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PART 1 - GENERAL

1.1 General

- .1 Contract scope includes the design, supply, delivery, installation assistance and commissioning of all equipment and appurtenances required for the complete replacement of 3 clarifier equipment systems inside existing concrete clarifier basins as shown on Drawings included with this Bid Opportunity.
- .2 Scope of Supply consists of the following major items:
 - .1 Provide installation instructions and equipment shop drawings.
 - .2 Fabricate and supply the equipment.
 - .3 Store and protect equipment in a manner that prevents damage or premature aging.
 - .4 Deliver the equipment;
 - .5 Inspect delivered equipment;
 - .6 Provide installation training;
 - .7 Inspect and accept each installed clarifier system;
 - .8 Supervise equipment performance testing and commissioning;
 - .9 Provide as-constructed Drawings;
 - .10 Provide technical support and remedy defects during the Warranty Period as detailed in GC 10.
- .3 Include all accessories required to ensure the new clarifier systems operate safely and satisfactorily.
- .4 Provide any appurtenances or services not specifically mentioned or included in the Contract Documents but which are necessary as part of the Work to ensure that the equipment is fully operational when installed.

1.2 Coordination

- .1 Co-operate and liaise with the Install Contractor to facilitate smooth transition from supply to installation and commissioning.

1.3 Installation Instructions

- .1 No later than ten (10) weeks following contract award, provide detailed installation instructions suitable for use in assisting the Install Contractor to assess the level of effort required to install the clarifiers. This submission shall include:
 - Installation instructions
 - List of parts
 - Overview and detail drawings describing the size of components to be shipped, and weights of major sections or components.
 - Provide handling instructions indicating specific requirements to ensure there is no uneven wear or distortion of components.

1.4 Shop Drawings

- .1 Refer to GC 4.04 - General Conditions.
- .2 Submit complete shop drawings within 10 weeks of notification of Contract Award.
- .3 Furnish as a minimum the following design and description information to establish compliance with these specifications:
 1. Certified general arrangement and tank dimensional drawings.
 2. Certificate of design stamped by a Professional Engineer registered and in good standing in the jurisdiction of design stating that the equipment to be provided for this project meets or exceeds all design requirements of these specifications. The certificate shall state the respective loads and design criteria.
 3. Drive mechanism rating calculations, stamped by a Professional Engineer registered and in good standing in the jurisdiction of design, verifying the compliance of the drive gears and bearings with the specified continuous torque rating and bearing life rating.
 4. Motor data and catalogue information. Electrical drawings as applicable to the supply of the clarifier equipment manufacturer.
 5. Catalog cut sheets marked to indicate specific model and size, for purchased sub-components.

1.5 Operating and Maintenance Manuals

- .1 Not less than four (4) weeks prior to commissioning the first of three clarifiers, submit to the Contract Administrator for review two (2) draft copies of Operating and Maintenance (O&M) manuals containing information required by the Specifications.
- .2 Submit O & M manuals in paper & electronic format.
- .3 Furnish four (4) complete operations and maintenance manuals. Provide information as specified in this Section for installation check-out, operation, maintenance, and lubrication requirements for each unit of mechanical, electrical, and instrumentation equipment.
- .4 Customize the O&M manuals to describe the equipment actually furnished. Do not include extraneous data for models, options, or sizes not furnished. When more than one (1) model or size of equipment type is furnished, show the information pertaining to each model, option or size.
- .5 Each manual shall be a bound, indexed binder with drawings and parts lists prepared specifically for this project.
- .6 In addition to information called for in the Specifications, include the following:
 - .1 Title sheet, labeled "Operating and Maintenance Instructions", and containing project name and date.
 - .2 List of contents.
 - .3 Certified as-constructed record drawings of all systems supplied. Include overview, general arrangement and detail drawings.
 - .4 All accepted shop drawings.
 - .5 Full description of entire mechanical and electrical system and operation.
 - .6 Address and telephone number of the Contractor and the nearest Contractor's Representative, including distributors for parts, servicing, and repairs.

- .7 Detailed Specification and O&M instructions for all items of equipment provided including a preventative maintenance program.
- .8 Process control/operating instructions for each component and the entire system as a whole. This shall include, but not necessarily be limited to:
 - .1 The Contractor's recommended step-by-step procedures for starting and stopping under normal and emergency operation. Include all specified modes of operation including recommended operation after the assembly or equipment has been in long-term storage.
 - .2 Control diagrams with data and information to explain operation and control of systems and specific equipment.
 - .3 Technical information on all alarms and monitoring devices provided with the equipment.
 - .4 Routine maintenance requirements including procedures and specific description of consumable items such as lubricants, filter, seals, etc. and listing Canadian sources of supply.
 - .5 Complete disassembly, inspection, repair and reassembly instructions including required tolerances, fastener preloads, specialty tools and any other information necessary to restore equipment to correct operation.
- .7 List of spare and replacement parts and consumables, specifically noting wear items, long delivery items, and other items convenient for stocking as optional replacement items.
- .8 List of special tools.
- .9 Nameplate information including equipment number, make, size, capacity, model number, serial number and equipment tag.
- .10 Submit separately originals of all warranties and guarantees.

1.6 Equipment Delivery

- .1 The schedule shall allow for a two (2) week period for the Contract Administrator to review and comment on the Contractor's Shop Drawings.
- .2 Ten (10) days before delivery, give notice to the Contract Administrator.
- .3 Goods shall be delivered to the project site at 2230 Main Street, Winnipeg, Manitoba in accordance with D13. Goods shall be delivered F.O.B destination, freight prepaid.
- .4 Provide protection during storage, handling and Transport. The Contractor shall identify each component with durable labels or tags securely attached to each piece of equipment, crate or container.
- .5 Protect polished and machined metal surfaces from corrosion and damage during shipment and storage. Protect threaded connections with threaded plugs or caps. Pack electrical equipment and control panels to prevent scratching, access by dirt, moisture, or dust or damage to insulation. Cover equipment having exposed bearings and glands so as to exclude foreign matter. All openings in the equipment shall be covered before placement in storage.
- .6 There is little room on-site for material storage. Therefore store clarifier systems until delivery is requested by the Install Contractor. As necessary meet with the Install Contractor and co-ordinate the sequence and timing of material deliveries with him. Material lists and installation drawings provided by the Contractor would be used as guidelines to assist in planning the delivery schedule.

- .7 Once all material for one clarifier system has been completed and placed in storage by the supplier, payment will be processed as per the Supplementary Conditions section D17.
- .8 Once authorized by the Contract Administrator, material can be shipped. The Contractor shall make available all details of shipment pickup and delivery dates, including information that will permit the Install Contractor to track the delivery's progress to the site.
- .9 The Install Contractor will be responsible for unloading material delivered under this contract.
- .10 The Install Contractor will inspect material delivered as it is unloaded against packing slips and the Supplier's detailed material lists. The Contractor's representative may wish to be present for unloading. The Install Contractor will then sign for and accept responsibility for the material delivered.

1.7 Installation Support

- .1 Provide detailed, illustrated instructions regarding equipment installation. If it is found necessary, or if so directed by the Contract Administrator, the Contractor's Representative may be asked to visit the site to provide assistance during installation.
- .2 Prior to completing installation, the Contract Administrator will inform the Contractor and arrange for his attendance at the Site to verify successful installation.
- .3 Then conduct a detailed inspection of the installation including wiring, electrical connections, controls and instrumentation, rotation direction, running clearances, lubrication, workmanship, and all other items as required to ensure successful operation of the equipment.
- .4 Identify any outstanding deficiencies in the installation and provide a written report to the Contract Administrator describing such deficiencies.
- .5 The Contract Administrator will make arrangements to resolve deficiencies and the Contractor shall then re-inspect and provide written confirmation each clarifier has been correctly installed and is ready for commissioning. This final inspection would include running the clarifier dry and performing dry torque tests.

PART 2 - PRODUCT

2.1 Description

- .1 Provide three (3) primary clarifier mechanisms suitable for installation in the City's existing concrete basins as shown on the contract drawings. Two clarifiers are nominally 35 m and one of 44 m diameter.
- .2 Each mechanism shall be a center column supported, center feed unit with peripheral effluent collection. Provide a center drive mechanism for rotation of the rake arms and scum skimming mechanism.
- .3 Design the equipment to effectively settle suspended solids and scrape the settled solids from the basin floor to the sludge withdrawal sump as shown on the drawings. The clarified effluent shall be collected uniformly by the peripheral launder. Surface scum shall be collected by the scum skimming equipment and discharged through the scum withdrawal pipe.
- .4 The equipment furnished for each clarifier mechanism shall include but not be limited to:
 - center drive assembly,
 - center support column with inlet openings,
 - energy dissipating inlet (EDI),
 - feedwell
 - center cage,
 - sludge collection arms with rake blades,
 - surface scum skimming equipment,
 - effluent weir plates and scum baffle,
 - anchorage parts
 - anchorage parts, anchor bolts, gaskets and assembly fasteners.
- .5 Design systems to avoid or mesh with obstructions left behind by removal of existing clarifier systems, including bolts, steel plates and similar items.

2.2 Materials

- .1 Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall have a minimum thickness of 6 mm (1/4") with:
 - All structural steel conforming to ASTM A-36 requirements; and
 - steel plate conforming to ASTM A283C requirements.
- .2 All aluminum fabrication shall conform to:
 - .1 CSA/CAN 3-S157 Strength Design in Aluminum
 - .2 CSA W59.2, Welded Aluminum Construction
 - .3 CSA S244, Welded Aluminum Design and Workmanship
 - .4 CSA W47.2 Certification of Companies for Fusion Welding of Aluminum
- .3 Unless noted otherwise all anchor bolts and other fasteners including handrail, skimmer, and rake blade squeegee fasteners shall be 316 stainless steel. Temporary bolts used for assembly only shall be high tensile steel. Apply an NSF approved anti-seize compound to all threads in mechanical connections.
- .4 The centre cage and submerged rotating trusses for the support of scrapers, sludge collection devices, skimmers, etc., shall be all-welded steel construction.

- .5 Design the drive main bearing for the total rotating weight with a minimum AFBMA B10 bearing life of 200,000 hours, suitable for 24 hour continuous operation.
- .6 Design all main drive components to provide a minimum wear life of 20 years.
- .7 Design all bearings other than the drive main bearing for a minimum AFBMA B10 bearing life of 100,000 hours, suitable for 24-hour continuous operation.

2.3 Clarifier Operating Parameters

	35 M (115 ft)	44M (145ft)
.1 Winter Design Average Flow	29.4 ML/d	46.2 ML/d
.2 Summer Design Average Flow	35 ML/d	55 ML/d
.3 Design Peak Flow	115.5 ML/d	181.5 ML/d
.4 Wastewater Temperature	5 to 20C	
.5 Average Ambient Temperature	-24 to +26C	
.6 Extreme Ambient Temperatures	-45 to +40C	

2.4 Design Requirements

- .1 Minimum design torques are listed below. Alarm, shut-off and ultimate torque shall be 120, 140 and 200% of the design AGMA continuous running torque listed respectively. No portion of the mechanism shall be damaged if operated for a few seconds at the ultimate torque value.

	35 M (115 ft)	44 m (145 ft)
.1 Drive continuous running torque	81,150 N-m	128,260 N-m
.2 Mechanism rotation	Clockwise	Clockwise
.3 Rake arm tip speed, approximately	3 m/min	3 m/min

2.5 References

- .1 American Society of Testing Materials (ASTM):
 - 1. A36 Structural Steel Specifications
 - 2. A992 Structural Steel Specifications
 - 3. 304 Bolt Specifications
 - 4. A123 Hot-Dip Galvanized Coatings
 - 5. A153 Hot-Dip Galvanized Bolts
 - 6. A48 Cast Iron Specifications
 - 7. A536 Ductile Iron Specifications
 - 8. A283C Steel Plate Specifications
- .2 American Iron and Steel Institute (AISI), Heat Treated Steel Specifications
- .3 American Gear Manufacturers' Association (AGMA), Gear Ratings
- .4 American Welding Society (AWS), Current Standards
- .5 Anti-friction Bearing Manufacturers' Association (AFBMA), Bearing Life Specifications
- .6 National Electrical Manufacturer's Association (NEMA), Motor Design Standards and Standards for Control Enclosures

2.6 Center Drive Assembly

- .1 Provide a center drive assembly with an integral motor and primary speed reducer coupled through roller chain and sprockets to a secondary worm gear reducer driving the main gear through a pinion. Provide an integral overload protection system. A cycloidal reducer directly coupled to the motor without the use of chains and sprockets and keyed to the pinion shaft is also acceptable.
- .2 The intermediate worm gear reduction unit and the final gear reduction unit shall be the product of the Contractor. Units purchased from a third party manufacturer will not be acceptable.
- .3 The complete package shall be of sufficient strength to sweep in changes 50mm grout on the tank bottom under its own power if required.
- .4 The continuous output torque rating of the spur and pinion gearing shall be based on the smaller of the rating values determined from the ANSI/AGMA standard and a design life of 20 years. The drive shall be designed and rated to develop the torque values listed in Section 2.4.

Submit for both sizes of clarifiers, calculations stamped by a Professional Engineer substantiating that the continuous output torque rating and design life conform to the specified values. Calculations shall include the spur gear, pinion, worm gear set, and all bearings used in the intermediate worm gear reduction unit and the final gear reduction unit.

The spur gear and pinion calculations shall specify the values used for the following design parameters for surface durability and strength ratings:

Number of Pinions	Pinion Pitch Diameter
Actual Face Width	Tooth Diametrical Pitch
Tooth Geometry Factors (I and J Factors)	Hardness Ratio Factor
Load Distribution Factor	Elastic Coefficient
Aspect Ratio	Life Factor
Allowable Contact Stress	Application Factor
Allowable Bending Stress	Rim Thickness Factor

Design the center drive unit for the continuous torque rating as specified in Section 2.5. The continuous torque shall be defined as the minimum torque at which the drive mechanism may operate continuously 24 hours per day, 365 days per year, for 20 years, at the specified sludge collector arm speed. Main gear and pinion calculations shall be based on Spur and Pinion Gearing: ANSI/AGMA 2001-C95, "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth." standard for rating the pitting resistance and bending strength of involute spur and helical gear teeth. Calculations shall clearly present the values used for the design parameters. Specifically, the load distribution factor shall be determined by the empirical method. For parameters which are material dependent, such as allowable contact stress, the calculations shall include a complete description of material and heat treatment used.

Size drive units such that the worm gear, spur gear and pinion meet Design Running Torque requirements in accordance with AGMA 2001-D21 and 6034-B92.

The continuous torque rating for the drive unit shall be the lowest value determined for the gearing.

- .5 All gears and bearings shall be oil bath lubricated with the main bearing totally submerged in oil. Oil pumps are not permitted.

The oil reservoir for the main bearing and gear shall have a section of minimum depth 50 mm (2") below the main bearing to positively prevent contamination of the main bearing and gears with condensate or other contaminants. Gear and bearing housings must also be fitted with oil level sight

- glasses and condensate drains. Condensate must be allowed to drain from a low point of the housing. Condensate and contaminants shall not drain through the lower pinion bearing.
- .6 Drive components will be located via a machined, registered fit to preserve the alignment of key drive components under all load conditions. Inspection of the completed drive unit shall be accomplished at the clarifier manufacturer's shop, with reports of all tests and certifications of material hardness being made available for review at the Contract Administrator's request prior to shipment to the job site.
 - .7 No underwater bearings shall carry any part of the vertical thrust load and all gearing must be completely enclosed and oil lubricated.
 - .8 Major drive components, main gears and bearings must be designed to allow for separate and individual replacement by plant personnel to facilitate quick and economical repairs.
 - .9 The primary gear reducer shall be of either worm/worm gear, helical or cycloidal design and shall be C-face or integrally mounted to the electric motor. The motor shall be minimum 1.0 HP (1.5 HP for 44 m diameter clarifier).
 - .10 The full voltage non reversing starter for the rake drive motor will be located remotely in the City's motor control centre.
 - .11 Supply all electrical devices on the rake drive, factory mounted and wired to the extent it is practical to ship.
 - .12 The motor shall be suitable for Class 1, Division 1, Group D locations. It shall be rated 575V, 3ph, 3W.
 - .13 Control devices, heat tracing, etc shall be NEMA 4X and again suitable for a Class 1 Division 1 environment.
 - .14 Submit a recommended motor control diagram for the City's use, as well as a control narrative providing a description of operation and the settings for all control and protection devices.
 - .15 Gearmotors shall conform to ANSI/AGMA 60009-A00, and shall have a service factor of 1.4, based on the specified continuous running torque. Gear reducers with a C-face mounted drive motor shall conform to ANSI/AGMA 6010-F97 and shall have a service factor of 1.25. All gearbox bearings shall be of the anti-friction type and running in oil in a ductile iron or fabricated steel housing.
 - .16 The motor and primary speed reducer shall drive a secondary worm gear reducer through a #60 roller chain and steel sprockets enclosed in a fibreglass, molded polyethylene, or galvanized 22 gauge steel guard. Sprockets and chain shall be designed for the connected horsepower of the drive with a minimum service factor of 4.0. Provision shall be made for adjustment of chain tension.
 - .17 The main drive unit shall consist of a worm gear secondary reduction unit, pinion and main spur gear assembly. The secondary reducer shall be a worm gear reducer specifically designed for this application. The worm gear shall be ductile iron or centrifugally cast high strength manganese bronze. The worm shall be hardened alloy steel. A pinion and shaft shall be keyed to the worm gear to transmit power from the worm gear to the spur gear. In order to maintain proper alignment between the pinion and the spur gear, the pinion shall be supported by bearings both above and below the spur gear. The bearings shall be fitted into precision machined bearing pilots to positively insure bearing and gear alignment.
 - .18 Minimum ball raceway diameter: 1.8m (72"). Load carrying balls: Minimum diameter 13mm (1/2"), chrome alloy hardened to 60-65 Rockwell C.

- .19 The main gear shall rotate and be supported on a ball bearing assembly provided with four replaceable liner strips fitted into the main gear and turntable base. Liner strips shall be special vacuum degassed, carbon corrected, alloy steel hardened to a Rockwell hardness of at least 43 to 46 Rc. The turntable base shall be a minimum 25mm (1") thick to insure adequate structural rigidity to properly support the drive bearing and gear. Forged alloy raceway fully contoured precision bearing sets are also acceptable.
- .20 The main gear and bearing shall be completely enclosed in a ductile iron or fabricated steel housing provided with neoprene dust seals. In order to ensure the maximum possible base rigidity and vibration dampening the gear housing shall be of full sidewall construction, integral with the base. If requested, shop inspection reports shall be made available for review.
- .21 The ductile iron housings shall be cast as a single piece to provide a leak proof enclosure. Seals or gaskets located below the oil level will not be acceptable. The base of the housing shall be mounted on the top flange of the stationary center column and designed to support the internal spur gear, the rotating clarifier mechanism, one end of the access bridge and bridge cover system. The housing shall be complete with seals, oil level dipstick, oil fill, and valved oil and condensation drains. A positive means of removing condensation and contaminant from the lower pinion-bearing pocket shall be provided.
- .22 All systems shall be suitable for operation at temperatures below 0°C.
- .23 Lubrication of the gear teeth shall be accomplished by means of an oil dam and the meshing action of the pinion and the internal gear teeth that shall force lubricant up the face of the teeth. Designs that require auxiliary oil pumps or circulating systems for lubrication will not be acceptable.
- .24 Overload Protection: Equip the drive unit with an electro-mechanical overload control device actuated by thrust from the worm shaft, or a device which directly measures torque from the main pinion. The control device shall activate an alarm for warning of overload, a motor cutout for overload protection and a back-up safety motor cutout for back up overload protection. The respective switches in the overload control device shall be factory calibrated and set to the following settings:
 1. Alarm - 120% of Design Running Torque
 2. Motor cutout – 140% of Design Running Torque
 3. Back-up motor cutout - 140% of Design Running Torque.

All drive control components shall be mounted in a waterproof enclosure of cast iron, epoxy coated aluminium, or stainless steel with a gasket sealed, removable cover. Cover the pointer with a clear plastic enclosure and install above the platform surface for visibility from the platform.

2.7 Walkway Access Bridge and Enclosure – Not Included

- .1 The walkway and related drive access platform are not included in this contract and will be supplied by the Install Contractor.
- .2 The walkway enclosure is not included in this contract and will be supplied by the Install Contractor.
- .3 The walkway and enclosure will not be supported from the clarifier mechanism. If required the bridge will be designed to support the scum trough.

2.8 Center Cage and Rake Arms

- .1 Provide a center cage of steel truss construction and connections for the two (2) sludge removal arms and feedwell supports. Bolt the top of the cage to the main gear which shall rotate the cage with the attached arms and feedwell. The minimum angle size used for construction of the cage and rake arms shall be 50 x 50 x 6 mm members.

- .2 Design to hold the sludge collection devices in a horizontal and vertical plane when subjected to momentary ultimate torque.
- .3 Connection to the internal spur gear shall be adjustable for proper alignment and allowance for structural tolerances.
- .4 The clarifier mechanism shall include two (2) sludge removal arms of steel truss construction with steel raking blades and adjustable 20 gauge, 316 stainless steel squeegees. The rake blades shall be properly spaced to insure complete raking of the basin floor twice per revolution.
- .5 Arms shall require no tie-bars for supports and should be an all shop welded construction.
- .6 The cage and rake arms shall be designed such that calculated stresses do not exceed the AISC allowable stress at twice the drive design rating.

2.9 Center Column

- .1 Provide a stationary center column with minimum 6 mm thick steel and suitably reinforced and designed to withstand the stalled torque of the drive mechanism. One end shall have a suitable support flange for bolting to the foundation with a minimum of twelve (12) 32 mm (1-1/4") diameter anchor bolts as shown on the plans. Provide a similar flange at the top of the column for supporting and securing the center drive assembly.
- .2 Openings shall be provided in the upper portion of the column to allow unrestricted passage of the flow into the feedwell. Size and location of outlet port shall be determined by the manufacturer based on limiting the velocity to 0.50 metres per second at peak flow.

2.10 Feedwell [and Energy Dissipating Inlet]

- .1 Support the feedwell with structural members attached to the center rotating cage. Fabricate the feedwell from 4.7 mm (3/16") steel plate with upper and lower reinforcing rim angles and stiffeners as required. Minimum feedwell diameters shall be 6.0 m and 7.5 m for the 35 m and 44 m diameter clarifiers respectively.
- .2 Install the feedwell top at the average daily liquid level.
- .3 Equip the clarifier with an energy dissipating inlet located inside the rotating feedwell. The dissipating inlet shall be designed to dissipate the energy of the incoming flow thereby inducing flocculation of the feed solids. The energy dissipating inlet shall have a bottom plate extending to within 25 mm (1") of the center column. The well shall be constructed of 4.7 mm plate. Baffled openings equally spaced around the periphery shall be provided for 1) energy dissipation, 2) directing exit flow direction tangential to the inlet wall and 3) prevention of downward flow.
- .4 Alternately, the energy dissipating baffle system shall consist of a secession of three (3) overlapping vertical target baffles with a series of four (4) increasing port areas designed to provide a "Gt" (t in seconds) value in the well not exceeding 5,000 with a velocity gradient "G" within the flocculation well not exceeding 65 fps/ft at a minimum water temperature of 10° C at maximum influent flow. Horizontal shelf baffles shall prevent downward movement in the flocculation zone. Baffles shall bolt to the center cage and well support beams.

2.11 Ducking Skimmer/Scum Trough

- .1 Provide a floating scum collection system that discharges into a rotating scum pipe for removal. The skimming system shall consist of skimmer assemblies, a rotating scum pipe assembly and additional devices specified and required for proper operation. The sludge collector arms shall support the skimmer assemblies. Designs that rely on the scum baffle for support will not be acceptable. The scum pipe shall be supported from the walkway. Each skimmer assembly shall be furnished with 316

SS pivot supports that allow the skimmer blade to pass under the scum pipe without interfering with the operation of the scum pipe. The scum pipe dipping cycle shall begin as a skimmer assembly approaches the scum pipe, by rotating the scum pipe to receive scum and flushing water and shall be completed by returning the scum pipe to the closed position as the skimmer assembly passes. The scum pipe shall discharge scum by gravity flow into a drop box attached to the scum pipe and located near the clarifier perimeter. The skimmer blade shall effectively move scum past the walkway enclosure rubber skirt.

- .2 Each clarifier shall be equipped with two skimmer assemblies. Each skimmer assembly shall collect floating scum the full distance between the scum baffle and the influent well. Each skimmer assembly shall consist of a skimmer blade, blade supports, support pivot bearings, wiper and return mechanism. The skimmer blade shall be 10 gauge 316 SS. The skimmer blade sections shall not exceed 3 m (10') in length and shall be approximately 300 mm (12") high with 100 mm (4") extending above the maximum water elevation for the basin. The skimmer blade shall be sealed between sections and shall have adequate supports attached to the sludge collector arms. The pivot bearings shall be suitable for underwater service and shall be of the water lubricated or self-lubricating type not requiring additional lubrication. Provide a neoprene or equal wiper on the outer skimmer blade to collect scum between the end of the skimmer blade and the scum baffle. A positive return mechanism actuated by a counterweight shall be provided to rotate the skimmer blade to the vertical position after it passes under the scum pipe.

Each skimmer assembly shall be provided with additional supports or stops as required to prevent damage to the equipment when the basin is dewatered or when the collector is operated in a dry clarifier.

- .3 The rotating scum pipe assembly shall be a 316 SS pipe with rectangular weir openings, and support bearings and a push-button electrically operated pipe rotation system, to operate the scum pipe. The scum pipe shall have a nominal diameter of 400 mm (16") and a wall thickness of not less than 6mm (0.25").

Line rotating scum pipe supports with nylon or equal material to provide a low friction contact surface to prevent wear between the scum pipe and supports. Provide each support with a skimmer blade guide to provide a gradual return of the blade to the water surface after ducking under the scum pipe. To facilitate this, a bearing/guide support shall be located and centered on each skimmer blade section. Supports (attached to the bridge) shall be fully adjustable for levelling the scum pipe. Blades shall be provided with replaceable wearing shoes where they contact the guides.

Overall support shall be such that a slight vertical or horizontal misalignment shall not interfere with smooth operation of the pipe.

- .4 Provide a suitable watertight seal for the open end of the pipe. This seal shall be so constructed that it shall remain effective even with a slight misalignment of the pipe. The seal shall not be affected by grease, mild acids, and alkalis. The seal shall be readily renewable without removing the pipe from the supporting brackets and shall not bind or impede the smooth action of the revolving pipe.
- .5 Provide a motorized drive on the scum pipe. The motor starter for this drive shall be provided by the City in a remote MCC room. Provide two "maintained contact" (dead man) pushbuttons at the trough location to control the position of the trough. The pushbutton and motor and all related electrical devices shall be rated for Class 1 Division 1 environment.

2.12 Effluent Weir and Scum Baffle

- .1 The Supplier shall select effluent weir plates to suite the elevations of the existing clarifiers. The effluent plates shall consist of 6 mm thick, 316ss sections. The Supplier shall establish the number or spacing and their depth to provide a peak flow at 1/2" below the top edge of the weir plate. The weir

sections shall be fastened to the tank wall using 316 stainless steel cinch anchor bolts, hex nuts, and stainless steel clamps, allowing for vertical adjustment.

- A. The following elevations are taken from drawing NEP-94 (Provided within the bid opportunity) :
 - 1. Top Water Level = 30.827' (9.396 m)
 - 2. Top of Launder = 30.271' (9.227 m)
 - 3. Bottom Water Level (Clarifier 1 & 2) = 30.607' (9.329 m)
 - 4. Bottom Water Level (Clarifier 3) = 30.271' (9.227 m)
 - B. The Supplier shall field confirm the elevations prior to supplying Shop Drawings.
 - C. The weir plates shall have vertical and radial adjustment capabilities of 1" in either direction.
- .2 The scum baffle plates shall consist of 300 mm deep x 6 mm thick 316ss sections supported from the tank wall by 316ss clamps and adhesive anchor rods and hex nuts, allowing for vertical and radial adjustment. In the area of the scum pipe the baffle shall extend 600 mm deep starting approximately 1.8 m preceding and ending 1.8m following the scum pipe.

2.13 Painting and Protective Coating

2.13.1 Part 1 – General

2.13.1.1 References

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Standard for Testing and Materials:
 - a. D4138, Standard Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.
 - b. D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 2. National Association of Corrosion Engineers (NACE): RP 0188-99, Standard Recommended Practice – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
 - 3. Occupational Safety and Health Act (OSHA).
 - 4. The Society for Protective Coatings (SSPC) (formerly Steel Structures. Painting Council):
 - a. SP 1, Surface Preparation Specification No. 1, Solvent Cleaning.
 - b. SP 2, Hand Tool Cleaning.
 - c. SP 3, Power Tool Cleaning.
 - d. SP 5, White Metal Blast Cleaning.
 - e. SP 6, Commercial Blast Cleaning.
 - f. SP 7, Brush-Off Blast Cleaning.
 - g. SP 10, Near-White Blast Cleaning.
 - h. SP 11, Power Tool Cleaning to Bare Metal.
 - i. Guide No. 3, PA, Guide to Safety in Paint Applications.
 - j. SSPC-PA2: Guide to Measurement of Dry Paint Thickness.
 - k. SSPC Manual Volume 1: Good Painting Practice.
 - l. SSPC: VIS1-89.
 - m. Guide No. 2, PA: Measurement of Dry Film Paint Thickness with Magnetic Gauges.
 - n. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

2.13.1.3 Definitions

A. Terms used in this Section:

1. Coverage: Total minimum dry film thickness in mils, or square feet per gallon.
2. g/cm²: Grams per centimeter squared.
3. MDFT: Minimum Dry Film Thickness.
4. MDFTPC: Minimum Dry Film Thickness Per Coat.
5. Mil: Thousandth of an inch.
6. MSDS: Material and Safety Data Sheet.
7. PSDS: Paint System Data Sheet.
8. SFPG: Square Feet Per Gallon.
9. SFPGPC: Square Feet Per Gallon Per Coat.
10. SP: Surface Preparation.
11. SSPC: Society for Protective Coatings (formerly Steel Structures Painting Council).

2.13.1.4 Submittals

A. Shop Drawings:

1. Data Sheets:

- a. For each paint system, furnish a Paint System Data Sheet (PSDS), Material Safety Data Sheets (MSDS), the manufacturer's Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system. The PSDS form is appended to the end of this section.
- b. Submit required information on a system-by-system basis.
- c. Furnish copies of paint system submittals to the coating applicator.
- d. Indiscriminate submittal of manufacturer's literature only is not acceptable.
- e. Coating manufacturer's written verification that submitted products are suitable for the intended use.
- f. Provide letter from coating manufacturer stating that coating applicator is certified or approved to apply the specified products.

B. Quality Control Submittals:

1. Applicator's Qualification: List of references substantiating experience.
2. Manufacturer's written instructions and special details for applying each type of paint.
3. Applicators quality control program, including, but not limited to:
 - a. Environmental test procedures and frequency.
 - b. Surface preparation testing, such as degree of cleanliness and profile.
 - c. Record keeping forms.
4. Field Testing: Inspection and test records.
5. Manufacturers' Certificate of Proper Application.

2.13.1.5 Quality Assurance

A. Qualifications:

1. Applicator: Minimum 5 years' experience in application of high performance protective coatings.
2. Applicator: Approved by manufacturer of specified coating systems where required by manufacturer.

B. Regulatory Requirements:

1. Meet federal, and local requirements limiting the emission of volatile organic compounds.

2. Perform surface preparation and painting in accordance with recommendations of the following:
 - a. Paint manufacturer's instructions.
 - b. SSPC-PA Guide No. 3, Guide to Safety in Paint Applications.
 - c. Federal, state, and local agencies having jurisdiction.
- C. **Delivery Acceptance:** The equipment supplier, coating manufacturer's technical representative and installation contractor shall observe and test the protective coatings after the equipment has been delivered and unloaded at the site. To determine locations where the protective coatings are damaged, all coated surfaces shall be visually observed and all submerged surfaces shall be holiday tested by the equipment supplier in accordance with NACE 0188. Perform additional tests as necessary or appropriate, as determined by the coating manufacturer's technical representative. All areas of defective coating shall be repaired in accordance with these specifications and the coating manufacturer's written recommendations. All testing shall be completed in the presence of the Contract Administrator. The equipment supplier shall submit a letter to the Contract Administrator summarizing the test results and the repairs that were made.
- D. **Installation Acceptance:** The equipment supplier, coating manufacturer's technical representative and installation contractor shall observe and test the protective coatings after the equipment has been installed. To determine locations where the protective coatings are damaged for warranty purposes, all coated surfaces shall be visually observed and all submerged surfaces shall be holiday tested by the equipment supplier in accordance with NACE 0188. Perform additional tests as necessary or appropriate, as determined by the coating manufacturer's technical representative. All testing shall be completed in the presence of the Contract Administrator. The equipment supplier shall submit a letter to the Contract Administrator summarizing the test results for warranty purposes.
- E. **Forty-Sixth Month Inspection:** The Owner will conduct an inspection of coated surfaces prior to the end of the extended warranty period. The Equipment Supplier will be notified in advance of this inspection and may attend at its option and at no additional cost to the Owner. A list of all coating defects and failures identified during the inspection will be prepared and transmitted to the Equipment Supplier. The list will serve as notice of repairs required under warranty at no additional cost to the Owner.
- F. **Repairs:**
 1. All defective coatings shall be repaired by the Equipment Supplier using coating materials, equipment, and methods similar to those used in the original work. Materials shall be of fresh manufacture and within the manufacturer's stated shelf life at the time of application. The Equipment Supplier shall provide an extended warranty of 1 year for all repairs.
 2. Equipment Supplier shall complete all required coating repairs within 30 calendar days of the 46th Month Inspection.

2.13.1.6 Delivery, Storage, And Handling

- A. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

2.13.1.7 Environmental Requirements

- A. Provide dehumidification, heating, and other environmental controls necessary to meet application and curing requirements of the coatings used.
- B. Do not apply paint in temperatures outside of manufacturer's recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.

- C. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

2.13.1.8 Special Guarantee

- A. Provide extended guarantee or warranty for a period of 5 years after the date of Substantial Completion.

2.13.2 Part 2 - Products

2.13.2.1 Manufacturers

- A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for the intended service conditions.
- B. Minimum of 5 years verifiable experience in manufacture of the specified product.
- C. Each of the following manufacturers is capable of supplying the products required for exposed, above water metals of the clarifier:
 - 1. A.W. Chesterton Products (ARC), Woburn MA.
 - 2. Carboline Coatings, St. Louis, MO.
 - 3. ICI Devoe, Louisville, KY.
 - 4. Sherwin-Williams, Cleveland, OH.
 - 5. Tnemec Coatings, Kansas City, MO.
- D. The following manufacturers are capable of supplying products required for submerged metals:
 - 1. A.W. Chesterton Products (ARC), Woburn, MA.
 - 2. Or approved equal.

2.13.2.2 Paint Materials

- A. General:
 - 1. Material Quality: Manufacturer's highest quality products and suitable for intended service.
 - 2. Materials Including Primer and Intermediate Finish Coats: Produced by same manufacturer.
 - 3. Thinners, Cleaners, Driers, and Other Additives: As recommended by manufacturer of the particular coating.
- B. Coatings for Submerged Metals. Provide coating system for submerged metals that are suitable for exposure to primary wastewater. The primary wastewater at the treatment plant consists of domestic sewage with some contribution from light industrial and food processing plants, including rendering plants. Previous experience at the plant indicates that coal tar epoxy will soften at the waterline where scum and grease accumulate.
- C. Coating manufacturer shall verify suitability of proposed protective coating using steel coupons prepared and coated with the submitted coating and submerged in the wastewater so that they are exposed to scum at the waterline, or other methods as deemed necessary by the coating manufacturer to verify coating performance, prior to application of the protective coating. Coordinate installation of coupons in the existing primary clarifiers at the plant with the Owner.

D. Coating Materials:

1. 100-Percent Solids Epoxy: 100-percent solids, two-component, chemical resistant epoxy suitable for the intended service, as manufactured by A.W. Chesterton, or approved equal.
2. Epoxy Primer and Epoxy Intermediate Coat: Polyamide or polyamidoamine epoxy, minimum 69 percent solids volume, suitable for application to exposed metals and compatible with the specified finish coat.
3. Polyurethane Enamel: Two-component aliphatic or acrylic based polyurethane, semi-gloss finish.

2.13.2.3 Colors

- A. Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at the site.

2.13.2.4 Abrasive Material

- A. Select abrasive type and size to produce a surface profile that meets coating manufacturer's recommendations for specific primer and coating to be applied. Some portions of submerged metal may have coatings that are difficult to fully remove. A more dense blast material may be required for some portions of the blasting work.

2.13.3 PART 3 - EXECUTION

2.13.3.1 General

- A. Metal components of the clarifiers shall be shop blasted and finished with the complete coating system specified herein.
- B. Metal components with protective coating that are excessively damaged in handling or shipment, in the opinion of the Contract Administrator, shall be completely abrasive blasted and re-coated with the appropriate coating system specified herein.

2.13.3.2 Examination

- A. Surface Preparation Verifications:
1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.
 2. Provide Contract Administrator minimum 7 days' advance notice to start of shop or field surface preparation work and coating application work.
 3. Perform such work only in presence of Contract Administrator, unless Contract Administrator grants prior approval to perform such work in Contract Administrator's absence.
- B. Schedule inspection with Contract Administrator in advance for cleaned surfaces and all coats prior to succeeding coat.

2.13.3.3 Blasting And Equipment Protection

- A. Preblast Cleaning Requirements:
1. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
 2. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.

3. Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.
- B. Field Abrasive Blasting:
1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed.
 2. Field abrasive blasting of existing steel parts to be repainted shall conform to the specified blast finish under Article PREPARATION OF SURFACES.
 3. Test abrasive blast waste for characterization as hazardous or dangerous. Dispose of abrasive blast waste in legal manner, following characterization of blast waste. All costs of disposal are the responsibility of the Contractor.
- C. Protection of Items not to be Painted:
1. Remove, mask, or otherwise protect aluminum surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
 2. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
 3. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.
 4. Mask openings in motors to prevent paint and other materials from entering the motors.
 5. Cover and enclose or otherwise protect clarifier drive mechanisms to prevent damage caused by blasting operations. The drive unit must be fully covered and sealed off to protect against grit and dust when sandblasting in the vicinity. All external openings and areas between the rotating main gear and the stationary base shall be taped closed, covered with polyethylene film and/or stuffed with rag waste. After sandblasting and before mechanical operation of the equipment, remove all inspection ports of the drive unit and visually inspect for any sign of grit. In the event of contamination, contact the drive manufacturer for instructions.
 6. Protect all surfaces adjacent to or downwind of work area from overspray. Contractor shall be responsible for any damage resulting from overspray.

2.13.3.4 Preparation Of Surfaces

- A. Metal Surfaces:
1. Where indicated, meet requirements of the following SSPC Specifications:
 - a. Solvent Cleaning: SP 1.
 - b. Hand Tool Cleaning: SP 2.
 - c. Power Tool Cleaning: SP 3.
 - d. White Metal Blast Cleaning: SP 5.
 - e. Commercial Blast Cleaning: SP 6.
 - f. Brush-Off Blast Cleaning: SP 7.
 - g. Near-White Blast Cleaning: SP 10.
 - h. Power Tool Cleaning to Bare Metal: SP 11.
 2. The words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” and “blast cleaning,” or similar words of equal intent in these Specifications or in paint manufacturer’s specifications refer to the applicable SSPC Specifications.
 3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.
 4. Ductile Iron and Cast Iron Pipe and Fittings:
 - a. Use DIPRA Surface Preparation Specification equivalent to SSPC grade specified.

- b. Follow additional recommendations of pipe and coating manufacturers.
- c. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.
5. Hand tool clean areas that cannot be cleaned by power tool cleaning.
6. Preblast Cleaning Requirements:
 - a. Remove oil, grease, and other surface contaminants prior to blast cleaning.
 - b. Remove salts and other water-soluble contaminants. Test for water soluble contaminants in accordance with SSPC Guide 15. The contaminant level shall not exceed 10 g/cm² for sulfates and 5 g/cm² chlorides.
 - c. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing, or as required by the coating manufacturers procedural guide.
 - d. Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.
 - e. Round or chamfer sharp edges and grind smooth burs, jagged edges, and surface defects.
 - f. Welds and Adjacent Areas:
 - i. Prepare such that there is:
 1. No undercutting or reverse ridges on weld bead.
 2. No weld spatter on or adjacent to weld or other area to be painted.
 3. No sharp peaks or ridges along weld bead.
 - ii. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
7. Blast Cleaning Requirements:
 - a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.
 - b. Select type and size of abrasive to produce a surface profile that meets coating manufacturer's recommendations for particular primer to be used.
 - c. Use only dry blast cleaning methods.
 - d. Do not reuse abrasive, except for designed recyclable systems.
 - e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry, and disposition of spent aggregate and debris.
8. Post-Blast Cleaning and Other Cleaning Requirements:
 - a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
 - b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.

2.13.3.5 Application

A. General:

1. The intention of these Specifications is for new exposed and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise.
2. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating for any purpose until completion of curing cycle.
3. Apply coatings in accordance with these Specifications and the paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.

4. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
5. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
6. Keep paint materials sealed when not in use.

B. Film Thickness, Coverage, and Adhesion:

1. Number of Coats: Minimum required without regard to coating thickness. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Maximum film build per coat shall not exceed coating manufacturer's recommendations.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces
 - a. Perform with properly calibrated instruments.
 - b. Recoat and repair as necessary for compliance with the Specifications.
 - c. All coats are subject to inspection by Contract Administrator and coating manufacturer's representative.
4. Visually inspect nonferrous metal, and plastic surfaces to ensure proper and complete coverage has been attained. Measure wet film thickness, using a wet film thickness gauge, to ensure proper coating thickness during application.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. The hiding shall be so complete that the addition of additional coats would not increase the hiding.
7. Thickness and Electrical Testing:
 - a. After repaired and recoated areas have dried sufficiently, final tests will be conducted by the Contract Administrator.
 - b. Measure coating thickness specified in mils with a magnetic type dry film thickness gauge, per SSPC PA2.
 - c. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
 - d. Measure coating thickness on ferrous metals with a magnetic thickness gauge in accordance with the procedures of SSPS PA 2, with the exception that the coating thickness shall meet or exceed the values specified herein.
 - e. Check each coat for correct millage. Do not make measurements before a minimum of 8 hours after application of the coating.
 - f. Holiday detect coatings 25 mils thick or less, except zinc primer and galvanizing, with a low voltage wet sponge electrical holiday detector in accordance with NACE RP0188-99.
 - g. Use water with 1 ounce per gallon of Kodak Photo-Flow solution as wetting agent. Holiday testing of exterior coated surfaces not subject to immersion is not required unless specifically directed by the Contract Administrator.

C. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Apply finish coats, including touchup and damage-repair coats in a manner which will present a uniform texture and color-matched appearance.

D. Unsatisfactory Application:

1. If item has an improper finish color, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Access:

1. Provide access for inspection by the Contract Administrator as required and when requested. Provide a dust free, suitable environment for inspection by the Contract Administrator.
2. Leave staging and lighting up until Contract Administrator has inspected surface or coating. Replace staging removed prior to approval by Contract Administrator. Provide additional staging and lighting as requested by Contract Administrator.

2.13.3.6 Field Quality Control

A. Testing Gauges:

1. Provide a magnetic type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA, Mikrotest.
2. Provide an electrical holiday detector, low voltage, wet sponge type to test finish coat, except zinc primer, high-build elastomeric coatings, and galvanizing, for holidays and discontinuities as manufactured by Tinker and Rason, San Gabriel CA, Model M-1.

2.13.3.7 Manufacturer's Services

A. The coating manufacturer's technical representative shall be present at the shop and at the construction site as follows:

1. On the first day of application of any coating.
2. A minimum of 6 hours additional site inspection visits, each for a minimum of 4 hours, and as required to provide Manufacturer's Certificate of Proper Installation.
3. As required to resolve field problems attributable to, or associated with the manufacturer's product.
4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

2.13.3.8 Cleanup

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.
- B. Upon completion of the Work, remove staging, scaffolding, and containers from the site or destroy in a legal manner.
- C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

2.13.3.9 Protective Coatings Systems

- A. System No. 2 Submerged Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast or Centrifugal Wheel Blast (SP-5)	100-Percent Solids Epoxy	2 coats, 250 microns (10 mils) MDFT PC

- 1. Total Coating Thickness: 500 microns (20 mils) MDFT.
- 2. Application Schedule: All exposed and submerged metal surfaces below the drive head.

- B. System No. 4 Exposed Metal – Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast or Centrifugal Wheel Blast (SP-10)	Epoxy Primer	1 coat, 75 microns (3 mils) MDFT
	Epoxy Intermediate Coat	1 coat, 75 microns (3 mils) MDFT
	Polyurethane Enamel	1 coat, 75 microns (3 mils) MDFT

- 1. Total Coating Thickness: 225 microns (9 mils) MDFT.
- 2. Application Schedule: All exposed metal surfaces above the drive head, including, but not limited to, motors, gear boxes, and non-galvanized metal components.

2.13.3.10 Supplements

- A. The supplements listed below, following “END OF SECTION,” are a part of this Specification.
 - 1. Paint System Data Sheet.
 - 2. Paint Product Data Sheet.

PAIN T SYSTEM DATA SHEET

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Substrate:		
Surface Preparation:		
Paint Material (Generic)	Product Name/Number (Proprietary)	Min. Coats, Coverage

PAIN T PRODUCT DATA SHEET

Complete and attach manufacturer’s Technical Data Sheet to this PDS for each product submitted. Provide manufacturer’s recommendations for the following parameters at temperature (F)/relative humidity:

Paint System Number (from Spec.):
Manufacturer’s Product:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer’s recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.: _____ max.: _____

Surface Temperature Limitations: min.: _____ max.: _____

Surface Profile Requirements: min.: _____ max.: _____

Attach additional sheets detailing manufacturer’s recommended storage requirements and holiday testing procedures.

2.14 Spare Parts

- .1 The intent of this specification is to provide uninterrupted operation for a minimum period of two (2) years. To meet this objective the clarifier manufacturer shall supply any spare parts, excluding lubricants that are required to meet this time frame. As a minimum, provide the following spare parts, per clarifier:
 1. One (1) sight glass for each main drive housing containing oil.
 2. One (1) set of skimmer wipers.
 3. One (1) set of sludge scraper arm wipers.

PART 3 - EXECUTION

3.1 Technical Support Services

- .1 Provide a service representative properly trained in inspection and operation of the mechanism to inspect and certify proper installation, that the torque settings of the drive overload protection device are correct, perform the torque test, and instruct the City's personnel on maintenance and operation.
- .2 Provide the services of a field service representative as required to suit the project installation schedule. This time will be for installer instruction, assisting and inspecting the Install Contractor's work, checkout and acceptance of completed installation, test monitoring, commissioning, and to instruct the Install Contractor and City's personnel in the start-up and proper operation of the equipment.
- .3 Estimated time and number of trips required by the Contractor's service representative is presented in the Bid Submission, Form B: Prices.

3.2 Torque Test

- .1 The clarifier mechanism shall be field torque tested. The purpose of the torque test is to verify the structural integrity of the mechanism structural steel design and center drive unit. The testing shall be carried out by the Install Contractor, under the supervision of the Contractor's Representative and as approved by the Contract Administrator before the mechanism is accepted and placed into operation.
- .2 The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the contractor in the tank floor at locations specified by the equipment manufacturer. A load shall be applied to the scraper arm in small increments by means of a ratchet lever connected to the cable assembly. The magnitude of the applied load shall be measured by calculating the torque from the distance of the line of action of each cable to the center line of the mechanism. A reading shall be taken at the drive design torque.
- .3 Verify that the alarm, motor cut-out, and back up safety motor cut-out switches are properly set and are in proper operation to protect the clarifier mechanism as specified.

3.3 Equipment and Performance Verification

- .1 After the installation has been verified, torque test completed, and any identified deficiencies have been remedied, equipment will be subjected to a demonstration test, running test, and equipment performance tests.
- .2 The Install Contractor will inform Contractor at least seven (7) days in advance of conducting the tests and arrange for the attendance of the Contractor. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contract Administrator.
- .3 Test Operation – Each clarifier will be filled with wastewater and placed in operation for up to 3 days. At any time during this period, the Contract Administrator will accept the performance test. The next clarifier will then be shut-down to permit installation of the next new clarifier system. Operating problems noted during this performance test shall be resolved and the system retested before the performance test can be accepted.

3.4 Welding

- .1 Shop welding procedures, welders and welding operators shall be qualified and certified in accordance with the requirement of AWS D1.1 "WELDING IN BUILDING CONSTRUCTION" of the American Welding Society.
- .2 Shop drawings shall clearly show complete information regarding location, type, size, and length of all welds in accordance with "STANDARD WELDING SYMBOLS" AWS A2.0 of the American Welding Society. Special conditions shall be fully explained by notes or details.
- .3 Welding shall conform to CSA W59.1 and ASTM E709.
- .4 All shop and field welding shall be seal welding.

DRAWINGS

SITE PHOTOS

REFERENCE DRAWINGS