REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

CONSTRUCTION AND EQUIPPING OF PUMPING STATION AND LIFT LINES IN RAM LOCALITY

VOLUME 5

BILL OF QUANTITIES

Part A – Preamble to Bill of Quantities

Part B – Bill of Quantities

JULY 2020

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT (B.T.D.)
P.O.Box : 70-492 Antélias
Tel : 04/712157-712158
Fax: 04/712159
Email: btd@btd-lb.com

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

GENERAL TABLE OF CONTENTS

PART A

PREAMBLE TO BILL OF QUANTITIES

TABLE OF CONTENTS

GENERAL

1.000 INTRODUCTION

1.010 GENERAL

The Bill of Quantities is not and does not purport to be either exhaustive or explanatory of all the obligations and duties of the Contractor who shall be deemed to have satisfied himself as to the correctness and sufficiency of the rates and prices entered by him in the Bill of Quantities all of which shall cover all his obligations under the Contract (including those in respect of the supply of goods, materials, plant or services etc.) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein and which may reasonably be inferred to be necessary for the Works as described in the Contract whether expressly mentioned therein or not.

1.011 ITEMS DESCRIPTION

A detailed description of the items and of the conditions under which and the manner in which the work is to be done and measured is not set out in each item of the Bill of Quantities. Reference should be made to this Preamble and all other documents forming the Contract.

1.012 DEFINITIONS OF BILL OF QUANTITY CATEGORIES

The Bill of Quantities is divided into several categories, listed below, to group the prices under the following:

A) Civil Works

B) Electro-mechanical Works

C) Transmission Pipelines

D) Boreholes

1.012.1 Civil Works

The Civil Works category shall include, but not be limited to, a complete topographic survey, soil investigations, excavation works, backfilling, road works, concrete works, blockworks, cladding, plastering, waterproofing, thermal insulation, aluminium works, glazing, painting, fencing, and all necessary works not mentioned above and needed for a good finishing and exploitation of the different structures. Also this category shall include, but not be limited to, the prices to supply and install all necessary hydraulic accessories needed for equipment of the reservoirs and related valve chambers.

1.012.2 Electro-mechanical Works

1.012.2.1Mechanical, Electrical and Control Equipment

The Mechanical, Electrical, and Control Equipment category of the BOQ shall include all the prices to supply the specified equipment including factory cost, factory tests, Engineer fees for factory tests and inspection, reports, packaging, shipping, handling, delivery on site and storage.

1.012.2.2 Mechanical, Electrical and Control Installation, etc...

The Mechanical, Electrical, and Control Installation, etc... category of the BOQ shall include the prices for installation, trenching, backfilling, interconnections, connection to power supply, operation and maintenance manuals, testing and commissioning for a complete system in place according to specifications and design drawings.

1.012.3 Transmission Lines

The relevant activities shall comprise, but not be limited to, a complete topographic survey and a survey of the existing facilities using the GPR technique or others if approved by the Engineer.

Also included are trial tests and as-built drawings.

Besides, the pipeworks shall mainly consist of the supply of the required pipes with all necessary fittings, trench excavation, preparation of suitable bedding and surrounds, pipe laying and trench backfilling. Special provision shall be made for stretches of pipes crossing highways, railways, and bridges.

Furthermore, the Works relating to transmission and distribution pipelines shall include the supply and installation of hydraulic accessories, such as gate valves, butterfly valves, air release valves, control valves, watermeters and others...

Also comprised are valve chambers in addition to their frames and covers.

The concrete works form an important element of these activities, especially regarding pipe supports, anchor blocks, thrust blocks, and others.

Moreover, the testing and commissioning of the pipes, besides road reinstatement where necessary, are also required.

1.012.4 Boreholes

Boreholes shall include the following:

- Supply, delivery and storage on site of temporary casing.
- Supply, delivery and storage on site of the final casing and screen column.
- Drilling of the wells by percussion or rotary method.
- Determine the hydrodynamic characteristics of the aquifer.
- Determine the physical and chemical quality of the pumped water.
- Installation of temporary casing.
- Grouting works.
- Installation of the final casing and screen column.

- Well development works.
- Well development control.
- Pumping test works.

1.013 RATES AND PRICES

The Contractor shall be deemed to have inserted against each item in the Bills such rates and prices as he may deem necessary to cover the requirements of the Contract. Where neither price nor rate is entered against an item or if the term "included" or any such similar term is used it shall be deemed to have been included in the other priced items in the BOQ and measured accordingly. All rates and prices entered against any item in the BOQ shall be deemed to include all the detailed requirements of the General and Particular Specifications and the requirements of the volume 1.

Rates and prices shall be inserted in the unit rate column of the Bill of Quantities. Each part of the Bill of Quantities shall be totalled and the totals carried to the Summary and Grand Summary.

1.014 MEASUREMENT

The Bill of Quantities includes items as lump sum and others as measured quantities.

1.014.1 Lump Sum

The lump sum items shall not be subject to re-measurement, and shall include the prices for all necessary construction, installation, testing and commissioning among others. The lump sum entered in the Bills shall include the price for a complete installation as described in the specifications.

The prices shall include all work necessary for completion of the Works and shall include the prices for all necessary building work such as forming box outs, supports plinths, cable trenches, and the like and all necessary safety and access works including guards, handrails, fire fighting equipment and the like.

1.014.2 Measured Quantities

All measurements in the Bill of Quantities are taken strictly net. The principle of net measurements shall apply to all Works executed. All quantities measured for payment shall be measured by the Engineer on the basis of actual net quantities of Work fixed in position. Item not used shall neither be measured nor included by the Contractor in his statements.

The quantities given in the Bill are the estimated quantities. In no sense shall such quantities be considered as limiting or extending the amount of the work to be done by the Contractor and of the materials to be supplied by him. The Contractor shall be responsible for checking quantities and for making any necessary surveys and investigations prior to placing any order for materials.

1.015 DEFINITIONS

The following definitions shall apply to items in the Bill of Quantities.

- **Extra - Over**
  Any "Extra-Over" (EO) item shall be measured and paid for in addition to the measurement of the basic item to which it relates.

- **Included**
  Where the term included is used in the Preamble or in the Bills, items stated to be included within other items shall not be subject to measurement and their costs shall be deemed to be included within the rates of the billed items.

1.016 DEALING WITH WATER

Unit rates of items in the Bills of Quantities especially excavation items or excavation works shall be deemed to include the prices for dealing with water flows (especially for water courses crossing, or excavation along a water course) and keeping the Works free of water, and shall include prices for dewatering and supporting of trenches and excavation limits for pipeline works and structure works (for reservoirs, pumping stations, etc...) the above-mentioned works shall not be measured and shall not be paid separately.

1.017 WATER AND POWER

Unless otherwise explicitly stated in the Contract, water and power for the purpose of constructing, cleaning, and testing the Works shall be provided by the Contractor at his own expense, and shall not be measured separately.

1.018 RECORDS AND "AS-BUILT" DRAWINGS

After the work has been completed, the Contractor shall submit "as-built" drawings prepared whilst surveying during construction, showing the Works as constructed together with all other information that may either be required or be useful for the operation and maintenance of the Works in the future, such as type of soil, dimensions and location of structures, size of existing pipelines and cables encountered during excavation.

The cost of preparing the shop drawings, "as-built" Drawings and Records shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately. The As-built Drawings shall be submitted, if required by the Engineer, on computer CDs.

1.019 TRAFFIC REGULATION CONTROL AND SAFETY PROVISION

The provision of traffic control, safety equipment, signs, diversions, control systems including obtaining approvals and liaison with third parties for work in public roads and streets or in private sector will not be measured separately but shall be included in pipes rates, and shall include but not by way of limitation:

- Preparing all necessary plans, details and schedules and submission to the Employer/Engineer to obtain all necessary approvals.
- Liaison with third parties, to get all the needed permits from the concerned authorities.
- Erecting, maintaining, moving and removal of safety barriers, signs and traffic control equipment.
- Establishment and management of road diversions.
- Watching and lighting.
- Maintaining Roads and Streets clean and free from construction debris.

2.000 BILL A - CIVIL WORKS

2.010 TOPOGRAPHIC SURVEY AND SITE DELIMITATION

The price per site of the topographical surveys shall include checking, completing and/or performing land surveying based on approved benchmarks, the existing ground elevation, property lines, northing and easting coordinates, topographical maps, layouts, delimitation of plots (official delimitation from the concerned Authorities), implantation of foundations and buildings, the measurement of earthworks etc.... as well as all other additional tasks imposed by the site and/or the Engineer. It also includes all necessary topographical works, official delimitation certificates and approved plans, labour expenses, transport costs as well as all expenses resulting from calculations and data transfer on drawings and/or on technical sheets that will accelerate the progress of works.

The site survey shall be supplied on paper duly signed and stamped, and shall be supplied also as digital data suitable for automated plotting.

2.011 SITE CLEARANCE

The lump sum price shall include cleaning the entire surface of the site and clearing it from any obstacle (material or equipment) located within the area of works, it shall also include the demolition of existing unused structures (reservoirs, valve chamber, reinforced concrete structures, etc....), labours, necessary equipment, transport of soil or wastes to public dumps (permit from the concerned Authorities is required to use these public dumps) and all tasks to deliver the site clear for excavation.

2.012 SITE REARRANGEMENT AFTER CONSTRUCTION

The lump sum price shall include the reinstatement of the site after completion of the works according to the drawings and to the engineer's instructions. It also includes backfilling all around the structures and foundations with selected materials and/or backfill in order to deliver the site in a good condition and prepared for the proposed improvements.

2.013 SOIL INVESTIGATIONS

The lump sum price of soil investigations according to BS 1377 (Methods of test for soil for civil engineering purposes) shall include various boreholes according to the nature of soil, in situ and laboratory tests, report determining the specifications and settlement description of the layers, the bearing capacity of the soil, the nature of foundations and the retaining structures if needed, level of water table, installation of piezometer, labour, mobilization and demobilization of equipment, tests, reports etc..., and this according to the detailed requirements of the general specifications.

2.014 EXCAVATION AND TRANSPORT OF UNSUITABLE BACKFILLING MATERIALS

The price per cubic meter of excavation shall include but not be limited to:

Excavation in all kinds of soils and rocks for structures and for access roads, use of all adequate equipment, transport of soil to environmentally approved disposal sites accepted by the Engineer, labour, dewatering, temporary and/or final retaining structures for trenches or open digs. The volume of excavations shall be measured from the geometric dimensions of structures and levels determined according to the site layout and drawings. No excess excavations or earthworks shall be paid for unless otherwise stated by the Engineer.

2.015 PREPARATION OF FORMATION UNDER RESERVOIRS AND OTHER CONSTRUCTIONS

The price per cubic meter for preparation of formation under the constructions foundation or slabs on grade shall include compacted gravels, sand, polyethylene sheet (150 μ), compaction equipment, labour and all material and equipment necessary to achieve the subbase and base to receive the concrete, the volume shall be measured according to geometric dimensions shown on the drawings.

2.016 BACKFILLING AND COMPACTION

The price of cubic meter of backfilling shall include backfilling layers (25 cm thickness each before compaction) placed and compacted for the needed area and behind retaining walls or other locations if ordered by written instructions from the Engineer or shown on the drawings. It shall also include geotextile sheets and drainage system if needed (minimum thickness 1.2mm, mass ≥ 300 g/m^2), bituminous coating, etc....

The volume of backfill materials shall be computed according to the dimensions shown on the drawings and the site layout and shall be composed of selected material for each case.

The price shall also include material, equipment, labour, etc... and all necessary tasks to achieve the work in perfect conditions.

2.017 BLINDING AND MASS CONCRETE C20

The price per cubic meter shall include all material, equipment, labour, transport, ... blinding and/or mass concrete and shall be composed of at least 250 kg of cement per cubic meter of concrete and shall be measured according to the geometric shapes shown on the layout drawings and/or Standard Drawings. Any quantity executed in excess of the indicated dimensions shall not be paid for. Any quantity less than that required in the Contract drawings and according to the specification documents shall be deducted or completed according to the instructions given by the Engineer.

2.018 REINFORCED CONCRETE C30 (RESERVOIRS)

The price per cubic meter shall include all material, equipment, labour, transport, admixtures (retarders, plasticizers, waterproofing materials, ...) batching, mixing, placing, vibrating, curing, testing, finishing, scaffolding, reservations for equipment, formwork, wrought formwork (fair face), surface levelling with mechanical float, etc... Dosage of cement shall be

400 kg/cu.m. for reservoirs and retaining aqueous liquid structures. All joints or sealing systems shall be included in the price. Measurement shall be determined according to the geometric shapes indicated on the layout drawings and/or buildings drawings; any quantity executed in excess of the indicated dimensions shall not be paid for. Any quantity less than that required in the Contract drawings and according to the specification documents shall be deducted or completed according to the instructions given by the Engineer.

The price shall also include all materials, equipment, labour, transport, storage, placing, bending, scaffolding, etc... reinforcing steel supplied, placed, bended, etc... with all needed materials, accessories and tasks to achieve the works in perfect conditions. Detailed bar bending schedules and sheets should be submitted for approval before placing and installation.

The price shall also include all needed works, labor, material, transport, formwork, etc... to execute a fair faced concrete for interior and exterior walls and ceilings.

2.019 REINFORCED CONCRETE C30 (BUILDINGS)

The price per cubic meter shall include all material, equipment, labour, transport, admixtures (retarders, plasticizers, waterproofing materials, ...) batching, mixing, placing, vibrating, curing, testing, finishing, scaffolding, reservations for equipment, formwork, wrought formwork (fair face), surface levelling, etc... Dosage of cement shall be 350 kg/cu.m. for technical buildings, channels, retaining walls, foundations, wellhead manholes, etc... All joints or sealing systems shall be included in the price. Measurement shall be determined according to the geometric shapes indicated on the layout drawings and/or buildings drawings; any quantity executed in excess of the indicated dimensions shall not be paid for. Any quantity less than that required in the Contract drawings and according to the specification documents shall be deducted or completed according to the instructions given by the Engineer.

The price shall also include all materials, equipment, labour, transport, storage, placing, bending, scaffolding, etc... of reinforcing steel supplied, placed, bended, etc... with all needed materials, accessories and tasks to achieve the works in perfect conditions. Detailed bar bending schedules and sheets should be submitted for approval before placing and installation.

The price shall also include all needed works, labor, material, transport, formwork, etc, to execute a fair faced concrete for interior and exterior walls and ceilings of technical rooms.

2.020 LEVELING WITH MECHANICAL FLOAT

The price per square meter includes material, equipment, transport, labour,... and consists in levelling horizontal surfaces of large areas of slabs on grade (reservoirs and/or technical buildings) by a mechanical trowel.

2.021 CYCLOPEAN CONCRETE

The price per cubic meter of cyclopean concrete shall include material, equipment, transport, supply, placing, mixing, labour ... and shall be composed of 300 kg of cement per cubic meter of concrete and a maximum of 40% of hard rocks (≤ 200mm). Formwork and scaffolding are included and cyclopean concrete shall be measured according to geometric shapes determined

by written instructions of the engineer. All tasks necessary for the completion of the work are deemed to be included in the price.

2.022 STEEL REINFORCEMENT

The price per ton include all materials, equipment, labors, transport, storage, placing, bending, scaffolding, etc... of reinforcing steel supplied, placed, bended, etc... with all needed materials, accessories and tasks to achieve the works in perfect conditions.

The price shall be paid per ton of reinforcement steel supplied, bended and placed, and shall be measured according with the dimensions figured on the drawings. Detailed bar bending schedules and sheets should be submitted for approval before placing and installation, these bar bending schedules and sheets will be used for calculation of reinforcing steel weight.

2.023 WATERSTOP

The price per linear meter of P.V.C. water-stop joints (expansion, contraction,...) and/or hypalon strip of 25 cm width shall include the supply, transport and the installation of the water-stop strips (up to 25cm width) according to drawings (essentially between mat foundations and walls of reservoirs). Any additional water-stop strips to be used according to particular methods of execution shall not be taken into account for measurement and written instructions from the engineer shall be obligatory. The price also includes the backing rod, sealant and fibre boards if needed.

2.024 NEOPRENE PADS

The price per linear meter of neoprene pads placed between reservoir roofs, slabs and walls shall include preparation and application of neoprene pads which shall withstand all strains exerted by the roof cover. As for reservoir with dome shape the price per linear meter of neoprene pads placed between reservoir dome and walls shall include for the double line of neoprene pads as shown on drawings. It shall also includes the supply and application of polystyrene, polyethene sheets as well as equipment, materials, scaffolding, accessories and others that turn out to be necessary for a good execution.

2.025 HOLLOW CONCRETE BLOCK WALL (20 CM THICK)

The price per square meter of built areas of hollow concrete blocks (20 cm thick) shall include concrete blocks, sand and cement for mortar, all materials, equipment, labour, expenses, scaffolding, placing, junctions, concrete lintels, openings,... and shall be measured according to net areas built from one side.

2.026 RENDERING OR PLASTERING OF INTERIOR AND EXTERIOR SURFACES

The price of rendering per square meter shall include all materials: cement, sand, water, equipment, labour, scaffolding, expenses,... supply, transport, placing mortars and shall be measured according to geometric shapes of rendered areas, no excess and no measurement shall be paid for re-entrant or salient angles of openings, chamfered angles or others. The rendering shall consist of three coats according to specifications.

2.027 EXTERIOR RENDERING WITH COLOURED BUSH HAMMERED RENDER

The price of exterior rendering with coloured bush hammered render per square meter shall include all material: cement, sand, water, equipment, labour, scaffolding, expenses,... supply, transport, placing mortars and shall be measured according to geometric shapes of rendered areas, no excess and no measurement shall be paid for re-entrant or salient angles of openings, chamfered angles or others. The rendering shall be according to specifications.

2.028 INTERNAL LINING FOR RESERVOIR

The price per square meter of internal surface waterproofing coating for reservoirs shall include preparation of the surface (sand blasting, water blasting), treatment of singular points (contraction or expansion joints, pipe penetration,...) material, transport, scaffolding, application in several layers, labour, expenses,... in conformity with the technical sheet of approved material, quality tests, structures test, before and after application, warranty. Crystallisation or mineralisation products shall be applied on reservoirs walls and slabs on ground, and flexible protective and waterproofing slurry products on bottom faces of roof slabs or domes.

2.029 WATERPROOFING OF RESERVOIRS AND OTHER BUILDINGS ROOF SLABS WITH THERMAL INSULATION

The price per square meter of roof slab waterproofing shall include material, transport, equipment, labour, supply, installation, preparation of support (screed,...), treatment of singular point (rain outlet, ventilations, openings,...), and shall be composed of a vapour barrier SBS or APP; thickness $\geq$ 2.5 mm fixed by adherence or semi-adherence, a thermal insulation with minimum thickness of 50 mm and a thermal conductivity α = 0.037 Kcal/h.m^2/°C, and a waterproofing membranes (SBS/APP) 4 mm thick minimum. Vertical upstands shall be aluminium self-protected, supply and installation of concrete protection grade C20 or concrete paving slabs and a non woven polyester sheet 200 g/m^2. Supply and installation works of necessary roof drains are deemed to be included is this item and shall not be paid for separately.

The membranes shall be measured only for horizontal surfaces and no measurements or excess shall be paid for vertical surfaces.

As for dome-shaped reservoir, the price per square meter of waterproofing of dome-shaped reservoir without thermal insulation shall include material, transport, equipment, labour, supply, installation, preparation of support, treatment of singular point, scaffolding and shall be composed of two layers of a liquid electrometric bitumen (aluminium colour) in order to assure a protective waterproofing of domes. Supply and installation works of necessary roof drains are deemed to be included is this item and shall not be paid for separately.

2.030 WATER TESTING AND DISINFECTION OF RESERVOIRS

The lump sum price of water testing of reservoirs per site shall include:

- Supply, transport and filling of reservoir with water, and checking for leaks. This operation shall be repeated to the Engineer's satisfaction.

- Water sampling for analysis and transport in an adequate packing to the laboratory, suppliers, labour,....

- Bacteriological analysis type B2 (2 per reservoir)

- Cleaning and disinfection including all material, scaffolding, labour, expenses and all tasks necessary to accomplish the work.

2.031 EXTERIOR STEEL DOORS AND WINDOWS INCLUDING GLAZING AND PAINTING

The price per square meter of exterior steel doors and windows shall include all material, equipment, transport, labour, expenses, water-resistant hardware, glazing (8mm glass) ventilation, mechanical protections, epoxy paint, louvers, openings, locking system, supply, installation, anchoring, reinstatement of support, finishing and all tasks and accessories, necessary to a perfect execution. Metal sheets shall be 3mm thick minimum.

2.032 METALWORK

The price per kilogram of metalwork (protection bars, louvers, ventilation, ladders, grating, railings, trap doors,...) shall include all material, equipment, transport, labour, expenses, hardware glazing (8mm glass), epoxy paint, supply, installation, anchoring, locking system, reinstatement of support, finishing and all tasks and accessories necessary to a perfect execution.

2.033 ALUMINIUM WORKS

The price per square meter of interior doors and exterior windows shall include all material, equipment, labour, expenses, manufacture, supply, transport, installation, glazing (8mm glass), anchoring, locking system, reinstatement of support, finishing and all tasks and accessories necessary to a perfect execution.

2.034 INDUSTRIAL FLOORING

The price per square meter of industrial flooring shall include all material, equipment, transport, labour, expenses, application, preparation of support, scaffolding, curing, finishing, cleaning, singular points, screed if necessary, and shall be composed of heavy duty chemical and abrasion resistant epoxy resin floor (5mm thick). For walls, 2mm thick of epoxy resin will be sufficient (the number of layers should be in compliance with the manufacturer recommendation and the Engineer's approval).

The surfaces shall be measured according to geometric shapes of painted area (floor, wall or ceiling), no measurement and no excess shall be paid for re-entrant or salient angles of openings.

2.035 WASHABLE PAINT INTERNAL OR EXTERNAL USE COATING

The price per square meter of washable paint includes all materials, equipment, transport, labour, expenses, scaffolding, application, preparation of support, finishing, cleaning, singular points, and shall be composed of a double layer of mastic, primer and a minimum of two coats of washable paint (latex emulsion and/or vinyl acrylic emulsion).

The surfaces shall be measured according to geometric shapes of painted area, no measurement and no excess shall be paid for re-entrant or salient angles of openings.

2.036 FENCE

The price per linear meter of fence shall include all excavation, reinforced concrete, metalwork, epoxy paint, finishing, material, labour, equipment, supply, transport, anchor bolts, reinstatement of property line, and all tasks necessary for a perfect execution. In case the fence has to be fixed on retaining walls and/or existing or new concrete structures, the contractor must take this constraint in consideration according to each site and adapt his price accordingly.

2.037 ACCESS GATE

The lump sum price of access gate per site shall include all excavation, reinforced concrete, steel access gate, locking system, epoxy paint, water resistant hardware, anchors, finishing material, labour, equipment, formwork, scaffolding, supply, transport, reinstatement of property line and all tasks necessary for a perfect execution. For access gate width refer to site layout.

2.038 ASPHALTING

The price per square meter of asphalting for structures and access roads layout shall include earthwork, sub-base preparation (scraping, levelling, compaction,...), sub-base material layer (hard stones, gravel, ...), base course material (hard crushed aggregate,...) bituminous tack coats, asphalt and all material, equipment, supply, transport, labour, expenses, drainage system, testing, quality control, hauling, spreading and compaction, and all necessary tasks for laying, jointing and a perfect execution and shall include, but not be limited to:

- Base course: supply, and transport of materials, earth work, scraping, levelling, compaction, labour, final thickness after compaction 20 cm, testing, quality control and all necessary tasks for a perfect execution.

- Asphalt: supply and transport of materials, bituminous, tack coat, asphalt and all necessary materials, labour, expenses, testing, quality, control, hauling, spreading and compaction and all necessary tasks for laying, jointing and a perfect execution.

2.039 CHANGES IN COST AND LEGISLATION (BILL A – CIVIL WORKS)

ITEM	DESCRIPTION	PRICE ADJUSTMENT FORMULA
1.0000	**General**	
1.0001	**Topographic survey and site delimitation**	NOT APPLICABLE
1.0002	**Site clearance**	NOT APPLICABLE
1.0003	**Site rearrangement after construction**	NOT APPLICABLE
1.0004	**Construction of access road**	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
1.1000	**Earthworks**	
1.1100	**Soil investigations**	NOT APPLICABLE
1.1200	**Excavation**	
1.1201	**Excavation in all types of soils and rocks and demolition of existing concrete structures and transport of unsuitable backfilling material to disposal sites**	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
1.1300	**Preparation of formation under reservoirs and other constructions**	
1.1301	Supply, preparation and compaction of the gravel and sand beds in addition to laying the polyethylene sheet under the construction's foundations.	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
1.1400	**Backfilling**	
1.1401	Backfilling and compaction	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
1.2100	**Concrete works**	
1.2101	Blinding and mass concrete Class C20	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.2102	Reinforced concrete Class C30, 400 kg of cement /cu.m, for reservoirs, including formwork	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.2103	Reinforced concrete Class C30, 350 kg of cement /cu.m, for other buildings, including formwork	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.2104	Extra over items 1.2102 and 1.2103 for fair faced concrete in reservoirs and other buildings	NOT APPLICABLE
1.2105	Extra over items 1.2102 for domes formwork	NOT APPLICABLE
1.2106	Concrete surface leveling with mechanical float	NOT APPLICABLE
1.2107	Cyclopean concrete	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.2108	Steel Reinforcement	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Lmc_1 / Lmc_0 * E_1 / E_0 + 0.15\}$
1.2200	**Water stop and bearing pads**	
1.2201	Water stop up to 25 cm in width	NOT APPLICABLE
1.2202	Neoprene pads between walls and roof slab	NOT APPLICABLE
1.3000	**Blockwork, cladding, and plastering**	
1.3001	Hollow concrete block wall 20 cm thick	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.3002	Rendering or plastering of interior and exterior surfaces	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.3003	Exterior rendering with bush-hammered render	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
1.4000	**Waterproofing, thermal insulation, and water quality control**	
1.4001	Internal lining for reservoirs	NOT APPLICABLE
1.4002	Waterproofing of reservoirs and other buildings roof slabs with thermal insulation	NOT APPLICABLE
1.4003	Water testing and disinfection for reservoirs	NOT APPLICABLE
1.4004	uPVC drain 100 mm diameter	NOT APPLICABLE

ITEM NO.	DESCRIPTION	PRICE ADJUSTMENT FORMULA
1.5000	**Metal and aluminium works**	
1.5100	**Metal works**	
1.5101	Supply and installation of exterior steel doors and windows including glazing and painting	$P_1 = P_0 * \{ 0.15 * L_1 / L_0 + 0.70 * Lmb_1 / Lmb_0 * E_1 / E_0 + 0.15\}$
1.5102	Supply and installation of metal works: steel protection bars for exterior windows, metallic ladders with or without safety hoops, gratings for channels, railings, locks and all other metal works, including painting	$P_1 = P_0 * \{ 0.15 * L_1 / L_0 + 0.70 * Lmb_1 / Lmb_0 * E_1 / E_0 + 0.15\}$
1.5200	**Aluminium works**	
1.5201	Supply and installation of interior aluminium doors and exterior aluminium windows, including glazing.	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.10 * Ver_1 / Ver_0 * E_1 / E_0 + 0.60 * Alu_1 / Alu_0 * E_1 / E_0 + 0.15\}$
1.6000	**Finishing works**	
1.6100	**Industrial flooring**	
1.6101	Supply and application of industrial flooring	NOT APPLICABLE
1.6201	Supply and application of washable internal or external use coating	NOT APPLICABLE
1.7000	**Fence**	
1.7001	Supply and installation of site's external fence, including painting	$P_1 = 25\% * P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\} + 75\% * P_0 * \{0.15 * L_1 / L_0 + 0.70 * Lmb_1 / Lmb_0 * E_1 / E_0 + 0.15\}$
1.7002	Supply and installation of the access gate (L = 4m)	$P_1 = P_0 * \{ 0.15 * L_1 / L_0 + 0.70 * Lmb_1 / Lmb_0 * E_1 / E_0 + 0.15\}$
1.8000	**Asphalting**	
1.8001	Subgrade compaction, sub-base and base preparation, and asphalting	$P_1 = 50\% * P_0 * \{0.15 + 0.15 * L_1 / L_0 + 0.45 * [(1.12 * B_1 + 66) / (1.12 * B_0 + 66)] + 0.25 * F_1 / F_0\} + 50\% * P_0$

For all the parameters figuring in the price adjustment formulas, refer to Volume 1, Conditions of Contract, Clause 70.1.

3.000 BILL B - ELECTRO-MECHANICAL EQUIPMENT AND WORKS

3.010 ELECTROMECHANICAL EQUIPMENT

3.010.1 Mechanical, Electrical and Control

3.010.1.1Mechanical, Electrical and Control Equipment

The Mechanical, Electrical and Control Equipment category of the BOQ shall include all the prices to supply the specified equipment including factory cost, factory tests, reports, packaging, shipping, handling, customs fees, delivery on site and storage. This category will be used to evaluate the country of origin for the equipment provided under this contract.

3.010.1.2 Lump Sum

The lump sum items shall not be subject to remeasurement, and shall include the prices for all necessary equipment. The lump sum entered in the Bills shall include all equipment necessary for a complete installation as described in the specifications.

3.010.1.3Provisional Items

Provisional Items shall be used at the discretion of the Engineer and only if ordered or required by the Engineer in writing.

3.010.2 Mechanical and Electrical Equipment

3.010.2.1 Pumping system

The price of the pumping system items shall include, but not limited to, factory witness test and report, supply of the complete pumpset, packaging, shipping and handling, customs fees, delivery on site, spare parts, storage, and supply of any other items and accessories deemed necessary for the complete installation and trouble free operation of the pumpset.

3.010.2.2 Piping and accessories

The price of the piping and accessories items, shown on drawings, shall include, but not limited to, supply of the complete piping system, all hydraulic equipment and accessories, packaging, shipping and handling, customs fees, delivery on site, spare parts, storage and any other items and accessories deemed necessary for the complete installation and trouble free operation of the mechanical system.

3.010.2.3 Well rising column

The price of the well rising column item shall include, but not limited to, supply, transportation, storage, installation and testing of seamless black steel pipes for the rising column in the well, including all necessary fittings and accessories (steel plates, couplings, reducers...).

Seamless black steel pipes shall be:

- Connected by threading,

- Able to withstand a working pressure of at least 80 bars,
- Able to withstand their own weight and the weight of the submersible pump set,
- Coated on both sides with epoxy suitable for use with potable water.

Seamless black steel pipes shall be measured by linear meters and shall be classified for payment according to pipe diameter.

3.010.2.4 Liquid chlorination equipment

The price of the liquid chlorination equipment items shall include, but not limited to, supply of the complete liquid chlorination system, all equipment and accessories, packaging, shipping and handling customs fees, delivery on site, spare parts, storage, and any other items and accessories deemed necessary for the complete installation and trouble free operation of the complete liquid chlorination system.

3.010.2.5 Surge Suppression Equipment

The price of the surge protection system items shall include, but not limited to, supply of the complete surge suppression system, all hydraulic equipment and accessories, packaging, shipping and handling customs fees, delivery on site, spare parts, storage, and any other items and accessories deemed necessary for the complete installation and trouble free operation of the surge suppression system.

3.010.2.6 Surge Anticipation Valve (Anti Water Hammer Valve)

The price of the surge anticipation valve shall include, but not limited to, supply of the complete valve, all hydraulic equipment and accessories packaging, shipping and handling, customs fees, delivery on site, storage and any other items and accessories deemed necessary for the complete installation and trouble free operation of the surge anticipation valve.

3.010.2.7 Lifting and Handling Equipment

The lump sum price of the lifting and handling equipment shall include but not limited to, supply of the complete lifting and handling equipment, all steel works, all controls and electric panels, packaging shipping and handling customs fees, delivery on site storage and any other items and accessories deemed necessary for the complete installation and trouble free operation of the lifting and handling equipment.

3.010.2.8 Electrical system

The price of the electrical system items shall include, but not limited to, supply of all electrical equipment, all electrical cables & wires, supply of all electrical control panels, supply of Software, spare parts, packaging, shipping and handling customs fees, delivery on site, storage, and any other items and accessories deemed necessary for the complete installation and trouble free operation of the electrical system.

3.010.2.9 Electrical power transformer (Provisional Item)

The price of the electrical power transformer shall include, but not limited to:

a) supply, transmission, storage, installation and testing of a pole-mounted oil-filled power transformer with ratings as specified, cooling by natural oil and air circulation (ONAN), connection type DYn11, including:

- Pole including foundations and support chassis.
- MV disconnect switch.
- Pole-mounted metallic box.
- LV circuit breaker.
- MV & LV cable terminations.
- LV cable connecting transformer secondary to LV circuit breaker.
- Neutral earthing.
- Transformer protection relay.
- All necessary fixing and mounting accessories.

Note: Contractor is to submit shop drawings of pole and transformer to EDL/Qadisha for approval. Price shall also include all fees required by EDL/Qadisha including supervision fees.

b) Supply, transmission, storage, installation and testing of all equipment and materials for the construction of a medium-voltage overhead power network, including:

- Poles including foundations.
- Conductor insulators.
- Bare copper conductors.
- Connection to existing MV grid.
- Connection to transformer MV terminals.
- Mounting, fixing and connection accessories.

Note: Contractor is to submit shop drawings of overhead lines routing, poles and accessories to EDL/Qadisha for approval. Price shall also include all fees required by EDL/Qadisha including supervision fees.

c) Insuring a LV subscription to EDL/Qadisha power including:

- Undertaking all administrative and legal procedures for subscribing to EDL/Qadisha power on the behalf of the Owner.

- All fees as required by EDL/Qadisha for the connection of the required power including the kWh meter, taxes, deposit…

This item shall be measured in unit of EDL/Qadisha electrical power transformer and power network, completely installed and tested and shall be classified for payment according to transformer's rated power.

The payment of the EDL/Qadisha electrical power transformer item shall be paid upon submission of original receipts of the EDL/Qadisha invoices with additional 15% cost plus on the paid invoices amount and for that a provisional sum is included in the Bill of Quantities for the pricing purposes.

3.010.2.10 Standby Generator Set

The price of the standby generator shall include, but not limited to, supply, transportation, storage, installation and testing of a standby generator set as shown and specified including:

- Diesel engine, 1500 rpm.
- Alternator, 400/230 V, 50 Hz, 3 phase, 4 wire, with standby power as specified.
- Cooling system including radiator, belt-driven fan, piping, make-up tanks and accessories.
- Starting system including batteries and battery charger.
- Exhaust system including a residential type silencer, piping, insulation, etc.
- Soundproof and weatherproof enclosure suitable for exposed outdoor installation.
- Fuel system including fuel tank, daily fuel tank, piping, fittings and related accessories.
- Control and instrumentation panel/cubicle to include automatic start-up on normal power failure.
- Main circuit breaker.
- Termination of cables to generating sets and control panels including cable terminal boxes and accessories.
- All necessary mechanical and electrical work.

This item shall be measured in unit of standby generator set completely installed and tested and shall be classified for payment according to generator's rated standby power.

3.010.2.11 Uninterruptible power supply

The price of the uninterruptible power supply shall include, but not limited to, supply, transportation, storage, installation and testing of an uninterruptible power supply (UPS) as shown and specified including:

- Sealed nickel-cadmium batteries.
- Batteries rack.
- Cables and cable connection up to the ICA compartment of MCC.

This item shall be measured by number of uninterruptible power supply completely installed and tested and shall be classified for payment according to UPS rated power.

3.010.2.12 Instrumentation and control system

The price of the instrumentation and control system items shall include, but not limited to, supply of the complete instrumentation, control and monitoring systems, supply of all wires and cables, supply of all furniture, packaging, shipping and handling customs fees, delivery on site, spare parts, storage, and any other items and access deemed necessary for the complete instrumentation and trouble free operation of the instrumentation, control and monitoring systems.

3.010.2.13 Domestic Lighting and Electrical System

The lump sum price for the domestic lighting and electrical installation shall include, but not limited to, supply of all electrical panel boards and their accessories, supply of all cables, conduits, junction boxes and their accessories, supply of all lighting fixtures, switches, sockets, plugs and their accessories, packaging, shipping and handling, customs fees, delivery

on site, spare parts, storage, and any other items and accessories deemed necessary for the complete installation and trouble free operation of the domestic lighting and electrical system.

3.011 ELECTRO-MECHANICAL WORKS

3.011.1 Mechanical, Electrical and Control

3.011.1.1 Mechanical, Electrical and Control Installation, Supply, Testing, and Commissioning

The Mechanical, Electrical, and Control Installation, Testing, Commissioning category of the BOQ shall include the prices for operation and maintenance manuals, installation, trenching, backfilling, interconnections, connection to power supply, testing and commissioning for a complete system in place according to specifications and design drawings.

3.011.1.2 Lump Sum

The lump sum items shall not be subject to remeasurement, and shall include the prices for all necessary construction, installation, testing and commissioning among others. The lump sum entered in the Bills shall include for a complete installation as described in the specifications.

The prices shall include all work necessary for completion of the Works and shall include the prices for all necessary building work such as forming box outs, supports plinths, cable trenches, and the like and all necessary safety and access works including guards, handrails, fire fighting equipment and the like.

3.011.2 Mechanical and Electrical works

3.011.2.1 Pumping system

The lump sum price of the pumping system shall include, but not limited to, concrete base, installation on site of the complete pumpset, connection to hydraulic piping system, connection to electric power system, connection to control and monitoring systems, preparation O & M manuals and any other items and accessories deemed necessary for the complete installation and trouble free operation of the pumpset.

3.011.2.2 Piping and accessories

The lump sum price of the piping, shown on drawings, and accessories shall include, but not limited to, installation on site of the complete piping system all hydraulic equipment and accessories, connection to electrical, control and monitoring systems, preparation of O & M manuals and any other items and accessories deemed necessary for the complete installation and trouble free operation of the mechanical system.

3.011.2.3 Liquid Chlorination Equipment

The lump sum price of the liquid chlorination equipment shall include, but not limited to, installation on site of the liquid chlorination system, all controls and electric panels, connection to pipework, connection to electrical, control and monitoring systems, preparation of O & M manuals and any other items and accessories deemed necessary for the complete installation and trouble free operation of the complete lifting system.

3.011.2.4 Surge Suppression Equipment

The lump sum price of the surge protection system shall include, but not limited to, installation on site of the complete surge suppression system, all hydraulic equipment and accessories, connection to hydraulic, electrical, control and monitoring systems, surge analysis and reports, preparation of O & M manuals and any other items and accessories deemed necessary for the complete installation and trouble free operation of the surge suppression system.

3.011.2.5 Surge Anticipation Valve

The lump sum price of the surge anticipation valve shall include, but not limited to installation on site of the surge anticipation valve, all hydraulic equipment and accessories, connection to hydraulic, electrical, control and monitoring systems, preparation of O&M manuals and any other items and accessories deemed necessary for the complete installation and trouble free operation of the surge anticipation valve.

3.011.2.6 Lifting and Handling Equipment

The lump sum price of the lifting and handling equipment shall include but not limited to installation on site of the complete lifting and handling system, all steel works, all controls and electric panels, packaging shipping and handling customs fees, delivery on site storage and any other items and accessories deemed necessary for the complete installation and trouble free operation of the lifting and handling equipment.

3.011.2.7 Electrical system

The lump sum price of the electrical system shall include, but not limited to, installation on site of all electrical equipment, all electrical cables & wires and all electrical control panels, preparation of O & M manuals, connection to the electric power system of (E.D.L.), connection to control and monitoring systems and any other items and accessories deemed necessary for the complete installation and trouble free operation of the electrical system.

3.011.2.8 Instrumentation and control system

The lump sum price of the instrumentation and control system shall include, but not limited to, installation on site of the complete instrumentation, control and monitoring systems, of all wires and cables, of all furniture, preparation of O & M manuals, installation, configuration and commissioning of all Software, connection to electrical and hydraulic systems, and any other items and access deemed necessary for the complete instrumentation and trouble free operation of the instrumentation, control and monitoring systems.

3.011.2.9 Training, testing and commissioning

The lump sum price for training, testing and commissioning shall include, but not limited to, on site tests for all, electrical, mechanical, control, and performance tests on equipment and systems, all measurements, equipment, apparitus, materials, power supply, and labor, tests reports, supply of necessary training sessions, training material and documentation, supply, transportation, accommodation and expenses of trainers and commissioners, and any other items and accessories deemed necessary for the comprehensive training of water authority and appointed personnel, and necessary for the on-site testing and commissioning of the plant.

3.011.2.10 Water analysis

The lump sum price for water analysis shall include, but not limited to, taking samples, transport to laboratory, perform the required analysis, submit reports, supply of any chemicals required for water analysis and any other items and accessories deemed necessary for the performance of the complete water analysis.

3.011.2.11 Domestic Lighting and Electrical System

The lump sum price for the domestic lighting and electrical installation shall include, but not limited to, installation on site of all electrical panel boards and their accessories, of all cables, conduits, junction boxes and their accessories, of all lighting fixtures, switches, sockets, plugs and their accessories, preparation of O&M manuals, necessary electric connections for the proper operation of the complete installation, connection to electric power system, testing and commissioning and any other items and accessories deemed necessary for the complete installation and trouble free operation of the domestic lighting and electrical system.

3.011.3 Technical schedules

The following Technical Schedules, where appropriate shall be completed by Tenderers in accordance with Clause 13 of instruction to Tenderers. Additional Technical Schedules shall be submitted for any alternative plant proposed by Tenderers.

PUMPSET		
1.1 PUMP		
Max. permissible sand content		g/m^3
Nominal flow		l/sec
Nominal head		m
NPSH at nominal flow		m
Manufacturer		
Required power		Kw
Efficiency at nominal flow		%
Speed		rpm
Impeller material		
Body material		
Manufacturing standards		

1.2 MOTOR		
Manufacturer		
Power at full load		kW
Efficiency at full load		%
Index of protection		
No. of starts per hour		

2. LIFTING & HANDLING		
Safe working load		Kg
Hoist manufacturing standards		

3. SURGE SUPPRESSION EQUIPMENT		
Surge tank material		
Working pressure		bar
Compressor manufacturer		

4. PIPES		
Manufacturer		
Material		

5. VALVES		
Manufacturer		

6. CABLES		
Manufacturer		

7. ELECTRICAL PANEL BOARD		
Enclosure IP rating		
Starter Rating		Kw

8. ACTUATOR FOR MOTORIZED VALVE		
Manufacturer		

9. U.P.S.		
Manufacturer		

10. PLC		
Make		

11. LEVEL SENSOR		
Make		
Type		

12. FLOW SENSOR		
Make		
Type		

13. PRESSURE SENSOR		
Make		
Type		

14. TEMPERATURE SENSOR		
Make		
Type		

15. DIGITAL INDICATOR		
Make		
Type		

16. MODEM		
Make		

17. TELEMANAGEMENT CENTER EQUIPMENT (CPU, Memory, I/O, Colour VDUs, Peripherals Printers)		
Make		
Type		

18. SOFTWARE		
Make and application name		

19. SYSTEM OPERATION		
Configuration		

3.012 CHANGES IN COST AND LEGISLATION (BILL B – ELECTRO-MECHANICAL EQUIPMENT & WORKS –BOOSTER AND/OR WELL PUMPING STATION)

S2.0000	**Mechanical, Electrical and Control Equipment**	
S2.0100	**Pumping system**	
S2.0101	Submersible Motopumpset	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0102	Surface Motopumpset	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0103	Hydraulic accessories (base frame, shock absorbers,supports, bolts, nuts, etc...)	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0200	**Piping and accessories**	
S2.0201	Rising column pipe	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Ta1 / Ta0 * E1 / E0 + 0.15}
S2.0202	Piezometric tube	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Et1 / Et0 * Yn1 / Yn0 + 0.15}
S2.0203	Air release valve with isolating valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0204	Sampling ball valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0205	Dismantling Joint	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0206	Check valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0207	Globe valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0208	Gate valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0209	Butterfly valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0210	Surge anticipation valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0211	Suction strainer	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0212	Y strainer	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0213	Rubber spherical joint	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0214	Stainless steel flexible joint	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0215	Electrical overhead crane	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0216	Surge supression equipment	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0217	Hydraulic accessories (bends, tees, pipes, flanges, gaskets, joints, bolts, nuts, supports, well head piece...)	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0300	**Liquid chlorination system**	
S2.0301	Chlorinator complete system (including pump, ejector, preregulators, auto-transfer switch, Cl2 flowmeter, Gas masks...)	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0302	Supply of Calcium Hypochlorite granules	NOT APPLICABLE
S2.0303	Chlorine mixer complete including agitator and mixing tank	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0304	Chlorine leakage detection system	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0305	Ventilators	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0306	Supply and installation of of outdoor shower system complete with 500 liters water tank including all piping, valves and connections	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0307	Accessories (pipes, bends, tees, joints, bolts, nuts, supports, flow switch, vacuum switch...)	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0400	**Electrical system**	
S2.0401	Emergency generator	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0402	Main ATS panel	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0403	Variable Frequency Drive (VFD) Starter control	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0404	Low voltage cables	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Cf1 / Cf0 * E1 / E0 + 0.15}
S2.0405	Electric actuator for globe valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0406	Electrical actuator for gate valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0407	Electric actuator for butterfly valve	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0408	UPS system	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15}
S2.0409	Grounding system - Lightning & Surge Protections	P1 = P0 * {0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15 }
S2.0410	Electric accessories (cables, Lugs, clamps, connectors, conduits, cable trays, insulation, junction boxes ...)	P1 = P0 * {0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15 }

ITEM	DESCRIPTION	PRICE ADJUSTMENT FORMULA
S2.0500	**Instrumentation and Control**	
S2.0501	Piezoresistive Level measurement	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Cf1 / Cf0 * E1 / E0 + 0.15)
S2.0502	Piezoresistive level measurement at reservoir	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
S2.0503	Piezoresistive pressure measurement	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
S2.0507	Water level protection system with 3 electrodes and relay	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Cf1 / Cf0 * E1 / E0 + 0.15)
S2.0508	Temperature measurement controller	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Cf1 / Cf0 * E1 / E0 + 0.15)
S2.0510	Telemetry cable	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Cf1 / Cf0 * E1 / E0 + 0.15)
S2.0505	Flow measurement	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
S2.0506	Flow switch	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
S2.0504	Manometer with three way isolating valve	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
S2.0511	Mimic panel	P1 = P0 * (0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15)
S2.0512	Control accessories (PLC, RTU, programming, transmission cables...)	P1 = P0 * (0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15)
S2.0600	**Domestic Plumbing and drainage system**	NOT APPLICABLE
S2.0700	**Fire extinguishers**	NOT APPLICABLE
S2.0800	**Electrical installation for buildings**	P1 = P0 * (0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15)
W2.0000	**Mechanical, Electrical and Control installation etc.**	
W2.0100	**Pumping system**	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
W2.0101	**Piping and accessories**	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
W2.0102	**Surge supression equipment**	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
W2.0103	**Chlorination system**	P1 = P0 * (0.15 * L1 / L0 + 0.70 * Pu1 / Pu0 * E1 / E0 + 0.15)
W2.0104	**Electrical system**	**P1 = P0 * (0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15)**
W2.0105	**Instrumentation and Control**	P1 = P0 * (0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15)
W2.0106	**Domestic Plumbing and drainage system**	NOT APPLICABLE
W2.0107	**Fire extinguishers**	NOT APPLICABLE
W2.0108	**Electrical installation for buildings**	P1 = P0 * (0.15 * L1 / L0 + 0.55 * Cf1 / Cf0 * E1 / E0 + 0.15 * Lma1 / Lma0 * E1 / E0 + 0.15)
W2.0109	**Training, testing and commissioning**	NOT APPLICABLE
W2.0110	**Water Analysis**	NOT APPLICABLE

For all the parameters figuring in the price adjustment formulas, refer to Volume 1, Conditions of Contract, Clause 70.1.

4.000 BILL C –TRANSMISSION PIPELINES

4.010 GENERAL

The hydraulic design of transmission and distribution pipelines is based on topographic surveys done during the design period. However, some or all topographical points like stakes or benchmarks may have disappeared due to works executed on the road after this period.

For this reason, the Contractor shall be deemed to have covered himself for checking quantities and for making any necessary surveys and investigations prior to placing or ordering for materials.

4.011 TOPOGRAPHIC SURVEY

The price shall cover performing land surveying of the designed networks layout. The surveyor shall start from approved benchmarks and shall mark the stations shown on drawings, using steel pegs and high quality paint. Distance between two stakes or pegs shall not exceed 30m.

Moreover, the Contractor is supposed to visit the site to check and be familiar with the present status of the survey.

EDM devices shall be used exclusively.

New longitudinal profiles shall be issued on transparent paper and AutoCAD files and shall be submitted to the Engineer's approval.

Vertical scale 1/200 and horizontal scale 1/2000

Measurement of topographic survey shall be in horizontal kilometres.

4.012 TRIAL PIT

Trial pits shall be measured by number and shall include for excavation in any material, any type of soil and rock, to a depth not exceeding 3m, hand excavation as necessary, backfilling, reinstatement of the surface to its original condition and reinstatement of road surfaces.

Payment will only be made for trial pits ordered in writing by the Engineer. Any measures taken by the Contractor to locate existing services or determine ground condition shall be included within the respective excavation item, whether separately itemised or not, and shall not be measured for payment.

4.013 TRIAL TRENCH

Trial trenches shall be measured by linear meters and shall include for all requirements as stipulated in item 'Trial pit' above.

4.014 AS-BUILT DRAWINGS

As-built drawings shall be measured by horizontal km and shall consist of new profiles, plans and details on scale similar to the design drawings scale.

Pipes, manholes, and accessories shall be shown clearly as well as effective cover depth of the crown of the pipe and distance between pipe axis and carriage edge or sidewalk, and between manhole cover centre and electric pylons or buildings corners. Adequate number (minimum one for each road or 250 m which is less) of transversal sections showing all existing underground utilities/or facilities, should also be submitted.

Payment shall only be made for as-built drawings approved by the Engineer and submitted on paper and AutoCAD files.

4.015 SUPPLY OF DUCTILE IRON PREFERRED C-CLASS PIPES INCLUDING ALL NECESSARY FITTINGS

Ductile iron preferred C-Class pipes shall be classified for payment according to diameter and shall be measured in linear meters of pipeline supplied and stored in good conditions.

The price shall cover all fittings, bends, tees, reducers, detachable joints, flanges, bolts, nuts, as well as fittings, joints and jointing material.

Only pipes, fittings, junctions, bends, etc... supplied and stored in good conditions and accepted by the Engineer shall be taken into account for payment.

4.016 SUPPLY OF HDPE PIPES INCLUDING ALL NECESSARY FITTINGS

Price shall include all the requirements as stipulated in item 4.015 above (for HDPE pipes).

4.017 TRENCH EXCAVATION

The price shall be calculated in terms of linear meters of dug trench only. The minimum width of trench is shown on the corresponding Contract drawings (refer to standard drawings).

This price shall include but shall not be limited to:

- Excavating in any type of soil, rock, structural fill, contaminated fill, clay or others.
- Excavating by hand or machine.
- Excavating in asphalted or non-asphalted roads, in fields, in valleys, in accessible or non accessible areas, including the execution of temporary access roads if needed.
- De-watering operations necessary for keeping the excavation free from water whether rain water or any other sources.
- Extra excavation depth carried out as shown on the longitudinal profiles or under the direction of the Engineer.
- Extra excavation carried out in width for laying of the HDPE duct.
- Transport of unsuitable backfilling materials to environmentally approved disposal sites accepted by the Engineer.
- Levelling or grading and compacting the bottom of excavations.
- Supporting, protecting and maintaining existing services and utilities.

- Temporary or permanent supports to sides of excavation, roads or structures as required by the Engineer (soil supports, sheet piling, etc...) or other method proposed by the Contractor and approved by the Engineer (micro-tunnelling , concrete piles, etc…).
- Traffic regulation and safety provisions as described in Volume 1- Appendix 1 – CDR Safety, Health and Environmental Regulations.
- Repairing of all damaged utilities caused by the execution of the works.

Any excavated quantity will not be paid by the Employer under this item, if it is dumped or accidentally falls in the valley or in the field.

4.018 SAND BEDDING AND SAND SURROUNDS

The sand bedding and sand surrounds shall be classified for payment according to pipe diameter and shall comply with the corresponding contract drawings (refer to standard drawings), and shall be measured by linear meters of completed pipeline.

Price shall include supply of material, backfilling, testing and compaction.

4.019 LAYING OF PIPES

Laying of pipes shall be classified for payment according to pipe material and diameter and shall be measured in linear meters of completed pipeline in place measured along the crown of the pipeline and the price shall include but not be limited to:

- Removal of any abandoned pipework within the excavation.
- Distributing pipes along the trench.
- Checking and cleaning pipe from dirt, oil, grease, etc..
- Supply of temporary or final supports.
- Laying of pipes.
- All necessary types of jointing, welding, etc…
- Checking pipe alignment and evaluations using topographical instruments.
- Installation of all fittings, bends, tees, reducers, dismantling joints, flanges, couplings, bolts, nuts as well as hauling, transport, unloading, and staking of pipes, fittings, joints, and jointing material.

The length measured for payment shall include the lengths of all fittings, valves and accessories installed in the line.

Only pipes, fittings, junctions, bends, etc… actually laid, jointed and tested and accepted by the Engineer shall be taken into account for payment.

4.020 BACKFILLING OF TRENCHES

1-Backfilling of trenches (for main roads – refer to Ministry of Public Works decree No. 13495 dated 5/11/1998 – Volume 4 - Annex 1) shall be classified for payment according to pipe diameter and shall be measured by linear meters along the crown of the pipeline (refer to standard drawings).

Sand Backfilling shall include for:

- Supply of imported materials.
- Backfilling in layers and compaction.
- Testing and compaction
- Supply and installation of the warning tape (Marker Tape)

2-Backfilling of trenches on other roads shall be classified for payment according to pipe diameter and shall be measured by linear meters along the crown of the pipeline (refer to standard drawings).

Backfilling shall include for:

- Supply of materials.
- Backfilling in layers and compaction.
- Testing and compaction
- Supply and installation of the warning tape (Marker Tape)

4.021 SUPPLY AND INSTALLATION OF GATE VALVES

Gate valves shall be classified for payment by nominal diameter and nominal pressure class and shall be measured by number of gate valves supplied and installed.

Price shall include for the supply and installation of all fittings necessary to joint the assembly to the pipeline (either new or existing), including thrust flanges, flexible joints, dismantling joints, supports and all necessary items to make a completed installation.

4.022 SUPPLY AND INSTALLATION OF AIR RELEASE VALVES

Air valves shall be measured by number for each air valve size, and nominal pressure, and shall include gate valves, riser pipe, flanges, bolts, nuts, supports and all necessary components to provide a complete installation.

Reinforced concrete chambers, covers and frames shall be measured separately by number. Cutting and reinstatement shall also be measured separately.

4.023 SUPPLY AND INSTALLATION OF PRESSURE REGULATING VALVES

Supply and installation of pressure regulating valves shall be measured by number for each diameter of pipeline and shall include the supply and installation of thrust flanges, by pass pipe, bends, tees, orifice plates, filters, butterfly valves, short piece pipes, gate valves, air release valves, manometers, collars, flanges, dismantling joints, chamber cover and frame in

addition to concrete works which include concrete chamber, supports and steel reinforcement and all works necessary to form a complete installation according to standard drawings.

4.024 SUPPLY AND INSTALLATION OF PRESSURE SUSTAINING VALVES

Supply and installation of pressure sustaining valves shall be measured by number for each diameter of pipeline. Price shall include all the requirements as stipulated in item 4.023 "Pressure Regulating valves" above.

4.025 SUPPLY AND INSTALLATION OF WASHOUTS

Washouts shall be measured by number for each washout size and pressure class and shall include gate valves, duck foot bends, tees, flap valves, drain pipe HDPE or D.I. pipes for washout with the needed length (excavation, bedding, supply, laying and backfilling) and all necessary items to make a complete washout.

Reinforced concrete chambers, covers and frames, shall be measured separately by number. Cutting and reinstatement shall be also measured separately.

4.026 SUPPLY AND INSTALLATION OF CONNECTIONS TO EXISTING RESERVOIRS

Connection to existing reservoir shall be measured by number and shall include pipes, bends, tees, concrete works, steel reinforcement, strainers, concrete supports, inserts, float valves (if any), filters, etc... (including excavation, bedding, compacting, supply, laying and backfilling, etc...) and all necessary items to make a complete connection system to existing reservoir.

4.027 SUPPLY AND INSTALLATION OF NEEDLE VALVES

Supply and installation of needle valves shall be measured by number for each diameter of pipeline and shall include the supply and installation of the needle valve, dismantling joints, Y strainers/filters, supports, thrust flanges, flexible joints, testing and commissioning, and all necessary items to make a completed installation.

Reinforced concrete chambers, covers and frames shall be measured separately by number. Cutting and reinstatement shall also be measured separately.

4.028 CONSTRUCTION OF PRE-CAST OR CAST IN SITU, REINFORCED CONCRETE VALVE CHAMBERS

Valve chambers where not included in another item, shall be measured by number according to chamber internal length and width and shall include for excavation, formwork, concrete, mass concrete, blinding etc..., reinforcement, rendering, external damp-proofing, painting, backfilling, floor drain, soak away, step irons access ladders, compacted gravel, sub-base and base layers, asphalt, etc... and all necessary items to make a complete chamber according to the contract drawings.

The valve chamber cover and frame shall be measured by number separately.

4.029 SUPPLY AND INSTALLATION OF VALVE CHAMBER COVER AND FRAME

Valve chamber cover and frame shall be measured by number and shall include all necessary materials and equipment including installation, labour, painting etc... in order to get an installed cover and frame according to the specifications.

4.030 SUPPLY AND INSTALLATION OF SURFACE BOX UNITS

Surface box units shall be measured by number and shall include for spindle guards, extension spindles, caps, couplings, covers, surface box units, and all necessary items to make a complete surface box unit.

4.031 CONCRETE WORKS

Cast in situ or precast concrete shall be measured by net volume shown on drawings.

Concrete, whether included in another item or separately measured, shall include for:

- All material, equipment, labour, transport, admixtures (retarders, plasticizers, waterproofing products, ...) batching, mixing, placing, vibrating, curing, testing.
- Formwork (Formwork shall be "sawn" finish to all buried external faces of concrete below a line 200mm below ground level and shall be "wrought" finish to all other faces).
- All needed excavation in all kinds of soils and rocks, use of all adequate equipment, transport of soil to disposal sites approved by the Engineer, labour, dewatering, temporary and/or final retaining structures for trenches or open digs, backfilling, compacting, cutting of asphalt.
- Forming of chamfers (25mm x 25mm) to all exposed external angles.
- Forming expansion, contraction, movement and construction joints and for all water stops, jointing materials, sealing compounds and formwork necessary for forming such joints;
- Building in of all pipes and fittings, bolts, frames, iron and steelwork and the like.
- Finishing of surfaces.
- Reinforcement.
- All necessary items to have the concrete works according to the specifications.

4.032 TESTING AND COMMISSIONING OF POTABLE WATER PIPES

Testing and commissioning shall be measured by linear meters along the pipe crown. The price shall include all the material, equipment and labour (water, pumps, barrels, manometers, valves, labour, power supply, etc...) and no payment shall be made before getting the Engineer's approval.

4.032.1 Cutting

Cutting of paved roads shall be measured by linear meters along the pipe crown. It shall include for asphalt cutting at both sides of the trench, and removal of excavated material to disposal sites.

Cutting and breaking of concrete pavements shall be measured by square meters, it shall include for cutting and breaking out of concrete pavement (the width of the cut trenches will be as shown on standard drawings) and removal of excavated material to disposal sites.

The price shall include cutting works and removal of material for widening of trench for chambers or other ancillary structures and fittings.

4.032.2 Reinstatement

Reinstatement of asphalt pavement shall be classified for payment according to type of roads, as for main roads two layers of asphalt shall be applied, and one layer for the other roads, and shall be measured by square meters of completed asphalted and reinstated trenches, the quantity to be considered for payment will be the quantity actually executed but not to exceed the quantities shown on standard drawings, otherwise it will be on the Contractor own expenses and will not be considered for payment. For trench reinstatement, the price shall include for:

- Transport of material.
- Recutting works.
- Base and sub-base courses, material.
- Compaction.
- Laying and application of material,
- Tests.
- Repairing of all defects, asphalt or concrete collapse.
- Etc..

The width of asphalt layers shall be in accordance with the standard drawings.

Reinstatement of concrete and concrete stair cases shall be measured by square meters of completed reinstated trenches, the quantity to be considered for payment will be the quantity actually executed but not to exceed the quantities shown on standard drawings, otherwise it will be on the Contractor own expenses and will not be considered for payment. For trench reinstatement, the price shall include for:

- Transport of material.
- Recutting works.
- Base and sub-base courses, material.
- Compaction.
- Laying and application of material,
- Tests.
- Repairing of all defects, asphalt or concrete collapse, Etc…

Reinstatement shall also include for any re-cutting works of asphalt or concrete required by collapse of trench edges and for base and sub-base courses and compaction according to drawings and complying with the specifications.

4.033 CHANGES IN COST AND LEGISLATION (BILL C –TRANSMISSION PIPELINES)

ITEM NO	DESCRIPTION	PRICE ADJUSTMENT FORMULA
3.0000	General	
3.0001	Site Topographic Survey	NOT APPLICABLE
3.0002	Trial pit not exceeding 3m depth	$P_1 = 60\% * P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\} + 40\% * P_0 * \{0.15 + 0.15 * L_1 / L_0 + 0.45 * [(1.12 * B_1 + 66) / (1.12 * / B_0 + 66)] + 0.25 * F_1 / F_0\}$
3.0003	Trial trench not exceeding 3m depth	$P_1 = 60\% * P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\} + 40\% * P_0 * \{0.15 + 0.15 * L_1 / L_0 + 0.45 * [(1.12 * B_1 + 66) / (1.12 * / B_0 + 66)] + 0.25 * F_1 / F_0\}$
3.0004	As-built drawings	NOT APPLICABLE
3.1000	Pipeworks	
3.1100	Supply of ductile iron preferred C-Class pipes including all necessary fittings (Bends, Tees, Reducers, Flanges, etc...)	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Tf_1 / Tf_0 * E_1 / E_0 + 0.15\}$
3.1200	Supply of HDPE pipes	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Et_1 / Et_0 * Yn_1 / Yn_0 + 0.15\}$
3.1300	Trench excavation	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
3.1400	Sand bedding and surrounds	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
3.1500	Laying of ductile iron pipes	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Tf_1 / Tf_0 * E_1 / E_0 + 0.15\}$
3.1600	Laying of HDPE pipes	P1 = P0 * {0.15 * L1 / L0 + 0.70 * Et1 / Et0 * Yn1 / Yn0 + 0.15}
3.1700	Backfilling of Trenches on main roadsincluding compaction and testing	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
3.1800	Backfilling of Trenches on other roads including compaction and testing	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
3.2000	Accessories	
3.2100	Supply and installation of air release valves	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Pu_1 / Pu_0 * E_1 / E_0 + 0.15\}$
3.2200	Supply and installation of pressure regulating valves	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Pu_1 / Pu_0 * E_1 / E_0 + 0.15\}$
3.2300	Supply and installation of pressure sustaining valves	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Pu_1 / Pu_0 * E_1 / E_0 + 0.15\}$
3.2400	Supply and installation of washouts	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Pu_1 / Pu_0 * E_1 / E_0 + 0.15\}$
3.2500	Supply and installation of connections to existing reservoirs	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Pu_1 / Pu_0 * E_1 / E_0 + 0.15\}$
3.2600	Supply and installation of connections to existing pipes	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Pu_1 / Pu_0 * E_1 / E_0 + 0.15\}$
3.3000	Valve chambers and Surface box units	
3.3100	Construction of pre-cast or cast in situ, concrete valve chamber (excluding cover and frame)	P1 = 45% * P0 * {0.15 * L1 / L0 + 0.70 * Lmc1 / Lmc0 * E1 / E0 + 0.15} +4% * P0 * {0.15 * L1 / L0 + 0.25 * F1 / F0 + 0.10 * Eqp1 / Eqp0 * E1 / E0 + 0.50} +40% * P0 * {0.45 * C1 / C0 + 0.15 * L1 / L0 + 0.10 * F1 / F0 + 0.30} +11% * P0
3.3200	Valve chamber cover	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Tf1 / Tf_0 * E_1 / E_0 + 0.15\}$

3.3300	**Surface box units for washouts**	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Tfi / Tf_0 * E_1 / E_0 + 0.15\}$
3.4000	**Concrete Works**	
3.4001	Mass concrete - Class C20 for blinding	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.3\}$
3.4002	Mass concrete - Class C25 for pipe supports, thrust blocks, anchors, pipe bedding and surround at river crossing.	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.3\}$
3.4003	Reinforced concrete - Class C25 for pipe anchors, supports, protection slabs, thrust blocks,drainage and irrigation	$P_1 = 50\% * P_0 * \{0.15 * L_1 / L_0 + 0.70 * Lmc_1 / Lmc_0 * E_1 / E_0 + 0.15\}$ $+5\% * P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$ $+45\% * P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.30\}$
3.5000	**Testing and commissioning of potable water pipes**	NOT APPLICABLE
3.6000	**Road Reinstatement**	
3.6100	**Cutting**	
3.6101	Cutting of paved roads for water pipes	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E1 / E0 + 0.5\}$
3.6102	Cutting, breaking-out and removal of concrete pavement or stair cases for water pipes	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E1 / E0 + 0.5\}$
3.6200	**Reinstatement**	
3.6201	Reinstatement of paved roads including recutting works	$P_1 = 50\% * P_0 * \{0.15 + 0.15 * L_1 / L_0 + 0.45 * [(1.12 * B_1 + 66) / (1.12 * / B_0 + 66)] + 0.25 * F_1 / F_0\} + 50\% * P_0$
3.6202	Reinstatement of concrete pavement or stair cases for water pipes, including base, sub-base courses and concrete pavement	$P_1 = P_0 * \{0.45 * C_1 / C_0 + 0.15 * L_1 / L_0 + 0.10 * F_1 / F_0 + 0.3\}$

For all the parameters figuring in the price adjustment formulas, refer to Volume 1, Conditions of Contract, Clause 70.1.

5.000 BILL D - BOREHOLES

5.010 MOBILIZATION

The price shall be paid for on lump sum basis including all costs and labour expenses necessary to the delivery, installation and dismantling of the drilling and testing equipments as well as all tools and devices, other than the pumping equipment. The price also includes all expenses necessary to the preparation of the site (cleaning of land and preparing access roads).

5.011 DRILLING

Execution of drilling works by rotary method for wells of different diameters.

The price shall be paid for every drilled linear meter and shall include all drilling costs, without exception (power, fuel, mud, water, air depression of parts and machinery, etc…) and the labour expenses required for drilling a well to the required diameter as well as taking sample cuttings from the ground and all measurements as stipulated in 704.2 of the Technical Specifications Vol. 3 and as per instructions from the Engineer.

5.012 GEOPHYSICAL LOGGING

The price shall be paid for every logged linear meter and shall include all logging costs without exception (logging system, probes, drawwork, power, etc..) and the labour expenses required for logging a well to the required depth.

5.013 VERTICALITY AND ALIGNMENT TEST

The price shall be paid for on lump sum basis including all costs and labour expenses necessary to conduct the tests, as well as all tools and devices (percussion machine, tripod, dummies, etc..), as stipulated in 705.1.1 of the Technical Specifications Vol. 3.

5.014 CASINGS

The price shall be paid on a linear basis and shall include the supply, transport, on-site storage and installation of casings including all the necessary accessories.

5.015 SCREENS

The price shall be paid for installed linear meter of screens including the supply, transport, on-site storage and installation of screens with all the necessary accessories.

5.016 WELL GROUTING

5.016.1 Supply of Cement

The price shall be paid for every ton of cement delivered on-site including supply, transport and on-site storage in its original packing.

5.016.2 Injection of cement in the annular space

The price shall be paid for every meter of placed grout including the preparation of the slurry (supply of the required quantities of water and sand) by using supplied cement and additives (where necessary). Grout shall be placed as stipulated in 704.9 of the Technical Specifications Vol. 3, and the Contractor shall bear all costs.

5.017 WELL DEVELOPMENT BY PUMPING

5.017.1 Supply and install of pumping equipment

The price shall be paid for every operation including all costs for supplying, transportation and installation of the pump at the specified discharge and head and later dismantle. This includes without restriction all costs and labour expenses necessary to the development of the well.

5.017.2 Well development (pumping at different rates)

The price shall be paid for on the basis of every hour of effective pumping and shall include operating the pump at progressively increasing rates including all the necessary requirements of power supply, generators, fuel, etc..

5.018 PUMPING TESTS

5.018.1 Step drawdown test

The price shall be paid for on the basis of every hour of effective pumping and shall be done with the same pumping system used in the development stage. The price shall include without restriction all the necessary labour, power supply, continuous level and flow measurements as stipulated in 704.12 of the Technical Specifications Vol. 3.

5.018.2 Constant rate test

The price shall be paid for on the basis of every hour of effective pumping, the pump shall be operated at a constant rate for 72 hours non-stop. The per hour price shall include all the requirements as stipulated in the step drawdown test above.

5.019 WATER ANALYSIS

5.019.1 Collection and delivery of water samples to an approved laboratory

The price shall be paid for on the basis of every water sampling operation and shall include all costs, sterilized supplies, transport and labour expenses necessary for water sampling as stipulated in 704.14 of the Technical Specifications Vol.3.

5.019.2 Physico-chemical analysis

The price shall be paid for on the basis of every analysis carried out including the interpretation and submittal of results.

5.019.3 Bacteriological analysis

The price shall be paid for on the basis of every analysis carried out including the interpretation and submittal of results.

5.020 REPORTS AND AS-BUILT DRAWINGS

5.020.1 Daily driller's log, detailed report and as-built drawings

The price shall be paid on a lump sum basis for the whole report and shall include the daily driller's log as stipulated in 706 of the Technical Specifications Vol. 3, and according to the Engineer's instructions.

5.020.2 Final well report

The price shall be paid for on a lump sum basis for the final report and shall include all requirements as stipulated in item "Daily driller's log" above.

5.021 CHANGES IN COST AND LEGISLATION (BILL D – BOREHOLES)

5.0000	**Site Preparation**	
5.0100	Site preparation and set up borehole drilling unit and later dismantle	NOT APPLICABLE
5.1000	**Drilling by rotary**	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E_1 / E_0 + 0.50\}$
5.2000	**Well construction**	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.70 * Ta_1 / Ta_0 * E_1 / E_0 + 0.15\}$
5.3000	**Verticality and alignment tests**	NOT APPLICABLE
5.4000	**Grouting**	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E1 / E0 + 0.50\}$
5.5000	**Well Development**	
5.5100	Supply, install and remove test pumping unit and all associated equipment including discharge pipeline	NOT APPLICABLE
5.5200	Pumping and surging at different rates	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E1 / E0 + 0.50\}$
5.5300	Supervise development test	NOT APPLICABLE
5.6000	**Well Testing**	
5.6010	Step drawdown test	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E1 / E0 + 0.50\}$
5.6020	Water level recovery measurements	NOT APPLICABLE
5.6030	Constant rate test	$P_1 = P_0 * \{0.15 * L_1 / L_0 + 0.25 * F_1 / F_0 + 0.10 * Eqp_1 / Eqp_0 * E1 / E0 + 0.50\}$
5.6040	Water level recovery measurements	NOT APPLICABLE
5.7000	**Water Analysis**	
5.7010	Collection and delivery of water samples to an approved laboratory	NOT APPLICABLE
5.7020	Physico-chemical analysis	NOT APPLICABLE
5.7030	Bacteriological analysis	NOT APPLICABLE
5.8000	**Reports**	
5.8010	Detailed daily reports	NOT APPLICABLE
5.8010	Final well report	NOT APPLICABLE

For all the parameters figuring in the price adjustment formulas, refer to Volume 1, Conditions of Contract, Clause 70.1.