

Date: 28th March 2026

LKC Reference: LKC 251087-R1

RE: REVITALISING BUXTON – ASSESSMENT ON PILING / FOUNDATION AND DRILLING INTO THERMAL SPRINGS

1. Introduction

LKC were asked to provide an assessment and potential mitigation with regards to the risk to the underlying thermal springs. LKC considers two main risks have been identified:

1. Drilling and piling into contaminated land.
2. Dealing with artesian water.

The key risk receptor is the underlying mineral water asset within the limestone (under artesian) and the potential for cross contamination. Any methodology or technique will need to be in-line with Buxton guidelines in drilling and excavating in an area of Thermal Springs^{1,2} as well as Environment Agency guidelines for piling in contaminated land³. Further drilling work will need to be required to supplement the initial site investigation.

In addition, there is a risk for artesian when drilling and piling that will need to be prevented or if not possible mitigated as to not lose the integrity of the thermal spring.

2. Contaminated Land

2.1. Drilling into Contaminated Land

The investigation protocol to mitigate the risks were as follows:

- The drilling method proposed to advance any further boreholes (additional future site investigations) will be by using the Geobor 'S' wireline technique, utilising 150mm diameter casing through the alluvium. Aquifer protection can be installed in these boreholes by placing a layer of bentonite pellets at the end of a casing section and allowing these to soak and expand (minimum of 20 minutes) before inserting the next casing string of a smaller diameter. This will usually be done between the 150mm and 125mm casing diameters once Made Ground / Contaminated superficial deposits have been passed and boreholes have reached the top of the Natural Strata. If no contamination encountered then the borehole will be advanced to top of bedrock using the 150mm casing, a bentonite plug installed and allowed to soak for 20 minutes, the exploratory hole will then be continued using the 125mm drill string, socketed into the bedrock.
- The temperature of any groundwater encountered in the borehole will be measured and recorded at regular intervals during drilling. High Peak Borough Council will be notified immediately of any occurrence of groundwater at or exceeding 15° C. Drilling will cease and the borehole temporarily capped.
- Use of biodegradable vegetable oil as lubricant.
- Water from drilling works to be collected in IBCs and disposed of responsibly Groundwater and arisings will not be allowed to enter water bodies or drains and will be contained on site using a suitable spill kit and spill berm to prevent any spill outside of the working area to occur.
- Any contaminated impacted rigs to be cleaned in a self-contained cleaning unit using the prescribed disinfectant presented in the Buxton guidance (Peracetic acid solution) before moving to new location. Where cleaning will likely be required is in the former gas works on

¹ High Peaks BC (2021). "Water in Buxton: Supplementary Planning Document." Consultation Draft Spring 2021.

² High Peaks BC (2020). "Drilling of Boreholes in the Vicinity of Buxton Thermal Springs".

³ Environment Agency, May 2001, "Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention", National Groundwater & Contaminated Land Centre report NC/99/73.

the eastern boundary and downgradient of this where contaminated soil was encountered. This will need to be investigated fully once full access to that area is allowed.

2.2. Piling and Shallow Foundations into Contaminated Land

Piling is proposed in the western part of the site into the proven mudstone.

Shallow ground improvements (using rigid inclusions) and lightly reinforced shallow spread foundation onto the weathered mudstone is proposed for the rest of the site. See plans.

With regards to shallow foundations onto the weathered mudstone the underlying thermal spring will be protected as foundations will sit on the weathered mudstone and not penetrate into the limestone.

With regards to piling, the same protocol as drilling (as required) will be utilised during piling works. Piling will be undertaken within the deeper mudstone and therefore will not penetrate into the underlying limestone, thus protecting the thermal springs.

Furthermore, the three techniques chosen by the piling contractor (all with casing), will prevent downward migration of contamination. This is summarised in the table below.

Foundation Works Risks Assessment with respect to environmental aspects (in the case that pile toe level needs to be below the bedrock aquifer)			
Risks / Piling Methodology	CFA (Continuous Flight Auger)	Cased CFA (CSP)	Rotary Bored Piling (LDA)
	Construction of the CFA piles will be completed by excavation of soil using an auger. The spoil is transported to the surface on the auger and concrete is pumped through the hollow stem as the auger is withdrawn.	Construction of the CSP will use the same technique as Continuous Flight Auger piling methodology comprising excavation of soil using an auger and simultaneous driving of casing. The spoil is transported to the surface on the auger and concrete is pumped through the hollow stem as the auger and casing are withdrawn. The string of the CSP rig will be surrounded in a full length casing.	Rotary bored secant piles use temporary casing during auger drilling to support the borehole and allow reinforcement and concrete to be poured in the open bore. Spoil is brought to the surface using augers, buckets or core barrels and the casing is removed once the concrete reaches the final level.
Creation of preferential pathways through a low permeability layer (aquitard) to allow potential contamination of an underlying aquifer	CFA is likely to ensure that an open pathway between aquifers is not created. This is because concrete will be injected as the auger is removed, sealing any potential pathway. The proposed CFA will form a good seal against the strata present.	CSP will ensure that an open pathway between aquifers is not created. This is because the piles will be cased during drilling and concrete will be injected as the auger is removed, sealing any potential pathway. The proposed CSP will form a good seal against the strata present.	Rotary bored piles will also be cased down to the competent strata (for bore stability and cutting pathway to potential contaminant) during drilling. The proposed Rotary Bored Piling will form a good seal against the strata present.
Driving solid contaminants down into an aquifer during pile drilling	During CFA piling the auger will be drilling into the ground as the bore progresses. This process is unlikely to drive any significant volume of material ahead of it as the auger will remove the material immediately adjacent. Overbreak will be slightly more onerous than the CSP technique.	During CSP piling the casing will be drilling into the ground as the auger progresses. This process is unlikely to drive any significant volume of material ahead of it as the auger will remove the material immediately adjacent and the casing has a small surface area.	During rotary piling the casing will be screwed into the ground as the auger progresses. This process is unlikely to drive any significant volume of material ahead of it as the auger will remove the material immediately adjacent and the casing has a small surface area.
Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.	Injection of concrete via the auger stem will be monitored and controlled during the works. The material used is inert and will form a good seal against the strata present.	Injection of concrete via the auger stem will be monitored and controlled during the works. The material used is inert and will form a good seal against the strata present.	Injection of concrete via the concrete tremmie will be monitored and controlled during the works. The material used is inert and will form a good seal against the strata present.

Any of the piling technique presented in the table will not pose any unacceptable risks to water resource receptors.

Further site investigation will refine the extent of the deeper mudstone and confine the extent of any piling requirements.

3. Artesian Groundwater

3.1. Drilling into Artesian

Depending upon the drilling depth into the Monsal Dale Limestone there is a potential to hit artesian water, which will be in direct continuity with the thermal springs.

This may be a potential in the centre and east of the site where the limestone is at shallow depth. It is unknown at this time at what depth confined artesian water is located and hence may require additional site investigation to provide rock core data at depth within the limestone.

Protocol would include the following:

- The temperature of any groundwater encountered in the borehole will be measured and recorded at regular intervals during drilling. High Peak Borough Council will be notified

immediately of any occurrence of groundwater at or exceeding 15° C. Drilling will cease and the borehole temporarily capped.

- If artesian groundwater is encountered during drilling High Peak Borough Council will be notified immediately. Drilling will cease and the overflow of water will be contained by temporarily capping the borehole and subsequently preventing overflow through installation of a fast acting barite / bentonite mix (pre-made) to slow the flow. If required casing and rig will be kept over the hole to slow down any water under pressure.

3.2. Piling into Artesian

There may be a potential to hit artesian in the centre and east of the site where the limestone is at shallow depth. It is unknown at this time at what depth confined artesian water is located and hence needs to be taken into account for any piling techniques or potentially identify another shallower foundation option.

Based on the above LKC understand foundation option have been revised to prevent penetration into limestone and thus prevent the chance of artesian and the compromise of the thermal springs.

Piling will only be undertaken on the eastern part of the site where mudstone is the thickest and piles will be socketed into the mudstone (see plans).

The centre and eastern part of the site will have lightly reinforced concrete spread foundations taken down to the weathered mudstone (see plans).

4. Conclusions

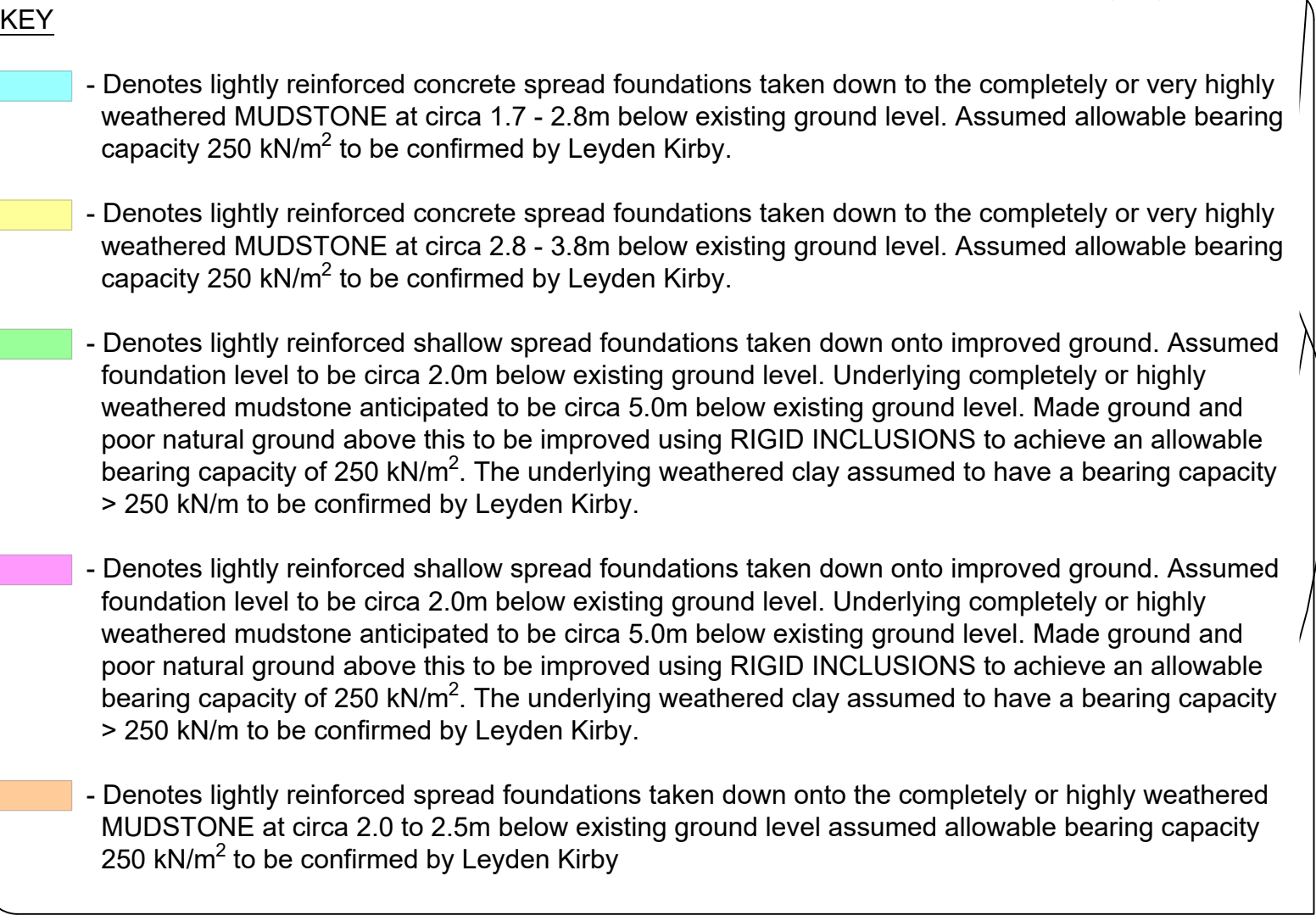
Based on the above protocol, mitigation and appropriate foundation techniques LKC considers the thermal springs will be protected.

I trust that our proposals are of interest, and we look forward to hearing from you in due course.

Dr Paul Quimby
Technical Director

ENCLOSED:

Plans showing location of piles (into mudstone) and shallow (non-piled) foundations (on weathered mudstone).



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