbon heat sources, further decarbonisation of the electricity grid and is more appropriate to comply with reduced carbon factors of the 2021 Building regulations and approved documents which came into force June 2022.

In addition, by avoiding central systems, the amount of materials involved is significantly reduced and embodied carbon reduced also.

This note covers both open loop and closed loop ground source heat pumps as well a centralised Air source Heat pump installation and explanation as to why these options were discounted as part of the design review.

The solutions that have been investigated all consider the feasibility of applying low carbon heat technology to the site, avoiding direct fossil fuels.

In addition it gives a narrative on how services from a district heating system could be routed in the building, to demonstrate the feasibility of adapting the building to such a system should it become available.

2. Ground Source Heat Pump - Open loop

Open loop ground source heat pumps use a small number of wells buried deep into the substrate to access water ways in the ground. The steady heat of these water ways is utilised via heat exchangers to provide useful heating to buildings. Below is a typical open loop abstraction well installation taken from CIBSE guidance.

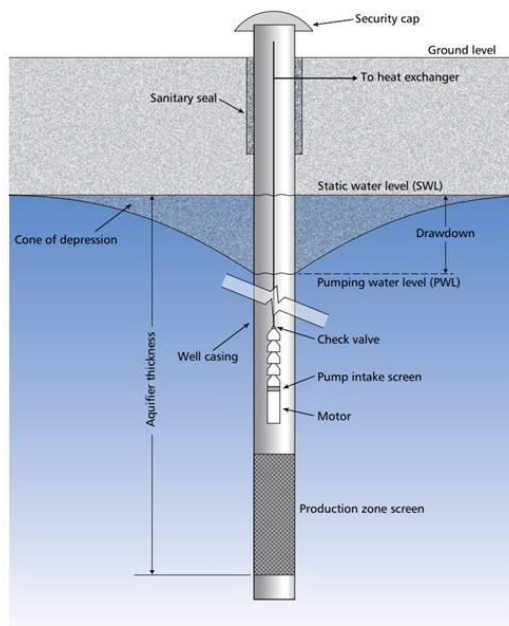


Figure 15 Example of an abstraction well (adapted from Kavanaugh and Rafferty (2014); courtesy of ASHRAE)

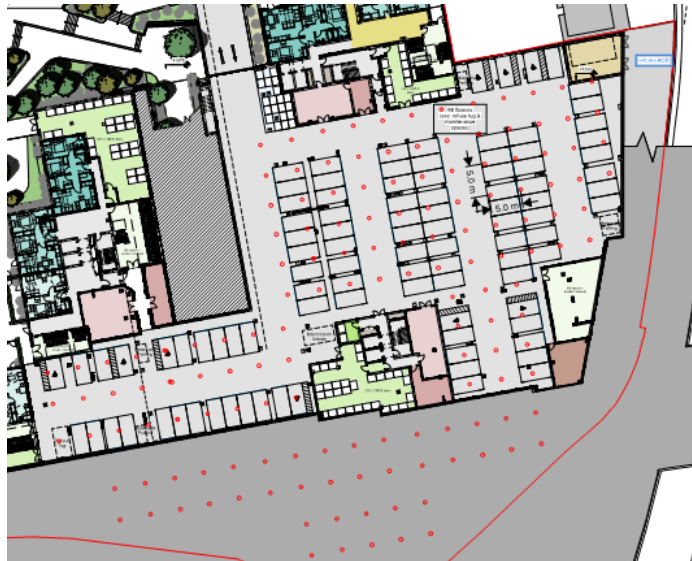
Open loop system has been discounted as appropriate for this scheme due to Geotechnical reasons. This has been explored and captured in the Fairhurst report " Technical Note – Potential Impact of installation of open loop heating pump wells on controlled waters"

3. Ground Source Heat Pump - Closed Loop

Ground source heat pumps utilise low grade heat from the ground via a number of water/glycol pipe loops buried deep within the ground.



Due to the number of bore holes required and the depth of each the solution requires specialist Geo thermal engineering feasibility and presents risks to the site.



The image below demonstrates the number of bore holes that would likely be required for this scheme. As shown the total floor area required exceeds that available for the site.

4. Centralised Air Source Heat Pump

This solution would require large bank of centralised Heat pumps to meet the load of the building. This solution has been assessed and discounted as appropriate for the scheme for the following reasons:

- » Due to site restrictions these units will need to be located on the roof of the building, This will utilise space that has currently been allocated to PVs. As there is no efficiency advantage in

central heat pumps vs local heat pumps, Reduction in PV's will have a negative impact on the building carbon emissions.

- » Overall efficiency of the heating system will be reduced due to distribution losses through long routes of pipework to each apartment. Should the building be adapted to future district heating, the likelihood is that distribution pipework would be routed in opposite directions to the district heating source, and may not be sized correctly for the same parameters as an air source heat pumps system, requiring replacement of much of the distribution likely in that event.
- » Resilience of the heating system will be compromised due to all units being fed from the same centralised system.
- » The external location of the units also presents a risk of noise to the occupants as well as the neighbouring buildings.
- » Additional energy management, billing will be required to manage an additional utility i.e. heat being delivered to each apartment. The tenants will be subject to additional standard charges compared to an all electric/local heat pump solution. In addition a centrally managed system is likely to be based on commercial energy tariffs, and may not be subject to energy price caps that benefit users should the current energy crisis continue.
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5. Future District Heating.

Should district heating be required in the future, there is scope to retro fit the required infrastructure.

The project team has assessed the impact of providing the services for this in the design. The strategy would be to re-allocate the cycle parking into a single central basement location and to convert the northernmost cycle storage to a heat exchanger/pump room, which has direct access to Weldale street where any district heating mains may be routed from.

From the pump room there is sufficient space for routing of heating mains pipework at soffit level in the basement car park, where it rises vertically and can distribute horizontally in each zone to serve apartments.

Should this occur the apartments heat pump units would be replaced by heat interface units with metered instantaneous domestic hot water and heating capability.

Refer to Hydrock drawing 20219-HYD-XX-XX-DR-ME-9020 rev P1 for proposed services routes and illustration that ample space has been considered for future pipework distribution in risers.

6. Conclusion

This design note has demonstrated that the alternative heating systems described above are not appropriate for the site at Weldale Street, Reading due Geo technical issues, site restraints, reliability, efficiencies and complexity of the solution. In addition, this note and supplementary drawing demonstrates that the building design allows for future installation of district heating systems to be carried out should these systems become available to the site.