The Contractor shall comply with all relevant road Laws. Where limits and/or speed limits have been placed in the vicinity of the Works, the Contractor shall provide for the necessary movement of plant and equipment in accordance with the requirements of the relevant authority.

The Contractor shall not obstruct any drainage pipes or channels in any road but shall divert them wherever necessary and use all proper measures to provide for the free passage of water.

The Contractor shall handover the completed works after proper cleaning of the site.

The contractor shall conduct his operation at all times, with a view to minimize as far as practicable noise and other objectionable nuisances (e.g. oil leakage, spillage, debris etc.)

13.0 TRENCHING

The schematic drawing with the details of trench is enclosed in the tender as per drawing No. 15792-10-03-27

The Contractor shall perform the excavation works so as to enable the pipe to be laid in conformity with the levels, depths, slopes, curves, dimensions and instructions shown in the Drawings, Specifications or as otherwise directed by the EIC.

Contractor shall excavate and maintain the pipeline trench on staked center line as per approved drawing taking into account the horizontal curves of the pipelines.

While trenching, care shall be taken to ensure that all underground structures and utilities are disturbed to the minimum. Suitable crossing shall be provided and maintained over the ROU wherever necessary to permit general public, property owners or his tenants to cross or move stock or equipment from side of the trench or another.

Trenching shall be made with sufficient slopes on sides in order to minimize collapsing of the trench. On slopes wherever there is danger of landslides, the pipeline trench shall be maintained open only for the time strictly necessary. Owner may require excavation by hand, local route and detouring and limiting the period of executing of the works. Before trench cuts through water table, proper drainage shall be ensured, both near the ditch and ROU in order to guarantee the soil stability.

The Contractor shall ensure that trench bottom is maintained in the square form as far as possible, with equipment, so as to avoid/minimize the hand grading at the bottom of the trench. The Contractor shall do all such handwork in the trench as required to free the bottom of trench from loose rock, pebbles and to trim protruding roots the bottom and sidewalls of the trench.

Excavation of trench/pit having PCC/RCC surface, more than 12" in thickness or more than 12" thick continuous asphalted multi-layer/Malba/Brick/Boulder, Additional rates are

payable over and above the Laying rates (of SOR No. 1) as per SOR item no 5.1. Sand padding to be done in case of Malba/Boulder or wherever required as per site conditions.

Excavation in Hard Rock:
Hard rock is defined as trench material with a single piece of rock, dimension exceeding 1.0 m in any direction, which requires cutting only by use of chisel/pneumatic chisel/drill or sledge hammer or removal of the same by additional excavation technique approved by EIC. Additional rates shall be payable for hard rock excavation as per the item SOR no 5.2 over and above the pipeline laying rates. Excavation through soil mixed with small boulders that have been used for a road base will not be considered as hard rock for the purpose of payment.

Excavation in congested Areas:
Congested area shall be defined as an area where MDPE pipeline has to be laid in narrow lanes (Less than 4.5M including footpath/drains) & houses in such locations have only one side entrance i.e. there is no back-lane between two back to back houses & pipeline has to be laid in front of the house. The rates are payable over and above the Laying rates as per relevant SOR item no 1. Such excavation shall be payable under SOR item no.- 5.3.

In addition, the contractor shall excavate trial pits as necessary to determine the pipe route. The number of trial pits will be agreed with the Site Engineer in advance of any excavation. In any event, trial pits shall be made at intervals of a maximum of 30 meters. Restoration of the abandoned trial pits and trenches shall be the contractor's responsibility and contractor shall ensure all open pit/ trench shall be back filled/ levelled/ restoration of pits at the time of day closing (end of day) otherwise the rates against the same shall not be payable. No payments shall be made for such type of jobs. The trial pits shall be excavated to minimum depth of 1.5 meters so as to locate any utilities present in the trench.

13.1 Depth of Trench

The minimum depth of cover shall be measured from top of pipe to the top of undisturbed surface of the soil or top of the graded working strip or top of road or top of rail, whichever is lower.

In case of crossing of water bodies, the minimum depth shall be measured from the top of the pipe to the bottom of Scour level.
The depth of the trench will be such as to provide minimum cover as stipulated below:

For Distribution and service lines

Minor Water Crossing/Canal	1.5 Meter
Uncased/Cased Road Crossing	1.2 Meter
Rail/Road Cased Crossing	1.7 Meter
Normal Areas	1.0 Meter

The minimum depth may be greater than as mentioned above as may be required by Government/Public authorities under jurisdictions. The Contractor shall perform such work without extra compensation, according to the requirement of concerned authorities.

Also, in case of Drains/Culverts/Utilities crossing through open cut where excavation cut is more than 1.5m, the extra excavation is inclusive in the laying rates. No separate payment is chargeable for extra excavation and includes backfilling as well.

In case, the depth could not be achieved due to practical problems and the same is demonstrated, EIC after examining thoroughly and considering the codes and standards may allow the contractor to provide suitable protection by way of concrete casing pipes or slabs.

13.2 Width of Trench

The width of the trench shall be wide enough to provide bedding around the pipe as specified and to prevent damage to the pipe inside the trench. Unless otherwise directed by the EIC and where ground conditions permit, the minimum distance from the inside edge of the trench wall to the outside of the pipe shall be as per the Drawing no 15792-10-03-27.

13.3 Trench Base

The trench bottom shall be cut or trimmed to provide a uniform bedding for the pipe and shall be free from stones, metal, wood, vegetation, clods of earth or other debris before placement of the pipe.

In case trenching is done in rocky terrain, a bedding of soft soil or sand shall be provided in the trench base at no extra cost to the satisfaction of EIC.

13.4 Malba

Accumulation of construction debris/building rubbish or discarded pieces of bricks/stones or excavation through soil mixed with small boulders/powdered rock due to which moiling is not possible and only open cut method can be used.

13.5 Clearances

Unless otherwise approved, the following clearances shall be maintained between the external wall of the gas pipe and the external surface of other underground assets/utilities in the vicinity of the Works.

- 150 - 300 mm where the gas pipe crosses other assets/utilities, etc., for electric cables, the clearance shall be 300mm minimum or special protection shall be provided as per approval of EIC.
- 300mm where the gas pipe is on a similar alignment to the other assets/utilities.

Where the above clearances cannot be achieved, or in other special circumstances, the EIC may approve/specify protection with concrete/MS coated pipe, etc. The protective material shall be supplied and installed by the Contractor at his cost subject to discretion of EIC.

13.6 Under Ground Interferences

The Contractor shall locate and expose manually all underground facilities if any during trenching. Safety barriers shall be erected along the trench to prevent any damages or accident. On locations where pipeline is laid under the existing facilities and near the approaches of the crossing, the trench shall be gradually deepened to avoid sharp bends.

All sewers, drains, ditches and other natural waterways encountered while trenching shall be maintained open and functional by providing proper temporary installations if required. Suitable dewatering pumps shall be deployed to dewater, if required.

Whenever it is permitted by Authorities and /or Owner to open cut paved road crossing, or where the line is routed within the road pavement, the Contractor shall remove the paving in accordance with the restrictions and requirements of the authorities having jurisdiction thereof as directed by Owner. After laying the pipeline, backfilling shall be immediately performed and all the areas affected connected with the excavation works shall be temporarily restored.

In case of damage to any of above referred structures/utilities the Contractor shall be responsible for repairs/replacement at his own cost, which shall be carried out to the satisfaction of concerned authorities, resident and Owner.

13.7 Others

Throughout the period of execution of such work, the Contractor shall provide and use warning signs, traffic lights or lanterns, barricades, fencing, watchman etc. As required by the local authorities' jurisdiction and/or Owner.

For all roads, paths, walkways etc. which are open-cut, the Contractor shall provide temporary diversions properly constructed to allow the passage of normal traffic with the minimum inconvenience and interruptions.

The paving shall be resorted to its original condition after the pipeline is installed.

The Contractor shall excavate to additional depth at all the points where the contour of the earth may require extra depth, or where deep trench is required at the approaches to crossings of roadways, railroads, rivers, streams, drainage and ditches without any extra cost implication to Owner.

The Contractor shall excavate all such aforesaid depths as may be required at no extra cost to Owner. The trench shall be cut to a grade that will provide a firm, uniform and continuous support for the pipe.

The Contractor shall take conducive measures to ensure the protection of underground utilities as per the instructions of Owner or relevant authorities.

Where the pipeline crosses underground utilities/structures, Contractor shall first manually excavate to a depth and in such a manner that the utilities/structures are located, then proceed with the conventional methods.

The locations, where the pipeline has to be laid more or less parallel to an existing pipeline cable and/or other utilities in the Right-of-way the Contractor shall perform the work to the satisfaction of the Owner of the existing pipeline/cable/utility. In such locations, the Contractor shall perform work in such a way that even under the worst weather and flooding conditions, the existing pipeline/utilities remain stable and shall neither become undermined nor have the tendency to slide towards the trench.

13.8 Bedding

The Contractor shall ensure that the pipe when placed in the trench is supported and surrounded by a bed of screened excavated soil, which shall be stone free and have a maximum grit size of 5mm, in order to ensure no damage occurs to the pipe. However, in case of rocky soil the bedding shall be done with approved good quality packing sand subject to the approval of the Site Engineer. The packing sand shall be placed to a minimum thickness of 150mm around the pipe in case of rocky terrain.

Unless directed by the EIC the quantity of bedding and surrounding sand shall confirm specifications. There shall be no void space in the packing sand around the pipe.

14.0 LAYING

14.1 Main line

Laying of MDPE pipelines shall be commenced only after ensuring proper dimensions and clean surface of the trench. The trench bottom shall be free from the presence of cuts, stones, roots, debris, stakes, rock projections up to 150 mm below underside of pipe and any other material, which could lead of perforation/tearing of the pipe wall. After ensuring above, the MDPE pipe coil shall be uncoiled smoothly through proper equipment's/care before laying pipe inside the trench ensuring no damage to pipe.

The contractor must ensure that Pipe caps are provided before lowering of Pipeline. The trench after this can be released for back filling leaving adequate lengths open at the ends for jointing.

Contractors shall ensure open ends of pipe placed in the trench shall be securely capped or plugged to prevent the ingress of water or other matter. The Contractor is to ensure that nothing enters inside the pipe during the laying process as this could cause a future blockage or regulator malfunction due to dust, etc.

In case of open cuts and moiling, where two pipes are to be laid parallel in same trench or same pits, charges shall be paid as per relevant SOR items.

Valves shall be installed at locations shown in the Design Plan or as directed by the EIC and joined with PE pipes by electro fusion techniques. The valves shall be placed on a concrete square block at the bottom to achieve equivalent support of the incoming and outgoing pipe.

Laying graphs/As-graphs with details of depth, length, offsets from minimum three (03) fixed different references, other utility crossings, fittings, sizes of the casing pipe used for the pipeline shall be prepared on daily basis and to be submitted to IGL representative/ EIC for approval. These details will further be incorporated in to As-Built Drawings.

Pipe may pass through an open drain or nallah with prior approval from EIC. Where this is permitted, the PE pipe shall be installed inside a concrete or steel sleeve for protection with no cost implications to the owner. The sleeve material shall be procured and laid by the Contractor with prior inspection and approval of the EIC for the quality of material. In general, the GI Sleeve material specification shall be confirming to IS 1239 (Heavy Duty) specification of reputed make; cost of GI sleeve shall be included in laying SOR.

In case of service line laying, where the excavated pit for mainline is used for laying of service line, the length of service pipe laid in the same pit and vertical pipe which rises out of the ground with transition fittings shall be paid as per SOR item no 1 to 5. The contractor shall excavate a minimum pit of size 0.5-meter x 0.5 meter (L X W) on any kind of surface along the wall at the customer premises for the service pipe which rises out of the ground with transition fittings through GI pipe sleeve/Half Round Concrete sleeve. This excavation along with other work necessary to break through the walls of the obstruction, insertion of MDPE pipe, sealing of the annulus between the pipe and the sleeve, sleeve and the wall, installation of sleeve, making of pedestal as per Drawing No 15792-20-03-18 min. Size 300 x 150 x 150 mm for GI Sleeve, min. Size 550 x 230 x 150 mm for Half Round Concrete Sleeve Drawing 15792-10-03-33 and simultaneous restoration of these pits shall be deemed included in the laying rates of pipes respectively. No separate payment of GI Sleeve / Half round concrete sleeve shall be charged to the owner. The material shall be inspected by TPIA / Consultant before installation. Also, the material test certificates, inspection reports approved by TPI/Consultant shall be submitted at the time of submission of bill. Any installation without inspection & approval may lead to penalties as per Special Conditions of Contract.

In case of service lines, Site In-charge shall decide either half round concrete sleeve or GI pipe sleeve shall be installed at any particular site depending upon site condition. The half round concrete sleeve shall be preferred over GI Sleeve, however in case where the installation of half round Concrete Sleeve is not possible due to technical feasibility and site conditions, GI sleeves shall be installed only after written approval from IGL Site In-charge. The rate of GI Sleeve / half round concrete sleeve shall be included in laying of 20/32 mm dia. As per SOR no 1.1 & 1.2 depending upon surface conditions. The details are mentioned below:

14.2 GI Sleeve

The contractor shall supply the minimum dia. Size of 2.5" & 3", 300 mm in length, GI sleeves (Heavy Duty reputed make) respectively for domestic & commercial / industrial installations. The material shall be inspected by TPIA / Consultant before installation. The material test certificates/ inspection reports shall be submitted at the time of submission of bill.

The installation of GI sleeve for service lines shall be done by sealing the annulus between pipe and sleeve, firm fixing of the GI sleeves by concrete mix pedestal, clamping, sand filling, etc.

The vertical portion of the sleeves shall be fixed to the wall of the premises in a secure manner. The Service lines shall be installed in accordance with the drawing enclosed in the tender.

14.3 Half Round Concrete Sleeve

The installation of Half Round Concrete sleeve for service lines shall be done by sealing the annulus between pipe and sleeve, firm fixing of the Concrete sleeves by concrete mix pedestal, clamping, sand filling, etc. Half round concrete sleeve shall be made as per attached drawing no 15792-10-03-33 or as per instruction of Site In-charge. The dimensions shown are tentative and may vary depending upon the site conditions. The material shall be inspected by TPIA / Consultant at the fabrication stage & prior to final dispatch at site for installation.

14.4 Crush Guard : - (For O&M and Project)

The installation of pre-cast RCC crush guard over Half Round Concrete Sleeve/ Pedestal shall be done by installing it resting on wall of building by fixing it with grouting nut and bolts in wall that may be detached during the event of leakage/testing. The material shall be inspected by TPIA / Consultant at the fabrication stage & prior to final dispatch at site for installation. The material test certificates/ inspection reports shall be submitted at the time of submission of bill.

The Crush Guard shall be installed in accordance with the drawing no. 15792-10-03-33 enclosed in the tender as per instruction of EIC.

14.5 LAYING OF SERVICE LINE IN OLD PROJECT AND O&M AREA:

O&M area shall be defined as those areas where PE line is already charged and handed over to owner. However, Old Project area shall be defined as an area where MDPE line is already been laid by another contractor (currently not working in respective zone), only service line connectivity shall be done by the contractor.

Laying of pipeline (for 20 & 32mm) in all type of surface i.e. all kinds including Kutcha, metal, concrete (PCC/RCC), bituminous, tiled, brick lined etc. after racking up of hard surface of any type by any methodology. Roads, Pavement, Footpaths etc. shall be made motor able once the pipeline is laid. Supply & installation of GI Sleeve / Half round Concrete sleeve shall be included in laying rates. The rate includes liasoning with statutory bodies and no separate rates are payable. Wherever service lines are to be laid after dismantling nallah / drain, no additional cost for dismantling and repairing shall be payable.

All service lines left out initially during mainline laying and laid by same contractor within six months of gas charging of that particular area shall be paid as per SOR no 1.

All service lines left out initially during mainline laying and laid by other contractor after gas charging shall be paid as per SOR 4.

Construction of RCC structure for MDPE protection for drain/nallah crossing as per Dwg.-15792-10-03-46A; payment against such executed item shall be payable as per SOR item no. 4.3. Construction of this structure shall be as per instruction of Site In-charge & in locations which are not prone to damage by heavy vehicular movement (Rates shall be irrespective of drain width).

14.6 MDPE PIPE LINE LAYING (20MM / 32 MM / 63MM) IN ALREADY EXCAVATED TRENCH IN BUILDER SEGMENT

Scope includes laying of MDPE pipeline in already excavated trench with or without casing insertion of the carrier pipe in casing pipe (on case to case basis) laying of warning mat electro-fusion of joints and re-installation of pre-cast slabs as per specification after instruction of EIC / Site Engineer of Owner.

In Case sand filling is also required as instructed by EIC/IGL representative SOR no. 21.4 shall be applicable over and above this rate. Refer Drawing no. 15792-10-03-34, 35.

15.0 JOINTING OF POLYETHYLENE PIPE

The procedure for jointing of PE pipe and fittings machines is attached as Annexure #2 and as per Specification for ELECTROFUSION FOR PE PIPES AND FITTINGS. Only Bar coded into electro-fusion machine (Automatically Readable) that can read the bar code of the fittings automatically shall be used for joining of the MDPE pipes/fittings. Manual feeding Electro-fusion machines are not acceptable for jointing purpose. The contractor has to submit the certificate of calibration of Fusion machine at the time of start of work and at fixed intervals as per the instructions of Owner. Contractor shall ensure that the machines are always available at site.

The contractor shall flush the Pipeline with air to remove dust, water, mud etc. before fusing the joints. Before jointing, the Contractor shall place packing sand under the pipes on both sides of the joint to keep the pipes in line and at the correct alignment during the jointing process. The jointing process shall start only after Alignment clamps with the correct size are aligned with the pipe and coupler during the electro-fusion cycle.

The Contractor shall ensure that polyethylene pipe is only cut with an approved plastic pipe-cutting tool (Rotary Cutter up to 63mm/Guillotine Cutter for 63mm and above). Before fusion is attempted, the contractor shall remove the oxidized surface of the pipe using Universal Scrapper up to 63mm/Rotary Peeler for 63 mm and above before inserting into the electro-fusion coupler. The tool must remove a layer of 0.1mm to 0.4mm from the outer surface of the polyethylene pipe. No fusion will be allowed without

clamping device and the approved cutting tools (Hack saw shall not be allowed for cutting the pipe).

The contractor has to supply all the consumables required for carrying fusion of the joints (like tissue paper, napkin, acetone etc.).

If, upon inspection, the EIC determines a joint is defective, Contractor shall remove the joint by an approved method. The cost of replacing joint shall be borne by the Contractor including the cost of pipe and fittings removed.

For electro-fusion joining, the contractor must bring own tools, tackles and equipment's. Only, approved Jointers shall carry out fusion of all joints. Contractors shall provide the list of jointers to be used on the job and make arrangements for Qualification Testing of the jointers in presence of Owner / Owner's representative as per the standard procedures. All approved Jointers shall bear identity cards signed by Owner / Owner's representative during fusion job and shall furnish the same on demand by Owner / Owner's representative. Applicable penalties shall be levied, in case; it is found that fusion is being carried by non-qualified jointers as per the provisions made in Special Conditions of the Contract.

Contractor shall arrange generator along with voltage stabilizer for power supply to fusion machine. Taking power connection form electric poles, connections without written permission from the concerned authorities or residential premises is strictly not permitted.

16.0 BACKFILLING

Backfilling shall be done after ensuring that appurtenance have been properly fitted and the pipe is following the trench profile at the required depth that will provide the required cover and has a bed which is free of extraneous material and which allows the pipe to rest smoothly and evenly. Dewatering shall be carried out prior to backfilling. No backfilling shall be allowed if the trench is not completely dewatered.

Prior to backfilling it should be ensured that the post padding of compacted thickness 150 mm is put over and around the pipe immediately after lowering where required.

Backfilling shall be carried out immediately after the post padding where required has been completed in the trench, inspected and approved by Owner/ Owner's representative, so as to provide a natural anchorage for the pipe avoiding sliding down of trench sides and pipe moment in the trench. If immediate backfilling is not possible, a padding of at least 300mm of earth, free of rock and hard lumps shall be placed over and around the pipe and coating.

The backfill material shall contain no extraneous material and/or hard lumps of soil, which could damage the pipe and/or coating or leave voids in the backfilled trench. In case, it is required and directed by EIC screening of the backfill material shall be carried out with specified equipment before backfilling the trench.

The surplus material shall be neatly crowned directly over the trench and the adjacent excavated areas on both sides of the trench to such a height which will, in Owner/Owner's representative opinion of provide adequately for future settlement of the trench backfill during the maintenance period and thereafter. The down shall be high enough to prevent the formation of the depression in the soil when backfill has settled into its permanent position should depression occur after backfill, Contractor shall be responsible for remedial work at no extra cost to Company. Surplus material, including rock left from this operation shall be disposed of to the satisfaction of landowner or authority having jurisdiction at no extra cost to Owner.

Where rock, gravel, lumps of hard soil or like materials are encountered at the time of trench excavation, sufficient earth, sand or select backfill materials shall be placed around and over the pipe to form a protective cushion extending at least to a height of 150 mm above the top of the pipe. Select backfill materials for padding that area acceptable shall be soil, sand, clay or other material containing no gravel, required selected backfill material has been placed, provided the rock or lumps of hard soil. The padding earth shall not contain any stones, i.e. the earth shall be screened for sand padding of the Pipeline in order to avoid damage to the pipeline. Contractor shall carry out all these works at no extra cost to Owner. Loose rock may be returned to the trench after the required selected backfill material has been placed, provided the rock placed in the ditch will not interfere with the use of the land by landowner, or tenant.

In case where hard rock is encountered or as desired by EIC / site engineer sand padding is to be provided up to height of 150 mm around the pipe.

When the trench has been dug through driveways or roads, all backfilling shall be executed with sand/suitable material in layers as approved by Owner /Owner's representative and shall be thoroughly compacted. Special compaction methods as specified may be adopted. All costs incurred there upon shall be borne by the Contractor. Trenches excavated in dikes which are the properties of railways or which are parts of main roads shall be graded and backfilled in their original profile and condition. If necessary, new and/or special backfill materials shall be supplied and worked-up to.

PE Warning Grid/Mat shall be placed on distribution main and service line inside premises, after backfill of the trench up to a height of 300mm on the top of the carrier pipes. The warning grid is to be unrolled centrally over the pipe section and thereafter further backfilling will commence.

Backfilling activity shall include proper compaction by jumping jack compactor, wherever required and as per instruction of EIC, and watering in layers of 150mm above the warning mat. Proper crowning of not more than 150mm shall be done. All the excavated material that could be used during the Restoration process shall be stacked and kept separately and properly. Wherever Road cutting/Tiles removal/PCC cutting has been done during excavation for laying, the area shall be back filled and compacted immediately so that no inconvenience is caused to the general public.