SECTION 11XXX

TOW-BRO SELECT: HYDRAULIC REMOVAL CLARIFIERS

PART 1 GENERAL

1.01 SCOPE

A. Description of Work

1. Furnish one (1) suction header type clarifier mechanism and components as specified herein for use in removal of activated sludge.

2. This specification covers the general requirements for the design, fabrication and assembly of one (1) clarifier mechanism.

B. Work and Components Included (But Not Limited To):

1. The Equipment Manufacturer shall furnish the items listed below:

a. Drive mechanism complete with a gearmotor reduction unit, micro-switch torque overload devices and shear pin

b. Center support pier, anchor bolt template

c. Tow-Bro® Unitube sludge removal header, manifold, seals, clamp kit and supports

d. Center cage, truss arm and tie chord A-frame with clevis assembly

e. Access bridge including center platform, grating, hand-railing and toe plate

f. One (1) surface skimmer which includes scum blade and hinged skimmer assembly

g. One (1) scum trough with flushing device

h. FEDWA® energy dissipating inlet (EDI) baffle system and supports

i. Flocculation feedwell and supports

j. All associated hardware and anchor bolts

2. Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts and manufacturer's service.

C. Work Not Included

1. The following items are specified under other sections of these specifications:

a. Sitework - Section ___________

b. Concrete and Grout - Section ___________

c. Metal Fabrication - Section ___________

d. Paint - Section ___________

e. Electrical - Section ___________

D. References

1. American Gear Manufacturers Association (AGMA):
   a. 201.02 - Tooth Proportions for Coarse-Pitch Involute Spur Gears.
   b. 390.03a - Handbook - Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears.
   c. 908 - Information Sheet - Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth.
   d. 2000 - Gear Classification and Inspection Handbook - Tolerances and Measuring Methods for Unassembled Spur and Helical Gears (Including Metric Equivalents).
   e. 2001 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
   f. 2004 - Gear Materials and Heat Treatment Manual.
   g. 6019 - Standard for Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears.
   h. 6022 - Design Manual for Cylindrical Wormgearing.
   i. 6034 - Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
   j. 9005 - Industrial Gear Lubrication.
2. American Institute of Steel Construction (AISC):
   a. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design.
   b. Code of Standard Practice for Steel Bridges and Buildings.
3. American Society of Mechanical Engineers (ASME)
   a. B29.1M - Precision Power Transmission Roller Chains, Attachments and Sprockets.
4. American Society for Testing and Materials (ASTM):
   a. A 36/A 36M - Standard Specifications for Structural Steel.
   b. A 48 - Standard Specification for Gray Iron Castings.
   c. A 148/A 148M - Standard Specification for Steel Castings, High Strength, for Structural Purposes.
   d. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
   e. A 325 - Standard Specification for High-Strength Bolts for Structural Steel Joints.

f. A 536 - Standard Specification for Ductile Iron Castings.

5. American Welding Society (AWS):

   a. D 1.1 - Structural Welding Code for Steel.

6. American Bearing Manufacturers Association (ABMA):

   a. 9 - Load Ratings and Fatigue Life for Ball Bearings.

7. International Conference of Building Officials (ICBO):

   a. Uniform Building Code (UBC).

8. National Electrical Manufacturers Association (NEMA):

   a. 250 - Enclosures for Electrical Equipment (1,000 volts maximum).

9. Related Work Specified Elsewhere

   a. The provisions of this section are a direct extension of the GENERAL MECHANICAL REQUIREMENTS, and although set forth only once within the specification, shall apply equally to this section.

1.02 QUALIFICATIONS

A. Manufacturer

1. It is the intention of this specification to cover minimum acceptable quality for a complete installation with the exception of the motor controls, electrical work and piping requirements.

2. Basis of Design for the material and equipment specified is the Tow-Bro® clarifier design and FEDWA inlet designed by Envirex® Products of Evoqua Water Technologies in Waukesha, WI.

B. Manufacturer's Experience

1. The equipment Manufacturer shall have not less than fifteen (15) successful years of experience in the design, construction and operation of the type specified at ten (10) different plants.

2. The Engineer may require evidence, in the form of operating records, from these plants to substantiate any claims concerning the ability of the equipment to perform as required.

C. General

1. The design and layout shown on the drawings are based on Evoqua Water Technologies – Envirex Equipment. If equipment other than Envirex is submitted to the Engineer for consideration as an alternate, it shall be the responsibility of the requesting Bidder to submit the following items for the substituting piece of equipment:

a. A revised drawing of the mechanical equipment and basin layouts. This revised drawing shall show the proposed location of the substitute unit and area required for replaceable or serviceable components. This drawing shall also show clearances of adjacent equipment and service area required by that equipment.

b. Changes in architectural, structural, electrical, mechanical and plumbing requirements for the substitution shall be the responsibility of the Bidder wishing to make the substitution. This shall include the cost of redesign by affected designers. Any additional cost incurred by affected subcontractors shall be the responsibility of the Bidder and not the Owner.

c. A minimum of five (5) references of identical or larger installations including:

1. Site City, State and Project Name
2. Clarifier size, dimensions and general description
3. Reference drawings of each installation
4. Contact Name, phone number and email address of individual employed by the owner of the equipment

1.03 SUBMITTALS

A. Operating instructions, manuals and shop drawings shall be submitted in accordance with GENERAL MECHANICAL REQUIREMENTS.

B. Alternate Equipment

a. If the Installing and/or General Contractor desires to offer equipment as an alternate to the specified equipment, he shall submit, within 14 days after the bid opening, substantial descriptive information in order that the Engineer may determine if the proposed alternate is equal to that specified.

b. No alternate will be considered unless, in the opinion of the Engineer and Owner, it conforms to the specification in all respects except manufacturer and model and minor details. Material variances will not be allowed.

c. Alternate equipment which is a "standard product" of the Manufacturer shall be modified, redesigned, or furnished with special features or special materials as may be necessary to conform to the requirements of this specification and contract drawings.

d. The Owner reserves the right to decide whether or not the proposed alternate will be acceptable.

2. The Contract, if awarded, will be on the basis of material and equipment specified without consideration of alternate equipment. In the event an alternate is allowed, the Contract price will be adjusted accordingly by a change order.

   a. By submitting a bid, the Contractor agrees and understands that Contract award will be made on the basis of the specified equipment.

   b. If an alternate is found to be not acceptable, the Contractor shall be responsible for supplying the equipment specified.

3. Descriptive information shall include the following:

   a. List of ten (10) installations of equipment in successful operation of the design in all essential regards as specified.

   b. Field dye performance data verifying the proposed header design proportionately removes sludge from the entire tank bottom. Test site and testing laboratory shall be identified along with test methods and apparatus used. Data shall be from an existing multiple orifice system incorporating a tapered header width operating under the following conditions.

      1. Minimum 70' diameter basin with minimum 10' side water depth.

      2. Flow and pressure head within the header shall be recorded at each orifice while the header rotates.

      3. Return sludge concentrations not less than 5,000 mg/l with not less than 1 MGD with maximum withdrawal rate at least 3 times minimum.

      4. Maximum velocity in header of 3.0 to 4.5 fps.

      5. Maximum header headloss at maximum flow not less than 1.0 feet.

      6. Actual pick-up of sludge shall be in close agreement with the ideal pick-up curve for uniform removal based on floor area swept.

      7. Calculations will not be an adequate substitute for dye verification data.

   c. Written certification that the proposed drive meets AGMA standards. Drive mechanism calculations prepared by a registered professional engineer and shall be submitted for approval along with published torque value of the proposed drive.

   d. General arrangement of drive unit verifying AGMA torque, overload protection system, housing and gear materials and horsepower. Provide values used for the following AGMA design parameters per AGMA Specification 6034-B92:

      1. Pitch diameter of worm gear (in.)

      2. Effective face width of gear (in.)

      3. Lead angle of threads at mean worm diameter (deg)

      4. Normal pressure angle of worm thread (deg)

      5. Sliding velocity of worm at mean diameter (fpm)

      6. Number of teeth

7. Service factor. Use 1.25

e. Provide the following AGMA design parameters per AGMA 2001-D04:

1. Pitch diameter of pinion and spur gear (in.)
2. Face width of narrowest of two mating gears (in.)
3. Pitch line velocity of pinion (fpm)
4. Allowable bending stress (Sat) of pinion and spur gear material (psi)
5. Allowable contact stress (Sac) of pinion and spur gear material (psi)
6. Geometry factor (J) for bending
7. Geometry factor (I) for pitting resistance
8. Load distribution factors Cm and Km
9. Dynamic factors Cv and Kv
10. Life factors Cl and Kl at 420,000 cycles of the main gear
11. Number of teeth
12. Reliability factors, Cr and Kr equal to or greater than 1.0

f. Complete assembly drawing of the collector components and List of Materials giving:

1. Type of material used for each component
2. Dimension, thicknesses and weights of each component
3. Header details giving orifice diameter, distance from center and cross section of header at each orifice
4. Manifold seal detail

1.04 GUARANTEE AND WARRANTY

A. Seller shall furnish its standard warranty against defects in material and workmanship for all Equipment provided by Seller under this Section. The Seller shall warrant the Equipment, or any components thereof, through the earlier of:

1. Eighteen (18) months from delivery of the Equipment or
2. Twelve (12) months from initial operation of the Equipment.

PART 2 DESIGN

2.01 MANUFACTURERS

A. The OWNER and ENGINEER believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this section.

1. Evoqua Water Technologies, LLC - Envirex Products, of Waukesha, WI
2. Or pre-approved equal

2.02 EQUIPMENT

A. General

1. Furnish and deliver suction type sludge collector for installation in one (1) concrete settling tank.
   a. Tank diameter to be 100 feet with inboard effluent launder.
   b. Tank side water depth to be 14 feet.
   c. Tank freeboard to be 2 feet.
   d. Floor slope to be 1/16 inch per 1 foot.
2. Clarifier Mechanism
   a. Provide a center pier supported, center feed design with peripheral overflow.
   b. Provide a center drive mechanism that supports a walkway, maintenance platform and rotating structural steel cage.
   c. The cage shall support the Tow-Bro® Unitube header, manifold and truss arm.
   d. One (1) surface skimmer which includes scum blade and hinged skimmer assembly.
   e. Fabricated steel structures shall be shipped in the largest sub-assemblies permitted by carrier regulations, properly match-marked and identified for ease of field erection.

B.

Table 1: Hydraulic Design Criteria (per clarifier)				
	MIN.	**AVE.**	**MAX.**	**PEAK**
Effluent Flow (MGD)				
Return Flow (MGD)				
Mixed Liquor Flow (MGD)				

Table 2: Clarifier Mechanism Design	
Internal Diameter, feet	100
Side-water Depth, feet	14
Minimum Freeboard, feet	2
Floor Slope	1/16 : 12
Center Pier	
Minimum inside diameter, inches	36
Flocculation Well	
Diameter	19’ 9”
Depth below water surface	6’ 0”
Number of Scum Ports	8
Well Thickness	3/16”
Configuration	Circle
FEDWA - EDI	
Plate thickness	3/16”
Impingement Zones	4
Maximum Baffle Exit Velocity (at Peak Conditions), fps	0.15
Skimmer	
Number of Skimmer Arms	1
Scum Trough	
Trough Width, feet	6
Maximum Headloss for Header, feet	1.0
Minimum Flow Velocity in Header, ft/s	0.50
Minimum Header Orifice Diameter, inches	1.5
Header Thickness, inches	1/4
Header Support Type	Tie bar

Table 3: Drive Design Criteria	
Ball Race Diameter, inches	42
Torque Requirements	
AGMA Rated Torque, ft-lbs.	21,900
Motor Shut-Off Torque, ft-lbs.	26,280
Momentary Peak Torque, ft-lbs.	43,800
Service Factor	1.25
Drive Output Speed, RPM	0.04

C. Materials

1. Drive housing shall be cast iron
2. Submerged Steel in contact with process water: A36 Carbon Steel
   a. **Alternatives:** Galvanized, 304 Stainless Steel or 316 Stainless Steel
3. Non-Submerged Steel: A36 Carbon Steel
   a. **Alternatives:** Galvanized, 304 Stainless Steel or 316 Stainless Steel
4. Grating: Aluminum
   a. **Alternatives:** Galvanized, FRP, etc.
5. Handrails: Aluminum
   a. **Alternatives:** Galvanized, etc.
6. Anchor bolts and hardware: Type 316 stainless steel.

D. Structural Members

1. Structural steel shall conform to Part 1.01-D.
2. Structural steel components shall have minimum thickness of 1/4" unless otherwise specified.
3. Sharp corners of cut or sheared edges will be dulled with one pass of a power grinder to create a smooth edge.
4. All welding shall conform to American Welding Society Standard AWS D1.1. Structural support members shall be shop welded for bolted field assembly. Field welding shall be minimal.
5. Design components so that stresses developed do not exceed allowable stresses, as defined by current AISC standards when designed for the AGMA rated torque.

6. Panel lengths and member sizes shall be selected such that slenderness ratios do not exceed 200 for compression and 240 for tension. For strength, the controlling member force shall be used to determine member size.

7. Maximum deflection in a span under combined live and dead loads shall not exceed L/360.

E. H-Drive Mechanism

1. General

   a. H-Drive mechanism consisting of primary helical gear reduction, intermediate worm gear reduction unit and enclosed final reduction unit consisting of internal spur gear and pinion in a turntable base is to be completely assembled and finish painted in the Manufacturer's shop.

   b. All gearing shall be enclosed in gray cast iron ASTM A-48 Class 40B housings. Fabricated steel housings, exposed gearing and submerged bearings will not be acceptable.

   c. The drive shall be designed to allow removal and replacement of internal gear, balls and strip liners without raising the walkway.

   d. All components of the drive mechanism shall be designed in accordance with AGMA Standard 6034-B92 "Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors", and Standard 2001-D04 "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth"; for 24-hour continuous, uniform load duty and 20-year design gear life at the specified output speed. The AGMA rated torque of the drive shall be the lowest value computed for worm gear set, spur gear and pinion for strength and durability.

   e. Select conservative values for bending strength and pitting resistance life factors Kl and Cl based on a minimum of 420,000 cycles of the main gear. The drive AGMA torque rating shall be as specified above with a minimum 1.25 service factor.

   f. All bearings shall be designed for a minimum B-10 life of 200,000 hours.

2. Primary Reduction Unit

   a. Provide commercially available helical gear reducer or gearmotor in a cast housing.

   b. All bearings shall be anti-friction type running in oil.

   c. Motor shall be totally enclosed, ball bearing type, of ample power for starting and continuously operating the drive mechanism without overloading.

   d. Motor to conform to NEMA standards and be suitable for operation on 230/460 volt, 3 phase, 60 Hertz current.

e. Primary reduction unit shall drive the intermediate reduction through a chain and sprocket arrangement with #80L self-lubricating chain and non-corrosive OSHA approved removable chain guard.

f. Provide proper chain tension by an adjustable steel base mounted on the intermediate reduction unit.

3. Intermediate Reduction Unit

a. Provide worm gear speed reduction with grease and oil lubricated anti-friction type bearings in cast iron housing securely bolted on the machined top face of the final reduction unit. Worm and shaft shall be a two-piece assembly for ease of maintenance. Cycloidal and planetary gearing will not be acceptable.

b. Align and maintain accurate centers with the final reduction gearing. Swivel base mounting of the intermediate unit will not be acceptable.

c. Mount an electro-mechanical overload device on the thrust end of the worm shaft consisting of plate spring assembly, plunger, indicator dial two (2) micro-switches (one N.O. and one N.C.) and a terminal block, all enclosed in a weather tight, gray cast iron housing. Amperage metering devices will not be considered equal to the overload device specified.

d. Micro-switches shall be factory set to: (1) sound an alarm when the load on the mechanism reaches 100% of the AGMA torque; and (2) stop the motor when the load reaches 120% of the AGMA torque.

e. Provide a shear pin device mounted on the drive end of the worm shaft.

4. Final Reduction

a. Provide internal, full depth involute tooth design, ductile iron spur gear driven by a heat treated steel pinion from the slow speed shaft of the intermediate reduction unit. Stub tooth design will not be acceptable.

b. Provide bearings at top and bottom of pinion to ensure complete tooth contact between mating surfaces. Pinion and pinion shaft shall be furnished as a two-piece assembly for ease of maintenance.

c. Provide cast iron turntable base with annular raceway to contain balls upon which the internal gear rotates. The ball race shall ensure low unit ball load, long life and stability without the use of submerged guide shoes, bumpers or steady bearings.

d. Provide four (4) 3/8" thick x 3/4" wide renewable special hardened (38-42 Rockwell C) steel liner strips force fitted (pins and cap screws not permitted) into the turntable base and internal gear for balls to bear on vertically and horizontally.

e. Provide an internal gear of split design with precision mating surfaces for ease of removal of gear, balls and liner strips without raising bridge. Drives without this feature are not acceptable.

f. Internal gear, pinion and balls to run in an oil bath and be protected by a felt seal and vertical neoprene dust shield.

g. Provide oil filling and level pipe along with a drain plug and sight gauge.

h. Turntable base shall be bolted to the center column and be designed to support the bridge, internal gear and rotating mechanism.

F. FEDWA Flocculation Baffles

1. Provide inlet baffles to promote effective mixing and tapered flocculation.
2. Flow shall impinge three (3) overlapping vertical target baffles in secession with a series of four (4) impingement zones. Maximum baffle exit velocity shall be less than 0.15 fps at peak influent flow.
3. Design to provide a "Gt" (t in seconds) value in the well not exceeding 6,000 with a velocity gradient "G" within the well of at least 35 fps/ft and not exceeding 60 fps/ft at a minimum water temperature of 10 degrees-C at peak influent flow.
4. Provide horizontal shelf baffles to prevent downward movement in flocculation zone.
5. Baffles shall bolt to center cage and well support beams.
6. The baffles to be fabricated from minimum 3/16" thick A36 carbon steel plate.
7. Hydraulic calculations shall be provided showing dimensional characteristics, port area, velocity, headloss, and mixing intensity.
8. LA EDI system shall be the only acceptable alternative to the FEDWA design

G. Flocculation Feedwell

1. The flocculation feedwell fabricated from 3/16" steel plate sections supported from the drive cage or bridge extensions.
2. Incorporate steel stiffeners at the top and bottom to maintain shape and rigidity.
3. Feedwell shall be of adequate size to diffuse the flow into the tank at a uniform flow through velocity.
4. Ports shall be cut into the flocculation feedwell to permit entrapped scum to escape.
5. Ports shall be baffled to prevent short circuiting to the weirs.

H. Center Pier

1. A cylindrical 1/4" thick steel plate center pier shall support the drive, collector mechanism and access bridge.
2. Top of pier to have a drive mounting plate set plumb with the centerline.
3. Drive to be positioned, leveled and grouted in place on top of pier with a non-shrink grout.

4. Manufacturer to provide minimum eight (8) 1" diameter anchor bolts and steel template/grout shield to accurately locate anchors.
5. Center pier shall serve as the influent pipe.
6. Center pier shall have a minimum of four (4) overflow areas at its upper end to diffuse flow into the flocculation feedwell at a velocity not to exceed 1.75 fps at maximum design mixed liquor flow.

I. Sludge Collection Header

a. The header shall be parallel to the tank floor and have a series of inlet orifices such that the entire tank bottom is swept clean in a single revolution.
b. The header shall be designed to uniformly remove sludge in proportion to the area swept with the removal of a larger volume of sludge at greater distances from the tank center.
c. Sludge shall be transported through the header to the center manifold, with removal being accomplished by hydrostatic pressure.
d. Provide a fully tapered, rectangular-shaped Unitube header varying in cross section from a maximum near the tank center to a minimum at the outer wall.
e. Fabricate header from 1/4" thick steel plate and hot-dip galvanized after fabrication. Provide steel plate counterweights not exceeding 50# each as necessary for proper equipment balance. Field welding of galvanized header or supports will not be allowed.
f. Longitudinal cross sectional axis to be mounted at an angle of 45 degrees to tank bottom to trap sludge.
g. Provide a 2" fluidizing vane as an integral part of header. Attach neoprene squeegee to fluidizing vane provided with 1" vertical adjustment.
h. Manufacturer to size and space header inlet orifices at regular intervals not exceeding 30".
i. Orifice design to be proportionate to the volume of sludge withdrawn from the entire tank floor at all flows.
j. Provide header flange with silicone seal for bolted connection to center manifold. Header shall be tie bar supported.
k. Alternate Manufacturers shall submit header verification field data in accordance with the Substitute Equipment Section of this specification.
l. Sludge withdrawal by means of individual riser pipes or stepped header construction will not be acceptable.

J. Center Cage, Truss Arm and Manifold

1. Center cage to be of an all-welded box truss construction made up of structural steel members having a minimum thickness of 1/4"
2. Provide one (1) truss arm per skimmer assembly.
3. Truss arm shall be furnished with a triangular three-point contact design for ease of installation and alignment. Truss shall be constructed with 1/4" minimum thick members. Truss shall be pinned at the base for vertical adjustment and connected to the center cage through strut and adjustable clevis assembly. Tie-rod and turnbuckle designs that do not provide lateral support will not be acceptable.
4. Provide a cylindrical manifold with two (2) seals for bolted connection to the sludge collection header and bottom of cage. A bottom seal plate shall be furnished by the equipment Manufacturer securely anchored to the floor and grouted in place after final adjustment.

K. Surface Skimmer

1. Provide skimmer arm consisting of scum blade and hinged wiper assembly.
    a. The scum blade shall span the full length between the flocculation feedwell and scum trough. Scum blade shall have a height of 5-in rigidly attached to vertical pipe supports and structural A-frame. The A-frame shall be bolted to the truss arm at maximum of 12’ spacing.
    b. Mount a hinged wiper assembly on the end of the scum blade to form a pocket for trapping scum. The wiper assembly shall maintain continual contact and proper alignment between scum blade, outer scum baffle and scum trough. The wiper blade shall have a wearing strip on its outer end which contacts the scum baffle and neoprene strip on its inner and lower edges which contact the scum trough.
    c. All springs, pivot points and threaded fasteners shall be constructed of 302 stainless steel. The hinged wiper assembly shall be hot dipped galvanized. The wiper blade shall be neoprene with Durometer range 50-60. The wiper assembly shall be the same dimension of the scum trough.
    d. Provide a manual lockout mechanism on hinged skimmer assembly to allow for flexible independent operation for surface ice. Lockout mechanism shall raise hinged skimmer assembly above water surface without removal.
2. Provide one (1) scum trough 6-ft wide with inclined beach of 1/4" thick plate, supported from the tank wall.
    a. Scum trough shall have an overall length of 4'-9" along the scum baffle consisting of beach plate, inner radius baffle, hopper and 6" discharge pipe. Manufacturer shall provide a loose plate flange for contractor to field weld and connect to scum drain piping.
    b. Beach plate to slope at a nominal incline of 1-3/4" per foot to a point 5" below the maximum water elevation. The trough shall be provided with a submerged shelf

extension spanning an additional 4’-0” along the scum baffle. An inner radius baffle extending 9" below and 3" above maximum water level shall run from the trough to the end of the submerged shelf.

3. Provide a mechanical flushing device made from 304 stainless steel and activated by the main tank skimmer arm. The flushing device shall pivot on a fabricated hinge that uses a 3/4” diameter minimum stainless steel pin/bolt. The flushing device will provide a counter weight action which in conjunction with a neoprene seal will assure a positive closure. The flushing device shall be held open to allow 15 to 25 gallons of flushing water per trip.

L. Access Bridge

1. Provide a bridge of pony truss construction extending from the tank wall to the stationary drive base.
2. Provide a bridge extension to provide access to the far-side of the drive mechanism.
3. Bridge to be designed for the dead load and a live load of 50#/sq. ft., with a deflection not exceeding L/360 of the span.
4. Provide a 3' wide walkway of 1-1/4" x 3/16" aluminum grating extending over the entire bridge length.
5. Provide a 2-rail handrail consisting of 1-1/2" diameter, Sch. 40 mechanically fastened aluminum pipe for rails and Sch. 80 posts. Post spacing not to exceed 5’. Omit handrail only where truss bridge members at 21" and 42" above the walkway provide the same function.
6. Provide a 4" high aluminum toe plate along both sides of bridge and bridge extension.
7. Provide a minimum 8' x 10' rectangular platform to provide a 2’ working clearance around the drive.

M. Effluent Weirs and Scum Baffles *(to be provided by Installing Contractor)*

1. Fabricate weirs from 3/16" thick x 9" FRP.
2. Weir shall have 90 degree, 2.5 inch deep "V" notches spaced 6" on centers.
3. Fabricate scum baffle from 1/4" thick x 12" FRP.

N. Anchor Bolts

1. All equipment anchor bolts shall be Type 316 stainless steel.
2. Equipment Manufacturer shall furnish steel template and grout shield to accurately locate center pier anchors and allow for grouting beneath the pier and manifold seal plate after final plumbing.

2.03 SURFACE PREPARATION AND FINISHING

A. The center drive mechanism shall be shipped, assembled and finish painted with manufacturer's standard paint system.

B. The Tow-Bro unitube sludge collection header shall be hot-dip galvanized after fabrication.

C. Submerged and/or non-submerged components shall be prepared by blasting to SSPC-SP10 and prime painted with one (1) shop coat of Sherwin-Williams Dura-Plate 235NSF Red Oxide multi-purpose epoxy to 4-6 mills DFT. Finish coats are to be applied in the field by the Contractor.

D. **Alternative:** Submerged and/or non-submerged components shall be hot-dip galvanized after fabrication per ASTM-A123.

E. **Alternative:** Submerged and/or non-submerged components shall be Type 304 stainless steel

F. **Alternative:** Submerged and/or non-submerged components shall be Type 316 stainless steel

G. Stainless steel shall be mechanically treated by waterjet and bead blast in accordance with ASTM A380 *Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems*

H. Galvanized and stainless steel components will be shipped unpainted.

PART 3 TESTING

3.01 CLARIFIER START-UP

A. A start-up inspection and test shall be performed on each clarifier to verify proper installation, alignment and operation.

B. Testing shall include the following:

1. Drive

   a. Alignment and Installation

      1. Check alignment of the drive and driven sprockets
      2. Check chain for proper tension
      3. Ensure proper fit of chain guard
      4. Measure the stop block clearance and lower drive housing
      5. Review and confirm the correct motor, gear reducer, and drive chain have been installed on the clarifier drive per the defined mechanism design
      6. Confirm installation of the proper shear pin
      7. Bump motor to confirm correct rotation

   b. Lubrication

1. Check the drive mechanism for the correct lubrication levels
2. Service all lubrication points and grease fittings
3. Check the air vents in the gear reducers

c. Micro-switches

1. The torque protection micro-switches must be connected per the diagram on the drive drawing.
2. The shut-down switch must be connected: a manual reset must be wired in the circuit when the motor shut-off switch is activated.
3. Set alarm and motor shut-off torque overload gap per the drive drawing

2. Clarifier Mechanism

a. Installation

1. Confirm proper installation of all field bolt material
2. Check the bridge and platform for proper level installation
3. Ensure proper spacing has been installed on the bridge expansion end to allow for sufficient room to expand and contract
4. Run the mechanism and check the horizontal plane at four points on the wall (90 deg. apart) for tanks up to 80’ in diameter, eight points (45 deg. Apart) for large tanks. Always recheck starting point.
5. Check manifold runs concentric to center pier
6. Check the slope of the header at fluidizing blade
7. Confirm that the upper and lower manifold seals are installed properly
8. Check the elevation and scum beach level relative to the max water surface
9. Preform alignment check of the header and truss arms
10. Proper tracking and alignment of skimmer assembly with water elevation and scum trough

PART 4 EXECUTION

4.01 INSTALLATION AND FIELD SERVICE REQUIREMENTS

A. The Contractor shall install the clarifier as shown on the drawings.

B. Equipment shall be installed in accordance with GENERAL MECHANICAL REQUIREMENTS and in accordance with the Manufacturer's recommendations to provide a complete installation.

C. The Contractor shall complete the following:

1. Plumb and grout the center pier
2. Add grout beneath the manifold seal ring and adjust for horizontal plane
3. Grout the floor in accordance with the Manufacturer's recommendations
4. Add grout between the center pier and drive unit

D. Operating Instructions and/or Operator Training

1. Manufacturer to provide two (2) trips and two (2) days of field service. One day shall be dedicated to a pre-grout inspection. After installation, a post-grout inspection shall be conducted followed by a general training seminar.

4.02 ELECTRICAL CONNECTIONS AND WIRING

A. Wiring and conduits for electrical power, control and instrumentation will be provided by the Electrical Contractor under DIVISION 16 - ELECTRICAL.