Audit Query Tracker Query No	Subject	Query (25/08/2017)	CGL response (26/09/2017)
1	Stability	Heave calculation revised to use accurate dead loading of existing building.	4.13 – The slab will span onto pad foundations, therefore following the same rationale as set out in the CGL report, total heave would be expected to be of the order of 12mm based on a net loading of 57kPa (excavation of 62kPa with slab load of 5kPa following conversation with Elliott Wood). This would be expected to occur within the centre of the excavation and would not have a significant effect on neighbouring structures. 4.14 – The floor slab is to span onto pad foundations with heave protection beneath. 4.15a – Comment on potential alluvial soils and that these could have an impact on ground stability is noted. The stability of the soils will be observed and managed by the contractor during excavation of the underpins. 4.15b – Assuming a cu of 60 kPa at formation level would give a stiffness (E' = 27MPa) and a predicted total settlement of some 9mm under net loading for a 1.2m wide footing – allowing for no excavation adjacent to the foundation (e.g. excluding the effects of long term heave). The VDISP input/output from the original BIA have been checked and are correct – the influence of the basement excavation reduces the predicted settlement to some 2.9mm total, increasing to 7.9mm with the underpin workmanship allowance. 4.15c – Long term and short term heave could potentially reduce the displacements experienced in the short term as seen in the response to 4.15b above. Noting this, a total underpin settlement of some 7mm short term, plus 5mm workmanship could potentially lead to an immediate settlement of some 12mm at the location of Section C-C in the short term. The span at section C-C is assumed to be 6m, therefore 12mm of settlement would give an angular distortion of 1:500.

			On this basis, in the short term, the angular distortion would be on the limit of Cat 0/Cat 1 damage as based on Rankin's work[1]. This is consistent with the previous findings of the BIA. 4.15d – Underpin walls are relatively thick members compared to the lateral loads they support and, when properly cured and properly, they do not deflect much. The key to ensuring this lies with the contractor, who must provide adequate temporary support to restrict lateral movements/rotation at the top and toe of the wall. In the more than 200 BIA reports and subsequent build-outs that CGL have been involved with, we have had only one case where lateral movements have been higher than predicted – this was due to contractor error in the compaction of underpin backfill material. Monitoring data for smaller, residential projects are rare, however CGL has previously provided Campbell Reith with evidence of monitoring data for a substantial underpinning project (circa 7m of underpinning), which recorded very low movements (of the order of 2mm to 3mm). For the most part, however, it is not possible to provide monitoring data directly as they are considered to be commercially sensitive. 4.15e – Elliott Wood to confirm
2	Stability	Clarification required about the form of construction of the basement slab	See responses above
3	Stability	Clarification of assumptions and statements made in ground movement and building damage assessment as described in Section 4.	See responses above.

[1] Rankin, W.J., Ground movements arising from urban tunnelling: predictions and effects, *From Bell, F.G., Culshaw, M.G., Cripps, J.C. & Lovell, M.A (eds) 1988. Engineering geology of underground movements, Geological Society Engineering Geology Special Publication No 5. Pp. 79-92.*