Section 9
Individual Submersible Sewage Pumps

A. General

1. Individual on-lot sewage pumps may be used to service individual properties which can neither be drained by gravity to the sanitary sewer system nor served by grinder pump due to inadequate head conditions. If the property can be drained by a gravity type system, the use of sewage pumps will not be permitted. Individual on-lot sewage pumps must discharge to a gravity type sewer lateral. Sewage pumps shall be used for pumping wastewater only and not for dewatering basements or yard areas. Pump units shall be sealed and protected from the ingress of storm water, groundwater or floor washings.

2. Individuals who wish to install on-lot sewage pumps must familiarize themselves with the Authority's "Individual Submersible Sewage Pump Management Plan". The proposed use of sewage pumps will be reviewed on a case by case basis by the Authority.

3. Simplex (single) sewage pump units shall be used at residential property locations, and simplex or duplex (double) sewage pump units may be used at commercial and industrial properties. Additionally, provision of a spare pump and a standby power supply are recommended for non-residential uses. Each installation will be reviewed by the Authority to determine the appropriate requirements for that individual installation.

4. Pump units shall be installed in either concrete, high-density polyethylene or fiberglass-reinforced polyester basins and shall be outdoor installations only. Indoor installations will not be permitted.

5. The pump package shall consist of the basin, pump(s) and motor(s), quick disconnect, pump removal system, junction box, float type start-stop level controls, motor high temperature shutoff, motor seal leak alarm, high water alarm, shutoff and check valves, discharge piping and fittings and all internal wiring terminating in a junction box.

6. The location of the sewage pump package and control panel shall be determined by the property Owner.

7. The following NEMA ratings are required for the specified areas:

    a. Outdoors, within 10 feet of the pump basin – NEMA 4X

    b. Outdoors, at least 10 feet from the pump basin – NEMA 4 or NEMA 4X

8. Pump discharge piping shall be connected to a minimum 2-inch diameter force main meeting the requirements of Section 6.

9. Provision of bollards to protect the structure and/or control panel is recommended in areas where there is potential for traffic.

B. Materials and Equipment

1. Submersible Pump Unit

   a. The pump shall consist of a centrifugal sewage pump capable of a minimum flow of 10 gpm at a Total Dynamic Head (TDH) as determined by site conditions. Pump shall be capable of handling 2" spherical solids.

   b. Acceptable Pump Type

      -Goulds Pump Co., Inc., Model 3887

      -or Equal

   c. Submersible Pump and Motor

      (1) The sewage pump and direct-coupled motor shall be designed and manufactured so as to operate when completely submerged in wastewater. Motor is to be constant speed (1600-1800 RPM) to operate on 240 or 115-volt, 60 Hz, single-phase service and shall be rated for continuous duty at full submergence. The motor is to be properly sized to drive the pump at any point on the pump curve, and shall be amply rated for the head and capacity values as determined by the site conditions, without exceeding 1.0 service factor load at minimum capacity design point. The motor shall be capacitor-start and shall be provided with thermal protection.

      (2) The stator winding shall be open type with class B insulation suitable for operation in clean dielectric oil. The stator shall be a register fit into the bearing housing to ensure positive alignment and bolted for ease of serviceability. The motor shall be provided with ball type anti-friction bearings which shall support the heavy duty rotor shaft and to handle all radial and axial loads imposed by the impeller while limiting shaft deflection at the mechanical seal faces. The ball bearings shall be designed for a B-10 life of 30,000 hours minimum.

      (3) The motor shall be protected by a silicon carbide mechanical shaft seal mounted on the pump shaft. The upper mechanical seal shall be tensioned by an independent spring system constructed of series 300 stainless steel metal components and Buna-N elastomers.

      (4) The impeller shall be semi-open with pump out vanes on the top of the impeller. The impeller shall be threaded to a 400 series stainless steel

shaft and must be secured by a thread-locking nut to prevent the impeller from loosening during short periods of reverse rotation.

(5) The pump casing shall be of ASTM A48 Class 30 gray cast iron of sufficient thickness to withstand 1.5 times the shut off pressure of the pump. Integral feet of cast iron shall be made a part of the casing. The discharge connection shall be a standard 2-inch NPT suitable for direct connection to the discharge piping.

(6) The impeller, casing, bearing/seal housing and motor cover shall be of ASTM A48 Class 30 high quality cast iron. Both inner and outer surfaces of cast iron shall be electrocoat-painted with thermo-setting acrylic enamel at 400 degrees F.

(7) The power cable shall be sealed at the motor end as it enters the motor casing by a two-part barrier to moisture intrusion. The first barrier shall be the compression of the oil and chemical resistant grommet which shall seal the outer jacket of the power cord. The second barrier shall be epoxy poured isolated conductors within the jacketed cable. The outer jacket of the power cord shall be oil and water resistant.

(8) For non-residential installations, the use of explosion-proof motors and the provision of a spare pump are recommended.

2. Level Controls

Sealed float-type mercury switches shall be supplied to control sump level and alarm signal. The mercury type switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket. A weight shall be attached to the cord above the float to hold the switch in the sump. Weight shall be above the float to effectively prevent sharp bends in the cord when the float is operated. Two float switches shall be used for starting and stopping the pump. A third switch shall be provided for high water alarm and redundant pump on (for duplex installation). The float switches shall hang in the sump and be supported by a stainless steel bracket and cord snubber which will give positive support to the controls and allow flexibility in setting the levels. All mounting structures and hardware shall be stainless steel.

3. Operation of the System

On sump level rise, the lower mercury switch shall first be energized, then the upper level switch shall energize and start the pump. With pump operating, the sump level shall lower to the low switch turn-off setting and the pump shall stop. If the level continues to rise when the pump is operating, the alarm switch shall energize and activate the alarm. All level switches shall be

adjustable for level setting from the surface. Duplex systems shall also have a lag pump on switch.

4. Corrosion Protection

   All materials exposed to wastewater shall have inherent corrosion protection, i.e. cast iron, fiberglass, stainless steel or PVC (galvanized steel is not acceptable). Any interior steel surfaces shall be adequately protected against corrosion. All fasteners shall be stainless steel.

5. Junction Box

   a. The junction box shall be constructed of fiberglass for corrosion resistance. The enclosure shall be of adequate thickness and properly reinforced to provide good mechanical strength. The junction box shall have a fully gasketed cover that is held in place by four stainless steel captive screws with slotted/flat sided heads totally encapsulated in PVC so that no metal parts are exposed. The cover shall be connected to the body with a stainless steel chain.

   b. An adequate number of sealing type cord grips shall be supplied for incoming pump and switch cords. The cord grips shall be made of non-corrosive material, such as PVC or nylon, and shall have rubber compression bushings that will make an effective seal around the wire jackets. The cord grip shall also seal to the junction box wall with an O-ring, gasket or other effective means.

   c. The hub shall be of a corrosion resistant material and shall be of adequate size to accommodate the number of wires required to operate the pump.

   d. A method for sealing the incoming wires in the junction box shall be supplied by the manufacturer so that condensation from the conduit or ground water will not enter the enclosure, or an explosion-proof conduit seal shall be required. Duct seal shall not be used.

   e. Wires shall be connected within the junction box by means of wire nuts and the connections further protected by non-hardening sealant.

   f. Electrical cable for power and control wiring between the junction box and each pumping unit shall be supplied. Wire size shall be selected in accordance with amp capacities required by the National Electric Code.

6. Valves

   a. Check Valves

(1) All pump installations shall include a check valve in the discharge piping inside the basin. The valve shall be gravity operated ball type. The check valve shall provide a full-ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow.

(2) The valve body shall be a high gloss, injection molded part made of PVC Type I-II with hub and socket compatible with 2-inch PVC pressure pipe, SDR 21. Dimensions for hub and socket shall be in accordance with commercial standards C5-272-65. Ball check valves shall include a corrosion resistant non-metallic ball and rubber-sealed seat.

b. Ball Valve

The pump shall be equipped with an isolation ball valve which shall be of PVC (Schedule 80), bronze or stainless steel construction, three-piece design, full port, with TFE seals and seat valves shall have screwed end connections and shall be lever-operated with an extension handle extended vertically to a supporting bracket fixed not more than twelve (12) inches below finished grade. Valves shall be as manufactured by Jamesway Corporation, Worcester Controls or approved equal.

7. Flexible Discharge Coupling

The pump discharge piping within the pump basin and the discharge force main shall be connected with a flexible discharge coupling to accommodate differential settling of the force main and the pump basin. Flexible discharge couplings shall be made of an inner corrugated hose sheathed in an outer braid. Flexible discharge couplings shall be constructed of stainless steel and shall be rated for 345 psi.

8. Basins

a. General

(1) Either concrete, high-density polyethylene or fiberglass basins may be provided. However, concrete basins shall be used in areas subject to traffic loadings. All basins shall register a minimum 4" above finished grade to prevent infiltration of surface water. The basin shall be located in an area not subject to ponding or flooding.

(2) For residential installations, SLSA recommends the basin have a minimum net effective storage volume of 140 gallons between the pump shut-off elevation and the invert of influent line from the connected structure.

(3) For non-residential installations, SLSA recommends a minimum operating tank volume of 140 gallons, or 24 hours of storage, whichever is greater, be provided. If anticipated daily sewage flow exceeds the available storage volume, the owner should perform backup calculations for the anticipated flow rate. Non-residential storage requirements may be reduced by provision of a back-up power source and a spare pump.

(4) A non-corrosive sign shall be attached to the basin cover indicating that the pump basin is a hazardous area where confined space entry procedures are required.

(5) The basin shall be provided with a concrete anti-flotation collar (minimum of 1 cubic yard (cy) of concrete) to prevent flotation of the basin at high groundwater elevation when the basin is empty.

(6) The minimum acceptable basin diameter is 36 inches.

(7) In all cases, the applicant shall confirm that a basin of sufficient volume and area is provided to allow for effective pumping system operation and maintenance.

(8) Watertight seals are required for all power and control connections within the basin as follows:

(a) between control panel motor feeders and junction box

(b) between junction box and motor leads

(c) between motor leads and pump housing

(d) for all control device conduits/leads and junction boxes inside basin

b. Concrete Basins

(1) Precast reinforced concrete chambers shall conform to ASTM Specifications C-478 (Latest Revision) and shall be of watertight construction. Joints between sections shall be provided with preformed plastic joint sealing material such as Ram-Nek as manufactured by K.T. Snyder Co.

(2) The preformed joint sealer shall be protected by a removable two-piece wrapper and shall be applied in strict accordance with the manufacturer's recommendations. The chemical composition of the

sealer shall meet the following requirements: bitumen - ASTM D-4-52, Inert Ash Mineral AASHTO T-111-42, Volatile Matter ASTM D-6-39T.

(3) Mixing water for mortar and concrete shall be clean and free from oil, acid, alkali, sewage or other deleterious substances.

(4) Portland cement shall conform to ASTM Specification C-150, Type I. Where specifically authorized or required, high early strength (Type 3) shall be used.

(5) Concrete shall have a compressive strength of not less than 3,000 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision). Aggregate shall be of quality, gradation and proportions as approved by engineer after submission of test results on the design mix. Each cubic yard of concrete shall contain no less than 6 bags of Portland cement. Slump of concrete shall not exceed 4 inches. Ready mixed concrete shall conform to ASTM Specification C-94 (Latest Revision).

(6) Reinforcing steel shall be clean and free from rust, scale or coatings that will reduce bond.

(7) The exterior of concrete basins shall be coated with bitumastic no less than twenty (20) mils in thickness. The coating shall be Bitumastic Super Service Black as manufactured by Koppers or approved equal.

(8) The interior of concrete basins shall be lined with PVC or HDPE to prevent hydrogen sulfide corrosion as specified in Section 5 – Manholes.

(9) Concrete basins shall be equipped with access frame and cover assembly of extruded aluminum with aluminum or stainless steel fittings. Each cover shall be provided with a lifting handle, safety catch to hold the cover and locking hasps. The cover surface shall be of a non-skid checkered pattern and shall be provided with a keyed lock in traffic areas or padlock in all other areas. The padlock shall be of the solid corrosion-proof case design with hardened steel shackle and zinc coating. In paved/traffic areas, basins shall meet the loading requirements of H-20 or H-25 as appropriate.

c. High-Density Polyethylene

(1) The basin shall be high density polyethylene, with a grade selected to provide the necessary environmental stress cracking resistance.

(2) Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250" thick (minimum).

(3) All seams created during tank construction are to be thermally welded and factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

(4) One 4-inch diameter inlet hub shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch PVC or Schedule 40 pipe. Hubs shall be field installed to meet field conditions.

(5) One 1-1/2" NPT discharge coupling shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (centerline of coupling to finished grade) shall be no less than 42".

d. Fiberglass Basins

(1) The basin shall be custom molded of fiberglass reinforced polyester resin using a lay-up and spray technique that will assure that the interior surface is smooth and resin-rich. The basin shall have a nominal wall thickness of 1/4-inch.

(2) The fiberglass basins shall be built in accordance with:

(a) Plastics Laminate ASTM C581 and C582.

(b) Chemical-Resistance Test ASTM C581. Previous tests will be acceptable provided laminates are representative.

(3) The basins shall be free of imperfections, sound, watertight, and of high quality workmanship. Basins shall have lifting lugs or other devices for unloading and installation. All conduit and piping connections shall be plugged for shipment.

(4) One minimum 4-inch diameter inlet hub shall be provided for each pump unit. The inlet hub shall be suitable for use with 4-inch PVC or Schedule 40 pipe. Hubs shall be field installed to meet field conditions.

(5) One minimum 2" NPT discharge coupling shall be provided for the pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (centerline of coupling to finished grade) shall be no less than 42".

(6) Fiberglass basins shall be equipped with an aluminum or fiberglass cover. The cover shall be bolted to the basin with stainless steel cap screws. Stainless steel nuts for the screws shall be bedded in the fiberglass to prevent turning and for corrosion resistance.

9. Electrical Control Panel

a. General

(1) A separate remote electrical control panel shall be installed. Panel shall contain all electrical components necessary for efficient control of the pumps and an audible alarm. In addition, the panel shall contain a U.L. listed NEMA sized motor contactor having a guaranteed component life span, without maintenance or contact replacement, of one million operations (definite purpose contactors will not be allowed). The panel shall have an adjustable or non-adjustable 2 pole bi-metallic temperature compensated U.L. listed overload relay meeting NEMA Class 10 tripping characteristics, and the auxiliary contact of the overload relay must be connected in series with the motor contactor coil to switch off the contactor in the event of an overload. The panel shall also have lightning protection and any other items required for proper control of the centrifugal type pump unit. The incoming wires/conduits shall be provided with a water tight seal.

(2) The enclosure shall contain an inner back panel for mounting of the internal components. The enclosure shall be fully gasketed, hinged, and NEMA rated for the applicable location as specified in paragraph A.6 of this section. The enclosure shall be stainless steel or UV-stabilized fiberglass, with combination closing latch and locking hasp.

(3) The control panel shall be fitted with an integral red alarm light on the top.

(4) The light shall be provided with a lamp test switch mounted within the panel. The alarm light shall be a flashing type activated by both moisture in the pump seal chamber and high water in the wet well and shall go out when the condition(s) ceases.

(5) Inside the control enclosure shall be an LED-style, red 1-inch neon glow lamp high water indication and an amber 1-inch neon glow lamp for moisture leak detection. The flashing light on the enclosure top shall flash when either or both lights within the enclosure are activated due to a failure.

(6) A nameplate shall be provided above each component with the name of the component inscribed or failure inscribed when labeling the indicator lights.

(7) A "Hand-Off-Auto" selector switch shall be provided within the control panel for operating the pump manually when in "Hand", pump disable when in "Off", and normal operation when in the "Auto" position. The selector switch shall not disable the alarms under any condition.

(8) A main disconnect switch integral to the panel shall be provided with a padlocking device to de-energize the panel. Toggle switch shall not be considered. From the load side of this switch shall be a two-pole circuit breaker for motor overload and short-circuit protection. Also, and in parallel with the above breaker shall be a circuit breaker for protection of the control circuit.

(9) An electrical wiring diagram shall be supplied and attached to the inside of the panel enclosure. This diagram shall identify wire color, external connections to a numbered terminal block and shall be arranged in a functional sequence ladder type diagram.

(10) The control panel enclosure shall be provided with a padlock. This lock shall be of the solid corrosion proof case design, with a hardened steel shackle and zinc coating.

(11) Wiring shall meet the following requirements:

(a) Minimum size for power wiring shall be #12 AWG

(b) Minimum size for control wiring shall be #14 AWG

(c) Minimum size for signal wiring shall be #18 AWG

(d) Analog signal to be shielded twisted #18 AWG

(e) Insulation to be 600 V XHHW for wet locations and THWN for dry/damp locations

b. Control Panel Supports (for post-mounted installation)

The control panel support for property owner installations shall consist of 3" x 3" x 3/16" gauge structural steel tubing (minimum yield strength 46,00 psi) or 4" x 4" pressure treated wood post, all horizontal support channels and panel connection hardware, coated with baked on epoxy ASA 61 paint. The length of pipe or post shall be embedded in a concrete foundation to the dimensions shown on the detail drawings.

C. Installation

1. The pump unit shall be installed at a location to be determined by the property Owner. Generally, the unit should be located in close proximity to the sewer service line near the building and the control panel may either be mounted on the building wall or on a post near the pump basin.

2. The depth of the sewage pump unit will be dependent upon the location and depth of the house service line. The minimum total unit depth from the invert of the sump pit to the top of the entry hatch shall be no less than six feet and no greater than sixteen feet.

3. All sewage pump basins shall be installed on a bed consisting of AASHTO No. 8 (PennDOT 1B) coarse aggregate and shall have a concrete anti-flotation collar poured around the bottom as shown on the drawings. The remaining excavated area shall be backfilled with excavated material containing no soil lumps, stones, concrete or foreign objects larger than three (3) inches in maximum dimension. The top of the basin shall project a minimum of 4 inches above grade and graded in a manner to slope away from the unit to prevent ingress of surface water. In driveway or sidewalk areas, top of basin shall be at grade and equipped with a watertight lid. Basins located in traffic areas shall be traffic rated (H-20 or H-25 as appropriate).

4. All electrical installations shall be in accordance with NEC and local codes.

5. Conduits shall be supported/anchored every 3 feet. All conduit straps shall be stainless steel.

D. Testing and Inspection

1. It is incumbent upon the property Owner or Contractor to notify the Authority a minimum of 24 hours in advance to inspect the pump after installation is completed. The Contractor shall provide all pressure gauges and other equipment necessary to perform the tests. The work will be tested and inspected for:

   a. Tank cracks, loose fittings and general workmanship.

   b. Minimum depth of force main and stone bedding.

c. All specified required fittings, valves and appurtenances.

2. A hydrostatic pressure test of 50 pounds per square inch (psi), or 150% of the normal working pressure, whichever is greater, shall be applied to the force main in accordance with AWWA C-600. There shall be no drop in pressure for a period of 15 minutes.

3. The following electrical testing is required of the Applicant before energizing:

   a. Equipment inspection and mechanical operation

   b. Megger all power circuits

   c. Ring all control circuits

   d. Check ground

4. The pipe trench will be backfilled only after the inspection and testing has been completed.

5. The pump shall be run through a normal pump cycle test to confirm on/off operation as well as the proper sounding of all alarms. Applicant is responsible for providing water for the test. Use of clean water is acceptable.

E. Detail Drawings

Relevant detail drawings are:

11 Typical Low-Pressure Service Line to Gravity Sewer

25 Fiberglass or HDPE Basin for Typical Individual Pump

26 Concrete Basin for Typical Individual Pump

27 Wall-mounted Control Panel (External Installation)

28 Post-mounted Control Panel (External Installation)

END OF SECTION