**SECTION 0000**

**SEWER CLEANING AND CCTV INSPECTION**

**WITH STORM SEWER DYE WATER FLOODING**

**PART 1 GENERAL**

* 1. DESCRIPTION
1. The intent of this work is to perform an Inflow and Infiltration investigation to locate defects or cross connections between the sanitary and storm sewer systems. The work shall consist of removing foreign material(s) from mainline sewers and completing a closed circuit television (CCTV) inspection in conjunction with dye water flooding of adjacent storm sewers and facilities. This cleaning is intended to restore the sewer to a minimum of 95% of its original carrying capacity.

	1. REQUIREMENTS
2. After cleaning and removal of debris, the pipe sections between manholes, or other structures, shall be examined by dye-water flooding and/or CCTV inspection for indications of inflow, infiltration, cross connections, etc. This will be accomplished by flooding the ground surface or designated storm sewer pipe segments with brightly colored-dye water to simulate a wet weather event. This process will be documented by CCTV inspection per the applicable NASSCO standards as referenced in 1.02 (B).
3. Traffic Control – The Contractor shall be solely responsible for all signage, flagging, cones, personnel and any other item required for traffic control. All costs for traffic control shall be incidental to the project, unless otherwise specified in the contract documents.
	1. RELATED SECTIONS **INSERT RELATED SECTIONS HERE**
	2. REFERENCES
4. National Association of Sewer Service Companies (NASSCO), *Jetter Code of Practice*.
5. National Association of Sewer Service Companies (NASSCO*)* prepared*, Pipe Line Assessment and Certification Program (PACP), TV inspection form and sewer condition codes.*
	1. SUBMITTALS
6. Safety Plan –The Contractor shall provide a safety plan and identify designated safety supervisory personnel to the Engineer. The plan shall include confined space entry provisions and training, listing of personal protective equipment, and a traffic control plan (if applicable).

B CCTV Technician NASSCO PACP Certification – The Contractor shall provide certification documentation for all technicians on the project.

C. The Contractor shall provide product literature and Material Safety Data Sheets (MSDS) for all dye products.

 **PART 2 - PRODUCTS AND EQUIPMENT**
2.01 SEWER CLEANING EQUIPMENT

1. Cleaning Equipment – Line cleaning for this work shall be accomplished using equipment suitable to the task.
2. High Velocity Cleaning Equipment – Where high velocity equipment is used, the equipment shall include an assortment of nozzles, milling or other heads, root saws, and other ancillary equipment necessary to accomplish the cleaning portion of the work.
3. Mechanical Cleaning Equipment – Mechanical means, such as bucket machines or rodders, for line cleaning may be used with the prior consent of the Engineer.

2.02 CCTV EQUIPMENT

1. Type of Equipment - CCTV cameras used for inspection shall be specifically designed and constructed for sewer inspection.
2. Camera View - The view seen by the camera shall be transmitted to a color monitor of greater than or equal to (≥) fifteen inches (15”) diagonal dimension.
3. Camera Movement - Camera systems shall be able to navigate minor objects, roots, and debris. The system used to move the camera through the pipe shall not obstruct the camera’s view or interfere with proper documentation of the sewer conditions. The camera shall be capable of traversing the sewer line for a distance of at least one thousand feet (1,000’). The camera shall have sufficient clearance to allow for the assembly to pass through sewer lines of nominal diameter six inches (6”) and larger.
4. Camera Accessories - The Contractor shall provide ancillary wheels, crawlers, tracks, or other adjustment plates, skids, arms, axles, etc. as may be necessary or dictated by flow conditions, pipe diameter, etc. These accessories shall be utilized to stabilize the camera in the pipeline, provide adequate propulsion in the pipeline for the camera, and/or to raise the camera above flow to provide a quality picture during CCTV inspection.
5. Camera Features – Cameras shall record all images in color. Cameras shall have pan and tilt capabilities, and shall have a minimum of three hundred sixty degree by one hundred eighty degree (360º x 180º) rotation capability. Illumination sensitivity shall be three (3) lux or less and provide a minimum of 460 lines of resolution. The focal distance shall be adjustable through range from one inch (1”) to infinity. There shall be no geometric distortion of the image.
6. Supplemental Lighting and Lighting Adjustments - Cameras shall also be provided with ancillary or supplemental lighting packs or units to provide sufficient light and illumination in larger diameter conduits or conduits where additional lighting may be necessary (e.g. HDPE pipe). Lighting intensity shall be adjustable to minimize glare. Lighting and picture quality shall be adjustable to provide a clear picture of the entire periphery of the pipeline for all conditions encountered.
7. Measurement of Distance - The distances traveled by the camera shall be measurable to one tenth of one foot (0.1’) by an onboard measuring device and shall provide video display readout of said distances in units of one tenth of one foot (0.1’). The cable footage counter shall be accurate to plus or minus (+/-) one foot (1’) per one hundred feet (100’).

2.03 DYE WATER FLOODING PRODUCTS AND EQUIPMENT

1. Type of Equipment- Inflatable or mechanical plugs suitable in size and shape shall be used to surcharge the storm sewers in the test area.
2. Dye Properties – Dye products shall be brightly colored, fluorescent, non-toxic, and biodegradable. Water used to dilute the dye shall be suitable for discharge to area streams and waterways.

**PART 3 - EXECUTION**

* 1. SEWER CLEANING
1. Protection of Public and Private Property – During sewer cleaning operations, precautions shall be taken to prevent damage to public or private property.
2. Water Supply for Jetting – Water required for jetting and cleaning shall be furnished by the Owner at no charge. The Engineer or Owner shall identify to the Contractor acceptable hydrants or other water supply points that shall be used during the project.
3. Pipe Cleaning – High velocity pipe cleaning shall begin at the downstream manhole of a pipe segment and proceed upstream to the next inline manhole. The jetter hose and affixed tool (nozzle, root saw, etc.), shall proceed against the flow (i.e. upstream) to the next structure in line (i.e. the upstream manhole) if possible. The Contractor shall dewater and remove all sludge, dirt, sand, rocks, grease, and other solid or semi-solid material and debris resulting from the cleaning operations from the downstream manhole of the sewer segment being cleaned. Passing material from sewer segment to sewer segment (without the debris being ultimately removed from the pipeline) shall not be permitted. The Owner shall provide a dump site for waste material removed from the various pipelines at no charge to the Contractor. The Contractor shall be responsible for the handling, hauling and disposal of all debris, silt, and accumulated solids removed from the sewer to this site(s).
4. Cleaning Pass Defined - For the purposes of this work, a “cleaning pass” in a sewer line shall be defined as one of the following:
	1. One complete, unimpeded “round trip” from the downstream manhole to the upstream manhole and return to the downstream point of origin by the jet hose and cleaning tool.

* 1. A movement by the jet hose and attached tool from the downstream point of origin (manhole or structure) of jetting to a pipe obstruction or blockage that will not allow the jetter hose and attached tool to complete a “round trip” per paragraph (1) above.
1. Light and Heavy Cleaning Defined - For the purposes of this contract light cleaning and heavy cleaning shall be defined as follows:
	1. **Light cleaning** shall be the movement of the sewer jet hose and affixed nozzle or tool upstream for two (2) cleaning passes **OR** less. During these two or fewer cleaning passes, ninety five percent (95%) or more of the sewer capacity shall be restored. If this level of capacity cannot be restored after two (2) cleaning passes, then the line segment shall be deemed to require “heavy cleaning” and the Contractor will continue until the line is restored to the desired capacity.
	2. **Heavy cleaning** shall be the movement of a sewer jet hose and affixed nozzle or tool for **more than two (2) cleaning passes** to restore the sewer to a minimum of ninety-five percent (95%) capacity.
	3. The Contractorshall notify the Engineer when heavy cleaning is required. All printed line segment reports shall contain the words “Heavy Cleaning XXX feet” in a prominent place on the report to denote that that particular line segment required heavy cleaning.
	4. Special Circumstances – There may be certain circumstances where the Contractor may discover that: 1) a line segment is completely blocked and the hose and cleaning tool cannot proceed any farther, or 2) a line segment, or part thereof, where further cleaning, removal of root balls, mineral deposits, protruding laterals, or other blockages and debris, may cause damage to the pipe. Should the Contractor identify said “special circumstances”, the Contractor shall safely clean and video inspect as much of the pipeline as possible and then submit all video inspections and reports to the Engineer. The Contractor will be paid for the portion of the sewer line that has been cleaned and inspected to the point of termination.
2. Removal of Roots – Roots shall be removed from the sewer line when:
3. The CCTV camera cannot pass by the root mass and continue down the pipeline for video inspection.
4. Roots shall only be removed by mechanical devices proceeding from the downstream manhole or access point to the root mass. No “reverse cutting” from the upstream manhole or access point will be permitted.
5. All lines that require root cutting will be inspected after root cutting is completed. Televising may be stopped and root cutting executed while the video recording is paused.
6. If it is determined that roots should be removed by the methods referenced above, said root mass will be removed under the pricing terms of “removal of roots”.
7. Removal of Mineral or Attached Deposits – Mineral or other attached deposits (MOAD) shall be removed when:
8. If the CCTV camera cannot pass by the MOAD and continue down the pipeline during video inspection.
9. MOAD shall only be removed by mechanical devices proceeding from the downstream manhole or access point to the root mass. No “reaming” from the upstream manhole or access point will be permitted.
10. All lines that require MOAD removal will be inspected after reaming is completed. Televising may be stopped and reaming executed while the video recording is paused.
11. If it is determined that a MOAD should be removed by the mechanical devices described above, said deposit will be removed under the pricing terms of “removal of mineral or attached deposits”.
12. Removal of hardened deposits such as concrete, mortar, or other cementitious type material found attached in the pipeline is beyond the scope of this project. Such material shall be documented and coded during the CCTV inspection as “Other Deposits” using the PACP modifier “DAZ”.
13. Removal of Protruding Taps – Protruding service taps shall be removed from the sewer when:
14. The CCTV camera cannot pass by the protruding tap and continue down the pipeline during video inspection.
15. Protruding taps will be only be removed by the mechanical device proceeding from the downstream manhole or access point to the tap. No “reverse cutting” from the upstream manhole or access point will be permitted.
16. It should be noted that removing protruding taps constructed of polyvinyl chloride (PVC) may result in cracking or other damage to the lateral pipe upstream of the mainline connection. As such, PVC protruding taps are not required to be removed.
17. All lines that require tap cutting will be inspected after tap cutting is completed. Televising may be stopped and tap cutting executed while the video recording is paused.
18. If it is determined that a protruding tap should be removed by mechanical devices referenced above, said tap will be removed under the pricing terms of “removal of protruding taps”

3.02 CCTV INSPECTION

1. Standards – Video inspection shall be completed per the Pipeline Assessment Certification Program (PACP®) as promulgated by the National Association of Sewer Service Companies (NASSCO).
2. Certified Technicians – Video inspection shall be completed by technicians who have been certified by NASSCO as PACP compliant and trained. The technician’s PACP certification number shall be included in all line segment reports as furnished as part of this project.
3. Certified Software – All video inspection and subsequent reports shall be compiled using the latest version of a PACP compliant software package as certified by NASSCO.
4. Video of Line Segments – Each line segment shall be video inspected one at a time. Each segment will have its own video file (with distinct file name) and corresponding line segment report. This shall apply to lines videoed from the upstream manhole moving to the downstream end and to lines being accessed from the downstream manhole or structure during “reverse setups”.
5. Discovery of Undocumented Structures – When intermediate and undocumented manholes are found, the Contractor shall conclude the video inspection upon reaching the undocumented structure. A video file and printed line segment report shall be generated per usual procedures for this line segment. *It should be noted that the video text overlay that was created at the start of this survey will now be incorrect. This information and display cannot be changed within the video file once a line segment report has begun. The electronic file’s name shall be changed to reflect the proper and accurate line segment information.* The report will indicate the location of the intermediate structure (by its footage upstream/downstream from the point of origin of the survey), its type and corresponding PACP code. Anew line segment report will then begin at the intermediate and previously undocumented structure (now named, labeled, and documented) and proceed to the next structure indicated on the project maps, or to the next intermediate and undocumented structure, if any.
6. Locating and Exposing Manholes and Structures – The Engineer or the Owner will locate and expose all manholes or other structures indicated on the project maps prior to the beginning of the project.
7. Corresponding Data – Each video clip or file and each digital photograph or file shall correspond to inspection data in the database, and each set of inspection data listed in the database shall be properly linked to the appropriate video file or photo(s).
8. Video Inspection Parameters – The following information shall constitute the desired parameters for video inspection for this project:
	1. Video Format – The Contractor shall make a continuous color digital recording in Motion Picture Experts Group (MPEG) 1 format.
	2. Minimum Resolution – Video files shall have a minimum resolution of six hundred forty by four hundred eighty (640 x 480) pixels and an interlaced frame rate at a minimum of twenty-nine point nine (29.9) frames per second.
	3. Rate of Inspection – Video inspection will not exceed a traverse rate of thirty feet (30’) per minute.
	4. Video Text Overlay – Each pipe segment video shall begin with a video text overlay (displayed for a minimum of five (5) seconds) and completed in accordance with PACP’s CCTV inspection form headers and instructions as follows:
		1. Line 1: Surveyed By
		2. Line 2: City
		3. Line 3: Street
		4. Line 4: Weather
		5. Line 5: Direction of Survey
		6. Line 6:Use of sewer
		7. Line 7: Pipe Material
		8. Line 8: Pipe Diameter/Height
		9. Line 9: Start Manhole Number
		10. Line 10: End Manhole Number
		11. Line 11: Inspection Time/Date
	5. Text Shown During Video – During the CCTV inspection, the video text overlay shall show the following text at all times:
9. Start Manhole number
10. End manhole number
	1. Evaluation of Defects and Observations – During the CCTV inspection, the camera shall stop at all defects, observations, and connections to ensure a clear view of the pipe condition and shall rotate the camera head to evaluate the defect, observation, or connection.
	2. Text Overlay of Observation – All defects and observations shall include a video text overlay of the appropriate PACP code/description.
	3. Naming of Video Files – The naming of the video file shall consist of the following: “UPSTREAM MANHOLE - DOWNSTREAM MANHOLE” as shown in the following example (plus the appropriate file extension), **or as may be pre-assigned by the Engineer or Owner (if any)**. The naming of all video files shall be consistent throughout the project:

123-124.mpg

1. Additional Inspection Procedures – Other inspection procedures shall include:
	1. Pan of Manholes – All manholes shall be panned. This video footage shall occur at the beginning of each pipe segment survey inspection from the bottom of the manhole panning up to the manhole shaft. In the instance when the manhole is the terminating manhole of a survey, then the pan shall occur at the end of the pipe segment survey.
	2. Reverse Setups – Obstructions may be encountered during the course of the CCTV inspection that prevents the travel of the camera. In instances when obstructions are not passable, the Contractor shall withdraw the equipment and begin a CCTV inspection from the opposite end of the sewer line, i.e. a reverse setup. If the video inspection is performed from this reverse setup vantage point, then a new video file shall be created and the name and corresponding header shall contain the word “REVERSE” in the upstream manhole name/label. This video file will be in numerical and chronological order immediately following the original video file. If the line only has one adjoining manhole and a reverse setup is not possible, the televising of the line shall be considered complete, the video inspection shall be abandoned, and the Contractor shall be paid for the footage successfully videoed. If it is determined that a reverse setup is necessary, said setup will be paid for under the pay item “reverse setup”.
	3. Excessive Depth of Flow or Sags– If, in the course of the video line inspection, pipe flow is in excess of the acceptable PACP standards, the Contractor shall take one of the following actions before completing the video inspection:
		1. Perform the video inspection during times of low flow conditions. If these conditions only exist outside the stated work periods of this project, the Contractor shall seek the Engineer’s approval before working during these times, OR
		2. Work the cleaning nozzle or tool in tandem with the camera. In this instance, the nozzle will “wick” or draw down the water level in the pipe or sag to allow the camera to pass and make a proper inspection of the footage involved in the sag. Care should be taken by the camera operator and jetter operator to maintain a proper interval between the cleaning tool and the camera. This proper interval will prevent a “back splash” of water or debris on the trailing camera that might otherwise degrade the quality of the video.
	4. DYE WATER FLOODING
2. Notice To the Public – Public notification and coordination with the local and/or neighboring Police and Fire Departments shall be accomplished according to the following: The Contractor shall distribute an Owner or Engineer approved notice to all residents and businesses in the test area. These notices shall be distributed no later than one (1) day or no sooner than ten (10) days prior to the commencement of the dye testing. The Contractor shall provide updates to maintain close coordination with the local Police and Fire Departments regarding dye testing areas.

B. Equipment - The Contractor shall furnish, install, maintain, and remove all sewer dye testing equipment (i.e. pipe plugs, etc.).

C. Cleaning Prior to Dye Water Flooding – Sanitary lines to be evaluated during the dye water flooding process shall be subject to Light Cleaning only (as defined in paragraph 3.01(G)(1) of these specifications). All sanitary sewer pipe sections with sags in excess of fifty percent (50%) shall be dewatered with a jetter truck during CCTV inspection. Sewers included in the dye water test area that require cleaning in excess of “Light Cleaning” will be subject to pricing for “Heavy Cleaning” (as defined in paragraph 3.01(G)(2) of these specifications).

D. Surcharging - The Contractor will isolate all storm sewers which cross or run parallel to sanitary sewers with plugs. Water from nearby hydrants will be used to flood each isolated storm sewer, and will be mixed with a brightly colored, non-toxic, fluorescent, biodegradable dye. The dye water will be held in the storm sewer to the crown of the pipe while the neighboring sanitary lines are televised to locate and identify infiltration or defects. Flooding areas shall include all storm sewer mains, leaders, inlets and catch basins in the test area. The maximum surcharge available shall be held in each storm sewer section for a minimum of fifteen (15) minutes prior to the beginning of the sanitary sewer CCTV inspection. The storm sewer shall remain surcharged until the sanitary sewer CCTV inspection has been completed in the test area.

E. Areas to Be Tested – The Contractor shall dye test the storm sewers identified in the study area by the Engineer. In areas where topography allows, the Contractor may combine multiple storm sewer segments and test simultaneously.

F. Storm Sewers below Sanitary Sewers – In areas where the crown of the storm sewer is located below the depth of the sanitary sewer invert, the need for dye water flooding during CCTV inspection may be eliminated. Work in these areas shall be paid for under the standard pay items of sewer cleaning and CCTV inspection.

* 1. QUALITY CONTROL
1. Review by the Contractor - The video recordings, photographs, and data shall be reviewed by the Contractor for focus, lighting, clarity of view, and technical quality.
2. Blocked or Distorted Video - Videos recorded while a camera has flipped over in the process of traveling or the viewing of laterals, obstructions, or defects are blocked by cables, skids, or other equipment will not be accepted. Shape, focus, proper lighting, and clear, distortion-free viewing during the camera operations shall be maintained. Failure to maintain these conditions will result in the rejection of the video by the Engineer.

**PART 4 - DELIVERABLES AND PAYMENTS**

* 1. MEASUREMENT
1. Distance Measurement - Measurement of the actual number of feet cleaned and televised shall be made from the center of the manhole to the center of the manhole.
2. Dye Water Flooding shall be paid on a per-linear-foot basis for the total length of sanitary sewer inspected.
3. Other Payments - Any ancillary items shall be paid on a per unit price basis as specified by the contract’s payment schedule. Root cutting, heavy cleaning, and mineral deposits removal will be paid on an individual basis and will be quoted separately.
	1. Removal of Roots – will be paid on a per foot basis for the footage of the entire line segment (upstream manhole to downstream manhole);
	2. Removal of Mineral or Attached Deposits – will be paid per foot basis for the footage of the entire line segment (upstream manhole to downstream manhole);
	3. Removal of Protruding Taps – will be paid per each;
	4. Reverse Setups – will be paid per each setup; and
	5. Bypass Pumping – will be paid per each instance.
	6. ACCEPTANCE
4. Defective Work – Within sixty (60) days of the final delivery of written reports and video documentation, the Engineer will notify the Contractor of any defective work. Defective work (if any) will be corrected by the Contractor within sixty (60) days of receipt of this written notification. These corrections will be made to the satisfaction of the Owner and Engineer.
	1. DELIVERABLES
5. Video Files - As part of the final submittal on this project, the Contractor shall submit all video recordings and database information (in approved PACP format), on DVDs or external hard drives (as dictated by the size and quantity of the files submitted). If a hard drive is submitted, the submittal shall include the power cord and USB connection cable. The external hard drive shall become the property of the Owner unless otherwise indicated or specified.
6. Written Reports – As part of the final submittal on this project, the Contractor shall provide two copies of a bound written report in the approved PACP format. This report shall include a cover page with the name of the project, scope of the project, and date of submission; an index page with listing of line segment reports; a complete set of line segment reports and a page or pages of holders containing the DVDs of this project’s data (if applicable).
7. Software – The Contractor shall provide the Owner one (1) copy of the “read only” version of its inspection software (and appropriate license(s), if any).
8. Incidental Costs – All reports, DVDs, hard drives, printing, copying, software, and other costs associated with developing and rendering these deliverables to the Engineer or Owner shall be considered incidental to the project.
	1. PAYMENTS
9. Pay Estimates - Pay estimates will be submitted on a regularly scheduled basis to the Engineer by the Contractor.
10. Approval of Quantities - The Engineer shall review the quantities submitted by the Contractor, and shall immediately inform the Contractor of its certification or disallowing of any quantities submitted for payment. If the quantities of work in question by the Engineer can’t be immediately resolved to the satisfaction of both parties, the pay estimate shall move forward without those quantities included. Said denied quantities may be resolved and submitted on the next pay estimate.

**END OF SECTION**

**RECOMMENDED PAYMENT SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item Number** | **Description** | **Est. Qty.** | **Unit** | **Unit****Price $** | **Total Price $** |
|  |  |  |  |  |  |
|  | **GENERAL ITEMS** |  |  |  |  |
|  | Mobilization | 1 | Lump Sum |  |  |
|  | Traffic Control | 1 | Lump Sum |  |  |
|  | **LIGHT CLEANING** |  |  |  |  |
|  | Light Cleaning 6” diameter pipe | 000 | Linear Feet |  |  |
|  | Light Cleaning 8” diameter pipe. | 000 | Linear Feet |  |  |
|  | Light Cleaning 10” diameter pipe | 000 | Linear Feet |  |  |
|  | Light Cleaning 12” diameter pipe | 000 | Linear Feet |  |  |
|  | Light Cleaning 15” diameter pipe | 000 | Linear Feet |  |  |
|  | Light Cleaning 18” diameter pipe | 000 | Linear Feet |  |  |
|  | Light Cleaning 21” diameter pipe | 000 | Linear Feet |  |  |
|  | Light Cleaning 24” diameter pipe | 000 | Linear Feet |  |  |
|  | **HEAVY CLEANING** |  |  |  |  |
|  | Heavy Cleaning 6” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 8” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 10” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 12” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 15” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 18” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 21” diameter pipe | 000 | Linear Feet |  |  |
|  | Heavy Cleaning 24” diameter pipe | 000 | Linear Feet |  |  |
|  | **CCTV INSPECTION** |  |  |  |  |
|  | CCTV inspection 6” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 8” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 10” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 12” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 15” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 18” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 21” diameter pipe | 000 | Linear Feet |  |  |
|  | CCTV inspection 24” diameter pipe | 000 | Linear Feet |  |  |
|  | **DYE WATER FLOODING** |  |  |  |  |
| 27 | Dye Water Flooding (with CCTV Inspection) Per Linear Foot | 000 | Linear Feet |  |  |
|  | **OTHER PAY ITEMS** |  |  |  |  |
| 28. | Removal of Roots | 000 | Linear Foot |  |  |
| 29. | Removal of Minerals or Attached Deposits | 000 | Linear Foot |  |  |
| 30. | Removal of Protruding Taps | 000 | Per Each |  |  |
| 31. | Bypass Pumping | 000 | Per Each |  |  |
| 32. | Reverse Setups | 000 | Per Each |  |  |
|  | **TOTAL BID** |  |  |  | **0,000,000.00** |