IRRIGATION AUTHORITY

Open National Bidding for Works

CONVERSION OF EXISTING PIVOT IRRIGATION SYSTEM INTO DRIP IRRGATION SYSTEM POINTE AUX PIMENTS SMALL SCALE IRRIGATION PROJECT

Procurement Reference No. Conv-Piv-Drip/IPU 24/01

BIDDING DOCUMENTS

Public Body: Irrigation Authority
5th Floor, Fon Sin Building
12, Edith Cavell Street
Port Louis

APRIL 2024

Section I: Instruction to Bidders

1. Introduction

The **Irrigation Authority** (IA) also referred as the Employer, invites eligible local contractors to submit their bid for the works described in detail hereunder. Any resulting contract shall be subject to the terms and conditions referred to in this document.

The Works referred to under this procurement exercise relate to Pointe Aux Piments Small Scale Irrigation Project which was implemented in the Year 2000. Most of the fields within the Project are irrigated by a Centre Pivot System and the remaining fields in the corners are under Drip Irrigation System. Since the Centre Pivot has reached its life span, a modern Drip Irrigation System will now be installed on the entire project area covering 38 ha of lands belonging to some 125 small Planters. The implementation of this project will improve water application efficiency and also to ensure a better irrigation service to the Planters.

The source of water for the Project is from La Nicoliere Reservoir and irrigation water is supplied to the Project command area to service a new gravity fed Drip Irrigation System via existing Filtration Plant and delivery main.

The Project Area is located in the Northwest of the island and found next to the village of Pointe Aux Piments as per the Context/Location Plan, Drg No. IA 24/PAP-Drip/01.

The Scope of Works for Conversion of the Existing Pivot Irrigation System into Drip Irrigation System shall be as follows:

a) Dismantling of existing valves and equipment on inlet of Centre Pivot System and return all the irrigation parts to the store of IA at Plaine des Papayes.

b) Diversion of existing Delivery Main PVC Pipe OD 160 PN 10 beyond existing Drain Valve Chamber in the vicinity of the compound of existing Centre Pivot with the supply, install and test of new extended Delivery Main of about 315 m long in PVC Pipe OD 160 PN10.

c) Connection works to existing Filter Outlet, found within the compound of M1B3L2 /M1B3L4 Filtration Plant Unit, and existing PVC Pipe OD 200 PN 16 complete with all associated fittings for the purpose of diverting flow of irrigation water to existing Delivery Main/new extended PVC Delivery Main OD 160 mm.

d) Supply, lay and test new Submain/Distribution pipeline of about 1215 m in PVC of OD 90 mm and PN 10 linking onto the exiting/new extended Delivery Main vide Main Headworks and running towards Small/In-Field Headworks.

e) Supply, lay and test PVC Distribution Maniflold of approximate total length of approximately 1450 m in PVC of OD 50/63/75/90 mm and PN 6 together with inserts/risers for connection to field dripper lines.

f) Supply, install and test of DN 160 Control Valves to be housed in reinforced concrete/blockwall chambers for Main Headworks, tapping water from the Delivery Main and feeding the Submain/Distribution pipeline vide the Control Valves.

g) Supply, install and test of DN 90 PVC Stop Valves to be housed in PVC Casings for Small/In-Field Headworks, tapping water from the Submain/Distribution pipeline and feeding the Distribution Manifold.

h) Earthworks associated with trenches for laying of pipes, excavation for construction of Headworks, etc.

i) Preparation of trenches including their shoring if necessary and placing of specified bedding materials.

j) Backfilling of trenches with the specified backfill materials.

k) Construction of temporary works where required.

l) Final testing and commissioning of the whole of the works including the making good of possible defects.

Participation is limited to citizens of Mauritius or entities incorporated in Mauritius. Joint Ventures should be among entities incorporated in Mauritius

1.1 Clarifications, if any, should be addressed to:

The General Manager
Irrigation Authority
5th Floor - Fon Sing Building,
12 Edith Cavell Street,
Port Louis.

The Employer will respond in writing to any request for clarification, provided that such request is received 14 days prior to the deadline for submission of bids.

The Employer shall respond to such request at latest 7 days prior to the deadline set for submission of bids.

1.2 Bidders are advised to carefully read the complete Bidding document, including the Particular Conditions of Contract in Section IV, before preparing their bids. The standard forms in this document may be retyped for completion but the Bidder is responsible for their accurate reproduction.

2. Validity of Bids

The bid validity period shall be Ninety (90) days from the date of bid submission deadline.

3. Works Completion Period

The Intended Completion period is **Two Hundred and Seventy (270) calendar days** from start date of works.

4. Site Visit

Bidders or their designated representatives are invited to attend a pre-bid meeting on **Thursday 18 April 2024 at 10h30 local time**. The meeting place shall be near the ***entry of Triolet State Secondary School (SSS Boys)***
The purpose of the pre-bid meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

5. Sealing and Marking of Bids

Bids should be sealed in a single envelope, clearly marked with the Procurement Reference Number, addressed to the Public Body with the Bidder's name at the back of the envelope.

6. Submission of Bids

Bids should be deposited in the Bid Box located at:
Irrigation Authority
5th Floor - Fon Sing Building,
12 Edith Cavell Street,
Port Louis.
not later than ***15.00 hours*** local time on ***Monday 13 May 2024.*** Bids by post or hand delivered should reach the above-mentioned address by the same date and time at latest. Late bids will be rejected. Bids received by e-mail will not be considered.

7. Bid Opening

Bids will be opened by the Irrigation Authority at **15.30 hours** on the same date of submission of Bids referred to in Section 6 above. Bidders or their representatives may attend the Bid Opening if they choose to do so.

8. Evaluation of Bids

The Public Body shall have the right to request for clarification during evaluation. Offers that are substantially responsive shall be compared on the basis of evaluated cost to determine the lowest evaluated bid.

9. Eligibility Criteria

To be eligible to participate in this bidding exercise, Bidder should:

(a) have the legal capacity to enter into a contract to execute the works;
(b) be duly registered with the CIDB under the grade that would allow him to perform the value of works for which he is submitting his bid. (Note 1)
(c) not be insolvent, in receivership, bankrupt, subject to legal proceedings for any of these circumstances or in the process of being wound up;
(d) not have had your business activities suspended;
(e) not be under a declaration of ineligibility by the Government of Mauritius in accordance with applicable laws at the date of the deadline for bid submission or appearing on the ineligibility lists of African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank Group and World Bank Group;
(f) not have a conflict of interest in relation to this procurement requirement; and
(g) have a Business Registration Card.

Note 1 Sub-contractors undertaking works are also subject to registration with CIDB as applicable to Contractors.

10. Qualification and Experience Criteria

Bidders should have the following minimum qualifications and experience:

(a) valid registration certificate with the CIDB under the grade that will enable the contractor to perform the works quoted for, under the following Class: ***Civil Engineering Construction Works*** and specialisation [***NOT APPLICABLE***].
(b) experience as Main Contractor in works of a similar nature and size including at least **one (1) project** involving pipelaying works having a contract price of minimum **MUR 15 million** over the last **ten years;** details of work under way or contractually committed; and clients who may be contacted for further information on those contracts.

(c) Qualification and Experience of Key Personnel required for the Contract shall be:

i. One Contract Manager having at least a Degree in Civil Engineering with at least 7 years General Experience with minimum 5 years Post-Registration Experience with the Council of Registered Professional Engineers of Mauritius. The Contract Manager shall be the main line of communication, responsible for planning and monitoring the works, liaison with authorities, report on progress and quality of works and shall attend all visits and meetings with the Project Manager and/or Employer;
ii. One Site Engineer (full time) having at least a Degree in Civil Engineering with a least 5 years in Civil Engineering Works; and
iii. One Foreman (full time) having at least 5 years of experience in pipe laying works and installation of hydraulic equipment associated with Drip Irrigation Projects.

(d) The minimum amount of liquid assets and/or credit facilities, net of other contractual commitments of the successful Bidder shall be **MUR 6 million**. The bidder shall also submit written evidence of same from its Bank.

11. Contents of bid

The Bid shall comprise the following:

(a) duly filled Bid Submission Form;
(b) duly filled Priced Bill of Quantities
(c) duly filled Qualification Information Form and attachments required
(d) report on the financial standing of the Bidder for the last three years, such as certified copies of Financial Statements or Audited Accounts as filed at the Registrar of Companies before the deadline set for submission of bids
(e) Valid Registration certificate with the CIDB, as applicable
(f) Signed C.V of Contract Manager;
(g) Documentary evidence of liquid assets and/or credit facilities (Note 1);
(h) Any other documents deemed necessary as per the requirements of this bidding document

Note 1

Bidders to demonstrate access to, or availability of, financial resources such as liquid assets, lines of credit, and other financial means, other than any contractual advance payments to meet the overall cash flow requirements for the contract and its current commitments. Documentary evidence may comprise but not limited to Bank certificate, Certificate from Auditors, Certificate from a Professional Accountant registered with MIPA, Certificate from Insurance companies.

12. Joint Venture

Bids submitted by a joint venture of two or more firms as partners shall comply with the following requirements:

i. the Bid shall include all the information required as per the Qualification Information form for each joint venture partner;
ii. the Bid shall be signed so as to be legally binding on all partners;

iii. the Bid shall include a copy of the agreement entered into by the joint venture partners defining the division of assignments to each partner and establishing that all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms; **alternatively**, a Letter of Intent to execute a joint venture agreement in the event of a successful bid shall be signed by all partners and submitted with the bid, together with a copy of the proposed agreement;

iv. one of the partners shall be nominated as being in charge, authorized to incur liabilities, and receive instructions for and on behalf of any and all partners of the joint venture; and

v. the execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

13. Prices and Currency of Payment

Bidders should quote for the whole works. Prices for the execution of works shall be quoted and fixed in Mauritian Rupees. Items for which no rate or price is entered by Bidders, shall not be paid for by the Public Body when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

Bids shall cover all costs of labour, materials, equipment, overheads, profits and all associated costs for performing the works, and shall include all duties. The whole cost of performing the works shall be included in the items stated, and the cost of any incidental works shall be deemed to be included in the prices quoted. Bidders are required to submit their bid prices **exclusive of VAT**.

14. Bid Securing Declaration

Bidders are required to subscribe to a Bid Securing Declaration in the Bid Submission Form.

15. Margin of Preference

Margin of Preference shall apply as per Directive 67 from the Procurement Policy Office.

16. Award of Contract

The Bidder having submitted the lowest evaluated responsive bid and qualified to perform the works shall be selected for award of contract. Award of contract shall be by issue of a Letter of Acceptance in accordance with terms and conditions contained in Section IV: General Conditions of Contract and Particular Conditions of Contract.

17. Performance Security and signing of contract

Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the *Employer*, the successful Bidder shall furnish a Performance Security, in the amount equal to 10% of the Bid price (exclusive of VAT), in accordance with the conditions of contract, using for that purpose the Performance Security Form included in Section V Contract Forms.

The contract agreement shall be signed within 28 days after the successful bidder receives the letter of acceptance unless the parties agree otherwise.
Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the contract within the required time may constitute sufficient grounds for the annulment of the award.

18. Notification of Award and Debriefing

Prior to the expiration of the period of bid validity, the Employer shall, for contract amount above Rs 15 million, notify the selected bidder of the proposed award and accordingly notify unsuccessful bidders. Subject to Challenge and Appeal, the Employer shall notify the selected Bidder, in writing, by a Letter of Acceptance for award of contract. Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

The Public Body shall after award of contract, exceeding Rs 1 million and up to Rs 15 million, promptly inform all unsuccessful bidders in writing of the name and address of the successful bidder and the contract amount.
Furthermore, the Public Body shall attend to all requests for debriefing for contract exceeding Rs 1 million, made in writing within 30 days the unsuccessful bidders are informed of the award.

19. Advance Payment

The Public Body shall provide an Advance Payment on the Contract Price as stipulated in the General Conditions of Contract. The Advance Payment shall be guaranteed by an Advance Payment Security as per the format contained in Section II.

The Advance Payment shall be limited to 15% percent of the Contract Price, less any provisional and contingencies sums.

20. Integrity Clause

The Public Body commits itself to take all measures necessary to prevent corruption and ensures that none of its staff, personally or through his/her close relatives or through a third party, will in connection with the bid for, or the execution of a contract, demand, take a promise for or accept, for him/herself or third person, any material or immaterial benefit which he/she is not legally entitled to.

21. Rights of Public Body

The Irrigation Authority reserves the right:
(a) to split the contract as per the lowest evaluated cost per lot; and
(b) to accept or reject any bid or to cancel the bidding process and reject all bids at any time prior to contract award without incurring any liability to the Public body.

22. Challenge and Appeal

Unsatisfied bidders shall follow procedures prescribed in Regulations 48, 49 and 50 of the Public Procurement Regulations 2008 to challenge procurement proceedings and award of procurement contracts or to file application for review at the Independent Review Panel.

(a) The Address, Telephone & Fax Number and Email Address to file Challenges in respect of this procurement is:

Irrigation Authority
5th Floor - Fon Sing Building,
12 Edith Cavell Street,
Port Louis.

Tel: +230 2106596

Fax: +230 2127652

Email: irrig@irrig.org

(b) The address to file Application for Review is:

The Chairperson
Independent Review Panel,
5th Floor,
Belmont House
Intendence Street
Port Louis

Tel : +230 2602228

Email : irp@gov.mu

Section II: Bidding Forms

Note: Bidders are required to fill all the forms in this section and submit as part of their bid. Non-submission of any form may lead to rejection of the bid

Table of Forms

Bid Submission Form

Date: _____

Bid's Reference No.: _____

Procurement Reference No: **Conv-Piv-Drip/IPU 24/01**

To: The General Manager
Irrigation Authority
5th Floor, Fon Sing Building
12, Edith Cavell Street
PORT LOUIS

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instruction to Bidders (ITB) Clause 8;

(b) We offer to execute in conformity with the Bidding Documents the Works for Conversion of Existing Pivot Irrigation System into Drip Irrigation System under Procurement Reference No: **Conv-Piv-Drip/IPU 24/01** consisting of, inter alia:

1. Dismantling of existing valves and equipment on inlet of Centre Pivot System and return all the irrigation parts to the store of IA at Plaine des Papayes.

2. Diversion of existing Delivery Main PVC Pipe OD 160 PN 10 beyond existing Drain Valve Chamber in the vicinity of the compound of existing Centre Pivot with the supply, install and test of new extended Delivery Main of about 315 m long in PVC Pipe OD 160 PN10.

3. Connection works to existing Filter Outlet, found within the compound of M1B3L2 /M1B3L4 Filtration Plant Unit, and existing PVC Pipe OD 200 PN 16 complete with all associated fittings for the purpose of diverting flow of irrigation water to existing Delivery Main/new extended PVC Delivery Main OD 160 mm.

4. Supply, lay and test new Submain/Distribution pipeline of about 1215 m in PVC of OD 90 mm and PN 10 linking onto the exiting/new extended Delivery Main vide Main Headworks and running towards Small/In-Field Headworks.

5. Supply, lay and test PVC Distribution Maniflold of approximate total length of approximately 1450 m in PVC of OD 50/63/75/90 mm and PN 6 together with inserts/risers for connection to field dripper lines.

6. Supply, install and test of DN 160 Control Valves to be housed in reinforced concrete/blockwall chambers for Main Headworks, tapping water from the Delivery Main and feeding the Submain/Distribution pipeline vide the Control Valves.

7. Supply, install and test of DN 90 PVC Stop Valves to be housed in PVC Casings for Small/In-Field Headworks, tapping water from the Submain/Distribution pipeline and feeding the Distribution Manifold.

8. Earthworks associated with trenches for laying of pipes, excavation for construction of Headworks, etc.

9. Preparation of trenches including their shoring if necessary and placing of specified bedding materials.

10. Backfilling of trenches with the specified backfill materials.

11. Construction of temporary works where required.

12. Final testing and commissioning of the whole of the works including the making good of possible defects.

    The Intended Completion period is **Two Hundred and Seventy (270) calendar days** from start date of works.

    The Whole of the Works shall be carried out in strict accordance with the Drawings, Scope of Works, Specifications and Performance Requirements, and Condition of Contract.

c) The total price of our Bid excluding VAT is: _____(MUR):

d) Our bid shall be valid for a period of **Ninety (90) days** from the date fixed for the bid submission deadline in accordance with the Bidding Documents and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

e) We hereby confirm that we have read and understood the content of the Bid Securing Declaration attached hereto and subscribe fully to the terms and conditions contained therein, if required. We understand that non-compliance to the conditions mentioned may lead to disqualification.

f) If our bid is accepted, we commit to obtain a Performance Security, if applicable in accordance with the Bidding Document;

g) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 9;

h) We are not participating, as a Bidder in more than one bid in this bidding process;

i) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible under the laws of Mauritius;

j) We have taken steps to ensure that no person acting for us or on our behalf will engage in any type of fraud and corruption as per the principles described hereunder, during the bidding process and contract execution:

i. We shall not, directly or through any other person or firm, offer, promise or give to any of the Public Body's employees involved in the bidding process or the execution of the contract or to any third person any material or immaterial benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

ii. We shall not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelisation in the bidding process.

iii. We shall not use falsified documents, erroneous data or deliberately not disclose requested facts to obtain a benefit in a procurement proceeding.

We understand that transgression of the above is a serious offence and appropriate actions will be taken against such bidders.

k) We understand that this bid, together with your written acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

l) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive; and

m) If awarded the contract, the person named below shall act as Contractor's Representative:

Name: .....

In the capacity of: .....

Signed: .....

Duly authorized to sign the Bid for and on behalf of: .....

Date: .....

Seal of Company .....

BID SECURING DECLARATION

By subscribing to the undertaking in the Bid Submission Form:

I/We accept that I/we may be disqualified from bidding for any contract with any Public Body for the period of time that may be determined by the Procurement Policy Office under section 35 of the Public Procurement Act, if I am/we are in breach of any obligation under the Bid conditions, because I/we:

(a) have modified or withdrawn my/our bid after the deadline for submission of bids during the period of bid validity specified by the Bidder in the Bid Submission Form; or

(b) have refused to accept a correction of an error appearing on the face of the bid; or

(c) having been notified of the acceptance of our bid by the **Irrigation Authority** during the period of bid validity, (i) have failed or refused to execute the Contract, if required, or (ii) have failed or refused to furnish the Performance Security, in accordance with the Instructions to Quote.

I/We understand this Bid Securing Declaration shall cease to be valid (a) in case I/we am/are the successful bidder, upon our receipt of copies of the contract signed by you and the Performance Security issued to you by me/us ; or (b) if I am/we are not the successful Bidder, upon the earlier of (i) the receipt of your notification of the name of the successful Bidder; or (ii) thirty days after the expiration of the validity of my/our bid.

In case of a Joint Venture, all the partners of the Joint Venture shall be jointly and severally liable.

Qualification Information

*[The information to be filled in by **Bidders** in the following pages shall be used for purposes of post-qualification or for verification of prequalification as provided for in ITB Clauses 9. This information shall not be incorporated in the Contract. Attach additional pages as necessary. Pertinent sections of attached documents should be translated into English. If used for prequalification verification, the Bidder should fill in updated information only.]*

1. Individual Bidders or Individual Members of Joint Ventures

1.1 Constitution or legal status of Bidder: [*attach copy]*

Place of registration: [*insert]*

Principal place of business: [*insert]*

1.2 Bidder shall provide *one (1)* of works of a nature and amount similar to the Works performed as Main Contractor over the last 10 years.

Project/Contract name and country	Name of client and contact person	Type of work performed and year of completion	Value of contract (national currency)
(a)			

1.3 Proposed subcontracts and firms involved. Refer to General Conditions of Contract Clause 7.

Sections of the Works	Value of subcontract	Subcontractor (name and address)	Experience in similar work
(a) (b)			

[Bidders have to ascertain that sub-contractors executing works are duly registered with the CIDB in accordance with CIDB Act 2008.

1.4 Name, address, and telephone, telex, and facsimile numbers of banks that may provide references if contacted by the Public Body.

2. Additional

2.1 Bidders should provide any additional information Requirements requested in the Bidding Document.

PREAMBLE

1. INTRODUCTION

1.1 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 stated 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 or of contingencies for which there is a Provisional Sum) 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 shown in the Drawings and described in the Specification whether expressly mentioned therein or not.

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

1.3 Rates and prices are to cover fixing or finishing the work completely and fixing, laying, jointing, building in or finishing are therefore not usually specifically mentioned in the Bill of Quantities. Rates and prices shall include for all building in of valves, penstocks, pipes, ladders, walkways or similar and for all necessary brackets, gaskets, bolts, nuts, fittings and fixtures whether or not they are mentioned in the Bill of Quantities, and for painting of valves and penstocks as specified.

1.4 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 no rate or price is inserted against any item in the Bills the cost thereof will be deemed to have been included in other items priced by the Contractor.

1.5 All measurements in the Bill of Quantities are taken strictly net. The principle of net measurement shall apply to all Works executed. All quantities measured for payment will be measured by the Project Manager on the basis of actual quantities in place of accepted Works executed according to the principle of net measurement. Items not used shall not be measured or included by the Contractor in his statements.

1.6 The quantities given in the Bill are only approximate. 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.

1.7 Subject to the provisions of the Conditions of Contract the Contractor shall value the Permanent Works executed at the rates in the Bill of Quantities.

1.8 Where the Bill of Quantities does not include separate items for Contractor's Equipment, Temporary Works and the like the Contractor shall be deemed to have covered his obligations in these respects in the rates and prices for Permanent Works.

2. GENERAL

2.1 Permanent reinstatement of trench and surfaces, whether included in another item or separately itemised, shall include, but not by way of limitation, for:

- obtaining a permit to work from the relevant authority;
- temporary reinstatement of asphaltic surfaces in accordance with the Specification;
- permanent reinstatement by the Contractor or by the relevant authority;
- trench widenings for chambers and other ancillary structures;
- the removal and subsequent replacement of all kerb stones, paving stones, street lamps, road signs and safety barriers and other street furniture and all other costs and charges in connection therewith;
- forming and reinstating all openings on the line of a pipeline in fencing, hedging, walling or similar feature;
- breaking and opening trench surfaces, including subsequent restoration and reinstatement in road and elsewhere including the removal of any form of foundation thereto;
- crossing and reinstatement of all lined open drains, culverts, ditches, water-courses and similar items.

The term 'temporary' restoration or reinstatement as applied to surfaces other than roads shall be deemed to include for all works necessary to return the surface to its original or similar condition.

2.2 The rates and prices for excavation, whether included in another item or separately itemised, shall include for all types of ground encountered and for all ground conditions above or below water level. The Contractor must make due allowance that permission will not be granted for the use of explosives for blasting and other operations. All excavation measured by volume shall be measured net to the dimensions specified or as shown on the Drawings.

No allowance shall be made for bulking or for any extra transport required due to bulking.

The rates and prices for excavation shall include, but not by way of limitation, for:

- all necessary excavations to formation levels, including refilling, backfilling, ramming and disposal of surplus;

- excavating to the correct depth and preserving the bottoms of excavations in a state suitable for the reception of concrete, pipes or pipe bedding, and for filling over-excavated volumes or disturbed areas to the net dimensions as indicated on the Drawings;

- any additional excavation required for formwork, working space, temporary or permanent shoring, and subsequent refilling and ramming and disposal of surplus;

- provision of storage areas for the temporary storage of any material required for backfilling which cannot be stored alongside the excavation for any reason, together with the cost of transporting, loading and unloading such material and all other charges incurred in this respect;

- trimming the bottoms including bottoming to falls, and trimming to sloping surfaces where required or indicated on the Drawings;

- taking all precautions by supporting faces of excavation to ensure the safety of the workmen and to prevent damage to adjacent walls, buildings and all other structures and services and to prevent damage to road and other surfaces by slip or breaking away of trench sides or other cause, including permanent and/or temporary shoring of trenches;

- dewatering of trench in waterlogged areas.

- keeping the site and trenches and all other excavations free from water from whatever cause arising;

- all temporary and permanent measures required to protect and support all existing pipes, cables and services; including all chambers, culverts, gullies, and foundations thereto, or repair or replace them should they become damaged due to the Contractor's activities;

- all barriers, warning tapes, lighting, warning signs, traffic controls and any other measures necessary to ensure complete safety around the area of the works; and

- soils testing as required by the Specification

- selected fill , screened fill and compact with material not exceeding 10 mm to trenches to depth of 300mm above top of pipe;

- leaving open the pipe sockets till approval of testing

- compacted fill over selected fill layer up to ground level/hump?

- Part return

- reinstatement

- Excavation in rock shall be measured by volume obtained by multiplying the horizontal area of the rock in the excavation by the average thickness of the rock above the required formation level or other excavation level ordered by the Project Manager. The average thickness of the rock mentioned above shall be determined by the Project Manager by taking the arithmetical mean of 5 measurements of depth or such other number of depth measurements as designated by the Project Manager on Site.

  The horizontal area of the rock in the excavation shall be the product of the maximum trench width specified and the length over which the rock occurs.

  If the Contractor is dissatisfied with the volume of rock measured by the Project Manager, he shall immediately inform the Project Manager of his disagreement and submit details of the rock measurement carried out by him. The disputed rock estimate shall then be remeasured in the presence of the Contractor and the remeasured quantity will become final for the preparation of the Certificates of Payment.

2.3 The quantities for trench excavation shall be measured in successive horizontal bands along the centre line of the pipe. The term 'depth to invert' means depth to the lowest internal surface of the barrel of the pipe, the term 'cover' means the distance from original ground level to the highest external surface of the barrel of the pipe, enlargements of pipes at sockets and the like being disregarded**.**

For the purposes of measuring excavation in trench and rock excavation by volume the trench width shall be taken as the outside diameter of the pipe plus 400 mm and the depth from ground level to the formation level except where otherwise stated.

2.4 Rates for pipe bedding shall include, but not by way of limitation, for importation of satisfactory materials including any crushed rock and disposal of surplus excavated material.

2.5 Rates for blinding concrete, whether included in another item or separately itemised, shall include for all additional excavation, disposal of surplus and all necessary sawn formwork.

2.6 All concrete measured by volume shall be measured net but holes and box-outs for pipes, mortices and the like shall not be deducted.

The rate and prices for all grades of concrete and reinforced concrete whether included in another item or separately itemised, shall include, but not by way of limitation, for:

- all design of concrete mixes and testing as specified;

- all formwork including stop ends, splays, chamfers, rebates holes, throatings, openings, box-outs, cut-outs, slots mortices and like items. (Formwork shall be 'sawn' finish to all buried external faces of concrete below a line 250mm below ground level and shall be 'wrought' finish to all other faces);

- forming of chamfers (25mm x 25mm) to all exposed external angles of concrete structures whether indicated on the Drawings or not;

- forming expansion, contraction, movement and construction joints and for all waterstops, jointing materials, sealing compounds and formwork necessary for forming such joints;

- the building in of all pipes and fittings, bolts, frames for covers, iron and steelwork etc. and making good;

- the finishing of all concrete surfaces to falls and levels as indicated on the Drawings and the trowelling smooth (steel float finish) of all surfaces exposed to view or in contact with water;

2.7 The rates for reinforcement in reinforced concrete, whether included in another item or separately itemised, shall include, but not by way of limitation for supplying, handling, cutting, bending, distribution, cleaning, fixing and provision of spacers, supports and lacings, etc. and all soft iron tying wire or fixing clips.

2.8 The rates and prices for precast concrete units, whether included in another item or separately itemised, shall include but not by way of limitation for all concrete, reinforcement, ties, formwork, chamfers, recesses and other features as shown on the Drawings.

2.9 Rates for concrete benching and screeding, whether included in another item or separately itemised, shall include for finishings to a steel trowelled finish and to the contours as indicated on the Drawings.

2.10 The quantities for pipelines and pipework shall be measured along the centre line of the pipe through all fittings, chambers etc.

Rates and prices for pipeline construction and pipework shall include, but not by way of limitation for:

- supply, storing, handling, distributing, protecting and maintaining in good condition, cutting, turning, laying at any depth, jointing, protecting, testing and cleansing the pipelines and pipe work, together with the installation and incorporation of all joints, bends and tees, branch and in-line valves, air and washout valves, hydrants and all other fittings, except where separate items are included, necessary to produce a complete and continuous pipeline;

- protecting all buried metal pipes, fittings, flange joints and couplings;

- painting exposed valves and fittings as specified;

- temporary and permanent support blocks to pipes;

- supply and placing of warning tapes .

2.11 The rates and prices for all testing, whether included in another item or separately itemised, shall include, but not by way of limitation, for providing all consumables, water, transport of water, labour and equipment and for furnishing all specified test reports and certificates.

2.12 Rates for thrust and anchor blocks shall include for concrete and all additional excavation, trimming and sawn formwork as necessary. The concrete is to be placed on the full extent of the excavation as detailed in the Drawings but the blocks shall be the minimum size consistent with the Drawings.

2.13 The rates for washout, line valve, air valve, and other chambers on pipelines and pipework shall include but not by way of limitation for all extra excavation, refilling, ramming and disposing of surplus granular fill, concrete and formwork, blockwork, reinforcement, pre-cast units, bolts, testing, making good ground surface and painting pipes, valves, covers and fittings.

2.14 The rates and prices for connecting a pipeline to or into an existing pipeline shall include, but not by way of limitation for:

- any necessary trial holes to locate the existing pipeline;
- all additional excavations;
- Interruption and resumption of water supply.

2.15 Rates for Compacted Crushed Stone, Hardcore, or Compacted Granular Material shall include for compacted material as specified and for disposal of an equivalent volume of surplus excavated material. The rates shall include for blinding with fine material as necessary and finishing to the levels, slopes or falls required.

2.16 Rates for Compacted Selected Excavated Material shall include for compacted material as specified to the levels, slopes or falls required and finishing where exposed with fine topsoil 200mm thick. The rates shall include for material excavated from any part of the works.

2.17 Rates for marker posts shall include but not by way of limitation for all excavation, refilling, ramming, disposing of surplus, concrete, formwork, reinforcement, making good ground surface, plates, numerals, lettering and painting.

2.18 Rates for imported selected fill shall include for compaction as specified and for disposal of an equivalent volume of any surplus excavated material including boulders accumulated as a result of the use of imported selected fill.

2.19 Rates for the filling of the troughs/depressions under the pivot paths with surplus excavated materials obtained from the construction of delivery main, submains, laterals and cutting work shall include handling of stack materials, filling, compacting, levelling and double handling where required.

3. SWABBING AND CLEANING OF PIPES

No separate payment shall be made for complying with the requirements necessary for the swabbing and cleaning of the pipelines. All the costs of these operations shall be incorporated in the rate for laying and testing of the pipelines.

4. SCHEDULES OR SUB-BILLS

4.1 Where in the Bill of Quantities there is a Schedule or subsidiary bill setting out the quantities of component materials and work which comprise a unit of work measured under a single item in a Bill, the total price of the Schedule or subsidiary bill shall be the rate for the appropriate items ordered by the Project Manager shall be valued by deducting from or adding to the said total price, amounts in respect of reductions or adding to the said total price, amounts in respect of reductions or increases in quantity valued at the rates set out in the said Schedule or subsidiary bill or in the absence of such appropriate rates at rates fixed in accordance with the provisions of Clause 40.4 of the General Conditions of Contract.

5. DAYWORKS

5.1 The contract rates to be provided by the Bidders in the Schedule of Rates shall be used for the valuation of:

(a) Work executed on a daywork basis pursuant to Clause 50 of the Conditions of Contract, and

(b) Provisional Sum items in the Bill of Quantities which are described as being for work on a daywork basis.

No work shall be carried out as daywork except on the written order of the Project Manager.

5.2 The Schedule of Rates to be used for Dayworks bill will apply for the duration of the Contract

5.3 The chargeable time shall be the actual time for which the labour or plant is used on the works.

Labour

5.4 The Contract Rates for various classes of labour in the Schedule of Rates shall cover all the Contractor's obligations whatsoever in providing and maintaining such labour at the place of work including wages, payment for conditions and for skill, bonus, travelling and subsistence allowances and expenses, guaranteed time, holidays with pay, insurances of all kinds, pensions, site supervision, watching, administrative and welfare charges, the use and maintenance of stagings, scaffolding, portable electric tools, non-mechanical plant and hand tools of every kind, overheads, profit and all incidental expenses.

5.5 The cost of supervising foremen and working-gangers shall be deemed to be included under site supervision.

5.6 The Contract Rates for labour are for units of man-days and shall be deemed to be a normal working day of 8 hours. Any less time shall be paid for proportionally.

5.7 If overtime on work being carried out by daywork is authorised by the Project Manager, the Contractor shall be paid for such overtime in the same proportion as it is paid to the workmen. Thus, if a man works for ten hours for which he is paid eleven hours, the Contractor shall be paid eleven hours (i.e. 1.375 days) for such a man.

Plant

5.8 The Contract Rates for plant in the Schedule of Rates shall apply to all plant whether belonging to the Contractor or hired by him and shall cover all the Contractor's obligations whatsoever in providing and maintaining such plant at the place of work including all fuel and lubricants, all auxiliary equipment necessary for efficient operation and use of the plant, overheads and profits but excluding operators.

5.9 Payment for plant on daywork shall be limited to items listed in the Dayworks Bill or added thereto by the Contractor when tendering, unless otherwise agreed by the Project Manager.

5.10 The Contract Rates for plant shall apply both to plant which is already available on Site and to plant brought to Site especially for daywork, but in the latter case the Contractor shall be paid for his additional costs in transporting such plant to and from the Site.

5.11 The rates for plant shall be inclusive of all fuels, greases and other consumable stores, and of spare parts etc. but exclusive of operators, drivers, attendants etc., who will be paid for under the item for labour on the instructions of the Project Manager's Representative. Idle time shall not be paid for.

Materials

5.12 Payment for materials executed on daywork basis will be made on the net quantity used.

5.13 The rates shall cover for profit, transport, wastage, all overhead charges, and other on-costs from whatever cause arising.

Bidder is requested to fill the Schedule of Rates (at pages 51 to 56) to cover all items of work in this contract. The contract rates to be indicated in the Schedule of Rates shall be used for adjusting extras or omission.

6. PROVISIONAL SUMS

6.1 No item for which a Provisional Sum is inserted shall be purchased by the Contractor until the Project Manager has given written instructions to this effect and it shall be the duty of the Contractor to make an application to the Project Manager sufficiently in advance of the progress of the work for instructions with regard to each such items. The Contractor

shall obtain competitive quotations and samples if required and shall submit these to the Project Manager for approval.

6.2 The Contractor shall produce to the Project Manager the receipted accounts for all articles purchased under provisional. No payment to the Contractor shall be made in respect of the items until the said receipts have been presented to the Project Manager.

6.3 The Bidder shall enter the rates of corresponding items described as Provisional Sum

6.4 Provisional sums inserted in the Bill of Quantities in respect of materials to be specially imported for the Contract by the Contractor shall be deemed to include insurance, freight, dock and all other charges. In the case of imported materials obtained through a manufacturer's agent in Mauritius the sum shall be deemed to include the agent's fees and charges.

6.5 The Bills of Quantities include items in respect of the Provisional Sums for materials and sub-contracts given in the form of a percentage of the sums to be expended to cover the Contractor's profit and overheads, including but not limited to the costs of obtaining quotations for, and the placing of orders or awarding sub-contracts, and all expenses in connection with administering such orders or sub-contract and financing cost for payment of these sums until recovery from Interim Certificates.

6.6 Items described as **Provisional Sum** or **Prov. Sum** or **Provisional** in the column of Description or Unit of the Bill of Quantities shall be subject for approval from the Project Manager prior of executing the items of work.. Such items may be used in whole or in part, or not at all as instructed by the Project Manager.

7. METHODS OF PAYMENT

For the purposes of statements submitted, the Contractor shall include in his monthly statement the percentages listed in this section following the completion or stage specified and in the order shown.

(A) COMPLYING WITH CONDITIONS OF CONTRACT (Clause 39 and 40)

(B) SUPPLY OF IMPORTED IRRIGATION EQUIPMENT
80 % of CIF upon shipment as per Clause 39.8 of Section IV Particular Conditions of Contract.

(C) PIPELAYING WORKS	Percentage of for pipeline
1. Completion of pipelaying, select fill, and testing	80%

2. Completion of backfill, pipe cleansing, levelling and clearing of site 20%

8. OFFICES FOR THE PROJECT MANAGER'S REPRESENTATIVE

8.1 The rates for the offices for the Project Manager's Representative shall include for:-

(a) Supply and erection of offices complete with curtains;

(b) Provision and replacement where necessary of furniture, equipment and facilities as specified;

(c) Provision of electrical and water services;

(d) Provision of wastepaper baskets, benching and shelving, crockery, cups, saucers, soaps, towels;

(e) All necessary maintenance, watchman, regular cleaning and insurance.

8.2 The cost of telephone connection and charges shall be paid for out of the Provisional Sum for such charges.

8.3 All the furniture and equipment shall be reverted to the Employer after the completion of the works.

9. SURVEY WORK

All survey work ordered on Site by the Project Manager and carried out in accordance with the Specifications shall be measured under the following categories:

(a) Beacon Bench Marks shall be measured by number. No separate payment shall be made inter alia for transferring levels, check levelling, erection of Bench Marks and preparation of location plans.

(b) Survey of pipeline routes shall be measured by plan length of the pipeline. No separate payment shall be made inter alia for transferring levels from Beacon Bench Marks, providing and establishing chainage markers, check levelling and providing record sheets.

10. SURVEYING EQUIPMENT FOR PROJECT MANAGER'S REPRESENTATIVE

10.1 The rates for the provision of surveying equipment shall be deemed to include for the provision, substitution, replacement, maintenance, testing, calibration, removal, and all other incidental expenses.

12. METHOD RELATED CHARGES

12.1 In order that the Contractor may cover his costs in executing the whole of the Works in conformity with the contract documents, where those costs are not properly attributable to the quantity of permanent works to be executed, he may cover such costs in the Bills of Quantities as method related charges.

12.2 A Bidder may insert in the Bills of Quantities and in the space provided, such items for Method Related Charges as he may decide to cover items of work relating to his intended method of executing the works, the costs of which are not to be considered as proportional to the quantities, rates and prices for the other items.

12.3 Each item for a Method Related Charge inserted by the Bidder shall be fully described so as to define precisely the extent of work covered and to identify the constructional resources (plant, equipment etc.) to be used and the particular items of permanent or temporary works to which the items relate.

ABBREVIATIONS

The following abbreviations are used in the document:

ha	Hectare(s)
Cu.m or m^3	Cubic metre
E.O	Extra Over
Prov. Sum	Provisional Sum
m	Metre
lin.m	Linear metre
mm	Millimetre
Tonne	Metric Tonne
Sq.m or m^2	Square Metre
km	Kilometre
%	Percent
Ch.	Chainage
P.V.C	Polyvinyl Chloride
M.S.	Mild Steel
c.c.	Centre to Centre
D.I.	Ductile Iron
C.I.	Cast Iron
P/E	Plain End
F/PE	Flanged and Plain End
D/F	Double Flanged
MAMSL	Metres Above Mean Sea Level
G.I	Galvanised Iron
DN or ND	Nominal Diameter

OD	Outside Diameter
PN	Nominal Pressure
G.S	Galvanised Steel
Prov.	Provisional
wks	Weeks
No	Number
MUR	Mauritian Rupees

BILL OF QUANTITIES

CONVERSION OF EXISTING PIVOT IRRIGATION SYSTEM INTO DRIP IRRIGATION SYSTEM
POINTES AUX PIMENTS SMALL SCLAE IRRIGATION PROJECT

CONTRACT :Conv – Piv- Drip/IPU 24/01

SUMMARY OF BILL OF QUANTITIES

BILL NO	DESCRIPTION	MUR.
1	GENERAL AND PRELIMINARY	
2	CONSTRUCTION OF DELIVERY MAIN AND SUBMAIN IN PVC PN 10	
3	CONSTRUCTION OF INFIELD NETWORK IN PVC PN 6	
	Sub Total	
	Add VAT at 15%	
	Add Contigencies	700,000
TOTAL AMOUNT CARRIED FORWARD TO BID SUBMISSION FORM		

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Signature of Contractor **Name**

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Position: **Date(DD/MM/2024)**
Authorised for and on behalf of:

Company: ----------

BILL NO. 1

GENERAL AND PRELIMINARY

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	SPECIFIC REQUIREMENTS				
1.01	Supply and erect signboards as specified	No.	1		
1.02	Progress photographs on CD and Hard Copy in album	No.	50		
1.03	Supply as-built drawings on hard copy and on CD	Sum			
1.04	Supply, operation and maintenance manuals	Sum			
1.05	Supply original Standards (BS, ISO,etc) as specified	Prov. Sum			10,000
	METHOD RELATED CHARGES ***The bidder shall insert, described and price any items which he considers necessary to complete the works and which are not covered elsewhere in the bills (use additional sheet if necessary)***				
1.06	Time related supervision and management cost for the duration of the construction.	Sum			
1.07	Mobilisation, plant and equipment	Sum			
1.08	Site establishment, Contractor's office and workers' welfare	Sum			
1.09	Insurance	Sum			
1.10	Guarantees	Sum			
1.11	Demobilisation	Sum			
1.13	**Others (to be specified and priced by Bidder)**				
	TOTAL OF BILL NO. 1 CARRIED TO SUMMARY OF BILL OF QUANTITIES				

BILL No. 2
CONSTRUCTION OF DELIVERY MAIN AND SUBMAIN IN PVC PN 10

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	CONSTRUCTION OF DELIVERY MAIN AND SUBMAIN				
	EXCAVATION WORKS				
2.01	Site clearance as specified. Rate to include for reinstating top soil after pipe laying.	lin.m	1530		
2.02	Survey along pipe routes as specified.	lin.m	1530		
2.03	Remove and cart away rock boulders over and adjacent pipe alignment as directed by Project Manager (Prov Sum)	m^3	20		
2.04	Excavate in trench for OD 160 mm PVC pipe or less to depth not exceeding 2.5 m, part return and compact and part stack to be reused and part cart away to spoil. Rate to include for excavation in rocks and extra over for thrust block and anchor blocks.	m^3	1051		
2.05	Excavate for unsuitable material below formation level where ordered by the Project Manager (Provisional Quantity)	m^3	5		
2.06	Supply, lay and compact imported selected backfill materials as directed by Project Manager	m^3	316		
	PIPE BEDDING				
2.07	Supply, place and compact Class B bedding to OD 160 mm OD PVC pipe as specified.	lin.m	315		
2.08	Ditto but to 90 mm OD PVC Pipe	lin.m	1215		
2.09	Supply, place and compact bedding material to fill extra depth below formation level after removal of unsuitable ground (Provisional Quantity)	m^3	5		
	PIPE LAYING, PVC PN10				
2.10	Supply, lay, joint and test 160 mm OD RRJ Type PVC pipe (PN 10)	m	315		
2.11	Supply, lay, joint and test 90 mm OD solvent weld Type PVC pipe (PN 10)	m	1215		
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
	PVC FITTINGS (*Pressure rating PN 10)*				
	BEND				
2.12	Supply, lay, joint and test 160mm PVC socketed bend 90°RRJ type	No.	10		
2.13	Ditto but 90 mm & solvent weld type	No.	59		
2.14	Supply, lay, joint and test 160 mm PVC socketed bend 45° RRJ type (Prov)	No.	8		
2.15	Ditto but 90 mm & solvent weld type (Prov)	No.	20		
2.16	Supply, lay, joint and test 160 mm PVC socketed bend 22½° RRJ type (Prov)	No.	4		
2.17	Ditto but 90 mm & solvent weld type (Prov)	No.	6		
2.18	Supply, lay, joint and test 160 mm PVC socketed bend 11 1/4° RRJ type (Prov)	No.	4		
2.19	Ditto but 90 mm & solvent weld type (Prov)	No.	6		
	TEE				
2.20	Supply, lay, joint and test all socketed 160 mm PVC equal tee RRJ type	No.	4		
2.21	Ditto but 90 mm equal tee & solvent weld type	No.	14		
2.22	Supply, lay, joint and test all socketed 160 x 90 x 160 mm PVC tee RRJ type (Prov)	No.	1		
2.23	Supply, lay, joint and test DN 150 all flanged Galv Steel Tee	No.	2		
2.24	Supply, lay, joint and test DN 150 flexible flanged adaptor to suit OD 160 mm PVC pipe	No.	6		
2.25	Supply, lay, joint and test PVC tee 90 x 63 x 90 mm solvent weld type (Prov)	No.	3		
	REDUCER				
2.26	Supply, lay, joint and test PVC reducer 160 x 90 mm solvent weld type.	No.	7		
2.27	Ditto but 90 x 75 mm (Prov)	No.	2		
2.28	Ditto but 75 x 63 mm (Prov)	No.	2		
2.29	Ditto but 63 x 50 mm (Prov)	No.	2		
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
	CONNECTION WORK NEAR B3L2/B3L4 FILTER PLANT (All Fittings of PN 16 Pressure Rating)				
2.30	Dismantle fittings for existing tapping to Pte aux Piment Project, consisting of gate valve, galvanized steel pipe piece, air valve, bend 90^0, etc and deliver same to IA's store at Plaines des Papayes	Sum			
2.31	Supply, lay, joint and test flanged DN 200 Blank flange	No.	1		
2.32	Excavate to expose existing DN 400 delivery pipe in Galvanised Steel, part return and compact and part stack to be reused and part cart away to spoil. Rate to include for extra excavation for thrust block	m^3	3		
2.33	Supply, lay, joint and test DN 400 flanged galvanised steel tee with DN 250 flanged branch. Rate to include for cutting of existing DN 400 pipe and associated works.	No.	1		
2.34	Supply, lay, joint and test DN 400 Flanged adaptor to suit Galvanised steel pipe	No.	2		
2.35	Supply, lay, joint and test 250 mm HDPE electrofusion Flanged adaptor to suit Galvanised steel tee on one side and HDPE pipe OD 250 mm	No.	4		
2.36	Supply, lay, joint and test DN 250 x DN 200 Flanged Galvanised steel reducer to suit existing galvanised steel pipe of PAP project.	No.	1		
2.37	Supply, lay, joint and test OD 250 mm HDPE pipe PE 100 grade, PN 16 with couplings, galvanized steel straps and RC support as per manufacturer's recommendation and drawings.	m	25		
2.38	Supply, lay, joint and test 250 mm HDPE Bend 90^0, PN 16, electrofusion type	No.	8		
2.39	Excavation work to expose part of existing pipe of PAP project and adjustment of pipe length as deemed necessary.	No.	1		
2.40	Supply, lay, joint and test flanged DN 250 flanged gate valve. Rate to include formwork, supply, casting of concrete, for support block	No.	1		
2.41	Supply, lay, joint and test flanged OD 250 HDPE saddle clamp with DN 63 female threaded outlet.	No.	1		
2.42	Supply, lay, joint and test male threaded DN 63 double orifice air valve complete with double female threaded DN 63 isolating valve and nipple	No.	1		
2.43	Provision for other items that may required for connection works. (Prov Sum)	Prov Sum			250000
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
	CONNECTION WORK NEAR PIVOT INLET (All Fittings of PN 10 Pressure Rating)				
2.44	Disconnect all fittings downstream of drain valve up to pivot inlet consisting of control valves, filter, etc and return same to IA's store at Plaine des Papayes (Prov)	Sum			
2.45	Supply, lay, joint and test 160 mm PVC bend 90^0	No.	1		
	CONSTRUCTION OF MAIN HEAWORKS WITH CONTROL VALVES				
2.46	Supply, install, test and commissioning of DN 160 control valves in chamber (Total B/F from item 26 of Schedule 1)	No.	4		
	CONSTRUCTION OF SMALL HEAWORKS WITH PVC STOP VALVE (Type 1)				
2.47	Supply and install PVC casing OD 350 mm of length approx. 0.9 m with two holes of appropriate diameter drilled to enable installation of Double Union PVC stop valve.	No.	11		
2.48	Supply and install PVC cap for above casing of diameter 350 mm	No.	11		
2.49	Supply, lay, joint and test 90 mm PVC double union stop valve	No.	11		
2.50	Supply, lay, joint and test 90 mm PVC union solvent weld type	No.	22		
2.51	Supply, place and compact 25/50 aggregates	m^3	0.4		
	CONSTRUCTION OF SMALL HEAWORKS WITH PVC STOP VALVE (Type 2)				
2.52	Supply and install PVC casing OD 350 mm of length approx. 0.9 m with two holes of appropriate diameter drilled to enable installation of Double Union PVC stop valve.	No.	10		
2.53	Supply and install PVC cap for above casing of diameter 350 mm	No.	10		
2.54	Supply, lay, joint and test 90 mm PVC double union stop valve	No.	10		
2.55	Supply, lay, joint and test 90 mm PVC union solvent weld type	No.	20		
2.56	Supply, place and compact 25/50 aggregates	m^3	0.3		
2.57	Supply, lay, joint and test 90 mm PVC equal tee solvent weld type	No.	5		
	MISCELLANEOUS				
2.58	Supply, place and compact Grade 20 concrete to thrust blocks to fittings inclusive of extra excavation and formwork.	m^3	32		
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
2.59	Payment of crop compensation to planters (Prov Sum)	Prov Sum			20000
2.60	Additional works as directed by Project Manager with regards to pipelaying for further extension of delivery main, submain, construction of main headworks, stop valves and any ancillary works (Provisional)	Prov Sum			600000
2.61	Provision for other items not mentioned above but required for incorporation in permanent works(Bidder to describe, quantify and rate all such items hereunder)	Sum			
	TOTAL C/F				

BILL No. 3

CONSTRUCTION OF INFIELD NETWORK IN PVC PN 6

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	EXCAVATION				
3.01	Site clearance as specified. Rate to include for reinstating top soil after pipe laying.	lin.m	1448		
3.02	Survey along pipe routes as specified.	lin.m	1448		
3.03	Remove and cart away rock boulders over and adjacent pipe alignment as directed by Project Manager (Prov Sum)	m^3	20		
3.04	Excavate in trench for OD 90 mm PVC pipe or less to depth not exceeding 1.0 m, part return and compact and part stack to be reused and part cart away to spoil. Rate to include for excavation in rocks and extra over for thrust block and anchor blocks.	m^3	599		
3.05	Excavate for unsuitable material below formation level where ordered by the Project Manager (Provisional Quantity)	m^3	5		
3.06	Supply, lay and compact imported selected backfill materials as directed by Project Manager	m^3	180		
	PIPE BEDDING				
3.07	Supply, place and compact Class B bedding to OD 90 mm PVC pipe as specified.	lin.m	802		
3.08	Ditto but to OD 75 mm PVC Pipe	lin.m	130		
3.09	Ditto but to OD 63 mm PVC Pipe	lin.m	516		
3.10	Ditto but to OD 50 mm PVC Pipe (Prov)	lin.m	15		
3.11	Supply, place and compact bedding material to fill extra depth below formation level after removal of unsuitable ground (Prov)	m^3	5		
	PIPE LAYING				
3.12	**PVC PN6** Supply, lay, joint and test 90 mm OD solvent weld Type PVC pipe	lin.m	802		
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
3.13	Supply, lay, joint and test 75 mm OD solvent weld Type PVC pipe	lin.m	130		
3.14	Ditto but OD 63 mm	lin.m	516		
3.15	Ditto but OD 50 mm	lin.m	15		
	PVC FITTINGS ***All PVC fittings shall be of pressure rating PN 10***				
	BEND				
3.16	Supply, lay, joint and test 90mm PVC socketed bend 90°solvent weld type	No.	4		
3.17	Ditto but 75 mm	No.	2		
3.18	Ditto but 63 mm	No.	2		
3.19	Ditto but 50 mm (Prov)	No.	2		
3.20	Supply, lay, joint and test 90 mm PVC socketed bend 45°solvent weld type (Prov)	No.	4		
3.21	Ditto but 75 mm (Prov)	No.	4		
3.22	Ditto but 63 mm (Prov)	No.	4		
3.23	Ditto but 50 mm (Prov)	No.	2		
3.24	Supply, lay, joint and test 90 mm PVC socketed bend 22½° solvent weld type (Prov)	No.	2		
3.25	Ditto but 75 mm (Prov)	No.	2		
3.26	Ditto but 63 mm (Prov)	No.	2		
3.27	Ditto but 50 mm (Prov)	No.	2		
3.28	Supply, lay, joint and test 90 mm PVC socketed bend 11 1/4° solvent weld type (Prov)	No.	2		
3.29	Ditto but 75 mm (Prov)	No.	2		
3.30	Ditto but 63 mm (Prov)	No.	2		
3.31	Ditto but 50 mm (Prov)	No.	2		
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
	TEE				
3.32	Supply, lay, joint and test all socketed 90 mm PVC equal tee solvent weld type	No.	2		
3.33	Ditto but 75 mm equal tee	No.	2		
3.34	Ditto but 63 mm (Prov)	No.	2		
3.35	Ditto but 50 mm (Prov)	No.	2		
3.36	Supply, lay, joint and test all socketed 90 x 75 x 90 mm PVC tee solvent weld type (Prov)	No.	2		
3.37	Ditto but 75 x 63 x 75 mm tee (Prov)	No.	2		
3.38	Ditto but 75 x 63 x 75mm tee (Prov)	No.	2		
3.39	Ditto but 63 x 50 x 63 mm tee (Prov)	No.	2		
	REDUCER				
3.40	Supply, lay, joint and test PVC reducer 90 x 75 mm solvent weld type.	No.	4		
3.40 a	Ditto but 90 x 63 mm (Prov)	No.	25		
3.41	Ditto but 75 x 63 mm (Prov)	No.	2		
3.42	Ditto but 63 x 50 mm (Prov)	No.	1		
3.43	Ditto but 50 x 32 mm (Prov)	No.	1		
3.44	Ditto but 63 x 32 mm	No.	25		
3.45	Ditto but 75 x 32 mm	No.	3		
	END OF LINE ASSEMBLY (Manifold End)				
3.46	Supply, lay, joint and test 32 mm PVC socketed bend 90°solvent weld type	No.	25		
3.47	Supply, lay, joint and test OD 32 mm PVC pipe of length not exceeding 0.8 m, solvent weld type	No.	25		
3.48	Supply, lay, joint and test 32 mm PVC double union PVC quarter turn valve	No.	25		
3.49	Supply, install OD 200 mm PVC PN 6 Pipe, of length not exceeding 300 mm to house end of line assembly	No.	25		
	MISCELLANEOUS				
3.50	Supply, place and compact Grade 20 concrete to thrust blocks to fittings inclusive of extra excavation and formwork.	m^3	4		
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
	<u>Supply & Install In-field Drip Equipment</u>				
3.51	Supply, install and test 16 mm barbed insert tappings with gromet on PVC PN 6 pipes	No.	882		
3.52	Supply, lay, joint and test 16 mm ND blind tube of length not exceeding 1.0 m to insert tappings	No.	882		
3.53	Supply, lay, joint and test 16 mm barbed connectors with stop to connect blind tube to dripper lines 16 mm	No	882		
3.54	Additional works as directed by Project Manager with regards to pipelaying for further extension of manifolds, end of line assemblies, stop valves, drip equipment and any ancillary works (Provisional)	Prov Sum			400,000
3.55	Provision for other items not mentioned above but required for incorporation in permanent works(Bidder to describe, quantify and rate all such items hereunder)	Sum			
	TOTAL OF BILL No. 3 CARRIED TO SUMMARY OF BILL OF QUANTITIES				

SCHEDULE 1

MAIN HEADWORK ASSEMBLY

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	CONSTRUCTION OF CHAMBER				
	Excavation				
1	Excavation for valves in chamber	m^3	7.56		
2	E/O item 1 for excavation in rock	m^3	1.5		
	Concrete Works				
3	Supply, place and compact concrete Grade 15 to blinding layer 50 mm thick as specified	m^3	0.21		
4	Supply, place and compact concrete Grade 25 for strip footing of Valve Chambers, 250 mm thick, allowing for draining hole	m^3	1		
5	Supply, place and compact concrete Grade 25 for walls of valve chambers, 150 mm thick, allowing for boxing of pipes as specified in drawing	m^3	0.44		
6	Supply, place and compact concrete Grade 25 for ring beam & roof slab of valve chambers, 150 mm thick, allowing for frame of cover as specified.	m^3	0.37		
7	Supply, place and compact concrete Grade 20 for valve support.	m^3	0.15		
8	Supply and place high tensile reinforcement steel to valves chambers as specified.	ton	0.2		
9	Supply, place and dismantle vertical formwork to side of base, wall, concrete support and slab	m^2	12		
10	Supply, place and dismantle horizontal formwork to soffit of slab	m^2	1.45		
11	Supply and place step irons in valve chambers as specified.	No.	6		
12	Supply and place cover as detailed in drawings	Sum			
	TOTAL C/F				

Item No.	Description	Unit	Qty	Rate (MUR)	Amount (MUR)
	TOTAL B/F				
13	Supply and place 75 to 25 mm sized aggregates to form drainage layer	m^3	0.4		
	BLOCKWALLING				
14	Hollow Concrete Blocks to BS 6073, Type A 3.5 N/mm^2 in cement mortar (1:3) as specified. Construct 150 mm thick walls with concrete block	m^2	9		
15	Subtotal of item 1 to 14				
16	**Subtotal of item 15 hereto brought forward**				
	DN 150 CONTROL VALVE ASSEMBLY				
17	Supply, lay, joint and test galvanised steel anchoring cut pipe piece of length 1000 mm with puddle flange centrally positioned as per drawing. Cut pipe piece to be flanged to DN 150 on one side and spigotted to fit PVC pipe OD 160 mm on other side.	No.	2		
18	Supply, lay, joint and test DN 150 flanged gate valve (PN 10)	No.	1		
19	Supply, lay, joint and test DN 150 flanged dismantling joint (3 tied)	No.	2		
20	Supply, lay, joint and test DN 150 flanged galvanized steel tee with one ¼" female threaded outlet and 63 mm female threaded outlet both with equivalent size isolating valve.	No.	2		
21	Supply, lay, joint and test glycerine type manometer with scale to read at 0.2 bar intervals up to 6 bars, with ¼" male threaded inlet to fit ¼"isolating valve of item 20	No.	2		
22	Supply, lay, joint and test DN 63 male threaded double orifice air valve to fit 63 mm isolating valve of item 20	No.	1		
23	Supply, lay, joint and test DN 150 double flanged pipe piece approx. 0.6 m long (exact length to be determined on site)	No.	1		
24	Supply, lay, joint and commission DN 150 flanged flow limiting and pressure reducing valve to regulate a downstream flow rate and pressure. (downstream pressure shall be adjustable in the range of 1.5 – 3.5 bars and flowrate shall be adjustable in the range of 3 to 10 lps)	No.	1		
25	Supply, lay, joint and test DN 150 flexible coupling to suit spigot end of galvanised steel pipe on one side and OD 160 mm PVC pipe on other side	No.	2		
26	**Total of item 16 to 25 carried to Item 2.46 of Bill No 2**				

SCHEDULE OF RATES

SCHEDULE OF RATES - 1

SCHEDULE OF RATES - 2

SCHEDULE OF RATES - 3

SCHEDULE OF RATES - 4

SCHEDULE OF RATES - 5

SCHEDULE OF RATES - 1

PLANT AND EQUIPMENT

The rates to be inserted herein are to include all operational maintenance costs including fuel, oil, grease, spare parts, repairs, any extra costs of overtime and all superintendence, overheads and profit. The rates shall also include for all travelling time and costs for the plant operators, etc, to, from and about the site. Idle time where due solely to the nature of the dayworks or the authorised method of procedure will be paid for at 1/2 (one half) of the rates entered herein. Idle time due to breakdowns, inefficiency or unsuitability or incompleteness of the plant will not be paid.

ITEM No	DESCRIPTION	UNIT	RATE (MUR)
1.01	Water Bowser (500L)	hr	
1.02	Concrete Mixer (1 m^3)	hr	
1.03	Concrete vibrator (50 mm)	hr	
1.04	Tipper truck (7 tonne)	hr	
1.05	Mobile Crane	hr	
1.06	Dumper (0.76 m^3)	hr	
1.07	Compressor & Tools (3 m^3/min)	hr	
1.08	Hydraulic Excavator (caterpillar, poclain, etc) and accessories	hr	
1.09	360° Backhoe Excavator (0.76 m^3) and accessories	hr	
1.10	Skid Steer loader (Bobcat, caterpillar, etc) and accessories	hr	
1.11	D8 Bulldozer and accessories	hr	
1.12	D4 Bulldozer and accessories	hr	
1.13	4 KVA generator and electric drill, Welding set	hr	
1.14	Tandem Roller 6.8 T		
1.15	Vibrating Roller 3.5 T	hr	
1.16	Hand Propelled Vibrating Roller	hr	
1.17	100 mm dia pump	hr hr	

Signature: ……. Date: ……

SCHEDULE OF RATES - 2

LABOUR

The rates inserted herein are to include all costs of labour and maintenance of tools and small plants such as scaffolding, trestles, wheelbarrows, picks, shovels, handpumps, etc; any extra costs of overtime, insurances, accommodation, travelling time and expenses to, from and about the site, etc; together with all superintendence, overheads and profit.

ITEM No	DESCRIPTION	UNIT	RATE (MUR)
2.01	Labourer	hr	
2.02	Pipelayer	hr	
2.03	Steel Fixer	hr	
2.04	Carpenter	hr	
2.05	Mason	hr	
2.06	Fitter	hr	
2.07	Driver	hr	
2.08	Planter Operator	hr	

Signature: …… Date: ……

SCHEDULE OF RATES - 3

MATERIALS

The Materials are to be all to the qualities and descriptions stated in the specifications. The rates inserted herein are to include all loading, transport, unloading, storage, double-handling,etc., together with all overheads and profit. Payment for materials authorised by the Project Manager for use on dayworks and not included in the following items shall be at net invoice costs received for supply and delivery to a central store or stockpile area on site. The net quantities and weights actually used and verified by the Project Manager only shall be certified and paid under dayworks.

ITEM No	DESCRIPTION	UNIT	RATE (MUR)
3.01	Crusher run 100 mm down	m^2	
3.02	Reinforced concrete, class 15, including formwork, casting, removing formwork, finishing etc.	m^3	
3.03	Reinforced concrete, class 25, including formwork, casting, removing formwork, finishing etc.	m^3	
	Class B bedding material		
3.04	Crushed Basalt Sand	m^3	
3.05	Stone pitching	m^3	
3.06	Portland Cement	m^2	
3.07	Coarse Aggregate any size	T	
3.08	Sand or Fine Aggregate	m^3	
3.09	Crusher Run 0/20	m^3	
3.10	Crusher Run 0/31.5	m^3	
3.11	Spalls/Hardcore	m^3	
3.12		m^3	

Signature: …… Date: ……

SCHEDULE OF RATES – 4

SURVEY EQUIPMENT

ITEM No	DESCRIPTION	UNIT	RATE (MUR)
4.01	Engineers automatic level and staff	day	
4.02	Theodolite, vernier reading to 1 second	day	
4.03	Lazer levelling device for pipelaying	day	
4.04	Electronic distance measuring device including theodolite	day	
4.05	Ranging rod and pole	day	

Signature: ……. Date:……

SCHEDULE OF RATES – 5

EXCAVATION AND BACKFILLING

ITEM No	DESCRIPTION	UNIT	RATE (MUR)
	Excavation The rates for excavation shall include trimming of sides, forming steps, keeping excavation free from water or mud, stacking and carting away of materials as directed by Project Manager.		
5.01	Excavation in soil to depth not exceeding 2 m	m^3	
5.02	Excavate in soil to depth exceeding 2 m but not exceeding 4 m	m^3	
5.03	Excavation in hard rock to depth not exceeding 2 m	m^3	
5.04	Excavate in hard rock to depth exceeding 2 m but not exceeding 4 m	m^3	
5.05	Excavate for unsuitable material below formation level where ordered by the Project Manager	m^3	
	Backfilling The rate to include for supply, placing and compaction as per specifications.		
5.06	Hardcore filling consisting of sound hardstone not exceeding 150 mm size and compacting in layers not exceeding 250 mm thick	m^3	
5.07	Soil materials free from organic matter and stones and compacted in layers not exceeding 150 mm Compact Class B bedding under pipes as specified	m^3	
5.08	Compact Class B bedding under pipes to fill extra depth below formation after removal of unsuitable ground	m^3	
5.09		m^3	

Signature : ……. Date :……

A . SCOPE OF WORKS, SPECIFICATIONS AND PERFORMANCE REQUIREMENTS

- Section 1 : General
- Section 2 : The Site
- Section 3A : Pipe and Pipework Materials
- Section 3B : Pipeline Construction
- Section 4 : Earthworks
- Section 5 : Concrete for Minor Works
- Section 6 : Miscellaneous Works

1.0 GENERAL

1.01 Location and Brief Description

The Works referred to under this procurement exercise relate to Pointe Aux Piments Small Scale Irrigation Project which was implemented in the Year 2000. Most of the fields within the Project are irrigated by a Centre Pivot System and the remaining fields in the corners are under Drip Irrigation System. Since the Centre Pivot has reached its life span, a modern Drip Irrigation System will now be installed on the entire project area covering 38 ha of lands belonging to some 125 small Planters. The implementation of this project will improve water application efficiency and also to ensure a better irrigation service to the Planters.

The source of water for the Project is from La Nicoliere Reservoir and irrigation water is supplied to the Project command area to service a gravity fed Drip Irrigation System via existing Filtration Plant and delivery main.

The Project Area is located in the Northwest of the island and found next to the village of Pointe Aux Piments as per the Context/Location Plan - Drg No. IA 24/PAP-Drip/01.

The Scope of Works for Conversion of the Existing Pivot Irrigation System into Drip Irrigation System shall be as follows:

a) Dismantling of existing valves and equipment on inlet of Centre Pivot System and return all the irrigation parts to the store of IA at Plaine des Papayes.

b) Diversion of existing Delivery Main PVC Pipe OD 160 PN 10 beyond existing Drain Valve Chamber in the vicinity of the compound of existing Centre Pivot with the supply, install and test of new extended Delivery Main of about 315 m long in PVC Pipe OD 160 PN10.

c) Connection works to existing Filter Outlet, found within the compound of M1B3L2 /M1B3L4 Filtration Plant Unit, and existing PVC Pipe OD 200 PN 16 complete with all associated fittings for the purpose of diverting flow of irrigation water to existing Delivery Main/new extended PVC Delivery Main OD 160 mm.

d) Supply, lay and test new Submain/Distribution pipeline of about 1215 m in PVC of OD 90 mm and PN 10 linking onto the exiting/new extended Delivery Main vide Main Headworks and running towards Small/In-Field Headworks.

e) Supply, lay and test PVC Distribution Maniflold of approximate total length of approximately 1450 m in PVC of OD 50/63/75/90 mm and PN 6 together with inserts/risers for connection to field dripper lines.

f) Supply, install and test of DN 160 Control Valves to be housed in reinforced concrete/blockwall chambers for Main Headworks, tapping water from the Delivery Main and feeding the Submain/Distribution pipeline vide the Control Valves.

g) Supply, install and test of DN 90 PVC Stop Valves to be housed in PVC Casings for Small/In-Field Headworks, tapping water from the Submain/Distribution pipeline and feeding the Distribution Manifold.

h) Earthworks associated with trenches for laying of pipes, excavation for construction of Headworks, etc.

i) Preparation of trenches including their shoring if necessary and placing of specified bedding materials.

j) Backfilling of trenches with the specified backfill materials.

k) Construction of temporary works where required.

l) Final testing and commissioning of the whole of the works including the making good of possible defects.

The whole of the works shall be carried out in strict accordance with the Drawings, Scope of Works, Specifications and Performance Requirements; and Conditions of Contract.

The completion period shall be **Two Hundred and Seventy (270) calendar days** from the Start Date.

1.02 List and Order of Materials

Prior to order for local manufacture or shipment the Contractor shall prepare and submit to the Project Manager for approval the lists of all pipes, fittings, valves, hydrants, jointing materials, etc required for the construction of each component of the Works from the information given in the Drawings, Bill of Quantities and the Specifications (Employer's Requirement).

The Contractor shall satisfy himself as to the quantities of the materials required for the Works and shall notify the Project Manager in writing if he considers that there are any discrepancies between the Drawings and Bills of Quantities or deficiencies in the Quantities indicated in the Drawings. The Contractor shall dig trial pits to locate exactly the existing pipeline and to verify the pipe diameter prior to order of any corresponding fittings required.

The Contractor shall prepare schedules for each component of the Works, in tabular or graphical form, showing how the various items of each component fit with one another. The Contractor shall satisfy himself that the various methods of connections, i.e. flexible couplings, flanges, flange adaptors, joints, threading's etc match with one another and he shall notify the Project Manager in writing of any discrepancy he may have discovered.

The aforesaid notifications shall be made two calendar weeks before work is scheduled to start on Site and an absence of notification within the prescribed period shall be deemed to be an absence of deficiencies or discrepancies in the Drawings and Contractual Documents.

The Employer or Project Manager will not be liable to the Contractor for any delay due to any deficit or discrepancy in the Drawings unless such deficiency or discrepancy is notified at that time.

1.03 Drawings of the Works

All the Drawings of the Works herewith attached in the Bid and numbered Drawing No. IA 24/PAP-Drip/01 to 19. It shall be the responsibility of the Contractor to check any information therein prior to submitting his bid and to start of works. Any modifications or assumptions made on these drawings shall be notified by the Bidder in the separate memorandum.

The Bidder shall submit with his bid any additional drawings which he has used for pricing his bid.

1.04 Details of Existing Pipelines, CEB Lines and Other Infrastructures

The Contractor shall verify the presence of pipelines, electric cables, underground structures and other infrastructures prior to execution of works within immediate surroundings to the site, and execute works without disturbing any of these features. Any disturbance caused to such infrastructures shall be immediately notified to the Project Manager.

Prior to excavations across the existing mains, the Contractor shall dig out the number of trial pits he judges necessary for exact identification of location and depth of the existing buried pipes. He shall submit to the Project Manager for approval a methodology for excavation at these crossings for laying the new pipes so as not to disturb or damage the existing one, prior to pipe laying works.

1.05 Programme of the Works

The Contractor shall submit at the time of the bid submission a Programme of Works to complete the Works in **Two Hundred and Seventy (270) calendar days from the start date**.

Within 7 (seven) days after the issue of the Letter of Acceptance, the Contractor shall re-submit to the Project Manager for his approval:

(a) A full detailed programme of works showing the timing, order of procedure and general methods for carrying out the works, with timing for mobilization of equipment and plant for purchase of important materials for different stages of works.

(b) The organisation, staff, labour, equipment and plant proposed to direct and administer the performance of the Contract.

The Project Manager may ask the Contractor to amend the Programme of Works at this time or any other time. The Works shall be carried out forward to completion with the greatest possible expedition to the satisfaction of the Project Manager in accordance with the Programme of Works.

The Contractor shall take the following into consideration while preparing the Programme of Works:

(i) The methodology for excavation near existing buried main pipes within the compound of M1B3L2 /M1B3L4 Filtration Plant Unit shall be approved by the Project Manager prior to the excavation works, so as to ensure there is no damage done to the pipes. Part of the excavation works and trimming works shall be done manually so as not to damage the pipes;

The Contractor shall dig out the number of trial pits he judges necessary for exact identification of location and depth of the existing buried pipes;

(ii) Reinstatement should follow immediately after backfilling works;

(iii) The Contractor shall ensure that all excavated materials and materials to be incorporated in the Works shall be stacked off roads to give free access to planters and other users;

(iv) During execution of works by the Contractor the Irrigation Authority will continue to carry out its day to day activities of irrigation operation within other parts of the Irrigation Project using the existing irrigation network. The Contractor will take all precautions so as not to damage the existing network in particular at places where excavation shall be done across these existing pipelines. In case of damage done by the Contractor on the existing network, he shall take immediate action to make good so that irrigation can resume the same day;

(v) Water cut shall be confined as far as possible to the places where works are under progress. Works requiring close down on the whole irrigation project shall done as far as possible on weekends or such other days when there are no irrigation activities. Water cut shall be limited only to the connection works on outlet pipe of filtration plant and existing delivery main within the compound of M1B3L2 /M1B3L4 Filtration Plant Unit. The Contractor shall inform the Project Manager (PM) at least two weeks prior to execute any work requiring water cut. The PM shall make arrangement for water cut after consultation with the Operation and Maintenance Department of the Irrigation Authority;

(vi) The Contractor shall carry out the work in an orderly manner so as to cause minimal disruption to farming activities

(vii) The programme shall show all resources (labour, plant and equipment and cash flow) necessary to plan the weekly and monthly progress between the commencement and completion dates;

The critical path with all activities involved therein shall clearly be shown.

1.06 Surveys

The Contractor shall supply to the Project Manager, in duplicate, maps and records in an approved form giving details of the location and levels of each bench mark to be established by the Contractor.

Levels shall be transferred and described to each Beacon Bench Mark within an accuracy of 5K mm, where K is the length in kilometers of the leveling circuit.

The method of surveying shall be to the approval of the Project Manager. Field books and tabulated data shall be well maintained and made available for inspection and checking by the Project Manager.

1.07 Standards

Except where otherwise specified, all materials to be supplied under the contract shall conform with the requirements of the relevant and latest standard issued by the International Standard Organisation and the workmanship shall conform with the requirements of the relevant and latest British Standard Codes of Practice issued by the British Standard Institution. Other equivalent national standard specifications may be used in the absence, or in the place of a relevant ISO or BSCP standard, at the sole discretion of the Project Manager and with his approval. The standards of workmanship and finish shall be uniform throughout be approved by the Project Manager.

The standards mentioned herein are issued by the Organisations listed in table 1.1 where the abbreviations used are defined.

All materials and workmanship not fully specified herein or covered by the standards mentioned before shall be of such kind as is used in first class work. The Project Manager shall determine whether all or any of the materials offered for use in the works are suitable for the purpose for which they are intended and the Project Manager's decision in that respect shall be final.

The Contractor shall supply at his own cost and shall permanently keep on sites all the standard specifications and Codes of Practice. These documents shall be available at all times for inspection and use by the Project Manager's Representative and shall revert to the Contractor at the end of the Contract.

Table 1.1

Name and Address	Abbreviation
International Standard Organisation Code Postale 56 1211 GENEVA 20, Switzerland	ISO
Mauritius Standard Bureau MOKA, Mauritius	MS
British Standard Institution 389 Chiswick High Road GB- London W4 4 AL	BS BSCP
Association Française de Normalisation 23, Rue Notre Dame des Victoires 75002 - PARIS, France	AFNOR
Deutsches Institut für Normung Benth Vertrich Strasse 1 BERLIN 30, West Germany	DIN
American Water Works Associtation 6666 West Quincy Avenue DENVER CO 80197, USA	AWWA
American Society for Testing Materials	ASTM

1916, Race Street PHILADELPHIA PA 19103, USA	
International Electrotechnical Commission Boite Postale 56 1211 GENEVA 20, Switzerland	IEC
Standard Comite Europeen de Normalisation Rue de Stassart, 36 B 1050 Bruxelles	CEN
Normes Francaise, AFNOR Tour Europe, F92049 Paris- La Defense FRANCE	NFC
Union Technique de L'Electricite 33, Ave. du General Leclerc BP 23-92262 Fontenay-aux-Roses - CEDEX	UTE
European Norm ON-CEN, PO Box 130, A-1021 WienAUSTRIA	EN
Indian Standard Bureau of Indian Standards Manak Bhavan, 9 Bahadur Shah Zafar Marg New Delhi-110002 INDIA	ISI
American Petroleum Institute American Society of Mechanical Project Managers American Welding Society American National Standards Institute 1819 L Street NW Washington DC 20036, USA	API, ASME AWS ANSI
Japanese Industrial Standards JISC C/o Standards Dept, Ministry of International Trade & Industry 1-3-1 kasumigaseki Chiyoda- KU Tokyo 100 – 8901 JAPAN	JIS

1.08 Quality of Materials

All materials, fixtures, fittings and specials to be supplied and generally all supplies to be made under the Contract shall be new and unused and shall be of ISO, BS, or other recognized standards, of first-grade quality and of the best design and workmanship. Inferior or low grade supplies shall be rejected by the Project Manager. When the Contractor shall obtain a quotation from Suppliers or Manufacturers for the supplies, the Contractor shall supply to the said Suppliers or Manufacturers all information to ensure compliance of the supplies with the Project Manager's Specifications and shall communicate a copy of the relevant clause of the said Specification to such Suppliers or Manufacturers if necessary.

1.09 Plant and Equipment

In addition to what has already been specified, all Plant and Equipment shall be designed to provide adequate protection against the entry of vermin and dust and to minimize fire risk and consequential fire damage.

All parts which can be worn or damaged by dust shall be totally enclosed in dust proof housings.

All equipment shall operate without excessive vibration and with minimum of noise.

All similar items of plant and equipment and their components together with spare parts shall be made from the same materials and shall be fully interchangeable.

All manually operated plant and equipment not located inside a building shall be provided with facilities for making it tamperproof. This is in addition to any requirements of the Specification for securing Plant under operational conditions.

2.0 THE SITE

2.01 Site

The site location is indicated on the relevant portion of the 1:25,000 map of Mauritius appended hereto as shown in Drawing IA 24/PAP-Drip/01 and further detailed in Drawings IA 24/PAP-Drip/02 to 19

2.02 Topography of Site

The land is relatively flat to gentle slope on most of the project.

2.03 Inspection of Site

The availability of above data and drawings do not relieve the Contractor of his responsibility to inspect the Site for further investigations required for design or execution of the Works.

He shall assess the presence of all visible structures or obstacles, rock piles and ranges, trees, shrubs, steep slopes etc., check the data described in Section 1 of the Employer's Requirements and ascertain that the equipment he intends to propose is perfectly adapted to operate fully and satisfactorily under topographical conditions of the site.

2.04 Access to Site

The Project Manager in consultation with the Employer shall grant possession of site or part of it to the Contractor as specified in Conditions of Contract.

2.05 Clearance of Site

Site clearance shall be carried out over areas to be occupied by the Works and for working space and shall consist of removal and carting away of all trees, sugar cane, bushes and other vegetation and the grubbing out of all roots and also rocks and boulders.
Topsoil so removed shall be kept aside and reused during site reinstatement.

2.06 Site to be tidy

The Site shall be maintained in a neat, tidy and healthy condition, and the Contractor shall remove all waste, debris and unwanted materials from the Site upon completion of project.

2.07 Safety on Site

The Contractor shall take necessary steps to ensure that the Site is run in an orderly manner and that safety precautions are enforced to avoid accidents to the personnel of the Contractor and to other parties working on Site.

2.08 Water and Electricity Supply

Water and electricity shall be made available by the Contractor for the purpose of the works

2.09 Planters' activities on site

The Contractor will take all precautions so as not to damage the existing network in particular at places where excavation shall be done across these existing pipelines and hydrants. In case of damage done by the Contractor on the existing network, he shall take immediate action to make good so that irrigation can resume the same day.

2.10 First Aid Outfit

The Contractor shall provide and maintain on Site in readily available positions near the sites of work, adequate first aid outfit. Fire extinguishers shall also be kept on site.

2.11 Maintenance of Services and Structures

The Contractor shall ascertain the location of all boreholes, watercourses, sewers, drains, water pipes, electricity and telecommunication cables other services and structures which may be encountered during the execution of the Works. He shall temporarily support or divert and subsequently reinstate all such services and structures as necessary and to the satisfaction of the Project Manager.

As soon as any such service or structure is encountered on, over, under, in or through the Site during the performance of the Contract, the Contractor shall make a record of the location and detailed description of such service or structure and shall send the same forthwith to the Project Manager.

Where permanent diversion or support of such service or structure is rendered necessary as the unavoidable result of the construction of the Works in accordance with the Contract, the Project Manager - after consultation with the Employer will instruct the Contractor as to the diversion or support to be provided and the Contractor shall be paid the costs thereof in accordance with Clause 37 of the General Conditions of Contract.

2.12 Site Records

Where specified or ordered by the Project Manager, the Contractor shall take and test samples of the materials and water in and about the excavations and in the fill.

The Contractor shall make records of the position and extent in the excavations of every type of service, stratum and ground water encountered during the construction of the Works and of samples taken and results of tests of such materials and water.

The Contractor shall also make records of the labour, plant and material employed on site. The plant schedules and labour time sheets shall be submitted for approval to the Project Manager's Representative on every working day.

The records shall be prepared in a form to the approval of the Project Manager and shall be submitted to him in duplicate as soon as practicable after the events and observations which they record.

2.13 Pipes, fittings and irrigation equipment and Store yard

All pipes, fittings, irrigation equipment and other materials to be used in temporary or permanent works shall be delivered from ships or local suppliers to a store yard close to the project area. The programme of delivery of these items shall be supplied by the Contractor in his separate memorandum. No equipment shall be stored directly on site of works without approval from the Project Manager.

The Contractor shall make his own arrangements for all land, store yards, stores, workshops, offices, etc. and for all services in connection therewith. The location of all store yards, stores, workshops, offices, etc. shall be agreed beforehand with the Project Manager and shall be such as to avoid obstruction and nuisance to the public. The yards shall be levelled fenced on all sides and maintained to the satisfaction of the Project Manager throughout the Contract period by the Contractor.

The Contractor shall deliver all pipes, valves, fittings and irrigation equipment to the store yard where they will be inspected by the Project Manager prior to acceptance. The Contractor shall then take over all accepted equipment and provide for their storage, security and insurance of same until incorporation in the Works at same yard.

The storage of the pipes, fittings and irrigation equipment shall be to the satisfaction of the Project Manager.

At time of delivery and acceptance, the equipment to be incorporated in the Works shall be inspected by the Contractor who shall thereafter be responsible for their storage, stock control and safe keeping. The Employer or the Project Manager shall be in no way responsible for breakages or losses of equipment at the Contractor's stores once the Contractor has received the items in good condition, and such items shall be replaced or repaired by the Contractor to the satisfaction of the Project Manager at no cost to the Employer.

The Contractor shall keep structured records on all items available in the store, i.e. date of shipment, date of delivery, date of issue to be incorporated in Works, quantity used/left in stock, quantity damaged, etc. Such records shall be made available to the Project Manager on a regular basis. The above records shall be kept separately for the different blocks shown in drawings.

2.14 Contractor to work from Points as directed

The Contractor shall work between such points as the Project Manager’s Representative may from time to time direct. To avoid any risk of flotation of large diameter pipelines during periods of heavy rains, the Contractor may have to progress with pipe laying work in an uphill direction, keeping completed sections of the pipeline filled with water.

2.15 Restrictions on use of roads

(a) Traffic Restrictions

The Contractor shall not run tracked vehicles or tracked plant on any public or private road without the written approval of the Project Manager and the responsible authority or owner and subject to such conditions as each may reasonably require.

The Contractor shall observe all weight and dimensions restrictions which apply to road and tracks in Mauritius and he shall comply with all restrictions which may from time to time be imposed by the Project Manager, Employer, Police, responsible authority or owner. Where damage to roads and tracks is caused by the Contractor this shall be repaired at the Contractor's expense. In particular the Contractor shall fill potholes in roads with road stone when these are deepened by his plant.

The Project Manager shall have the power to restrict the Contractor's use of any roads, either in direction of traffic, speed of traffic or numbers of vehicles in order to preserve such roads or to make such roads safe for use by the general public.

Where other Contractors require the use of these roads or tracks, the Project Manager may prescribe times of usage, or any other form of control, which shall be executed by the Contractor, including the supply of traffic lights, flagmen, or any other thing.

(b) **Pipelaying in Public Roads**

Notwithstanding requirements stated elsewhere in the Specification, the Contractor shall comply with the additional requirements contained in this Clause whenever carrying out any work in connection with pipelaying in or adjacent to public roads.

The Contractor shall at all times carry out any work in or adjacent to public roads in a manner to the approval of the Project Manager and the responsible authorities and only at such times and during such hours as may be agreed by the competent authority. The Contractor shall obtain any permits from authorities that are required.

At no time shall the Contractor commence work in or adjacent to any public road without prior approval of the Project Manager.

The Contractor shall, when working in or adjacent to any public road, cause the least interference possible to the flow of traffic and shall at all times, maintain unimpeded sufficient width of the carriageway to permit single lane traffic.

The Contractor shall control the flow of traffic past restrictions caused by his operations by means of stop/go boards or traffic signals positioned at both ends of the restricted section of road. Traffic control shall be to the approval of the Ministry of Public Infrastructure and Public Safety, the police and the Project Manager and be in operation at all times and for as long as any restrictions caused by the Contractor's operations exist. They shall be continuously attended by flagmen. Warning signs shall be posted well in advance of any section of restricted road.

All sections of roadway affected by the Contractor's operations shall be bounded by barriers, tapes, bunting or similar means to afford adequate and effective warning to all road users.

The Contractor shall at no time string pipes along the carriageway of any public road.

The Contractor shall arrange his work in or adjacent to public roads in such a way that the length of road restricted by his operations shall at no time exceed 50 m without the written consent of the Project Manager and restricted sections of road shall be separated by at least 500 m of clear unrestricted roadway.

(c) **Flagging, Lighting, Watching and Traffic Control**

The Contractor shall be responsible for watching and lighting the Works and for the flagging and control of traffic and he shall comply with the requirements of the Employer and Police and the relevant authority in these matters.

(d) **Access Roads**

All surfaced roads, tracks and surfaced areas used by the Contractor shall be continually maintained by him in good condition. Immediately after ceasing to use any road, track or surfaced area the Contractor shall restore it to the satisfaction of the Project Manager and the responsible authority or owner.
The provision of this Clause shall apply also to the shoulders and verges of any existing sealed road used by the Contractor and affected by his operations.

2.16 Site Office and services for Project Manager (not applicable)

Site Office

The sub office of the Irrigation Authority at Chemin Grenier in the building of the Mauritius Cane Industry Authority shall be used by the Project Manager as site office.

2.17 Contractor's staff, Communication, Offices etc.

(a) **General**

The Contractor shall advise the Project Manager at which of his offices any notices may be served.

(b) **Language of Correspondence and Records**

All communications between the Contractor, the Project Manager and the Employer shall be in the English language. All books, time sheets, records, notes, drawings, documents, specifications and manufacturers' literature etc. shall be in the English language. If any document is in a language other than English a certified translation to English by an approved translator shall be submitted to the Project Manager or his Representative.

(c) **Contractor's Duty Staff & Offices**

The Site Representative of the Contractor shall be permanently on the Site during normal working hours and immediately available at all other times. He shall be delegated full authority to act upon instructions given by the Project Manager or his authorised staff and shall be fluent in the spoken and written English language.

The Contractor shall provide and maintain at the site, offices for the use of his representative and to which written instructions by the Project Manager can be delivered. Any instructions delivered to such offices shall be deemed to have been delivered to the Contractor.

(d) **Public Relations**

The Contractor shall designate within his site organisation competent staff whose responsibility shall be to ensure good public relations.

(e) The Contractor shall provide and maintain suitable and sufficient shelters and mess rooms for his workmen and supervisory staff.

The Contractor shall provide sufficient closets or latrines and washing facilities to the satisfaction of the relevant authority. They shall be properly screened and maintained in a clean and sanitary state at all times.

The mess rooms, closets and latrines shall be located in positions to be approved by the Project Manager. The Contractor shall be responsible for making all arrangements for the disposal of waste from mess rooms, closets and latrines.

2.18 Demolition of contractor's temporary buildings

The Project Manager may at any time before the end of the Defects Liability Period give the Contractor notice in writing to demolish and remove those Temporary Works which are no longer required, whereupon the title to such Temporary Works shall revert to the Contractor. After the demolition and removal of the Temporary Works as required by the Project Manager, the Contractor shall level, clear, restore and make good the sites and surrounding ground and after emptying them shall fill in all latrines, drains, pits and similar items leaving the whole area in a neat and tidy condition to the satisfaction of the Project Manager and the relevant authority.

2.19 Inspections by Project Manager during Defects Liability Period

The Project Manager will give the Contractor due notice of his intention to carry out any inspections during the Defects Liability Period and the Contractor shall thereupon arrange for an authorised representative acceptable to the Employer to be present at the times and dates named by the Project Manager. This representative shall render all necessary assistance and take note of all matters and things to which his attentions is directed by the Project Manager.

2.20 Site records and Progress photographs

The Contractor shall ensure that records pertaining to the Works are kept up to date. These records shall include labour, plant and material on site, excavation, additional works, etc.

Digital Colour photographs illustrating the progress of the Works shall be taken as directed by the Project Manager. The location, date when taken and the direction in which the camera was facing shall be inscribed on each photograph. All digital photographs shall be given on a CD at fortnight intervals to the Project Manager.

2.21 Signboards

The contractor shall erect signboard at the start of construction work (as detailed in Figure 2.1 at the end of this Section) at locations to be indicated on site. The board shall be weatherproof and mounted on stout posts so as to withstand strong winds associated with cyclones.

The boards shall indicate relevant information about the project such as the Project name, the Funding Agency, the Employer, the Project Manager and the Contractor, with lettering shown in blue on white background and in sizes not less than 50 mm high.

2.22 Notice of Operation

The Contractor shall give full and complete written notice of all important operations to the Project Manager to make such arrangements as the Project Manager may consider necessary for the inspection of works and for any other purpose. The Contractor shall not start any important operation without the written approval of the Project Manager.

2.23 Progress Meetings

The Contractor's Contract Manager shall attend regular progress meetings on Site which will be convened by the Project Manager. He shall also attend any other meetings requested by the Project Manager.

2.24 As-built Drawings

In case of change in Contract Drawings during execution of works the Contractor shall submit the revised drawings to the Project Manager for approval. An as-built drawing shall be submitted to the Employer accordingly prior to issue of Completion Certificate under Clause 53 of Conditions of Contract.

2.25 Conditions of Site and Wayleave

Before carrying out any work on the Site, the Site shall be inspected by the Contractor in conjunction with the Project Manager to establish its general condition which shall be agreed and recorded in writing, and where in the opinion of the Project Manager it is deemed necessary, by means of photography.

The Contractor shall ensure that no existing pipe network or sugar cane/vegetable plantation is damaged during works under the contract.

Employer shall be responsible for all wayleaves acquisition for the purpose of the works.

The limit of site for construction of Main Headworls shall be a circular area of radius 5.0 m having as centre the chamber.

The limit of sites shall be 8 m wide and wayleaves forming part of the 8 m shall be acquired as shown in figures 2.2 and 2.3 (see end of Section 2):

Figure 2.2 Temporary wayleave 5m for delivery and submain passing adjacent existing track road or 8m when passing across cane fields

The damage caused to existing plantation within the permitted wayleave zone in the planters' field shall not be compensated.

Any damage caused as a result of the Contractor's operations to plantations beyond the permitted wayleave mentioned above shall be made good (site reinstatement, crop compensation, and other

damage) at the Contractor’s own expense within two weeks after receipt of Project Manager’s instruction.

Two weeks prior to start of survey or any physical works the exact boundaries of the permitted wayleave zones will be established on site jointly by the Project Manager and the Contractor.

In the event of any planter’s boundary/cornerstone or other survey mark established for the purpose of land title being disturbed or displaced as a result of the Contractor's operations the Contractor shall forthwith replace the beacon and shall employ the services of an approved sworn land surveyor for this purpose.

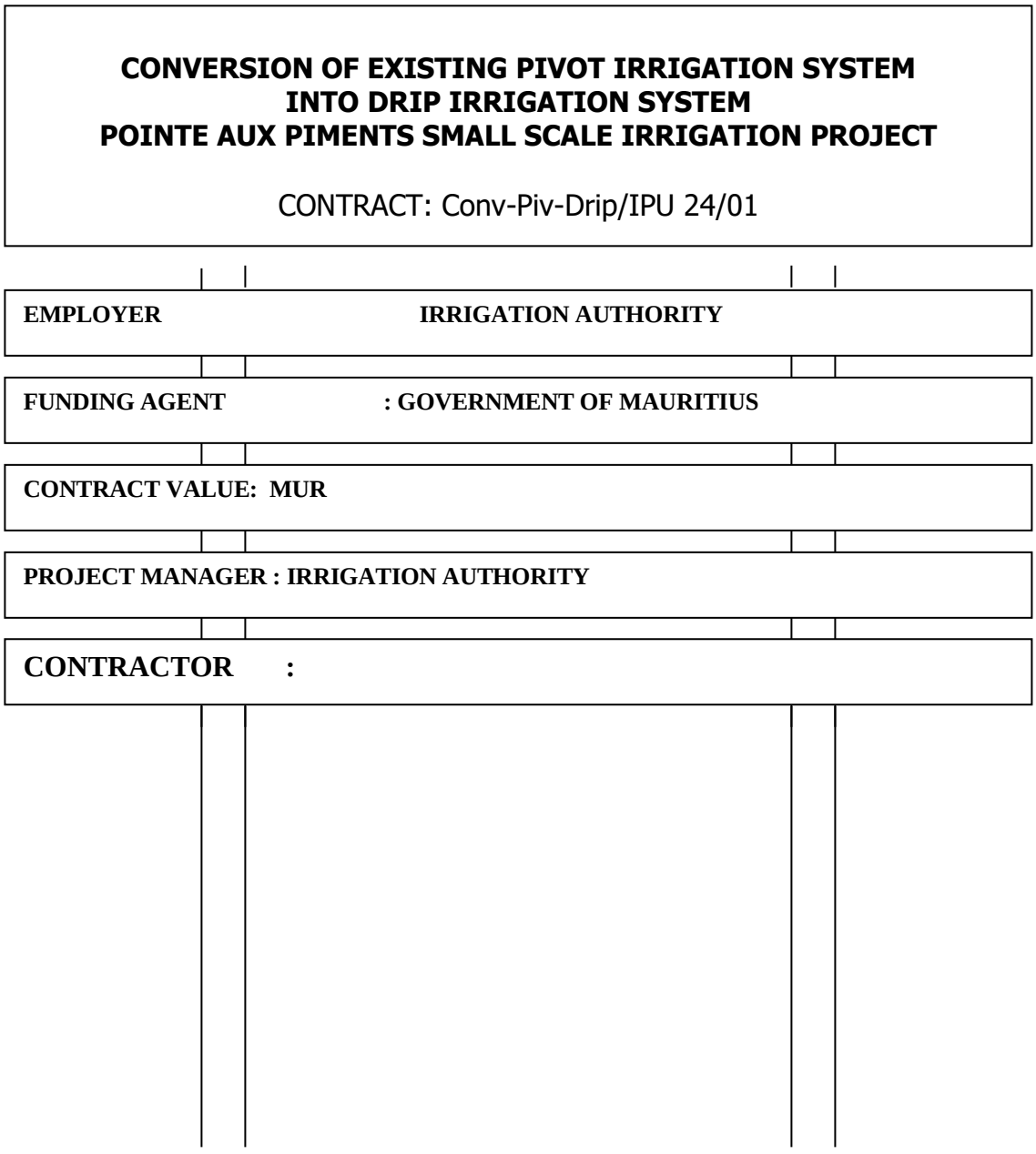

Fig 2.1 - Signboard

Fig 2.2 - Wayleave

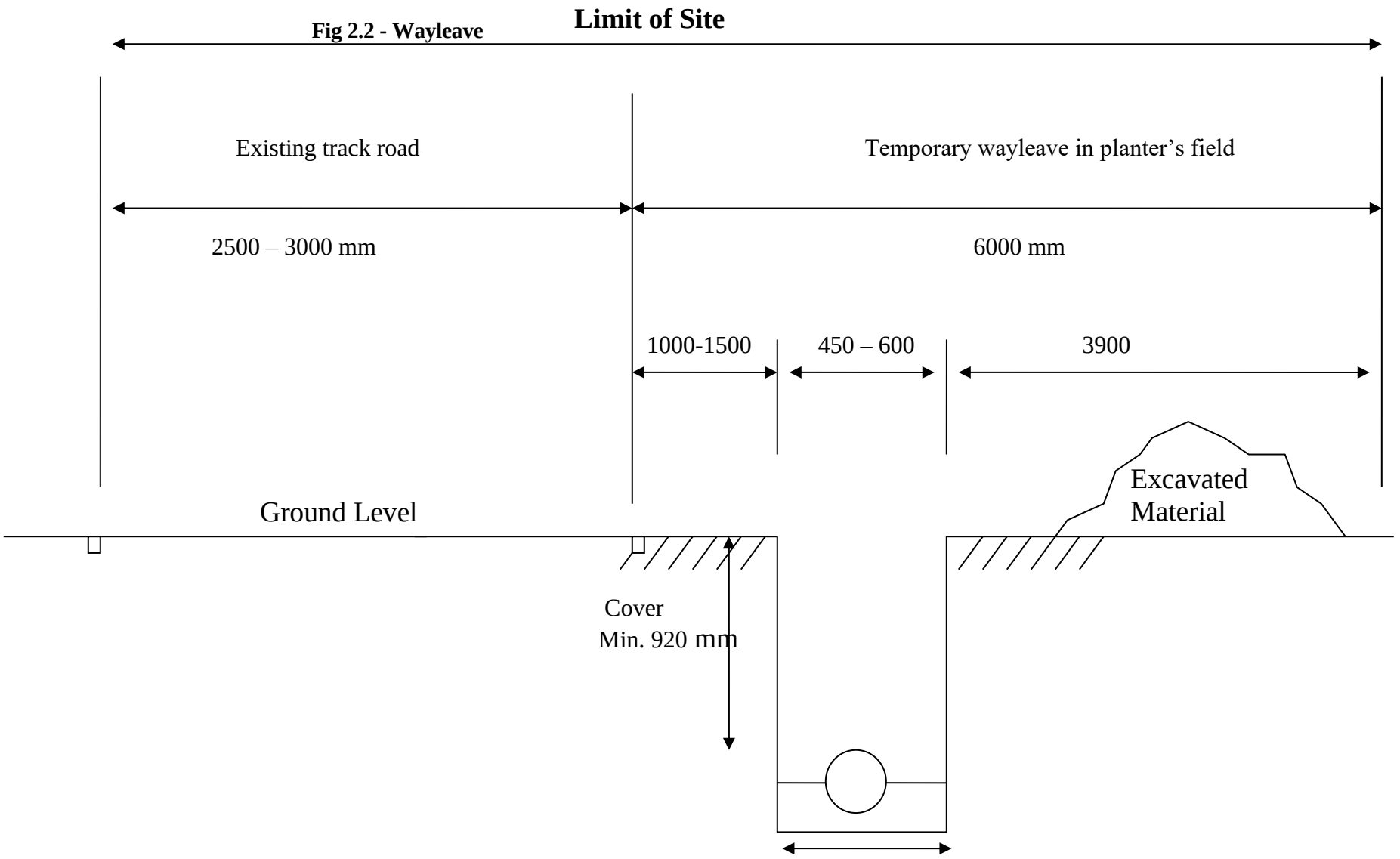

Figure 2.2

SECTION 3A -PIPES AND PIPEWORK MATERIALS

SECTION 3 B - PIPELINE CONSTRUCTION

SECTION 3A - PIPES, PIPEWORK MATERIALS & PIPELINE CONSTRUCTION

3.0 GENERAL

3.01 General Description

In this Section "Goods" refers to pipes, valves and pipe fittings.

All goods to be supplied shall be suitable for waterworks purposes in the conditions prevailing in Mauritius and particularly in the location of the works, for the conveyance of water. The bid has been prepared on the basis that all pipes shall be manufactured from Ductile Iron and/or Steel Pipe and Polyvinyl Pipe (PVC), High Density Poly Ethylene (HDPE) and Low Density Poly Ethylene (LDPE) in accordance with this specification. Fittings shall be either of Ductile Iron or Steel or PVC or cast iron or HDPE depending on the pipes connection and specification. Alternative bids are permitted and alternative pipe material offered should be equivalent to the Original Bid with Ductile Iron, Steel and PVC. Equivalent means similar quality, durability and reliability. This means that the Manufacturer of alternative material should show that his material should have the same levels of quality, durability and reliability as Ductile Iron, Steel, PVC, HDPE or LDPE pipes as specified. The Manufacturer should have a considerable track record of having produced similar pipe diameters and pressure class as requested here. The manufacturing process should have a quality control and assurance program comparable to the DI, Steel, PVC or HDPE manufacturers, which is ISO 9001 or ISO 9002. The raw material and manufacturing process should be under the same stringent standards as DI, Steel, PVC HDPE or LDPE pipes. The manufacturing of pipes, which fails to meet these criteria will lead to a non responsive bid and shall no longer be taken into consideration. The Bidder shall submit original brochures and technical data on pipes, valves proposed in their Bids to enable the Employer to assess their proposal.

3.02 Storage of Pipes and Fittings

The Contractor's responsibilities within the scope of this Section comprises manufacture, testing at works as necessary, supply and delivery to a storage yard pipes, valves and fittings as specified. The Contractor shall make his own arrangement for acquisition of storage area, access, fencing, storage cover, lighting and watching as mentioned in Section 2.13 of Employer's Requirements.

3.03 Periods for Delivery

In order to comply with the requirements of the installation programme, the Contractor shall arrange his delivery programme to meet the stage delivery periods stated in the Program of Works or Program of Shipment/Delivery calculated from the date of the Notification of Award.
The Contractor may be required to concentrate his earliest deliveries in order to meet the programme for installation and due flexibility should therefore be allowed for in manufacturing.

3.04 Programme

The Contractor shall submit at the time of the bid submission a Programme of Works to complete all the supplies and works in **Two Hundred and Seventy (270) Calendar Days calculated from the start date**.

Upon issue of Letter of Acceptance, the Contractor shall resubmit for approval a Program for the Works containing readjustments required by the Employer within 7 days from the date of the

Letter of Acceptance. The programme shall also take due regard of the time required for drawing approval, testing and inspection at the works, freight and delivery to the specified storage area.

3.05 Approval of Drawings

The Contractor shall submit to the Project Manager for approval within 2 days of the Project Manager's Order to Commence the Works detailed drawings of the Goods and a general arrangement of a typical installation, including critical dimensions for associated civil works. They are to be accompanied, if required, by calculations and explanations to show that they comply with all requirement of these Specifications.

Three days shall be allowed for approval by the Project Manager following receipt of drawings. Alteration to approved drawings shall only be made with the written consent of the Project Manager.

3.06 Inspection and Testing at Works

Details of the type of manufacturing process shall be submitted for the Project Manager's approval. Independently of the tests to be made on the constituent materials and on the Goods in accordance with the provisions of the Specification the Project Manager will have the right to ask that factory checks be made concerning either the ways in which materials are used or on the manufacturing processes such as casting, founding, cooling, annealing, burring, welding, riveting, centrifuging, machining, drilling of flanges or any other process.

In this respect, the Contractor shall authorise the Project Manager to carry out the corresponding inspections at the various stages of manufacture.

The Project Manager reserves the right to inspect all or part of the stages of manufacture of components at any Sub-Contractors factory under the same conditions as those applied for inspection at the Contractor's factory.

All Goods shall be tested at works in accordance with the provisions of Section 3A of the Specifications.

All Goods shall be subject to inspection prior to packing for shipment. Such inspection shall include visual inspection, compliance with the Specification, checking of test results as required by the Specification and appropriate Standard or other superior internationally recognized standard and witness testing as required. An inspection of packing and marking of all items may also be undertaken prior to shipment.

For all tests and inspections the Contractor shall also provide the Project Manager prior to dispatch with test and inspection certificates from an Independent Inspection Agency approved by the Project Manager. The test and inspection certificates shall pertain to actual witness of test and physical inspection by the Agency on the particular consignment. Inspection by the Independent Inspection Agency shall not, however, relieve the manufacturer of his responsibility to furnish material and perform work in accordance with this specification and the relevant standards.

For the items tested, inspected and found to be satisfactory a Project Manager's approval will be issued allowing the Contractor to proceed with arrangements to deliver the materials.

The Contractor shall furnish the Project Manager with a manufacturer's certificate in respect of every consignment of the goods confirming that all items of goods comprising the consignment comply in all respects with the specified standard. The original and one copy of such manufacturer's certificate shall be delivered to the Project Manager not later than 7 days prior to the intended date of delivery of the Goods to the storage area.

3.07 Final Pre-Shipment Inspection

All finished pipes shall be required to be visually examined and shall be free of injurious defects such as cracks, laminations and undercuts or burrs (especially for PVC). The final pre-shipment inspection shall be attested by `a certificate from the same Independent Inspection Agency responsible for carrying the test and inspection at the place of manufacture.

3.08 Marking

Except where expressly agreed between the Contractor and the Project Manager all components of the Goods shall be marked in a clear and lasting manner with the following information:

- symbol of factory where component was manufactured;
- date of manufacture
- nominal diameter, pressure class;
- symbol designating quality of material;
- direction of flow (where applicable).

3.09 Packing, Transportation and Handling

All materials are to be properly packed and clearly marked :
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In addition all fittings shall be marked according to their reference Bill of Quantities item number.

All sensitive materials such as gaskets etc., shall be fully protected by means of a moisture-excluding coating or a drying agent or a plastic sealant or plastic covers and/or wooden crates as appropriate to the approval of the Project Manager.

The Contractor shall provide all necessary means of protecting the Goods during loading, transit, unloading and rehandling and delivery to the storage area. The measures adopted by the supplier at the port of shipment, at the port of unloading and for the transport to the site of work shall be to the approval of the Project Manager. Likewise, the methods adopted by the civil works Contractor on site will be subject to the approval of the Project Manager. No unprotected hooks or wire slings will be permitted.

All packing shall be suitable for unpacking and repacking during inspection and for storing the Goods at the site in the open air at the Contractor's storage area.

All flange connections shall be fitted with protective covers. Nuts, bolts and washers shall be properly labelled and packed in cases. Sealing gaskets shall be fully protected against moisture and properly labelled and packed in cases.

All spare parts which are ordered shall be delivered with the main order and shall be adequately labelled, protected and packed in a suitable container or containers complete with three copies of a detailed inventory.

The Contractor shall supply all necessary materials and equipment for making good, where instructed by the Project Manager, any damage to coatings of pipes, fittings and valves.

3.10 DESIGN, MATERIALS AND WORKMANSHIP

3.10a) Design

The Contractor shall design the Goods to comply with the duties stated in this Employer's Requirements, to the Project Manager's satisfaction and in accordance with modern practice and it shall be such as will facilitate inspection, cleaning, maintenance and repair and ensure satisfactory operation under all conditions.

The general mechanical design of the Goods and particularly that of the seals, and other wearing parts, shall be governed by the need for long, trouble-free operation without frequent maintenance or attention being necessary.

3.10b) Standards of Workmanship

The standard of workmanship shall be to the satisfaction of the Project Manager and shall comply with the requirements of the standards or codes of practices issued by any of the organisations.

The Contractor may propose other internationally recognised codes of practice or regulations equivalent to those specified for approval by the Project Manager. Such approval to these alternative standards must be obtained prior to manufacture of an items to be supplied under this Contract. Two copies of such alternatives standards are to be supplied in English to the Project Manager when required.

3.10c) Materials

All materials used in the manufacture of the Goods shall be approved by the Project Manager.

All materials shall be new and of first class quality, free from imperfections and selected for long life and minimum maintenance. Particular attention shall be paid to the prevention of corrosion either due to the proximity of dissimilar metals or due to severe ambient conditions. All parts shall be corrosion resistant or adequately protected against corrosion.

They shall have no modifying effect whatsoever on the physical, chemical bacteriological or organoleptical qualities of the water normally conveyed in the system under consideration, either by reason of the materials construction or leaching from protective coating and painting system. All materials shall be such as have been proved under working conditions to be the most suitable for the purpose for which they are used.

3.11 Reliability of Equipment

The Goods shall be so manufactured as to ensure the highest standards of operational reliability. All Goods shall be capable for long life with a minimum of maintenance and to meet the following conditions :

a. They shall be suitable for the conveyance of raw or treated water under pressure;

b. They shall be capable of withstanding without damage all stresses that will be induced during handling, testing and operation;

c. They shall be watertight under all operating and testing pressure prescribed by the respective Standard;

d. They shall have long-term resistance to all external factors by virtue of the nature of the materials used in their manufacture as far as water action is concerned and, in a more general manner, the surrounding environment;

3.12. PARTICULAR TECHNICAL REQUIREMENTS

3.12.1 Pipes General

3.12.1a Supply

The Contractor shall supply the following information for each nominal diameter of pipe viz Ductile Iron (DI), Steel Pipes and Polyvinyl Chloride Pipe (PVC).

a.	External diameter	
b.	Internal diameter	
c.	Overall length per unit	Tolerance to EN 545
d.	Effective length per unit	or to any other equivalent standards
e.	Unit weight	
f.	Thickness	

The Contractor shall state the method and conditions for loading transport, unloading and storage of pipes. Restrictions regarding temperature, humidity, orientation and the like shall be stated, if any, together with maximum number of pipe diameters that can be stocked vertically, for each diameter.

3.12.1b Marking

Except where expressly agreed between the Contractor and the Project Manager all pipes shall be marked with the following information.

- symbol of factory
- date of manufacture
- nominal diameter
- pressure class
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All this information shall be marked in a clear and long-lasting manner.

3.13 Fittings General

3.13a. Supply

Pipe fittings shall be to the diameters and classes indicated in the Bill of Quantities and in accordance with the specified standards.

The Contractor shall supply the following information for each nominal diameter of fittings:

a.	External diameter	
b.	Internal diameter	
c.	Overall length per unit	Tolerance to EN 545 or to any other equivalent
d.	Effective length per unit	standards
e.	Weight	
f.	Thickness	

The Contractor's shall state the conditions of storage required for all fittings. Restrictions regarding temperature, humidity, orientation etc. and the like shall be stated, if any.

3.14 Pipes/Fittings

3.14a Manufacture

Ductile iron pipes shall be manufactured and generally tested in accordance with EN 545 or ISO 2531. All ductile iron pipes shall be capable of withstanding an internal pressure of 16 bars.
Pipes with flexible joints and with flanged end will be required to withstand a minimum works hydraulic proof test pressure as specified in Table 13 of EN 545.

After satisfactory hydraulic testing, the pipes shall be coated externally using metallic zinc as specified in EN 545 or ISO 8179 and hot applied bitumen based material conforming to the space requirements specified in EN 545, or alternative approved system. The pipes shall be lined internally either with cement mortar incorporating sulphate resisting Portland cement to BS 4027 or with an approved polyurethane coating. The thickness of the lining shall be as stated in Table 8 of EN 545.

All pipes shall be carefully finished internally and the linear measure of surface roughness for the pipes in the form of the parameter in the Colebrook-White equation shall be equal to or smaller than 0.03 mm.

Pipes with flexible joints shall generally be in standard lengths of 5.5 to 6.0 m but not a mixture of lengths for each diameter unless otherwise approved by the Project Manager.

Flexibly jointed pipes shall have an approved push-fit joint incorporating a suitably retained and shaped rubber ring complying with BS 2494 Part I. Each joint after installation shall be capable of accommodating a deflection of at least 1½ degrees in any direction.

All pipes and fittings, except those encased within chambers shall be protected with polyethylene sleeves manufactured in accordance with ISO 8180. The nominal thickness of the film shall not be less than 200 microns nor more than 250 microns.

3.15 Ductile Iron Fittings

3.15a Manufacture

Ductile iron fittings shall be manufactured and tested in accordance with EN 545, ISO 2531 or other approved standards. They will be required to withstand a minimum works leak tightness test pressure as specified in Table 13 of EN 545.

The bore of all fittings are to be true, smooth, clear and coated externally with metallic zinc as specified in EN 545 and approved hot applied bitumen based material in accordance with BS 4147, or with cold applied black bitumen material in accordance with BS 3416. Internally fittings shall be coated with an approved hot applied bitumen based material in accordance with EN 545 or with cold applied black bitumen material to BS 3416 or with cement mortar incorporating sulphate resisting Portland cement to BS 4027.

The outer surface of all fittings shall be truly cylindrical in shape and concentric with the bore. Wall thicknesses shall comply with EN 545.

Where spigot fittings are specified these shall have an internal diameter compatible for jointing with standard ductile iron pipe joints. Where flanged ends are specified these shall be cast integrally with the fittings to a thickness and drilling pattern specified in ISI 2531to suit PN 10 or, PN 16, flanges as indicated in the Bill of Quantities. Flange jointing material comprising galvanised, or cadmium plated nuts, bolts washers and rubber gaskets shall be as specified and of the sizes and numbers required for one set for every flanged joint. All bolts and nuts shall be dipped in linseed oil before packing to ensure that the nuts and screws on to the bolts without difficulty.

3.16 Steel Pipes and Fittings

3.16a) Manufacture

Steel pipes and fittings shall be manufactured and generally tested in accordance with AWWA Manual M11 '*Steel Pipe – A Guide for Design and Installation'*. The physical properties of the pipes shall be as per the requirements of AWWA C200 – *"Standard for steel water pipe 6 inches and larger"*. The methods used for testing the physical properties of the pipes shall be as described in ASTM A370.

3.16b) Design Criteria

A design stress of 50 percent of the specified minimum yield strength shall used in determining the minimum wall thicknesses of the pipes. Only steel with a range of tensile stress between 290 N/mm^2 and 360 N/mm^2 shall be used in the manufacture.

The pipes for the delivery mains shall be manufactured to withstand an internal design pressure of 16 bars.

The manufacturer's calculations of the wall thicknesses of the pipes shall be submitted to the Employer for approval.

3.16c) Non Destructive Tests

Test on Welds

Spiral welds shall be required to be tested by ultrasonic flow detection in accordance with Clause 9.7.4 of API 5L or by Fluoroscopic Inspection in accordance with Clause 9.7.3 of API 5L.

Hydrostatic Tests

The pipes shall be required to withstand a minimum works hydraulic proof test pressure as specified in Clause 9.4.3 of API 5L to induce a hoop stress of 90% of the minimum yield stress. All test pressures shall be held for a minimum of 10 seconds and test results recorded on a pressure recording chart.

3.16d) Repair of Defects

The finished pipes shall be free from unacceptable defects. Defects in the parent metal of welded pipes will be considered unacceptable when the depth of the defect is greater than 12.5 percent of the nominal wall thickness. Cracks, sweats and leaks in welds shall not be acceptable.

Repair of defects will be permitted, except that the repair of defects in the parent metal will not be permitted if the depth of the defect exceeds one third of the nominal wall thickness of the pipe and if the length of that portion of the defect in which the depth exceeds 12.5 percent is greater than 25 percent of the outside diameter of the pipe. Repairs shall conform to the following requirements.

(i) The defect shall be completely removed and the cavity thoroughly cleaned.
(ii) The repair weld hall be made by automatic welding or manual welding by a welder qualified under Sec. IX, part A, of the ASME Boiler and Pressure Vessel Code, or under AWS B2.1, or under any other code acceptable to the Employer.
(ii) Each length of repaired pipe shall be tested hydrostatically in accordance with section 3.4 of AWWA C200.

3.16e) Destructive Testing

Transverse tensile testing shall be conducted on samples at the rate of one per 100 pipes in accordance with Clause 9.3.1.4 of API 5L. Weld tensile tests shall be carried out at the rate of one per 100 pipes and guided bend test on spiral welds and skelp welds shall be carried out at the rate of one per 50 pipes.

3.16f) Protective Coatings

External protective coating to the pipes and fittings shall be by fusion bonded epoxy to AWWA C213 and shall have a minimum thickness of 350 microns.

Steel fittings shall be manufactured to mount on the pipe ends through welding or sleeve couplings. The ends of pipes or fittings to valves shall be finished as flanges to the same pressure rating as the valves.

3.16g) Field Welding

Joints shall be welded on site using welding methods in accordance with ISO 9956. The competence of the welder should be certified according to ISO 9606. Preparation for the welding and details of the welds shall be in accordance with API 1104 or prEN 1708 part 1. Each welded joint shall be inspected visually according to EN 970 and subsequently tested ultrasonically according to prEn 1712 and 1713.

An air test shall be carried out after each joint has been completed in order to localise any defect in any particular joint.

3.17 Flexible Couplings

3.17a. Supply

This section deals with flexible couplings for the jointing of:

a. Ductile iron fittings to ductile iron pipes
b. Steel fittings to steel pipes
c. Ductile iron pipes
d. Steel pipes
e. PVC pipes
f. Asbestos Concrete Pipe
g. Valve flanges and the like to ductile iron or steel pipes (flange adaptors).

The Contractor shall supply the following information for each nominal diameter of coupling:

a. Nominal bore (or bores in the case of stepped coupling)
b. Coupling length
c. Weight
d. Nominal pressure
e. Typical detailed drawings, including cross sections for each diameter of offered couplings.

The Contractor shall state the conditions of storage required for all couplings. Restrictions regarding temperature, humidity, orientation etc. shall also be stated.

3.17b. Manufacture

Flexible coupling shall be made of ductile iron or steel to the diameter and class indicated in the Bill of Quantities. Flexible couplings (standard, stepped or flange adaptor) shall be of the Dresser, Viking Johnson or similar type and shall be obtained from an approved manufacturer. Couplings including all nuts, bolts and washers or gaskets shall be provided with a factory applied thermoplastic polyamide coating. Flexible couplings shall be supplied without a locating stud. For every two flanges of the same diameter and pressure class the Contractor shall provide all necessary nuts, bolts, washers and gaskets.

Stepped couplings shall be suitable for connecting difference types of pipes as indicated in the Bill of Quantities.

Flanged adaptors shall be suitable for connecting PN 10, PN 16 or PN 25 drilled flanges to BS 4504 to ductile iron or steel pipes as indicated in the Bill of Quantities.

3.18 PVC Pipes and Fittings

The unplasticized Polyvinyl Chloride pressure pipes shall be solvent weld and manufactured in accordance with MS 5, 1981 or alternatively with ISO 161. Part I or AFNOR T 54 - 003 or T 54 - 016. The pipes shall be in PN 16 for underground laterals or as specified.

Unless otherwise specified, the PVC pipes shall be of the spigotted type and shall be manufactured in lengths not exceeding 6 metres.

The fittings for PVC pipe shall comply with ISO 264 or AFNOR T 54 - 029 or may be manufactured in cast iron or steel but shall be protected against corrosion.

3.19 Gate or Section Valves

Unless otherwise specified by the Project Manager, gate valves shall be double flanged and manufactured in accordance with AFNOR NF E 29-423, E 29-425 and E 29-426 or to BS 5150 or other standard to the approval of the Project Manager and shall be of the wedge type. All valves shall have a drain plug, and easing screws shall be fitted on all sizes above 200 mm nominal diameter.

The valves shall have inside screw spindles and shall close clockwise. The spindle shall be shouldered to allow repacking of the gland whilst the pipeline remains in service.

The spindle shall be made of stainless steel at least equivalent to x 20 C 13. The wedge gate shall be solid and the wedge facing rings and body seats shall be made of stainless steel or alternatively of bronze of gun metal.

The valves which are to be installed in the ground shall be of the double flanged type with fully enclosed gearing and operation mechanisms and shall be so designed that no bolts, nuts etc. are exposed to the soil and shall be in stainless steel 1.43.01 according to DIN 17440.

The valves which are to be directly installed in the soil shall be provided with surface boxes which can withstand a 10 tonne load and shall be supplied complete with protection tube, extension spindles and accessories at no extra charge. The extension spindles and protection sheath shall be such a design that, if necessary, cutting to the true total length is possible. The surface boxes, protection form corrosion by a 250 micron coating of bitumen epoxy.

The extension spindles shall be equipped with square headed key handles with dimensions of 19 mm x 19 mm for all sizes of valves.

The valves to be installed in chambers shall be supplied with either a cast iron or malleable iron hand wheel.

The valves to be installed directly in the ground shall be supplied with cast iron caps and one solid forged valve tee key for every 5 valves to be installed. The flanged valves shall be supplied with flange adaptors and connecting bolts and nuts at no extra charge where specified or required.

The Contractor shall submit to the Project Manager the manufacturer's certificate which shall show that the valves and their components comply with the above specified requirements.

3.20 -a Air Valves

Air valves for automatically exhausting or admitting air from and into pressure pipelines are required in two types according to the purpose to which they are intended

- one way air valves which automatically release air form the pipeline into the atmosphere.

- two way double orifice air valves which automatically release air from the pipeline into the atmosphere or admit air into the pipeline during emptying.

The orifice or orifices of these valves shall allow large volume of air to be released during pipe filling and admit large volumes of air into the pipeline during emptying.

The large orifice of the air valves shall be designed to prevent premature closure whilst air is being released from the pipeline. The floats shall be made of rubber coated with carbon steel.

Both one way and two way air valves shall be fitted with a gauged outlet orifice designed to prevent water hammer resulting from the sudden filling of the drained air pocket by the flow of water.

These valves must allow the evacuation of small volumes of air that can accumulate at the highest points of the pipeline during normal operation.

All the air valves shall be fitted with an isolating valve to allow safe dismantling during operation.

The Contractor shall indicate in writing to the Project Manager the manufacturer's recommended maximum diameter of the pipes on which each size of air valve can be mounted. The Contractor shall submit to the Project Manager technical notes on design of the air valves.

3.20 – b Pressure Safety or Relief Valves

Pressure safety valves shall be drop-tight spring-loaded or pilot relief valves. They shall automatically discharge water so as to prevent a predetermined pressure to be exceeded. The relief pressure shall be adjustable by means of a screw.

These valves shall be of the full lift type and shall have a side outlet discharge. The body of the valve shall have a locking device so as to prevent tampering with the pressure adjusting screw. The valves are to be mounted on steel risers having diameters recommended by their manufacturer as a function of the nominal diameter of the pipelines on which they are to be assembled. These risers shall be fitted with an isolating valve to allow an easy dismantling of the pressure relief valve during operation. A 16 mm manometer connection supplied with a screwed stopper shall be mounted on the riser.

The spindle of the pressure relief valves shall be in stainless steel and the body of the valve shall be of bronze, cast iron or gun-metal.
The pressure relief valves shall be adjusted to a preset value of 10 bars.

3.20. c Pressure Reducing Valves

The pressure reducing valves shall be downstream pressure stabilisers, the main function of which is to automatically reduce the upstream pressure to a preset value but adjustable downstream pressure so that this downstream pressure is maintained during operation whatever the variations of the upstream pressure above the preset value and whatever the variation in flow-rate between zero flow to the maximum flow rate.

The range of the downstream pressures of the pressure reducing valves shall be adjustable between 4 to 8 bars whatever the upstream pressures within the limit of the maximum static pressures.

The maximum pressure variation in the regulated downstream pressure shall not exceed 10% of the preset regulated pressure.

The pressure reducing valves shall be fitted with drain plugs and with two pressure gauges , one upstream and one downstream of the pressure regulating device. These manometers shall be mounted through three-way valves. Double filters should be incorporated on the tapping of the control mechanism on the PRV to facilitate maintenance.

3.20. d Flow Straightener

The 400 mm ND flow straightener shall be double flanged, drilled to PN 16, and include necessary seals.
It shall be placed immediately before the flow meter. It shall hence reduce a minimum all the turbulences in the pipeline.
The body shall be of cast iron to resist a maximum pressure of 16 bars. Its length should not exceed 600 mm.

3.20. e Strainer

The 400 mm strainer shall be easily removable from pipeline for cleaning.
This basket shall be removable vertically without disconnecting the body of trainer from pipeline. The strainer shall be of the straining basket type.
The body of the strainer shall be manufacture in cast or ductile iron and it shall be fitted with a vertically mounted straining basket with a mesh opening of 100 sq mm. The basket shall be reinforced to resist the pressure exerted on its walls when the straining surfaces are partly clogged. The cover of the strainer shall be in ductile or cast iron and hall be firmly bolted on the body. The contact between the body and the cover shall be drop-tight. The strainer shall be flanged to PN 16 for connection to the pipeline. The maximum head loss shall to exceed 15 KPa when the strainer is clean and the velocity of

the water in the strainer is 1.5 m/sec. The friction loss shall not exceed 36 KPa at the same velocity, when the straining surface is clogged at 25% of its area. A drain plug shall be fitted at the bottom of the strainer which shall be supplied with manometers fitted to its upstream and down-stream ends to enable the monitoring of the headloss through the strainer.

3.20.f Flowmeter

The flow meter shall comply with ISO 4064 and shall be suitable for use with filtered water at temperatures between 10° and 45° C under the estimated maximum flow, permissible head loss, accuracy and operating pressures given below:

- Nominal Diameter of pipeline (mm) = DN 400
- Estimated Maximum Flow (l/s) = 250
- Maximum Permissible Head Loss (kPa) = 15
- Maximum Operating Pressure (kPa) = 1000
- Accuracy at Maximum Flow = 2.5%

The flow meter shall be supplied complete with an instantaneous flow indicator, a dial type flow integrator or totaliser. The integrator dial shall be directly visible on the meter. The flow integrator shall have a counter recording in cubic metres.
The readings shall in l/s and cubic metres. SI units shall be acceptable. The full scale deflection shall be at least 250 l/s.

3.21 Jointing of Pipes and Equipment

Unless otherwise specified, all joints used for connecting steel pipeworks shall be flanged. However, flexible or dismantling joints shall be used in the assemblies to enable easy dismantling. All flanges shall be to BS 4504 or other recognized standards. Threaded connections on fittings shall be to BS 21 or ISO 7/1 or other recognized standards

3.22 Steel Pipework

All the steel pipework shall be hot-dipped galvanised for internal and external protection. The galvanisation shall be in accordance with BS 729 or other recognized standards.

3.23 Flanges & Bolting for Pipes, Valves and Fittings

Flanges and bolting for pipes, valves and fittings shall all be to BS 4504 or alternatively to AFNOR NF E 29-201 or ISO 2084 or to other standard to the approval of the Project Manager, provided that they are each compatible with the other for the purposes of jointing like-sized components and are such that corrosion by galvanic action shall be avoided. The rating and test pressure of the flanges shall not be less than the rating and test pressure of the pipeline specified.

3.24 Bolts, Nuts & Washers

Black hexagonal bolts and nuts and flat washers shall be to BS 4190 or alternatively to AFNOR AF E 27-411 or other standard approved by the Project Manager.

3.25 Flexible Couplings and Flange Adaptors

Flexible couplings for steel and cast iron pipes and flange adaptors at valves and specials shall be suitable for use with water at a maximum temperature of 40°C and for the appropriate pipe test pressures.

SECTION 3B - PIPELINE CONSTRUCTION

3.26 Setting Out

The wayleaves, easements or other rights of way for pipelines will be defined by the Project Manager across any private land or any land belonging to the Employer or to the Government.

The Contractor shall, where required by the Project Manager set out the boundaries and shall provide, erect and maintain in the position until final completion of the works using substantial timbers, stakes or other approved members, not less than 1.5m high indicating the said boundaries. Such stakes shall be provided at each and any change of direction of the boundary and at intervals not exceeding 100m and at such intermediate points as are deemed necessary by the Project Manager.

The Contractor shall, in the presence of the Project Manager set out the pipeline alignments in accordance with the Drawings making any changes the Project Manager may deem necessary, confirming also, the exact locations of all manholes, valves, air valves, washouts and hydrants, etc. The Contractor shall supply, install and maintain in position until trench excavation, marker posts at each and any change in direction of the pipeline and at intervals not exceeding 100m and at such intermediate points as are deemed necessary by the Project Manager. Such markers shall be substantial posts in either concrete or steel or other approved materials and not less than 1.5m high.

No work shall commence upon any portion of the Contract until such time as ground levels have been taken by the Contractor in an approved manner and checked and accepted by the Project Manager to ensure that a firm record has been established for measurement and setting out purposes. Should the Contractor fail to comply with this clause, the Project Manager shall base the final measurement on other survey data.

3.27 Handling and Transport of Pipes and Fittings

The loading, unloading and handling of pipes and fittings shall be carried out using cranes, lifting beams, padded hooks and broad banded slings of approved design, strictly in accordance with the recommendations of the manufacturer and to the approval of the Project Manager. Particular care shall be taken at all times to avoid damage of any kind. The use of lifting hooks is not permitted.

The protective cover, discs, etc. provided by the manufacturer shall not be permanently removed until immediately prior to installation.

When pipes are loaded for road transport they shall be carefully handled to prevent damage to the coating. Pillows shall be provided between lashing and the pipes. All cradles and lashings shall be of such widths as to prevent damage to the coating of the pipe, or distortion of the pipes.

All valves shall be handled with care and shall always be transported on timber packings and where possible in the manufacturer's original packing if this is suitable.

In the event of any damage being caused, the Contractor shall be liable for the cost of all repairs or replacements and the costs of any delays. The Project Manager shall determine whether the damage shall be repaired and if it is to be repaired, the manner of such repair, or whether the damaged piece shall be replaced.

3.28 Storage of Materials

The Contractor shall only store pipes, fittings and other materials at places approved by the Project Manager and shall at all times provide adequate supervision and when no activity is in progress at such areas, a watchman to prevent the theft or damage. Any damage incurred due to lack of such supervision or protection will be the Contractor's responsibility.

Pipes shall not be stacked higher than recommended by the manufacturer. The area on which the pipes are to be stacked shall be free draining, grass or other vegetation shall be kept cut and suitable timber or cradles shall be provided on which the pipes shall be laid. End stops to all stacks shall also be provided.

Fittings and valves shall not be stacked more than one tier high and they shall be supported off the ground by suitable timbers.

Air valves, rubber joint rings, gaskets, bolts and similar fittings and materials shall be kept in approved locked premises and such fittings and materials shall not be distributed to the trench side until immediately prior to laying, fitting, jointing or assembly thereof. All rubber joint rings and gaskets must be stored in a cool damp location and all fittings and materials shall at all times be stored in the shade under cover and protected from the weather to the satisfaction of the Project Manager.

The Contractor shall take any necessary precaution to prevent fire in the storage areas and shall provide and maintain fire breaks and other precautions.

3.29 Stringing of Pipes

Pipes shall be handled and transported as recommended by the Manufacturer. Where pipes, fittings or any other materials are laid out on the site adequate personnel shall be provided.

Pipes shall be placed on suitable pillows or other supports approved by the Project Manager. End caps shall not be removed until such time as the pipe is to be inspected and laid.

At places where the pipeline route crosses roads, tracks or any other access and where approved by the Project Manager, the Contractor shall deposit the pipes so that access by the public is in no way restricted. Where the pipeline crosses any field or other place frequented by people or livestock similar provision shall be made.

The Contractor may be prohibited from using certain roads and other tracks for the purpose of stringing on account of adverse weather conditions and no extra cost he may incur on this account or for any other road restriction, delay, or any other thing which increases the cost of his haulage will be allowed.

3.30 Examination of Pipes Prior to Laying

Shortly before laying or fixing any valve, pipe or fitting the Contractor shall carefully examine each valve, pipe and fitting to ascertain damage or defect. All damage and all defects revealed by this examination shall be repaired and remedied to the satisfaction of the Project Manager.

Internal cement mortar lining shall be inspected prior to laying and any defect or crack exceeding 0.8mm shall be made good using an epoxy mortar. PVC spigotted ends shall be free from burrs.

3.31 Laying Pipes

Immediately before any pipe is lowered into the trench the plug shall be removed from the end of the last pipe laid and the new pipe shall be carefully lowered into the trench in an approved manner.

Each pipe and fitting shall be laid true to alignment curve and gradient in accordance with the Drawings or as directed by the Project Manager. The minimum gradient shall not be less than 1 in 500.

Pipes shall be boned to gradient and sight rails shall be provided for this purpose at intervals not exceeding 50m and at all changes in grade.

No dips or summits will be permitted other than as shown on the Drawings unless otherwise instructed by the Project Manager.

Pipes and fittings laid in trench shall have the minimum cover stated on the Drawings or as otherwise directed by the Project Manager.

Unless otherwise shown on the Drawings long radius curves in pipelines shall be negotiated by deflections taken up in the joints of one or more pipes. The Contractor shall provide all information on allowable pipe deflections and check that pipes are not installed beyond allowable deflection limit. The Project Manager shall approve pipe laying only after verifying that pipe deflections are within the limits.

Pipes laid in trenches shall be laid and firmly bedded on an even and uniform bed. Where pipes are not laid on a granular bed, the bottom of the trench shall be smooth and free from stones or other projections. Pipes shall not be dragged along the trench bottom. Joint holes shall be excavated below the trench bottom and shall be as small as possible and shall be filled in and compacted after the pipes are laid and before the refilling of the trench is commenced. Survey pegs in the trench bottom shall be removed.

Each type of joint shall be made in full compliance with the manufacturer's instructions. Special care shall be taken to ensure the absolute cleanliness of the pipe ends and joint components and only the recommended lubricants shall be used.

Pipe jointing shall only be carried out by experienced personnel and with close supervision by the Contractor.

The Contractor shall take all steps necessary to ensure that no dirty water or other extraneous matter is allowed to enter the pipes during or after laying. In the event of dirty water or extraneous matter entering the pipes the Contractor shall immediately carry out the necessary cleaning as may be directed by the Project Manager.

As pipelaying proceeds the Contractor shall prove pipelines are free from obstruction by passing through the pipeline a 'badger' which must be kept in the pipes at all times during construction of the pipelines. The 'badger' shall be pulled forward and any obstructions or dirt removed immediately after the laying of each pipe and before the next one is placed in position, so that the barrel of the pipe is left perfectly clean.

The 'badger' shall consist of polyurethane foam with dimensions approved by the Project Manager, with suitable attachments to allow for pulling through the pipes.

Except when necessary for jointing, the end of the last pipe laid shall be plugged to the satisfaction of the Project Manager and the Contractor shall provide a sufficient number of and use proper plugs for this purpose.

Any damage to the external coating or to the internal lining of pipes, fittings, etc. sustained during laying shall be repaired and made good to the satisfaction of the Project Manager who shall be afforded facilities of examining and testing any damaged areas of sheathing, coating or lining.

Pipe trenches shall not be backfilled until permission to do so has been obtain from the Project Manager. Subject to such permission being obtained trenches shall be backfilled without delay to at least the minimum extent required by the specification in readiness for pressure testing.

3.32 Laying Ductile Iron or Steel Pipes or PVC Pressure Pipe

The pipes shall be laid on a bedding as shown on the Drawings or as directed by the Project Manager.

Details of pipe beddings are shown on the Drawings.

3.33 Cutting Pipes

Ductile iron pipes shall be cut with an approved mechanical pipe cutter and in conformity with the pipe manufacturer's recommendations. The edges of the cut shall be clean, true and square. The use of an oxyacetylene flame cutter will not be permitted in any circumstances. The edges of the cut together with those parts of the pipes from which the coating has been removed shall be given two coats of bituminous paint and the internal lining repaired, if damaged, to the approval of the Project Manager. When the cut pipe is to be inserted in a "Tyton" type joint it shall be bevelled for 10mm at 30° to pipe axis to remove sharp or rough edges.

PVC pipes shall be cut by means of a saw and the cut end shall be trimmed smooth and slightly chamfered externally by means of a hand file.

3.34 Proprietary Joints and Couplings

Proprietary joints and couplings shall be assembled in accordance with the manufacturer's instructions. The Contractor shall be responsible for obtaining such copies of the manufacturer's instructions as he requires, at his own expense.

The Contractor shall be responsible for obtaining all the necessary special tools, lubricants and appliances necessary for making the joints.

Where pipes are laid above ground and jointed with bolted flexible couplings the nuts bolts and gaskets shall be protected against vandalism by sheathing with an approved heat-shrink moulding as manufactured by Raychem of Swindon UK or similar approved.

3.35 Flanged Joints

Flanged joints shall be made with the gaskets and nuts, washers and bolts provided by the materials supplier. Two washers shall be used per bolt, one under the bolt head and the other under the nut. The tightening of the bolts shall be carried out in the sequence and to the torque recommended by the manufacturer. A torque wrench should always be used and in no case shall excessive tightening be exerted on any nut or bolt.

3.36 Protection of Joints

All buried flange joints shall be protected externally by painting with an approved bitumen paint and then the joint shall be wrapped using 'Denso' paste, mastic, tape and outerwrap, or similar approved materials all in accordance with the manufacturer's instructions.

All flanged adaptors and mechanical couplings shall have a RILSAN nylon coating applied by the manufacturer and no further external protection is required. Where flanged adaptors and couplings have been damaged in shipping, transport, handling or laying such damage shall be made good in accordance with the manufacturers instructions.

The Contractor shall supply all tools and materials necessary for compliance with this clause.

3.37 Grouting in Ironwork & Pipes

All brackets, anchorbolts and other ironwork for which holes have been boxed out or left in the concrete of a structure shall be carefully grouted into their correct positions in all particulars. The grouting in shall be carried out with cement and sand grout in such a manner that there shall be no apparent difference in the texture or colour throughout the face or seepage of water either between the iron work and set grout or between the set grout and the surrounding structures.

The above instructions shall apply also to the building in of pipes except that the class of concrete used for that part of the structure shall be used in lieu of cement grout.

3.38 Fixing Valves

Valves and other fittings shall be securely fixed and where required extension spindles and headstocks shall be properly aligned and fixed in vertical position and valve caps shall be fixed securely using the locking nut. They shall be tested for ease of operation and watertightness. Any damaged protective coating shall be made good and they shall be left clean in all respects.

3.39 Thrust Blocks

Concrete thrust blocks shall be formed at bends, tees and valves in accordance with the typical sections shown in the Drawings or otherwise as directed by the Project Manager. The additional excavation shall be made after the bends, etc have been jointed and the concrete shall then be placed with all possible speed. The back of supports and blocks shall abut on to solid ground with all loose material being removed before concreting.

The concrete used for thrust and anchor blocks shall be Grade C20 or as shown on the Drawings and after placing shall be kept in view for not less than six hours. No pressure shall be applied in any section of main until the concrete has had at least three day's curing.

Flexible joints shall not normally be cast into thrust blocks. Where the size of thrust block does not make this possible, additional flexible joints shall be provided no greater than half the pipe diameter beyond each face of the block.

3.40 Anchor Blocks

Anchor blocks to prevent side slips shall be constructed where directed, and in accordance with details provided by the Project Manager.
Anchor blocks to prevent longitudinal slip shall be constructed where the slope of the pipe is greater than 1 in 10 or as otherwise directed by the Project Manager.

3.41 Marker Posts

Precast concrete marker posts as detailed on the Drawings shall be erected along the line of buried pipelines at intervals and locations directed by the Project Manager and at all gate valves, air valves, hydrants, washouts and changes in direction. Plates shall be fixed to the post annotated as shown on the Drawing.

Posts alongside a roadway shall be set back against the nearest wall, hedge or similar and the appropriate horizontal and vertical distance to the valve or pipeline to the nearest 100mm shall be shown on the post or marker plate. The annotation shall be thus:

2.1H/1.2V

indicating 2.1m horizontal distance in front of the post and 1.2m vertical distance below ground.

3.42 Concrete Surround to Pipes

Where pipelines pass under streams and rivers or where directed by the Project Manager, the section of pipeline under the stream or river and for a minimum distance of 1.0m clear on either side of the bank or edge thereof or such greater distance as the Project Manager may require shall be surrounded with Grade C20P concrete or as shown on the Drawings so as to provide a minimum 150 thickness protective surround to the pipe.

Concrete surround shall be broken at all pipe joints to retain flexibility in the pipeline. No joints shall be concreted in without the prior approval of the Project Manager.

3.43 Floatation of Pipeline

The Contractor shall be solely responsible for ensuring that flotation of the pipeline does not occur during construction. The extent of the backfill placed over each pipe after laying and before testing shall be such as will prevent flotation of the pipeline and shall not be construed as limiting in any way the extent of the backfill so placed or which may be so required.

Should any section of the pipeline float out of line or level the section of pipeline so affected shall be removed and re-laid in accordance with the Specification to the satisfaction of the Project Manager, and any damaged sections shall be discarded. The cost of the work and any pipe damaged and discarded through causes of flotation shall be borne by the Contractor.

3.44 Inspection of Pipeline

Before being filled with water the pipeline shall be inspected externally and internally for large diameter pipes by the Project Manager and the Contractor shall provide all necessary attendance including lighting and other facilities for this purpose except transport.

3.45 Hydrostatic Test

After the Contractor has ensured that the length of pipeline to be tested is clean inside and free from all foreign matter, the ends shall be sealed off. At all summits, a valve for releasing air shall be fitted and, at the lowest points, valve connections shall be fitted for the pump and measuring apparatus.

The Contractor shall make adequate arrangements for resisting the thrust on the pipeline stop ends during testing, such as providing temporary concrete blocks, or other arrangements, approved by the Project Manager. The Contractor shall submit to the Project Manager the plans of the anchor blocks he proposes to use for approval at least 10 days before the testing of the pipelines starts. The Project Manager may modify the anchor block arrangements approved by him in all cases where he considers that modifications are necessary in order to suit localised soil conditions. Buttressing of the pipeline already laid will not be permitted, and all permanent anchors shall be in position before testing starts. Testing against closed valves will not be permitted.

The length of pipeline under test shall be filled slowly as approved by the Project Manager, the water shall be metered and the quantity recorded and care taken to expel all air.

After the air has been expelled from the pipeline and all measurements properly recorded, a small capacity high pressure positive displacement pump shall be connected, drawing from a suction tank where the volume change can easily be checked and measured. The positive displacement pump shall be capable of output control such that the volume of water pumped can be recorded and plotted against the resulting pressure measured at the lowest point of the pipeline under test, the time of all readings being also
recorded. Should the plot differ appreciably from the graph expected from the bulk modulus of the water and Young's modulus of the pipe making it evident that there is air in the pipeline, then bleeding of the air shall be carried out and repeated until there is no air in the pipeline.

The pipeline under test shall remain filled and under moderate pressure for a period of 24 hours or such other period approved by the Project Manager. The tested section of pipeline shall be thoroughly inspected by the Contractor and all leaks detected during this period shall be repaired before the test is carried out. The maximum length of the pipe to be put under test at a time shall not exceed 500 m or as specified by the Project Manager.

The test pressure shall be raised steadily to two -thirds of the maximum pressure required at the lowest point of the length of pipeline under test and shall be held at this pressure for not less than

four hours. Provided the testing appears satisfactory, raising of the test pressure shall be resumed until the specified test pressure for the lowest point of the length of pipeline under test is attained. The test pressure shall be maintained for a period of 4 hours or such other period approved by the Project Manager, the rate of leakage being measured by the fall in level of the pump suction tank.

For steel and PVC pipes that the test shall be considered acceptable if the leakage is less than V calculated with the following formula:

$$V = 8D\sqrt{P}$$

where V is the volume of water injected, expressed in litres, for a period of 30 minutes into a 1000 metres long pipeline section

D is the normal diameter (ND) of the pipeline, expressed in metres

P is the test pressure, expressed in bars.

For ductile iron pipes, the test shall be considered acceptable if the leakage is less than that determined by the following formula:

$$L = 7.67 \times 10^{-5} ND\sqrt{P}$$

where L is the allowable leakage in litres per hour
N is the number of joints in the length of pipeline tested
D is the nominal diameter of the pipe, in millimeters
P is the average test pressure in bars.

The test pressures for all pipes shall be 1½ times the operating pressure subject to a minimum of 60 m head unless otherwise by the Project Manager. Any other formula may be used after approval by the Project Manager.

Pipes failure, leaks or any other defects shall be located, made good and the pipeline retested by the Contractor, all at his own expenses to the satisfaction of the Project Manager.

The cost of the additional fittings required to connect different sections of the pipeline already tested, shall be borne by the Contractor.

3.46 Cleansing of Pipelines

After the pipelines have been completed and pressure tested satisfactorily as herein specified the Contractor shall flush out and cleanse the pipelines.

Pipelines shall be cleansed in sections. In DN 300 and larger pipes this shall be carried out by means of passing polyurethane foam swabs through the pipelines. The swabs shall be to the approval of the Project Manager. In smaller pipes cleansing shall consist of flushing through with clean potable water. The flushing shall be repeated until the discharge runs clean to the approval of the Project Manager.

Swabs shall be passed through pipelines at speeds of between 0.2 and 0.4 metres per second to obtain the best cleaning results with the minimum number of passes. Should it be apparent from the debris collected that damage to the lining has occurred, the Contractor shall be wholly responsible for repairing the lining to the satisfaction of the Project Manager.

The swabbing operation shall be controlled by an experienced Project Manager to ensure that no undue surges in the pipeline, heavy docking of the swab or over pressurising of the pipeline occur causing damage to any of the permanent works. Any damage caused shall be made good by the Contractor to the satisfaction of the Project Manager.

The Contractor shall make all necessary arrangements for the transportation of water from the point of supply to the required location and make all arrangements for the disposal of the water. All disposal methods and locations shall be to the approval of the Project Manager.

The Contractor shall be solely responsible for the provision of all labour, materials and chemicals necessary for carrying out the foregoing operations.

3.47 Completion of Testing

After the test on completion has been accepted by the Project Manager all temporary connections used during testing shall be closed off and securely blanked to the satisfaction of the Project Manager, and the pipeline left filled with water.

3.48 Painting

All pipes and fittings exposed to view shall be painted after making good the manufacturer's primer or shop coat with two coats of Bitumastic Aluminium Paint.

3.49 Information for as-built drawing

The Project Manager shall approve all information collected by the Contractor required for the as-built drawings, in particular any change with respect to drawings in bidding document.

4.0 EARTHWORKS

4.01 CONDITIONS OF SITE AND WAYLEAVE

Before carrying out any work on the Site, the Site shall be inspected by the Contractor in conjunction with the Project Manager to establish its general condition which shall be agreed and recorded in writing, and where in the opinion of the Project Manager it is deemed necessary, by means of photography. The Contractor shall ensure that no existing pipe network or sugar cane/vegetable plantation is damaged during works under the contract. Employer shall be responsible for all wayleaves acquisition for the purpose of the works.

The damage caused to existing plantation within the permitted wayleave zone in the planters' field shall not be compensated.

Any damage caused as a result of the Contractor's operations to plantations beyond the permitted wayleave mentioned above shall be made good (site reinstatement, crop compensation, and other damage) at the Contractor's own expense within two weeks after receipt of Project Manager's instruction.

Two weeks prior to start of survey or any physical works the exact boundaries of the permitted wayleave zones will be established on site jointly by the Project Manager and the Contractor.

In the event of any planter's boundary/cornerstone or other survey mark established for the purpose of land title being disturbed or displaced as a result of the Contractor's operations the Contractor shall forthwith replace the beacon and shall employ the services of an approved sworn land surveyor for this purpose.

4.02 NOTICE TO BE GIVEN BEFORE COMMENCING EARTHWORKS

The Contractor shall give to the Project Manager at least seven days written notice of his intention to commence earthworks on any part of the Site so as to enable the Project Manager to be furnished with all ground levels and other particulars he may require for the purpose of measurement. The earthworks shall not be commenced until written approval has been received by the Contractor from the Project Manager.
The Project Manager shall have the right to direct the Contractor as to the length or location of portions of excavation which shall be opened at any one time, in addition to the normal limits to lengths of open excavation imposed by the local authorities.

4.03 LOCATION OF EXISTING SERVICES

The location of existing services shown on the Drawings is approximate only. Before carrying out any demolition or excavation for construction purposes the Contractor shall, at his own cost, accurately locate in both line and level all existing services within the Site of the Works whether indicated on the Drawings or not, and furnish the Project Manager with 3 copies of the relevant information in the form of AutoCad drawings. Prior to excavations across the existing mains, the Contractor shall dig out the number of trial pits he judges necessary for exact identification of location and depth of the existing buried pipes. He shall then submit to the Project Manager for

approval a methodology for excavation at these crossings for laying for the new pipes so as not to disturb or damage the existing one, prior to pipe laying works.

4.04 SITE CLEARANCE AND TOPSOIL REMOVAL

Site clearance shall be carried out over the areas to be occupied by the Permanent Works and for working space. The site clearance shall be carried out before beginning excavation or other work, and shall include the clearance of all trees, stumps, bushes and other vegetation and the grubbing out of all roots and the removal of all boulders and rock heaps. The limits of the areas to be cleared shall be as indicated on the Drawings or as will be defined by the Project Manager.

Following the establishment of ground levels (section 4.06), the Contractor shall strip topsoil over the width of the trench and to a depth of up to 300mm. The topsoil so removed shall be set aside separately for re-use or disposal as directed by the Project Manager.

Topsoil is defined as the surface layer of soil which by its humus content supports vegetation. This layer of soil is unsuitable, due to weathering and vegetable content, as a formation to roads and concrete structures or as a backfill or bedding material. The presence, extent and depth of topsoil that needs removal shall be agreed with the Project Manager.

Subject to the requirements of this clause all other materials arising out of site clearance shall be disposed by the Contractor off the Site, or on the site in a manner and place approved by the Project Manager.

Where shown on the Drawings or directed by the Project Manager, trees shall be uprooted or cut down as near to the ground level as possible and all timber shall be deemed to become the property of the Employer. The Contractor shall cut and stack such timber as is salvable as directed by the Project Manager.

Bushes, undergrowth, small trees, stumps and tree roots shall, where directed by the Project Manager, be grubbed out, burnt and deposited off the site in dumps to be provided by the Contractor. All holes left by the stumps or roots shall be backfilled with suitable material in a manner approved by the Project Manager.

The Project Manager may require that individual trees, shrubs and hedges are to be preserved and the Contractor shall take all necessary precautions to prevent their damage.

In the case of wayleaves for mains, pipelines and the like, the area to be cleared shall extend over the full width of the wayleave but the Contractor shall preserve as far as practicable all grass and other vegetation outside the limits of trenches and permanent works within the wayleave and shall not unnecessarily destroy crops or any vegetation whose removal would not be essential to his operations.

Before beginning clearance within any wayleave the Contractor shall give seven days written notice of his intention to the Project Manager who will determine the extent and limits of such clearance having regard to the Contractor's requirements, the rate of Contract progress, the reasonable wishes of owners and occupiers, weather conditions and other factors which in the opinion of the Project Manager may affect or be affected by the Contractor's proposals.

Where the pipeline crosses plantations the top soil shall be reinstated to the satisfaction of the Project Manager to permit replanting.

4.05 EROSION

The Contractor shall take particular care at all times to prevent erosion on every site and elsewhere on land which may be affected by his operations and the Project Manager may impose such reasonable limitations and restrictions upon the method of clearance and upon the timing and season of the year when clearance is carried out as the circumstances warrant. The Contractor shall take precautions to minimise dust nuisance from his operation and these shall include damping down of dust as required by the Project Manager.

4.06 GROUND LEVELS

Following the completion of Site clearance and before the commencement of any earthworks or demolition, the sites shall be surveyed in conjunction with the Project Manager to establish existing ground levels and these agreed ground levels shall form the basis for the calculation of quantities of any subsequent excavation and filling. These levels shall be taken before any topsoil is removed.

4.07 TRIAL PITS

The Contractor shall, at his own cost, excavate refill and restore in advance of his programme such trial pits as he may require for the location of existing underground services and obstructions.

4.08 DEMOLITION AND REINSTATEMENT

Where the pipeline crosses roadside drains the Contractor will be required to demolish any concrete slab or stone kerb and to reinstate the drain after pipelaying. Reinstatement of the drains shall be paid under dayworks

4.09 EXCAVATION GENERALLY

Excavation shall be made in open cutting unless tunnelling or heading is specified or approved by the Project Manager and shall be taken out as nearly as possible to exact dimensions and levels so that the minimum of infilling will afterwards be necessary.

It shall be the Contractor's responsibility at all times to ensure the stability and safety of excavations and the Contractor shall take all measures necessary to ensure that no collapse erosion or subsidence occurs.

The sides of all excavations shall be kept true and shall where necessary be adequately supported by means of timber, steel or other type struts, walling, poling boards, sheeting, bracing and the like. All supports shall be of sound design and construction and shall be sufficiently watertight to permit excavation, concreting and other work to be completed satisfactorily.

Excavations shall be kept free from water and it shall be the Contractor's responsibility to construct and maintain temporary diversion and drainage works and to carry out pumping and to take all measures necessary to comply with this requirement.

If the Contractor encounters any unsound material in the formation, he shall immediately inform the Project Manager who will instruct the Contractor in writing as to whether or not the said

material shall be treated as unsound. Unsound material shall be removed and disposed of to the satisfaction of the Project Manager. Unless otherwise specified or ordered by the Project Manager, the voids so formed shall be filled with concrete Grade 10 in the formations to structures, with the same material as that which comprises the fill in the formation to embankments, with compacted granular material in the formation of pipelines and with concrete Grade 10 filling approved by the Project Manager in the formation to roads. If, in the opinion of the Project Manager, the unsoundness is due to failure of the Contractor to comply with the Specification including keeping the excavation free from water, the cost of dealing with the unsound material shall be borne by the Contractor.

The Contractor shall not deposit excavated materials on public or private land except where directed by the Project Manager in writing or with the consent in writing of the relevant authority or of the owner or responsible representative of the owner of such land and only then in those places and under such conditions as the relevant authority, owner or responsible representative may prescribe.

4.10 EXCAVATION IN EXCESS

If any part of any excavation is in error excavated deeper and/or wider than is required the extra depth and/or width shall be filled with Grade C15P concrete or compacted granular or other approved fill to the original formation level and/or dimensions as the Project Manager may require.

In pipe trenches where the pipe is not bedded on or surrounded with concrete, the excess excavation shall be filled with compacted granular material. Excess excavation in rock trenches shall be filled with Grade C15P concrete up to 150mm below the pipe invert.

4.11 MECHANICAL EXCAVATION

Mechanical excavation shall be employed by the Contractor only if the subsoil is suitable and will allow the timbering of the trenches or other excavations to be kept sufficiently close up to ensure that no slips, falls or disturbance of the ground take place or there are no pipes, cables, mains or other services or property which may be disturbed or damaged by its use.

When mechanical excavators are used a sufficient depth of material shall be left over at the bottom of the excavation to ensure that the ground at formation level is not damaged or disturbed in any way. The excavation shall then be completed to formation level by hand.

4.12 EXCAVATION FOR PIPELAYING

Excavations for pipelines shall be to the gradients indicated on the Drawings or as directed by the Project Manager. Curves, where necessary, shall not involve angular deviations at any pipe joints greater than those recommended by the Manufacturer and approved by the Project Manager

The width of trench excavated for any size of pipe shall be the minimum required for efficient working after allowance has been made for any timbering and strutting, and shall be to the approval of the Project Manager or as shown on the Drawings.

The maximum width of the trench shall be:

(a) for pipes equal or less than 160 mm ND : Maximum width of trench = 450 mm

(b) for pipes greater than 160 mm ND: Maximum width of trench = OD of pipe + 400 mm.

For pipes greater than 160 mm ND, the maximum distance between the sides of the trench and the barrel of the pipes shall be 200 mm inclusive of any allowance required for trench support.

The minimum depth between the original ground level and crown of the main pipeline shall be 920 mm unless otherwise specified. In the event that the pipe is exposed overground or lacks the minimum cover, concrete surrounded or compacted earthfill shall be supplied as instructed by the Project Manager.

Properly painted sight rails and boning rods of predetermined measurement shall be supplied as specified in the Specification for pipe-laying. They shall be used to ensure that the excavation is to a true and even gradient.

The maximum length of open excavation ahead of pipelaying shall not, except with prior written approval of the Project Manager, exceed 500 metres.

The Contractor shall excavate the pipe trench to a depth of 150 mm below the invert of the pipe.

If the trench formation becomes weathered prior to the laying of the pipes the Contractor shall excavate the weathered soil and replace it with compacted granular fill to the original formation level at no extra cost.

The materials excavated from trenches shall be laid compactly at the sides of the trench except where in the opinion of the Project Manager this would so obstruct any road or footpath as to prevent the passage of traffic or pedestrians.

In such cases the Contractor shall excavate the trench in such lengths and keep the excavated materials at such distance as the Project Manager may require.

Where excavation for pipelaying is carried out behind thrust blocks on existing pipelines adequate support arrangements shall be provided to transfer thrusts to the surrounding ground.

4.13 BOULDERS ALONG PIPE ALIGNMENT

Rock in the form of boulders predominantly above ground level and located along the pipeline shall be removed, if required by the Project Manager, who shall determine in each case whether the removal of the boulder is necessary to achieve the required alignment or profile or to ensure the future safety of the pipeline.

4.14 HEADINGS

Where excavation for pipes in heading is specified or shown on the Drawings or permitted by the Project Manager it shall be carried out to the approval of the Project Manager and to dimensions which will permit a proper inspection to be made. The heading shall be properly and securely timbered. The pipe shall be laid on a minimum thickness of 150mm of Grade C15P concrete. After the pipe has been laid, jointed and tested the heading shall be filled in short lengths not exceeding 1 metre with Grade C15P concrete or as directed. Great care shall be taken to ensure that the heading is completely filled with concrete and hard filling shall then be rammed into the concrete at the crown of the heading.

Special precautions shall be taken to prevent a slump in the concrete and to ensure that no slips or falls of the heading or in the ground above or in the shafts can take place. The Contractor shall allow for leaving in all timbering.

The Contractor shall be responsible for the proper restoration of any road surfaces, pipes, cables or other things or property which may be damaged.

4.15 SLIPS, FALLS AND EXCESS EXCAVATION

Slips and falls of material from the sides of the excavation and embankments shall be prevented.

In the event of slips or falls occurring in the excavations and where excavations are made in excess of the dimensions of the permanent works, the voids so formed shall be filled as specified below. When such voids in the opinion of the Project Manager may affect the stability of the ground for the support of the Works or of the adjacent structures and services, they shall be filled solid with concrete Grade 10. In other cases they shall be filled with selected excavated material placed and compacted to the approval of the Project Manager.

4.16 EXCAVATION FOR FOUNDATIONS OF STRUCTURES

The Contractor shall give sufficient notice to the Project Manager to enable him to examine foundations well in advance of concrete being placed and no placement shall occur until such inspection shall have been carried out and the formation approved.

If the formation has become weathered prior to the placing of concrete the Contractor shall remove the weathered material and replace it with Grade C15P concrete at his own cost as directed by the Project Manager.

If the Project Manager so directs, a bottom layer of excavation of not less than 75mm thickness shall be left undisturbed and subsequently taken out by hand immediately before concrete or other work is placed. Similarly, where concrete or other materials is to be placed in contact with the side face of an excavation the Contractor shall, if the Project Manager so directs, leave undisturbed the last 75mm thickness of the excavation to that face until it is taken out neatly to profile by hand immediately before the concrete is placed.

Areas of excavation which are to receive a layer of concrete blinding or drainage layer under structural concrete shall be covered with such blinding or layer immediately the excavation has been completed and inspected and approved by the Project Manager.

All surfaces shall be free of oil, water, mud or any material which in the opinion of the Project Manager is not desirable.

Excavations for foundations and for thrust and anchor blocks shall be to such depth as shown on the Drawings or as the Project Manager may direct and no concrete or other materials shall be placed until the formation has been examined and approved. Due notice shall be given to the Project Manager to enable him to examine the formation well in advance.

4.17 CLASSIFICATION OF ROCK EXCAVATION

The Project Manager's decision on the classification of excavated material shall be final. Rock excavation shall be based on the following guidelines:

"Rock" shall include all material which, in the opinion of the Project Manager requires blasting or the use of metal wedge hammers or the use of compressed air drilling for its removal or cannot be extracted by ripping with a tractor of less than 180 hp and rear mounted heavy duty ripper. Individual boulders greater than 0.5 cubic metres in volume shall be included when their nature and size are such that they cannot be removed without recourse to one of these methods.

Decomposed rock, altered rock, agglomerates and tuffs will not be considered as rock.

The breaking of concrete or road surface or road base will not be considered or paid for as rock excavation.

The Project Manager's decisions to the necessity or otherwise of rock excavating methods or appliances shall be final.

In case of any doubt, the Project Manager shall base his decision on the following criteria:

	ROCK
Typical Material	Basalts
Unconfined Crushing Strength	greater than 40 N/mm²
Hammer Blow	Solid Note from Ringing to Dully
Pliers Crushing	Not possible
50mm diameter Core in Hand	Cannot break 500mm long piece
Soaked in Water for one hour	No change

4.18 ROCK SURFACES UNDER CONCRETE STRUCTURES

The surface of rock excavation under concrete structures shall be prepared by picking, barring and wedging or other methods which will leave the rock in as sound a condition as may reasonably be expected according to the rock quality.

Rock surfaces shall be thoroughly cleaned by compressed air and water jet or such means as the Project Manager may direct before concrete is placed.

4.19 KEEPING ROCK FACES DRY

The Contractor shall keep free of running water and pools the surfaces of rock upon or against which concrete is to be placed and no concrete shall be placed until surfaces of the rock are properly drained. Special precautions are to be taken to prevent running water from washing out cement or concrete while it is setting or in any other way injuring the Works. Drains and pipes shall be provided in or behind concrete as may be necessary for the temporary conveyance of water and shall afterwards be grouted up.

4.20 EXPLOSIVES

The use of explosives for rock blasting will not be permitted.

4.21 EXCAVATED MATERIALS SUITABLE FOR RE-USE

In so far as they may be suitable and comply with the Specification, materials arising from excavations may be used in the Works.

During excavation, the Contractor shall ensure that all material suitable for re-use and which he intends for re-use are kept separate and set aside and protected as necessary to prevent loss or deterioration.

The materials forming the surface and foundations of roads, road verges, tracks and footways shall when excavated, and if required for further use, be carefully separated. All hard materials shall be kept free from soil or other excavated materials.

In particular, during excavation of pipe trenches the Contractor shall ensure that all granular or other approved material suitable for filling around and over pipes shall be kept separate and re-used for this purpose.

Paving slabs, bricks and similar surfaces shall be carefully removed and stacked. Prior to the commencement of excavation the number of badly broken and unsuitable paving slabs, bricks etc. on the line of the excavation shall be agreed with the Project Manager.

In verges and other grass surfaces the grass and top soil shall be stripped and separately stacked.

4.23 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

All surplus excavated material shall be disposed of by the Contractor to **tips** provided by the Contractor and approved by the Project Manager.

The Contractor shall not sell any materials arising from excavation, demolitions and the like carried out on the site.

The Contractor shall not deposit excavated materials on public or private land except where directed by the Project Manager in writing or with the consent in writing of the relevant authority, owner or responsible representative of the owner of such land and only then in those places and under such conditions as the relevant authority, owner or responsible representative may prescribe.

Surplus material may not be tipped on the site without the written permission of the Project Manager. In the event of such permission being granted the Contractor shall observe all conditions attached thereto.

4.24 BACKFILLING OF EXCAVATIONS

All backfilling of excavations shall be thoroughly compacted in layers not exceeding 300 mm compacted thickness and by means which will not damage the Works.

Backfilling of excavations for reinforced concrete structures shall be with suitable material approved by the Project Manager.

"Granular material" as backfill is defined as decomposed basalt, crushed stone, quarry dust, gravel, sand or similar in which the clay or silt content is not predominant. Topsoil shall not be gradeified as granular material.

4.25 PIPE BEDDINGS

Details of pipe beddings are shown on the Drawings.
Granular bedding material shall be 4 – 6mm aggregates to BS 882.

Class A bedding shall comprise a 120 degrees cradle of Grade C15P in-situ unreinforced concrete under the pipe with selected backfill material to a depth of 300mm above the crown of the pipe.

Class B bedding shall comprise a 180 degrees bed of granular bedding, with selected backfill material to a depth of 150mm above the crown of the pipe.

Class S bedding shall comprise a complete surround of single-size aggregates to a depth of 150mm above the crown of the pipe.

Granular bedding and selected backfill material, placed around and to a thickness of 150mm above the crown of the pipes shall be placed simultaneously on both sides of the pipe in layers not exceeding 150mm thickness and compacted by the use of hand rammers taking particular care to compact the material under the barrel of the pipe and around joints.

In trenches where there is a continuous accumulation of groundwater, the trench shall after obtaining the approval of the Project Manager, be over-excavated by 150mm and shall be backfilled using compacted granular material in accordance with the above table.

4.25 SELECTED BACKFILL MATERIAL

The initial backfill in contact with the pipes shall be selected material and shall not contain large stones, rocks, tree roots or similar objects which through impact or by concentrating imposed loads might damage the pipes. The material shall be capable of being compacted without the use of heavy rammers and should be free from material larger than 75mm or stones larger than 20mm.

If the quantity of suitable material which can be obtained from the excavations is insufficient, the Contractor shall either screen the excavated material without additional cost or transport suitable material which has been screened from other excavations on the site without additional cost. In cases where no sufficient material exists on the site, the Contractor shall import suitable material after obtaining the written approval of the Project Manager.

4.26 BACKFILLING OF PIPE TRENCHES

The trench above pipe surround level (300mm above the crown of the pipe) shall be filled with approved back fill material obtained from the trench excavations, free from boulders or rock fragments larger than 50 mm.

If the quantity of material which can be obtained from the pipe trench excavation is insufficient, the Contractor shall either screen the excavated material or transport suitable material from other excavations on the site without additional cost. In cases where no sufficient material exists on the site, the Contractor shall import suitable material after obtaining the written approval of the Project Manager.

Across roadways the material shall be placed in layers not exceeding 300mm thickness and compacted by the use of rammers to achieve a density of not less than 95% maximum dry density at optimum moisture content +5% to -2% as determined by the BS Heavy Compaction Test to BS 1377.

The density of the compacted fill shall be determined by the Contractor by using the "sand replacement" method when directed by the Project Manager.

For trenches in fields and open areas where agreed by the Project Manager the trench backfill shall be compacted to obtain a density of not less than 85% maximum dry density at optimum moisture content +5% to - 2% as determined by the BS Heavy Compaction Test to BS1377.

Before backfilling trenches the Contractor shall obtain approval from the Project Manager of the methods he proposes to use and he shall demonstrate by means of tests that the specified compaction can be achieved. The method of compaction shall at all times be to the approval of the Project Manager.

4.27 MAKING GOOD SUBSIDENCES AFTER REFILLING

All refilling, whether over foundations or in pipe trenches shall be thoroughly compacted by ramming and any subsidences due to consolidation shall be made up with extra compacted material.

Should subsidences occur after any surface reinstatement has been completed the surface reinstatement shall first be removed, the hollows made up, and then the surface reinstatement re-laid.

Any subsidence that occurs adjacent to the Site of the Works which is attributable to the Contractor's activities shall be reinstated at the Contractor’s own expense and to the full satisfaction of the Project Manager.

4.28 REMOVAL OF SHORING FROM EXCAVATIONS

Shoring shall be removed from the excavations before or during the process of refilling except in so far as this removal would be likely to cause damage to adjacent property, structures or structure foundations in which event the Contractor shall leave in the excavation such shoring as he considers necessary or as may be ordered by the Project Manager to prevent damage the proper repair of which the Contractor shall be solely responsible for in the event of any such damage occurring.

4.29 REINSTATEMENT OF SURFACES

All surfaces whether public or private which are affected by the Works shall be reinstated temporarily by the Contractor in the first instance and in due course when the ground has consolidated fully he shall reinstate the surfaces permanently.

The temporary reinstatement and maintenance and permanent reinstatement and maintenance of all surfaces of roads, tracks, paths, fields, verges and any other surfaces which have been affected by the operations of the Contractor shall be his sole liability and shall be carried out to the satisfaction of the Project Manager and of the responsible authority or owner.

Temporary reinstatement shall be carried out immediately the trenches are refilled.

Permanent reinstatement shall not be carried out until the ground has consolidated completely and the Contractor after first obtaining the approval of the responsible authority shall inform the Project Manager before carrying out this work. In the event of further settlement occurring after the completion of the permanent reinstatement the Contractor shall forthwith make good the reinstatement to the approval of the Project Manager or responsible authority.

For the purposes of temporary and permanent reinstatement in bitumen and stone surfaced roads the surface width of trenches shall be increased by 150mm on each side of the trench for a depth of 75mm to provide a solid abutment for the surfacing material.

Reinstatement of stone surfaced roads shall consist of 100mm single-size aggregates placed in one layer 200mm thick thoroughly compacted by an approved roller and surface blinded with fine aggregates so as to leave a tight closed even surface, all to the satisfaction of the Project Manager.

Materials forming the surface and foundations of bitumen and stone surfaced roads, tracks and footpaths may if they are approved by the Project Manager be used by the Contractor in the temporary reinstatement of surfaces. The Contractor shall provide all additional materials necessary for the reinstatement. All materials shall form a surface similar to the adjoining surface. The surface shall be well compacted.

Trenches in open ground shall be reinstated to the condition in which the ground was before excavation was commenced. The final surface of the trench shall be flush with the surrounding ground.

In verges and other grass surfaces and after the refilling has been thoroughly consolidated the topsoil shall be re-laid rolled and planted with grass as may be necessary and watered until the grass has become well established. Should the grass fail it shall be replanted as required until a satisfactory growth is obtained.

The Contractor shall take all necessary precautions to ensure that no toxic materials which may cause damage to vegetation or livestock or pollute streams or watercourses are used in any temporary or permanent reinstatement and shall indemnify the Employer against any claims arising out of the use of such materials.

If at any time any trench becomes dangerous the Project Manager shall be at liberty to call on the Contractor to restore it to a proper condition immediately.

If the work or reinstatement as carried out by the Contractor is not to the satisfaction of the Project Manager and/or the responsible authority and should the Contractor not remedy the defect forthwith any remedial work considered necessary may be undertaken by the Employer and/or the responsible authority at the Contractor's expense.

4.30 FORMING BANKS AND FILLED AREAS

Banks and filled areas shall be made and built up to the levels dimensions and shapes as shown on the Drawings or as may be subsequently directed by the Project Manager.

Before any filling is started, the ground on which the fill is to be placed shall be stripped of all grass and topsoil and all roots vegetable matter and other unsuitable substances removed.

The filling to be used in the embankments and filled areas shall be material selected by the Project Manager from that arising from surplus excavation, the material being placed according to its nature as shall be directed, that is, coarse hard material may be placed at the bottom with the fine materials and/or soil placed at the top or at the surface.

The fill shall be placed in layers not exceeding 150 mm thick, each layer being thoroughly compacted by an approved roller to the satisfaction of the Project Manager.

4.31 BORROW AREAS

The Contractor shall select the sites, if any, from which he shall import material for the purpose of the Works and shall obtain the Project Manager's approval.

The Contractor shall excavate the site of borrow pits to expose the material required for fill and shall excavate the said material.

After the required amount of material has been excavated from each borrow pit, the Contractor shall reinstate the borrow area by spreading the previously removed superficial materials in layers not exceeding 250 mm in thickness over the area of the excavation and by grading and trimming the surfaces, all to the satisfaction of the Project Manager. Where practicable such grading shall be made to prevent the accumulation of surface water.

The Contractor shall submit for the approval of the Project Manager his proposal for the use of borrow pits one week before the proposed date of starting earthworks at the site of each borrow pit.

4.32 RESTORATION OF BORROW AREAS, SPOIL TIPS AND QUARRIES

Any spoil tips, quarries or other borrow areas developed by the Contractor for the purpose of the Works shall be finished to safe and fair slopes to the approval of the Project Manager.

4.33 TOP SOILING AND GRASSING

Where required surfaces shall be soiled with fine sifted soil or silt not less than 100 mm compacted thickness which shall be raked and brought to a fine tilt. The Contractor shall supply approved material for this purpose or use the material provided in Section 4.04.

Surfaces required to be grassed shall be planted with approved local grass at a spacing of 200mm x 200mm. The grassed areas shall be replanted if the first or subsequent operation is unfruitful or if for any reason the grass is destroyed. Grassed areas shall be watered and attended until the grass has become well established.

4.34 FREE DRAINING FILL

Free draining fill for use as backing to walls shall consist of sound hard stone or broken rock or concrete derived from demolition of structures. The particles shall be roughly cubiform and shall be between 75 mm and 25 mm in size. All smaller particles dust rubbish and organic matter shall be excluded.

4.35 HARDCORE

Hardcore shall consist of sound hard stone or broken rock or concrete derived from excavations or demolition of structures and shall be graded from 150mm to 50mm in size, except that sufficient but not excessive blinding materials of smaller sizes may be permitted at the discretion of the Project Manager.

SECTION 5.0 CONCRETE FOR MINOR WORKS

5.01 SCOPE

This Specification applies to structural concrete in chambers, in thrust blocks, blindings, supports, fill etc.

5.02 CONCRETE

The concrete used in the Works shall be of the grade shown on the Drawings or detailed in the Bill of Quantities.

Except where otherwise specified herein, the concrete ingredients, manufacture, testing and workmanship shall conform with the recommendations of Sections 6 and 7 of BS8110 Part 1 and 2.

This specification includes 4 grades of concrete

Grade C15
Grade C20
Grade C25
Grade C30

The grade number refers to the 28 day characteristic strength in N/mm².

The concrete composition shall generally conform to the requirements of the prescribed mix design, as set out in Table 5.2 - Prescribed Mixes. Small quantities of concrete may with the approval of the Project Manager be batched in accordance with Table 5.1 -Nominal Mixes.

Table 5.1 Nominal Mixes

Grade of Concrete	Approx. volume of aggregate (m³) per m³ concrete		Approx. cement per m³ finished concrete, in bags (each 50kg)	Remarks
	Fine	Coarse		
C15N	0.450	0.900	6	Aggregate max. size to be 20mm. Fine aggregate to Zone 2 of BS 882. Water not to exceed 28 litres per 50kg of cement
C20N	0.400	0.875	7	
C25N	0.375	0.825	8	
C30N	0.350	0.725	10	

Table 5.2 - Prescribed Mixes

Mass of Dry Aggregate to be used with 100 kg of Cement

	Aggregate	Nominal Maximum Size of Aggregates (mm)							
		40		20		14		10	
	Workability	Medium	High	Medium	High	Medium	High	Medium	High
	Range for standard sample (mm)	50-100	80-170	25-75	65-135	5-55	50-100	0-45	15-65
	Range for sample taken in accordance with Clause 9.2 of BS 5328 (mm)	40 - 110	70-180	15-85	55-145	0-65	40-110	0 - 55	5 - 75
Grade of Concrete	MATERIAL	Weight in kg							
C15P	Total Aggregate	790	690	680	580	N/A	N/A	N/A	N/A
C20P	Total Aggregate	660	600	600	530	560	470	510	420
C25P	Total Aggregate	560	510	510	460	490	410	450	370
C30P	Total Aggregate	510	460	460	400	410	360	380	320
		Percentage by Mass of Fine Aggregate to Total Aggregate							
C15P		30	45	35	50	N/A	N/A	N/A	N/A
C20P	Grading Zone 1	35	40	40	45	45	50	50	55
C25P		30	35	35	40	40	45	45	50
C30P	2	30	30	30	35	35	40	40	45
C30P	3	25	25	25	30	30	35	35	40
	4								

N/A not applicable

Notes on the use of table 5.2

Note 1. The proportions given in the tables will normally provide concrete of the strength in N/mm2 indicated by the grade except where poor control is allied with the use of poor materials.

Note 2. For grade C15P a range of fine-aggregate percentages is given; the lower percentage is applicable to finer materials such as zone 4 sand and the higher percentage to coarser materials such as zone 1 sand.

Note 3. For all grades, small adjustments in the percentage of fine aggregate may be required depending on the properties of the particular aggregates being used.

Note 4. For grades C20P,C25P and C30P and where high workability is required, it is advisable to check that the percentage of fine aggregate stated will produce satisfactory concrete if the grading of the fine aggregate approaches the coarser limits of zone 1 or the finer limits of zone 4.

5.03 STRUCTURAL CONCRETE

The cement content of structural concrete shall not be less than 300 kg per cubic metre and the water/cement ratio shall not exceed 0.55 (27.5 litres per 50kg of cement).

The slump shall be 50 mm +/- 25mm when tested to BS 1881.

Coarse aggregate shall be 20mm max. size.

5.04 CEMENT

Cement shall be Ordinary Portland cement to BS 12. Cement which is not fresh and dry before mixing shall not be used in the Works.

The Contractor shall supply samples of cement, when requested by the Project Manager, both from the Contractor's store on site and from the place of manufacture.

The Contractor shall supply the manufacturer's test certificate for each consignment of cement received at the site and shall maintain a record, available for inspection by the Project Manager of the location of concrete made from each consignment.

For the purpose of BS12, the site shall be deemed to have a tropical climate.

5.05 DELIVERY AND STORAGE OF CEMENT

All cement shall be delivered to the Site in properly marked, sound and sealed paper bags or other approved containers, unless written approval from the Project Manager is obtained for the handling of cement in bulk.

Cement shall be delivered in quantities sufficient to ensure the proper progress of the Works and the quantities held in stock on Site shall be to the approval of the Project Manager.

All cement shall be stored in a weather-proof and reasonably air-tight building provided solely for that purpose. The floor of the building shall be raised above the ground level to prevent the absorption of moisture. Storage in the open may be permitted on small works by the written authority of the Project Manager, in which case the cement shall be placed on a raised platform and amply protected by waterproof coverings to the approval of the Project Manager.

Each consignment of cement shall be stored separately so as to provide easy access for inspection and testing. After they have been approved by the Project Manager, consignments shall be used in the order in which they were delivered. Bags of cement should not be stocked higher than about 1.5 metres.

5.06 CEMENT MEASURED BY WEIGHT

All cement used in the Works shall be measured by weight. Cement from partly filled or unsealed bags shall not be used.

5.07 REJECTION OF CEMENT

Notwithstanding the receipt of the test certificate required by Clause 5.04 the Project Manager may reject any cement as a result of further tests. The Project Manager may also reject cement which has deteriorated owing to inadequate protection or other causes or in any other case where the cement is not to his satisfaction.

The Contractor shall remove all rejected cement from the Site without delay.

5.08 WATER

Water shall be potable and shall comply with the requirements of BS 5328.

The water used for making and curing concrete and mortar shall be free from objectionable quantities of silt, organic matter, alkali, salt or other impurities including chemical impurities. In particular, inorganic matter in solution shall not exceed 500 mg/l and in suspension shall not exceed 30 mg/l.

The water shall be from an approved source and shall contain no deleterious matter which significantly affects the setting time or strength or durability of the concrete or which has any effect on the appearance of the hardened concrete by discoloration or efflorescence or prevents the achievement of the approved test cube strengths at 28 days for the appropriate grade of concrete.

The Contractor shall deliver to the Project Manager, without charge, samples of the water proposed for use on the Works for the Project Manager to carry out such tests as he may require to confirm its suitability. Samples will be delivered sufficiently in advance of the work for completion of the tests before the water is required for use and at such other times during the course of the Contract as the Project Manager may direct.

If required by the Project Manager the Contractor shall, without extra charge, treat the water taken from rivers, canals or from any other source to such a degree as may be necessary in order to render it suitable for making concrete and mortar.

5.09 QUALITY AND GRADING OF AGGREGATES

Aggregates for concrete and mortar shall comply with BS 882 "specification for aggregates from natural sources for concrete" and BS 1201 at the time of use and shall be obtained from sources approved by the Project Manager. Aggregates used should be hard, durable and clean and free from adherent coatings such as clay. They should not contain harmful impurities in such a form or in sufficient quantity to affect adversely the strength or durability of the concrete or the reinforcement.

(a) Fine aggregate shall be derived from crushed stone, but the Project Manager will permit the addition of a suitable amount of coral sand, as necessary, to the crushed stone sand where in his opinion it is impracticable to obtain the approved grading of the combined aggregate otherwise. The maximum quantities of clay, silt and dust shall, in any event, not exceed 3 per cent by weight when using the test given in Clause 7.2.4 of BS 812: Part 1. When tested in accordance with BS 812 the grading of fine aggregate shall be within the limits given by either Zone 1, 2 or 3 of Table 2 of BS 882. Fine aggregate within the limits of Zone 4 shall not be used in the Works.

(b) Coarse aggregate shall comply with the requirements in Table 1 of BS 882 for graded aggregate to the normal maximum size approved for the appropriate grade of concrete. If required by the Project Manager the Contractor shall obtain the specified grading by combining single sized aggregates in proportions to give the specified grading.

The aggregates must not contain salts or other chemicals which, in the opinion of the Project Manager, might affect the setting time, strength, durability, quality or appearance of the concrete or the strength or durability of any embedded reinforcing steel. The Project Manager may reject any aggregates that are not to his satisfaction or, if he considers that washing may render the aggregates acceptable, he may order them to be washed before use in the Works. When washing is ordered it shall be done using water of the quality specified in Clause 5.08 of the Specification and using methods and plant approved in advance by the Project Manager and all costs arising therefrom shall be borne by the Contractor. If such washing fails to render the aggregates acceptable to the Project Manager they shall not be incorporated in the permanent work.

The aggregates shall be such that concrete, when made and tested in accordance with Building Station Digest 35 (2^{nd} series), shall not show a drying shrinkage greater than 0.065 per cent.

5.10 STORAGE OF AGGREGATES

Each size of fine and coarse aggregate shall be stored in separate bins or on areas covered with sheet metal, concrete or other hard and clean surface, which shall be self-draining and protected from contamination by earth or other deleterious matter.

5.11 PRELIMINARY TESTS ON AGGREGATES

Before concreting is due to start, the Contractor shall submit to the Project Manager samples of the fine and coarse aggregates proposed for use in the Works so that the necessary tests can be performed prior to concreting.

Sampling shall be carried out in accordance with the methods described in BS 812. Samples shall be of a size sufficient to carry out all preliminary tests which the Project Manager may order in addition to the concrete tests specified in Clause 5.16 and to provide the 50 kg sample for comparison purposes described below.

The samples shall then be tested, as set out in BS 812 or as the Project Manager may direct, by the Contractor in the presence of the Project Manager.

If the source of aggregates is changed at the Contractor's request and with the approval of the Project Manager at any time during the course of the Works, all sampling and testing described in this Clause shall be repeated at the Contractor's expense.

After approval has been given for any particular aggregate, a sample of the approved aggregate weighing at least 50 kg shall be retained by the Project Manager as a standard against which all future samples shall be compared.

5.12 WORKS TEST ON AGGREGATES

During the course of the Contract, fine and coarse aggregates from each source of each grading shall be tested on Site or at an approved laboratory as often as requested by the Project Manager and at least once weekly during concreting. The Contractor shall furnish the Project Manager with a copy of each test result. The sampling of aggregates must be in accordance with the methods described in BS 812, BS 882, 1201 and BS 1377.

5.13 ADDITIVES

Concrete and mortar shall be made from cement, aggregates and water unless specified otherwise, and no other ingredient shall be mixed with the concrete, or mortar, without the Project Manager's approval.

5.14 CHEMICALS IN MATERIALS

The sulphate content, whether as gypsum or more soluble salts, of concrete ingredients when measured as S03 shall not exceed 6 per cent of the weight of cement in the concrete.

The chloride content when measured as C1 shall similarly not exceed 0.20 per cent of the weight of cement.

5.15 MIX PROPORTIONS OF CONCRETE

The proportions of the mix shall be approximately as shown in the Table 5.2 - Prescribed Mixes but these proportions may be varied to obtain workability and the specified strength requirements. Admixtures may not be used in ordinary structural concrete.

A trial mix of the concrete to be used shall be made in the presence of the Project Manager sufficiently in advance of the commencement of concreting to permit the 28 day compression test result of the cubes taken from the mix to be approved by the Project Manager as a result of satisfactory preliminary tests made in accordance with Clause 5.16.

After the concrete mix has been approved by the Project Manager, the Contractor shall not alter the proportions or sources of the ingredients without having obtained the Project Manager's approval. If the proportions are changed at the Contractor's request and with the approval of the Project Manager at any time during the course of the Works, all the Preliminary Tests of Clause 5.16 shall be repeated at the Contractor's expense.

The Project Manager will not permit and the Contractor shall not commence concreting in the permanent work until the details of the concrete mix and the test results have been submitted to and approved by the Project Manager.

5.16 TRIAL MIXES AND PRELIMINARY CUBE TESTS

The Contractor shall prepare trial mixes in order to satisfy the Project Manager regarding the workability, strengths and surface finishes of the proposed mixes for each grade of concrete.

The trial mixes shall be made and compacted in the presence of the Project Manager, using the same type of plant and equipment as will be used for the Works.

The Contractor shall make trial mixes for each grade of concrete and, for each trial mix, three separate batches of concrete shall be made. From each batch of concrete six preliminary 150 mm test cubes shall be made, three for tests at 7 days and three for tests at 28 days, all in accordance with BS 1881. They shall be tested in a nominated laboratory and the certified copies of the results of all tests shall be submitted to the Project Manager.

A trial mix will be acceptable with respect to strength if not more than 5% of test results fall below the specified characteristic strength (or 2/3 of the characteristic strength in the case of 7 day tests) at 28 days.

From the same mix as that from which the preliminary test cubes are made, the consistency of the concrete shall be determined by the compacting factor test in accordance with BS 1881, or other method approved by the Project Manager. The compacting factor for all grades of concrete shall not exceed 0.95. The remainder of the mix shall be cast in a wooden mould and compacted. After 6 hours the sides of the mould shall be struck and the surface examined in order to satisfy the Project Manager that an acceptable surface can be obtained with this mix.

The Contractor shall also determine the slump of fresh concrete of each individual batch of his trial mixes, in accordance with BS 1881.

5.17 WORKS CUBE TESTS

During the course of the Works and at such time as the Project Manager may direct, 150 mm Works test cubes of concrete shall be made on Site for all grades of concrete used and shall be tested at the nominated laboratory in accordance with BS 1881.

The Works test cubes for each grade of concrete shall not have more than 5% of test result below the specified characteristic strength (or 2/3 of the characteristic strength in the case of 7 days) at 28 days.

In the event of concrete failing to comply with the Specifications:

(a) If a cube shall have a strength less than the minimum specified, the concrete which it represents may be rejected by the Project Manager and shall be broken out and removed by the Contractor when ordered. In addition the Contractor shall comply with the requirements of (b) below.

(b) If the average strength of four consecutive cubes shall fail to exceed the characteristic strength as specified, no further concrete of that grade shall be placed in the permanent work until the Contractor shall have discovered the cause of such failure and shall have rectified it to the satisfaction of the Project Manager. If in the opinion of the Project Manager it is necessary, he will increase the value of the target mean strength (in accordance with the principles of Clause 6.4 of BS 8110 Part I) and the Contractor shall make new determinations of the proportions of concrete ingredients and new trial mixes all as specified until the difference between the target mean strength and the characteristic strength is such that the concrete produced for the works satisfies the requirements of this Clause.

The Contractor shall comply with the requirements of sub-clauses (a) and (b) of this Clause at no extra cost to the Employer.

The concrete shall also be tested for compaction and the bulk density of each cube shall be determined in accordance with BS 1881. The weight per cubic metre of fresh concrete and the water absorption of hardened concrete shall be measured as directed by the Project Manager.

The sampling, making and curing of test cubes together with the provision of cube moulds, all other necessary equipment and apparatus and the packing and transport to a nominated laboratory shall be as specified and to the approval of the Project Manager.

5.18 MIXING WATER AND SLUMP TESTS

The amount of water introduced into the mix shall be strictly controlled; it shall not exceed 0.55 (27.5 litres per 50 kg of cement) and shall otherwise be the minimum amount consistent with complete compaction. The device for measuring water shall show accurately the quantity of water discharged into the mix.

Water shall not be added to the mixed concrete during its transport from the mixer to the place where it is to be placed and prior to placing at the place of deposit.

Frequent slump tests shall be carried out in accordance with BS 1881 on samples of concrete taken immediately before placing to determine the consistency of concrete.

The Contractor shall supply slump cones and compacting rods at every place where concrete shall be tested for slump at the place of deposit.

5.19 CONTROL AND MIXING OF INGREDIENTS

The Contractor shall proportion the ingredients of each batch of concrete accurately by weight and the concrete shall be thoroughly mixed in a batch mixer of an approved size and type so as to ensure a uniform distribution of the materials throughout the concrete.

The concrete shall be mixed for at least one and a half minute after all the materials including water have been deposited in the mixer and before any portion of the batch is discharged.

In special circumstances, at the discretion of the Project Manager, the proportioning of materials by volume may be approved. In such circumstances the cement content of the concrete shall be increased by 10% over the amount in the approved mix. The boxes used for proportioning shall be deep and narrow to the approval of the Project Manager and shall be separately constructed for each grade of concrete to be proportioned by volume. The 'bulking' of sand shall be determined and allowed for.

5.20 TRANSPORTING AND PLACING OF CONCRETE

The concrete shall be handled so that at the point of deposition, it is of the specified quality and approved consistency, nothing having been added to it or lost from it since leaving the mixer. The point of deposition should as close as possible to its final position to avoid segregation and to ensure full compaction.

The Contractor shall always obtain the Project Manager's approval before any concrete is placed in the Works. The shutter or area of deposition shall be thoroughly cleaned to remove sawdust shavings and all other foreign matter. All Constructional Plant and materials required or which may be required, during the concreting work and for curing, shall be on Site and fully prepared for the work. The Project Manager's approval to place concrete will only be given after all these preparations and other relevant requirements of the Specification have been carried out and compiled with.

The method of conveying and depositing concrete shall be such as to prevent segregation of the materials. The concrete shall be placed in the shutter or area of deposition. If any delay has occurred after mixing and the concrete has begun to set, it shall not be used in the Works and shall be removed from the Site. Concrete shall not be freely dropped from a vertical height greater than 2 m unless otherwise directed by the Project Manager.

When placing concrete in walls, the concrete must not come into contact with the form face. Should it be necessary the Contractor shall place baffle boards at the top of the forms.

Concrete shall not be placed under water without the written authority of the Project Manager and approval by the Project Manager of all Constructional Plant and methods to be used.

Concrete shall be deposited in approved quantities and in horizontal layers of such depth as to permit thorough incorporation with the layers below by vibration, spading, ramming and working. Each layer of concrete must be fully compacted before placing the next one and the Contractor shall make sure that each new layer is placed while the underlying is still responsive to vibration.

The formation of cold jointed must be avoided. Where concrete is to be deposited against or on top or previously executed work, the surface of the old concrete shall be thoroughly wire-brushed and hacked and cleaned with water and air under pressure to expose the surface of the aggregate and to remove all laitance.

The Contractor shall not place concrete in the permanent work during heavy rains.

When the air temperature exceeds 30°C the Contractor shall not place concrete in the permanent work without taking such precautions as may be required to keep the temperature of the concrete during the mixing and setting below 38°C, e.g. keeping the concrete materials and shutters shaded form the sun, and the aggregate and shutters sprayed with water.

Concrete shall not be poured against shutters which are hotter than 30°C without the approval of the Project Manager.

5.21 READY MIXED CONCRETE

Ready mixed concrete shall be used only with the approval of the Project Manager and the Contractor shall furnish details regarding the location of the depot and the capacity of bench being used and the travelling time between depot and Site.

All ready mixed concrete shall comply with BS 5328: 1981. Any batch reaching Site after two hours by truck-mixers will be rejected by the Project Manager.

Ready mixed concrete will be sampled once every 10 m^3, that is every second delivery.

5.22 COMPACTION OF CONCRETE

The Contractor shall regard the compaction of concrete as a work of fundamental importance and shall produce a watertight concrete of maximum density compatible with the approved mix design. Compaction shall be assisted by the use of mechanical vibrators of the immersion type. The number and type of vibrators available for use during each period of concreting shall be to the approval of the Project Manager, which will not be given if sufficient standby vibrators are not readily available.

Vibrators shall not be allowed to come into contact with the reinforcement or shuttering and great care shall be taken to avoid over-vibration causing segregation or pockets in the finished mass. All personnel handling vibrators shall be trained in their proper use.

The Contractor shall use 25 mm diameter (needle) pokers in very thin sections and other confined places including reinforced concrete walls. Such pokers shall also be used in conjunction with larger vibrators where reinforcement, ducts and other obstructions cause congestion. At least three pokers shall be used for every 6 metres of length of wall.

5.23 CURING OF CONCRETE

All concrete surfaces which are exposed to the drying effect of wind, sun and high temperatures either immediately after casting or after removal of shutters, shall be completely covered by a damp thick hessian sheet or similar approved material as soon as the surface is finished or shutters removed. Thereafter, the covering shall be sprayed with water of the quality specified in Clause 5.08 so as to remain continuously wet.

All materials, spray equipment and an ample supply of water for curing shall be ready on Site before any concreting starts.

Curing shall continue until a minimum period of 7 days has elapsed after casting of the concrete.

5.24 CONSTRUCTION JOINTS

The details and positions of construction joints shall be submitted to the Project Manager for approval before any concreting takes place.

Construction joints shall be made watertight. They shall be formed in straight lines with rigid shuttering perpendicular to the principal line of stress and as far as practicable at points of least shear. They shall be the plain butt type unless otherwise approved.

5.25 FAULTY WORK

Any portion of the work which is honeycombed or otherwise inferior shall, on the written instruction of the Project Manager, be immediately cut out and reconstructed in an approved manner without extra charge. Plastering of defective work shall not be permitted.

5.26 FORMWORK (SHUTTERING)

Formwork Shuttering shall include all temporary moulds for forming the concrete together with all temporary constructions (false work) required to support such moulds.

When so instructed the Contractor shall submit the design and details of the shuttering he intends to use for approval by the Project Manager.

Shuttering shall be made from good quality timber free from loose knots, shakes and warped surfaces. The board faces in contact with concrete and the board edges shall be planed smooth and joints shall be tongued and grooved.

Alternatively, with the approval of the Project Manager, shuttering may be made from either (a) metal with accurately aligned and close fitting joints, or (b) plywood or hardboard supported by close boarded timber or not supported depending on the thickness of the plywood or hardboard. The plywood or hardboard used shall be resistant to deterioration by water and shall be fixed and jointed in such a manner as to give a perfectly smooth and even finish to the concrete.

Formwork shall be accurately formed and shall be of sufficient strength and rigidity as to carry the weights and pressures of the concrete without deformation. It shall be tight so as to avoid the loss of grout and shall be clean and free from damage.

A method of support for shuttering which would result in holes or tie wires extending the whole width from face to face of permanent work will not be permitted.

Unless otherwise shown on the Drawings, exposed arises shall be formed with a chamfer measuring 20 mm x 20 mm.

Back shuttering shall be used to form concrete surfaces which are designed to be concealed by earth backfill or further construction and shall comply with the specified requirements for shuttering except insofar as the board faces are not required to be planed. Back shuttering shall be such as will prevent the loss of any ingredient from the concrete and will produce a dense concrete surface.

Unless otherwise approved, top shuttering shall be provided to concrete faces where the slope exceeds one in three.

Before each concreting operation is commenced, shuttering shall be carefully examined and cleaned.

For concreting in hot weather, the Contractor shall design and strike the shuttering so that the concrete surfaces can be exposed for curing to commence as soon as possible.

No concreting shall be commenced until the Project Manager has inspected and approved the erected shuttering.

The surface finish to be achieved on formed concrete surfaces shall be as shown on the Drawings and as defined hereunder.

Class F1 Finish

This finish is for surfaces against which backfill concrete will be placed.
Formwork may be sawn boards, sheet metal or any other suitable material which will prevent the loss of fine material from the concrete being placed.

Class F2 Finish

This finish is for surfaces which are permanently exposed to view but where the highest standard of finish is not required.
Forms to provide a Class F2 finish shall be faced with wrought thick tongued and grooved boards with square edges arranged in a uniform pattern close jointed or with suitable sheet material.
The thickness of boards or sheets shall be such that there shall be no visible deflection under the pressure exerted by the concrete placed against them.
Joints between boards or panels shall be horizontal and vertical unless otherwise directed.
This finish shall be such as to require no general filling of surface pitting, but fins, surface discolouration and other minor defects shall be remedied by methods agreed by the Project Manager.

Class F3 Finish

This finish is for surfaces prominently exposed to view where good appearances is of special importance.

To achieve this finish, which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets.

The sheets shall be arranged in an approved uniform pattern.

Wherever possible, joints between sheets shall be arranged to coincide with architectural features or changes in direction of the surface.

All joints shall be provided between sheets to maintain accurate alignment in the plane of the sheets.

Unfaced wrought boarding or standard steel panels will be permitted for Class F3 finish.

The Contractor shall ensure that the surface is protected from rust marks, spillages and stains of all kinds.

Curved Surfaces

For curved surfaces where F2, F3 finishes are called for, the formwork face shall be built up of splines cut to make a tight surface which shall then be dressed to produce the required finish.

Alternatively single curvature surfaces may be faced with plastic or plywood linings attached to the backing with adhesive or with escutcheon pins driven flush. Linings shall not bulge, wrinkle or otherwise deform when subjected to temperature and moisture changes.

Tolerances

All parts of formed concrete surfaces shall be in the position shown on the Drawings within the tolerances set out in Table 5.3

In cases where the Drawings call for tolerances other than those given in Table 5.3 the Drawings shall rule.

Where precast units have been set to a specified tolerance, further adjustments shall be made as necessary to produce a satisfactory straight or curved line.
When the Project Manager has approved the alignment, the Contractor shall fix the units so that there is no possibility of further movement.

Table 5.3 - Tolerances

Class of finish	Tolerance in mm (see Note 1)		
	A	B	C
F1	10	10	+25 to -10
F2	5	10	+ or - 15
F3	2	5	+ or -10

Notes 1: The tolerances A, B and C given in the table are defined as follows:

A is an abrupt irregularity in the surface due to misaligned formwork or defects in the face of the formwork

B is gradual deviation from a plane surface as indicated by a straight edge 3m long
In the case of curved surfaces the straight edge shall be replaced by a correctly shaped template.

C is the amount by which the whole part of a concrete face is displaced from the correct position shown on the Drawings.

Striking of formwork shall be carried out having regard for the climatic conditions prevailing, and shall be undertaken at the sole risk of the Contractor. Where premature removal of formwork takes place and excessive deformation is apparent, with or without distress in the concrete, the work shall be made good as described in this Specification.

The following striking times are included as a guide for normal conditions and shall be treated as a minimum requirement:

Walls, beam sides, columns		1 day
Suspended Slabs	(props left under)	4 days
Ditto	(props removed)	8 days
Beam soffits	(props left under)	7 days
Ditto	(props removed)	16 days

All exposed concrete arrisses are to have 20mm x 20mm chamfer.

Remedial treatment to surfaces

If on stripping any formwork the concrete surface is found in any way defective, the Contractor shall make no attempt to remedy such defects prior to the Project Manager's inspection and the receipt of any instructions which the Project Manager may give.

Defective surfaces shall not be made good by plastering.

Areas of honeycombing which the Project Manager agrees may be repaired shall be cut back to sound concrete or to 75mm whichever is the greater distance.

In the case of reinforced concrete the area shall be cut back to at least 25mm clear distance.

The cavity shall have sides at right angles to the face of the concrete. After cleaning out with water and compressed air, a thin layer of cement grout shall be brushed on to the concrete surfaces in the cavity and it shall then be filled immediately with concrete of the same class as the main body but with aggregate larger than 20mm nominal size removed.

A form shall be filled to a point above the top edge of the cavity.

After seven days the lip concrete shall be broken off and the surface ground smooth.

Surface irregularities which are outside the limits of tolerance set out in Table 7.3 shall be ground down in the manner and to the extent instructed by the Project Manager.

Defects other than those mentioned above shall be dealt with as instructed by the Project Manager.

5.27 REMOVAL OF SHUTTERING

Shuttering shall be removed only under skilled supervision and in such manner as will not damage the concrete.

The minimum periods which shall elapse between placing the concrete and the removal of the shuttering for the various parts of the structure are given in the Clause 5.26 but compliance with these requirements shall not relieve the Contractor of the obligation to delay the removal of the shutters if the concrete has not sufficiently set. Due to variations in site temperature and dependent of the curing conditions the Project Manager may, at his discretion, vary the time listed in Clause 5.26 and the rates shall be held to cover such contingency.

5.28 REINFORCEMENT MATERIALS

Steel reinforcement shall be plain mild steel bars or high yield deformed bars complying with BS 4449, or cold worked deformed bars complying with BS 4461. Steel reinforcement shall be cut from straight bars free from kinks and beds or other damage and cold bent by experienced competent workmen. At the time of incorporation in the works the reinforcement shall be clean and free from loose mill scale and loose rust.

Bars of diameter 20 mm or greater shall be bent in a bending machine designed for the purpose and approved by the Project Manager. Bending and cutting shall be in accordance with BS 4466 unless otherwise specified or ordered by the Project Manager.

The Contractor shall supply the Project Manager with the certificates of the manufacturer issued in accordance with BS 4449 and BS 4461 for all the required tests, including the rebend test, in respect of each consignment delivered to Site.

Steel fabric reinforcement shall comply with BS 4483.

5.29 BENDING SCHEDULES

The Contractor shall ascertain for himself from the information given on the Drawings and in the Specification, the precise requirements of steel reinforcement to be obtained for the Works. The accuracy of any Bending Schedule which may be supplied by the Project Manager to the Contractor is not warranted.

5.30 FIXING REINFORCEMENT

Bars shall not be lapped, except where shown on the Drawings, without the written approval of the Project Manager. Where such laps are approved no additional payment will be made for extra steel required. Steel reinforcement shall be accurately placed and fixed in the positions shown on the Drawings and retained rigidly in that position during the placing of concrete.

Tack welding, with the prior approval of the Project Manager, may be permitted for fixing bars crossing at right angles, but no other welding will be allowed. Supports, spacers and ties shall be subject to the approval of the Project Manager; concrete spacers shall be made of the same quality concrete as that for the work in which they will be embedded. Metallic spacers, fixing clips and tying wire shall be compatible with the material of the reinforcement and the specified cover shall be maintained.

Reinforcement projecting from previously cast concrete and not wholly embedded in concrete shall not be bent and rebent or reshaped without the prior approval of the Project Manager.

The main wires of adjacent sheets of steel fabric reinforcement shall be lapped at least 300 mm and the transverse wires at least 150 mm or as specified in the drawings.

Reinforcement which have a very superficial layer of rust shall be brushed before use.

5.31 COVER TO REINFORCEMENT

Except where otherwise shown on the Drawings the concrete cover to the nearest reinforcement (exclusive of concrete blinding, or mortar rendering) shall be 50 mm.

The distance between any two parallel bars shall not be less than 5 mm more than the nominal maximum size of aggregate in the concrete, except at approved laps. Contact lapping of bars will be approved when the lap length is 25 per cent more than the bond length of the smaller diameter bar or 25 times the bar size plus 150 mm, whichever is the larger.

5.32 GRANOLITHIC CONCRETE

Granolithic concrete shall consist of basalt or granite aggregate graded between 5mm and 10mm mixed in the proportions by weight of 1:1 of cement/sand/aggregate placed to a low workability and while still green steel trowelled to a smooth dense finish.

5.33 PRECAST CONCRETE UNITS

Precast concrete units, shall be true to dimension and shape with true arrisses and with perfectly smooth exposed faces free from surface blemishes, air holes, crazing and other defects, whether developed before or after building-in.

5.34 CONTROLS - RECORDS

The Contractor shall, with respect to each portion of the works, maintain written records that provide the following information:

- the date on which each portion was concreted, the time taken to place, and the class of concrete;
- daily weather conditions, including maximum and minimum temperatures;
- nature of samples, dates on which they were taken and from which portion of the works;
- results of all strength tests;

a copy of these records shall be available at all times for the Project Manager's inspection.

6.0 MISCELLANEOUS

6.01 CEMENT MORTAR

Cement used for mortar, rendering, grout, screeding and other construction work shall be in accordance with Section 5.

Cement mortar for blockwork, rendering, tiling and screeding shall consist of ordinary Portland cement and approved natural sand mixed by hand or approved mechanical mixer in the proportions by volume of one part cement to five parts sand unless otherwise specified or shown on the Drawings. The cement and sand shall first be mixed dry until the cement colour can no longer be distinguished from the sand in any part of the mass and the whole shall then be uniformly wetted by approved means while undergoing further mixing. The water content shall be just sufficient to ensure mixing. The water content shall just be sufficient to ensure a dense mortar of stiff consistency and adequate workability to permit trowelling or floating into place. The workability of cement mortar to be used for rendering may be improved by adding an approved plasticiser in the proportions recommended by the supplier of the plasticiser.

Mortar shall be prepared and used as rapidly as possible after mixing. Under no circumstances shall any mortar be used that has stiffened by commencing to set. Fresh mortar shall not be mixed with mortar prepared earlier and all batches shall be used entirely separately.

Water used for cement mortar, rendering, screeding and other construction work shall be in accordance with Section 5.

6.02 WARNING TAPE

The marker (warning) tape shall be made with plastic. The width of the tape shall be 300 mm and minimum thickness shall be 100 microns.

6.03 LABELS AND REFERENCES

The Contractor shall put references or labels on all permanent aboveground equipment or works (hydrants, chambers, valves, etc.) in paint (colour to be provided by PM) using proper characters format approved by the Project Manager.

6.04 ROADWORKS

6.04.1 General

The workmanship covered in this section applies to rehabilitating of existing sprinkler/track roads and construction of new sprinkler road within the plot of land under consideration.

6.04.2 Terminology

Sub-grade: The prepared earth surface (approved formation level) on which the sub-structures of the roads will be constructed.

Sub-base course: The layer of approved granular material laid on the formation layer which acts as the secondary load-spreading layer underlying the base.

Base course: The upper layer of approved "crusher run" on the sub-base which acts as the primary load-spreading layer underlying the surfacing which will carry the traffic.

"Crusher run": Graded crushed stone material used for blinding of the base course with grading between 0 and 31.5 mm (0/31.5)

6.04.3 **Sources of Material**

The Contractor shall be responsible for locating and providing materials for use as sub-base and base course.

Before ordering any materials, the Contractor shall submit, for the approval of the Project Manager, the name of the Manufacturer/Supplier of all items to be used in the Works and the source of supply of all materials to be used. The Contractor shall ensure that the materials proposed conform to the Specification and Drawings prior to submission for approval of Project Manager.

6.04.4 **Site Clearance**

Clearing site shall consist of clearing the ground of bushes, hedges, shrubs, stumps, rubbish, loose boulders and other objectionable material excluding soil and rock. It shall include the loading, carriage and disposal of all materials to tip as chosen by the Contractor.

6.04.5 **Excavations**

Excavation shall consist of the loosening, digging, loading, hauling and disposal of all materials to the lines and widths as shown in the drawings or as directed by the Project Manager on site. It shall include compaction, finishing and shaping of all surfaces formed by such excavations.
All necessary precautions should be taken to protect existing services belonging to the Irrigation Authority while carrying out the excavation works. Should any damage occur to the existing services, same have to be made good at the Contractor's own cost to the satisfaction of the Project Manager.

6.04.6 **Preparation of Formation for Sub-grade**

The formation shall be cleaned of all foreign matter; and any loose material, potholes, ruts, corrugations, and other defects which may have appeared shall be corrected; if directed by the Project Manager, the Contractor shall scarify, water, grade and re-compact the subgrade to levels. No payment shall be made for preparation of subgrade surface and the costs thereof shall be deemed included in the other rates and prices.

The subgrade, once it has been finally shaped, levelled and compacted and approved by the Project Manager, shall be protected from damage. Storage or stockpiling of plant or materials on the finished subgrade shall not be permitted.

Where the subgrade is damaged by the Contractor's own vehicles or vehicle belonging to the general public or by rain or from any other cause, then the damaged or deformed material shall be dug out and shall be replaced with approved compacted material at the Contractor's expense.

6.04.7 **Stone Sub-base and Crusher Run Base Course**

Construction of new sprinkler road

"Grabbeaux" (Hardcore of broken basalt stone graded to maximum size of 150 mm) shall be laid as a sub-base course of 250 mm thick and constructed to a finished level of about 100 mm below the stone kerb. After the placement of the stones to form the sub-base layer the material shall be been well rolled and compacted by 10 ton vibrating roller until the layer is thoroughly keyed and the compacted layer contains no more than 10% void.

Crusher Run of graded crushed stone material (0-31.5) shall be used fill the voids and produce a final surface of 100 mm thick base course. The aggregate forming the base course shall consist of crushed stone which is tough and durable, roughly cubical in shape and free from excess of flat and/or elongated, particles of clay, top soil or other deleterious matter and shall be to the approval of the Project Manager. The Contractor must ensure that there no "troughs" remaining on the road surface. Rolling shall include a minimum of 4 passes of a 10 ton vibrating roller and rolling shall be continued until no further movement is visible under the roller wheels.

Rehabilitation of existing sprinkler road

"Grabbeaux" (Hardcore of broken basalt stone graded to maximum size of 100 mm) shall be laid to maximum thickness of 100 mm within areas of existing sub-base course to fill pot hole, depressions, weak spots, damaged sections caused during site clearance, etc. as required and directed by the Project Manager. Rolling and compaction shall be carried out as described above.

Crusher Run of graded crushed stone material (0-31.5) to maximum thickness of 100 mm shall be used to fill voids between stones of existing sub-base course and produce as required and directed by Project Manager. Rolling and compaction shall be carried out as described above.

6.04.8 **Compaction**

Compaction of each layer shall be completed as soon as possible after the material has been spread. Compaction should be carried out by compaction in layers, wetting if necessary, using a 10 ton vibrating roller and shall be to the approval of the Project Manager.

6.04.9 **Inclined Roads**

Where sprinkler roads or access roads are inclined the Contractor will fill pot holes and depressions in a similar manner as for level roads. Except the road surface will have to be built up to natural level maintaining the uniformity of the slope.

6.04.10 Turning Radius at the Junction of Access Roads with Sprinkler Roads

Where road surfacing is to be carried out at the junction of an access road and a sprinkler road, the kerb shall be laid so as to form a turning radius of 3.5 m to allow the easy turning of a tractor and trailer without causing damage to land and crops. These curves shall be smooth and shall be aligned with the edges of the roads.

6.04.11 Road Edges

The Contractor will ensure that the rehabilitating of existing kerbing of roads or construction of new kerb shall be straight and well defined using closely spaced ranging rods, nylon string or similar methods. In the cases of existing roads which may not be straight, care should be taken to provide smooth curves to follow the alignment of the road.

6.04.12 Construction Limitations

In respect of work with rehabilitation of sprinkler road, the layer on which graded stone/aggregates for graded crushed stones is to be laid on existing sub-base shall be cleaned of all foreign matter. Potholes, loose material, ruts, depressions and other defects which have appeared due to improper drainage, traffic or any other cause shall be corrected and if directed by the Project Manager, the Contractor shall scarify, water, grade and recompact the layer to line and level all at his own expense.

No graded stone shall be laid until the underlying layer has been inspected and approved by the Project Manager. Rolling shall be suspended if and when such rolling causes wave-like motions in front of the roller.

6.04.13 Approval of Works

All Works shall be approved by the Project Manager and Contractor shall give a minimum 2 days' notice.

6.05 Painting

Unless otherwise specified, the workmanship and quality of materials for painting shall comply with BSCP 231.

The Contractor shall regard the preparation of surfaces to be painted as work of fundamental importance, the object of which is to ensure the production of sound, clean

and dry surfaces which shall have no detrimental effect on the material to be treated and the subsequent treatment.

Galvanised Surfaces

Galvanised surfaces shall be treated before painting with an approved etching primer (other than a mordant containing copper), which shall be supplied in two parts for mixing at Site in accordance with the manufacturer's instructions. The surface shall afterwards be thoroughly rinsed with clean water and allowed to dry.

The metal surfaces shall be painted with one undercoat and two coats of a gloss finishing paint of a type and colour complying with BS 2525 to 2527 and approved by the Project Manager. Each coat of paint must be allowed to dry before another coat is applied.

Other Steel or Metal Surfaces

Unless otherwise specified all metal surfaces other than galvanised steel and windows and door fittings, shall be primed with one coat or red lead paint to BS 2523 immediately after cleaning and shall then be painted with two coats of a gloss finishing paint complying with BS 2525 to 2527.

6.06 Welding

Welding shall be metal-arc welding complying with the requirements of BS 5137. All welds shall be continuous.

B. DRAWINGS

LIST OF DRAWINGS

(Bounded and Titled as 'DRAWINGS')

Section IV: General Conditions of Contract and Particular Conditions Of Contract

Any resulting contract shall be placed by means of a Letter of Acceptance and shall be subject to the General Conditions of Contract (GCC) - **Ref: W/GCC10/12-21**, for the Procurement of Works (available on website *ppo.govmu*.org) except where modified by the Particular Conditions of Contract below.

Procurement Reference Number: **Conv-Piv-Drip/IPU 24/01**

The clause numbers given in the first column correspond to the relevant clause number of the General Conditions of Contract.

Particular Conditions of Contract

A. General	
GCC 1.1(c)	Delete Sub-Clause 1.1(c) in its entirety.
GCC 1.1 (o)	The Defects Liability Period is **6 Months** from the Completion Date.
GCC 1.1(p)	Delete Sub-Clause 1.1(p) in its entirety.
GCC 1.1 (r)	The Employer is: **Irrigation Authority**, 5th Floor Fon Sing Building, 12 Edith Cavell Street Port Louis. The Authorised Representative is Mr. G. SEETAH, General Manager.
GCC 1.1 (v)	The Intended Completion Period for the whole of the works shall be ***Two Hundred and Seventy (270) calendar days*** calculated from the start date of works**.** The start date shall be 7 days from the date of issue of the order to commence work to be issued by the Project Manager.
GCC 1.1 (y)	The Project Manager shall be a representative of the Irrigation Authority nominated by the General Manager.
GCC 1.1 (aa)	The Site is located at Pointe Aux Piments and is defined in drawings No. Drg No. IA 24/PAP-Drip/01.

GCC 1.1 (dd)	The Start Date shall be seven (7) days from the issue of order to commence to be issued by the Project Manager.
GCC 1.1 (hh)	The Scope of Works under this procurement exercise for the Conversion of the Existing Pivot Irrigation System into Drip Irrigation System shall consist of: a) Dismantling of existing valves and equipment on inlet of Centre Pivot System and return all the irrigation parts to the store of IA at Plaine des Papayes. b) Diversion of existing Delivery Main PVC Pipe OD 160 PN 10 beyond existing Drain Valve Chamber in the vicinity of the compound of existing Centre Pivot with the supply, install and test of new extended Delivery Main of about 315 m long in PVC Pipe OD 160 PN10. c) Connection works to existing Filter Outlet, found within the compound of M1B3L2 /M1B3L4 Filtration Plant Unit, and existing PVC Pipe OD 200 PN 16 complete with all associated fittings for the purpose of diverting flow of irrigation water to existing Delivery Main/new extended PVC Delivery Main OD 160 mm. d) Supply, lay and test new Submain/Distribution pipeline of about 1215 m in PVC of OD 90 mm and PN 10 linking onto the exiting/new extended Delivery Main vide Main Headworks and running towards Small/In-Field Headworks. e) Supply, lay and test PVC Distribution Maniflold of approximate total length of approximately 1450 m in PVC of OD 50/63/75/90 mm and PN 6 together with inserts/risers for connection to field dripper lines. f) Supply, install and test of DN 160 Control Valves to be housed in reinforced concrete/blockwall chambers for Main Headworks, tapping water from the Delivery Main and feeding the Submain/Distribution pipeline vide the Control Valves. g) Supply, install and test of DN 90 PVC Stop Valves to be housed in PVC Casings for Small/In-Field Headworks, tapping water from the Submain/Distribution pipeline and feeding the Distribution Manifold. h) Earthworks associated with trenches for laying of pipes, excavation for construction of Headworks, etc.

	i) Preparation of trenches including their shoring if necessary and placing of specified bedding materials. j) Backfilling of trenches with the specified backfill materials. k) Construction of temporary works where required. l) Final testing and commissioning of the whole of the works including the making good of possible defects. **The whole of the works shall be carried out in strict accordance with the Drawings, Scope of Works; Specifications and Performance Requirements; and Conditions of Contract.**
GCC 2.2	Sectional Completions shall not be applicable to this Contract. However the Contractor may request and the Project Manager shall issue a Completion Certificate in respect of: (a) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Project Manager and, otherwise than as provided in the Contract, occupied or used by the Employer, or (b) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contract or has not been agreed by the Contractor as a temporary measure). If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contract, the Project Manager may issue a Completion Certificate in respect of the part of the Permanent Works before completion of the whole of the works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defect Liability Period.
GCC 2.3(i)	The following documents also form part of the Contract: (a) Pre-award correspondences (b) The Letter of Acceptance (c) Post-award Submission - Performance Security - Insurance Policies - Joint Venture Agreement (if any) - Programme of Works

	(d) Technical Documents submitted by the Bidder including all catalogues & brochures (e) Any other document submitted by the Bidder which the Employer considers as necessary to be included in the Contract
GCC 3.1	The language of the contract is English The law that applies to the Contract is the law of Mauritius.
GCC 5.1	The Project Manager **shall not** delegate any of his duties and responsibilities without the approval of the Employer.
GCC 8.1	Schedule of other contractors: ***Not Applicable***
GCC 9.1	To add under Key Personnel: i. One Contract Manager having at least a Degree in Civil Engineering with at least 7 years General Experience with minimum 5 years Post-Registration Experience with the Council of Registered Professional Engineers of Mauritius. The Contract Manager shall be the main line of communication, responsible for planning and monitoring the works, liaison with authorities, report on progress and quality of works and shall attend all visits and meetings with the Project Manager and/or Employer; ii. One Site Engineer (full time) having at least a Degree in Civil Engineering with a least 5 years in Civil Engineering Works; and iii. One Foreman (full time) having at least 5 years of experience in pipe laying works and installation of hydraulic equipment associated with Drip Irrigation Projects.
GCC 13.1	Except for the cover mentioned in (d)(i) hereunder, the other insurance covers shall be in the joint names of the Contractor and the Employer and the minimum insurance amounts shall be: (a) for the Works, Plant and Materials: ***Contract Price + 15%*** (b) for loss or damage to Equipment: ***Cost of Equipment + 15% of its Value*** (c) for loss or damage to property (except the Works, Plant, Materials, and Equipment) in connection with Contract: ***MUR 1,000,000*** (One Million Rupees) (d) for personal injury or death:

	(i) of the Contractor's employees: ***As per Law of Mauritius***. (ii) of other people: ***MUR 2,000,000*** *(Two Million Rupees)* This cover shall be in the joint name of the two parties covering any third party and extended to the site representatives of the Irrigation Authority. (e) for loss or damage to materials on-site and for which payment have been included in the Interim Payment Certificate, where applicable. The Contractor shall choose to take the insurance covers indicated above as separate covers or a combination of the Contractor's All Risks coupled with the Employer's liability and First Loss Burglary, after approval of the Employer. All insurance covers shall be of nil or the minimum possible deductibles at sole expense of the contractor.
GCC 14.1	Site Investigation Reports are: There are no Site Investigation Reports available for consultation. Available information concerning the site are described in the specifications, bill of quantities and drawings. Bidders are however advised to visit and examine the site of works and surrounding prior to submission of bid. They should acquaint themselves with the nature of the site, extent of the work, limits of site, sizes and accessibility to existing chambers, means of access, general nature of the soil and all other matters which may influence preparation and execution of their bid. All costs incidental thereof shall be at the Bidder's own expense. No claim due to ignorance of these factors as mentioned in the preceding paragraph shall be entertained from the contractor. The costs of visiting the site shall be at the Bidder's own expense.
GCC 16.1	The Intended Completion period is **Two Hundred and Seventy (270) Calendar Days** from start date of works.
GCC 20.1	Delete Clause 20.1 and replace by the following: The Employer shall, in due time and in conformity with the progress of the works, place the site and access thereto at the disposal of the Contractor, in accordance with the approved Programme of Works referred to in Clause 25.1. Notwithstanding the Programme of Works, access to sections of the site and possession thereof shall be given to the Contractor only following sugarcane harvesting along these sections. In the event that any section of the site not being accessible due to sugarcane not having been harvested or

	otherwise and subject to other sections having been placed at the disposal of the Contractor, he shall revise his progamme and mobilise to the section/s placed at his disposal at no extra cost to the Contract. The Contractor shall be wholly responsible for obtaining a site for his camps, offices, stock piles of aggregates, constructional plant and other temporary works and for making all payments in connection therewith.
GCC 23.1 & GCC 23.2	Appointing Authority for the Adjudicator: **No Adjudicator shall be appointed for this Contract.**
GCC 24.	No Adjudicator shall be appointed under the contract and arbitration shall not apply. If any dispute arises between the Employer and the Contractor in connection with or arising out of the Contract, the parties shall seek to resolve any such dispute by amicable agreement. If the parties fail to resolve such dispute by amicable agreement, within 14 days after one party has notified the other in writing of the dispute, then the dispute shall be referred to court by either party.
B. Time Control	
GCC 25.1	The Contractor shall submit for approval a Program for the Works within **Fourteen Days** from the date of the Letter of Acceptance. This detailed programme shall take into account the climatic and meteorological conditions and shall clearly show the following: - the planned weekly progress of works from commencement date till completion and input of resources (labour, plant and equipment and cash flow) required for this progress - critical path with all activities therein - the start and completion dates for each activity of works within the Site of Works under the Project that may be considered in having their own substantial completion periods. The Contractor shall need to contemplate for allowing normal or parts of irrigation activities vide the existing network while implementing the conversion works. - the monthly cash flows - the organigram of the management and personnel on the site, their number, nationality, date of mobilization - the dates of arrival on site of the heavy equipment and plant - the means to carry out the topographical survey and geotechnical

	control. In the preparation of the Program of Works, the Contractor shall also ensure that - order of all irrigation equipment (pipes, fittings, dripper lines, valves, etc.) from abroad be done within 3 days after approval of Program of Works; - all locally manufactured galvanized fittings be made available on site within 21 days after the possession of site. - the methodology for excavation near existing buried main pipes shall be approved by the Project Manager prior to the excavation works, so as to ensure there is no damage done to the existing mains; and - the Contractor shall ensure that all excavated materials and materials to be incorporated in the Works shall be stacked off roads to give free access to planters.
GCC 25.3	Program updates shall be required and the period between Program updates is fourteen (14) days. The amount to be withheld for late submission of an updated Program is **MUR 1,000** per day delayed.
C. Quality Control	
GCC 33.1	The Defects Liability Period is **6 months** calculated from the date of completion of the works certified by the Project Manager in accordance with Clause 53.
GCC 34.1	Delete sub-clause 34.1 and replace by the following: Should any defect arise during the contractual period and up to the end of the Defects Liability Period and the Contractor fails to correct the Defect within the time specified in the Project Manager's notice, this shall constitute a breach of the Contractor's obligations under the contract. The Project Manager shall assess the cost of having the defect corrected and recover the money from monies due to the contractor or from the Performance Security.
GCC 37.1	To add: Prior to issue of any Variation Order (VO) involving cost implication, the Project Manager shall assess the variation and seek the approval of the Employer.
GCC 37.2	To add: The Project Manager shall assess all quotations and submit recommendation to Employer for approval prior to issue of the VO.

GCC 38	Add the following paragraph: The Contractor shall submit updated cash flow estimates on a monthly basis.
GCC 39	Add the following at end of Sub-Clause 39.1: The Contractor shall submit his statement together with detailed substantiation of quantities for each item of works executed, supported by drawings showing the location of each of the items with relevant measurements, progress report with updated photographic records, daily diaries, instructions, test results and compliance certificates for particular items of works and materials as per requirements given in Specifications, all signed approval sheets of the Project Manager and correspondences for all variation works and other particulars to fully substantiate the works executed. The Contractor shall also submit information as per sub-clause 52.2. No payment will be assessed by the Project Manager unless it is accompanied by these details. Payments will be made by the Employer provided that the certificate from the Project Manager comprises the relevant substantiations and other details which may be required by the Employer.
GCC 39.2	Replace in line 2 of Sub-Clause 39.2: "Statement" by "Detailed Statement".
GCC 39.7	Payment shall be made as per progress of works without payment for Plant and Material on site.
GCC 39	Add Sub-Clause 39.8: Upon shipment of any materials listed in the Bill of Quantities partial payments may be made to cost of materials to the extent of 80 % of the C.I.F. value of imported materials as supported by Invoices and Bills of lading and on the undertaking that all materials shipped are vested upon the Employer. Payments on materials shall be continued throughout the execution of the works except that no payment shall be made on any material which, in the opinion of the Project Manager, has been brought on to the site prematurely or is not properly stored or is in excess of the quantities required to complete the works or is not in accordance with the requirements of the Contract. The quantities given in the bill of quantities are estimated values and the Contractor shall verify them. The Project Manager shall not be responsible for any excess materials remaining on completion of the works. The payment of any sum by way of payment for any material shall not prejudice the right of Project Manager to reject such material.

D. Cost Control	
GCC 40	Replace Clause 40 as follows: "The Project Manager shall certify the Contractor's statement within 14 days of date of its receipt provided it is complete in accordance with Clause 39 *[Payment Certificates]* and shall issue a Payment Certificate accordingly. The Project Manager shall deduct therefrom any proportion for Advance Payment, Retention money, Liquidated Damages and other monies due to the Employer. Payments shall be made by the Employer within 28 days of the date of receipt of the Payment Certificate from the Project Manager, provided it is complete in accordance with Clause 39. In the event of failure of the Employer to make payment within the time stated, the Employer shall pay to the Contractor interest rate of one percentage point (1%) above the prevailing Key Repo Rate as published by the Central Bank of Mauritius upon all sums unpaid from the date by which the sums should have been paid. No interest shall be payable in case the Contractor fails to comply with the provisions of Clause 25 *[Program]*, Clause 32 *[Tests]*, Clause 38 *[Cash Flow Forecasts]* and Clause 39 *[Payment Certificates]*. The Employer shall not be liable for delayed payment where the Contractor fails to submit his statement after a period of more than 42 days after completion of works or any part thereof. The Employer reserves the right to return the payment application to the Contractor and the payment certificate to the Project Manager in case of non-submission of updated cash flow estimates, program of work, test results, and/ or any relevant substantiations required. The provisions of this sub-Clause are without prejudice to the Contractor's entitlement under any other Clause. Payments will be made by the Employer in so far as the statement from the Contractor comprises the relevant substantiations and other details which may be required in consideration of Clause 39 *[Payment Certificates]*. Items of the works for which no rate or price has been entered in shall not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract. No payment will be made by the Employer in case the Performance Security and Insurance Cover are not in conformity with the Contract requirements, especially as regards project value covered and validity.

	The Minimum amount of Interim Payment shall be MUR 1,000,000.00.
GCC 41.1 (l)	The term "exceptionally adverse weather conditions" is hereby defined as any one of the following events: (i) 100 mm rainfall or above recorded in one day of the nearest rain station; (ii) An official declaration of 'Torrential Rain' by meteorological Department of Mauritius; and Cyclone warning Class II or above
GCC 43.1	The currency of the Employer's country is: **Mauritian Rupees.**
GCC 44.1	Delete 44.1 and replace by the following clause: The Contract is **not** subject to price adjustment. It shall be a fixed price which shall not be revised or adjusted for any fluctuations in the cost of inputs**.**
GCC 44.2	Not applicable.
GCC 45.1	10% of the amount shall be retained from any payment in respect of the value of work certified. Half of the retention money will be released after formal taking over of the Works and the remaining shall be released after the Defect Liability Period subject to the Contractor making good all defects. ***The Limit of Retention Money shall be 5% of Contract Price.***
GCC 46.1	The liquidated damages for the whole of the works shall be **MUR 5,000 (Mauritian Rupees Five Thousand)** per calendar day beyond the Intended Completion Date. The maximum amount of liquidated damages for the whole of the Works is **10 %** of the Contract Price.
GCC 47.1	The Bonus for the whole of the Works is not applicable.
GCC 48.1	The Advance Payments shall be: **15 % of the awarded Contract Price** and shall be paid to the Contractor no later than Thirty (30) days after the signature of the Contract Agreement provided that he submits, in addition to the Performance Security to be provided under Clause 49 of the Condition of the Contract, an Unconditional Advance Payment Guarantee for the full amount of the advance, in accordance with the provision of Clause 48 of the Conditions of Contract and in the form of a Bank Guarantee in the Format given in Section V or any other form acceptable to the Employer.

GCC 48.1	Replace Sub-Clause GCC 48.3 by the following The repayment of the advance shall be effected by deductions from interim payment and, if necessary, from the balance due to the Contractor. Repayment shall start with the first interim payment due under the Contract and shall be completed by the time the sum of interim payment reaches 80%. The amount to be deducted from each interim payment shall be calculated using the following formula: $R = \frac{Va \times A}{Vt \times 0.8}$ where R = the amount to be repaid Va = the amount of the advance Vt = the initial value of the Contract (less provisional sums) A = the amount of the interim payment (**less** revision of price and before deduction of retention **but** including amount for materials on site)
GCC 49.1	Replace Clause GCC 49.1 by the following The Performance Security amount is **10 %** of the awarded Contract Price and shall be in the form of an unconditional Bank Guarantee as per the format in Section V, and shall be valid until the issue of the Defects Liability Certificate.
E. Finishing the Contract	
GCC 53.1	Add the following paragraph: The Project Manager shall carry out the final commissioning of the whole works in the presence of the representative of the Employer. The Project Manager shall seek the approval of the Employer prior to issue of the Certificate of Completion to the Contractor.
GCC 53.2	Replace the contents of Sub-Clause 53.2 by the following: The Certificate of Completion shall be issued within 21 days from the date of completion of all works, provided that the works have satisfactorily passed all tests as prescribed in the Contract and the Contractor has remedied any defect which the Project Manager may have previously given notice.

GCC 54.1	Replace the contents of Sub-Clause 54.1 by the following: The Employer shall take over the Works within 21 days from the date of the Certificate of Completion.
GCC 56.1	The Contractor shall supply copies of the "as built" drawings of the project and the operation and maintenance manuals for : - All hydraulic valves and equipment installed; - the pipe installations and chamber details; and - other drawings as requested by the Project Manager The number of copies and date by which "operation and maintenance manuals" and "as built" drawings are to be submitted by the Contractor are as follows: - Draft: In 2 copies, 2 weeks before requesting the Completion Certificate under Clause 53 of GCC. The Project Manager shall scrutinize adequacy of submission, and send copy to Employer. - Final: In 5 copies, duly approved/endorsed by the Project Manager , at time of Taking over by the Employer under Clause 54 of GCC All as built drawings duly signed by the Project Manager shall also be submitted on USB Key in AutoCAD drawing format.
GCC 56.2	The amount to be withheld for failing to produce "as built" drawings and operating and maintenance manuals by the date required in GCC 56.1 is **MUR 100,000.**
GCC 57.2 (g)	The maximum number of days is: 60 days
GCC 59.1	The percentage to apply to the value of the work not completed, representing the Employer's additional cost for completing the Works, is *[insert percentage]*.