A. The Contractor shall obtain existing utility information, and execute trial pits to locate and confirm services at pit/shaft locations and elsewhere as required.

B. Preconstruction photographs and pre construction grid survey of surface levels along the length of the proposed tunnel shall be taken by the Contractor.

1.3.3 Cavity Grouting

A. In case cavities have been confirmed to exist along the tunneling route by geophysical survey, such cavities shall be grouted.

B. Grouting of existing cavities where required shall be carried out by means of drilling and pressure grouting of cement, cement/sand or cement/bentonite mortar to fill in the cavities and open fissures. This work shall be designed, carried out and tested by a specialized Contractor to a method statement approved by the Engineer.

C. Boreholes shall be drilled vertically to the required depth below existing ground levels. Grouting shall be completed from the base of the boreholes up to ground levels. Verification boreholes shall be drilled, water pressure tested and grouted to assess the effectiveness of the treatment.

D. Drilling shall be executed using rotary drilling methods with a casing advancer system to prevent borehole collapse in unconsolidated materials. Borehole diameter shall be a minimum of 100mm.

E. Grouting shall be carried out in stages in accordance with the approved method statement. Inflatable packs shall be used as necessary to isolate areas requiring grouting and to enable pressure grouting. Grout shall be pumped through flexible hoses or steel pipes to the grout hole location. Grouting pressure shall be regulated up to a maximum of 2 bar unless ground conditions dictate otherwise. Grout shall be introduced to the grout hole via a tremmie pipe placed at the base of the borehole. The tremmie pipe shall not be removed until 100% grout is observed and maintained at the grout hole surface.

1.3.4 Pits/Shafts

A. It is envisaged that pits/shafts will be constructed as follows but the final design will be the responsibility of the Contractor to the approval of the Engineer.