A. The Contractor shall use only NDM equipment that is appropriate for the intended installation, site and ground conditions, length of drive, and other relevant factors and can meet the contents of these specifications to the satisfaction of the Engineer. It is envisaged that the NDM equipment will have the following capabilities but the final choice of equipment will be the responsibility of the Contractor to the approval of the Engineer.

1.2.1.1 Tunnelling Machine

a) Steerable and incorporating hydraulic rams to move the articulated head.

b) Designed to ensure no rotation or rolling during installation.

c) Remote controlled and can transmit information such as jacking force, face pressure, length, roll, pitch, steering attitude, temperature, valves open or closed, cutter torque, rate of progress, slurry pressure, slurry flow, earth face pressure to a microprocessor console on the surface from where the system is operated.

d) Incorporates meters and gauges to measure the slurry flow and pressures.

e) Capable of operating under groundwater conditions as necessary with a hydrostatic balance not less than 3m head of water.

f) Fitted with a calibrated laser target, robustly constructed and rigidly secured.

g) Guidance system shall be laser or an approved equivalent for the control of tunnel alignment. The guidance system shall be mounted independently of the thrust wall or machine jacking rig or anything else that may move during operations.

1.2.1.2 Thrust System

a) The rig shall distribute the thrust to the pipes via a thrust ring and packing. The jacks shall apply the thrust to the thrust ring by means of a symmetrical distribution. Interjack stations shall be used where frictional resistance or other causes would otherwise result in unacceptable thrust forces.

b) If used, spacer blocks shall be true and free from any distortions.

c) All thrust rings shall be true and free from any distortions and sufficiently stiff so as to transfer the load from the jacks uniformly to the packing.

d) Other than at the shield, each group of jacks shall be interconnected to ensure that an evenly distributed load is applied to the thrust ring.