SECTION 22 14 00 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm water piping buried beyond 5 feet of building.
2. Storm water piping buried within 5 feet of building.
3. Storm water piping above grade.
4. Unions and flanges.
5. Roof drains.
6. Parapet drains.
7. Canopy and cornice drains.
8. Special purpose downspout covers.
9. Downspout nozzles.
10. Area drains.
11. Exterior planter drains.
12. Cleanouts.
13. Sumps.
14. Interceptors.
15. Catch basins.
16. Maintenance holes.
17. Sump pumps.
18. Bedding and cover materials.

1.2 REFERENCES

A. General: Comply with Appropriate Standards.

1. Plumbing and Drainage Institute: PDI.
2. Standard Urban Stormwater Mitigation Plan: SUSMP.

1.3 SUBMITTALS

A. Submit data on all materials, fittings, accessories and equipment.

B. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump pumps, and maintenance holes.

D. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump-pumps, catch basins and maintenance holes.

E. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

2. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

3. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

F. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 WARRANTY

A. Furnish one-year minimum warranty.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit spare parts lists, exploded assembly views for pumps and equipment.

PART 2 - PRODUCTS

2.1 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Coordinate with Civil Engineer.

B. Cast Iron Soil Pipe: CISPI, ASTM A888 service weight, hubless.

1. Fittings: Cast iron, ASTM A888 and CISPI – with stainless steel clamp and shield assembly.

2. Joints: CISPI ASTM C564, rubber gasket joint devices.

3. Manufacturers – Heavy Duty Stainless Steel Couplings

a. **Husky / Anaco / McWane Inc.;** Husky SD 4000.

b. Clamp-All Products / NORMA Group.

c. Ideal-Tridon / Ideal Clamp Products, Inc.

4. Manufacturers – Heavy Duty Cast Iron or Ductile Iron Couplings

a. MG Coupling / MG Piping Products Company.

b. Victaulic Company.

c. Or Approved Equal.

C. Ductile-Iron Pipe and Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
    a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
    a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    b. Gaskets: AWWA C111, rubber.
3. Flanges: ASME 16.1, Class 125, cast iron.

D. ABS Pipe: Pipe, fittings and joints shall comply with codes and standards in effect at time of installation.

2.2 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: CISPI, ASTM A888 service weight, hubless.

1. Fittings: Cast iron, ASTM A888 and CISPI – with stainless steel clamp and shield assembly.
2. Joints: CISPI ASTM C564, rubber gasket joint devices.
3. Manufacturers – Heavy Duty Stainless Steel Couplings
    a. **Husky / Anaco / McWane Inc.;** Husky SD 4000.
    b. Clamp-All Products / NORMA Group.
    c. Ideal-Tridon / Ideal Clamp Products, Inc.
4. Manufacturers – Heavy Duty Cast Iron or Ductile Iron Couplings
    a. MG Coupling / MG Piping Products Company.
    b. Victaulic Company.
    c. Or Approved Equal.

B. Ductile-Iron Pipe and Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
    a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

b. Gaskets: AWWA C111, rubber.

3. Flanges: ASME 16.1, Class 125, cast iron.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53 / A53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

C. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

4. Cast-Iron Flanges: ASME B16.1, Class 125.

5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

D. Grooved-Joint Systems:

1. Manufacturers:

a. Anvil International / Mueller Water Products, Inc.

b. Star Pipe Products.

c. Victaulic Company.

d. Ward Manufacturing, Inc.

2. Grooved-End, Steel-Piping Fittings: ASTM A47/A47M, galvanized, malleable-iron casting; ASTM A106, galvanized-steel pipe; or ASTM A536, galvanized, ductile-iron casting; with dimensions matching steel pipe.

3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.4 SPECIAL PIPE FITTINGS

A. Rigid, Unshielded, Non-pressure Pipe Couplings: ASTM C1461, sleeve-type reducing or transition-type mechanical coupling molded from ASTM C1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
    - **a. Anaco / McWane Inc.**
    - **b. Or Approved Equal.**

B. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:
    - **a. Cascade Waterworks Mfg. Co.**
    - **b. Dresser, Inc.; General Electric Company.**
    - **c. EBAA Iron, Inc.**
2. Center-Sleeve Material: Ductile iron or malleable iron.
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

C. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.

1. Manufacturers:
    - **a. EBAA Iron, Inc.**
    - **b. Or Approved Equal.**

D. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:
    - **a. SIGMA Corporation.**
    - **b. Or Approved Equal.**

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A674 or AWWA C105, high-density, cross laminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

B. Form: Sheet or tube.

C. Color: Black.

2.6 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe CISPI: ASTM A888, service weight, hubless.

1. Fittings: Cast iron, ASTM A888.

2. Joints: ASTM C564, rubber gasket and stainless steel clamp and shield assemblies.
3. Unions for Pipe 2 inches and Smaller:
    a. Copper Piping: Class 150, bronze unions with soldered brazed joints.
    b. Brass Ball valve and 6" nipple: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
4. Flanges for Pipe 2-1/2 inches and Larger:
    a. Copper Piping: Class 150, slip-on bronze flanges.
    b. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.7 ROOF DRAINS

A. Manufacturers:
    1. Jay R. Smith Mfg. Co. / Morris Group International
    2. Zurn Industries, LLC / Rexnord Corporation.
    3. MIFAB, Inc.

B. Roof Drain (RD-1):
    1. Assembly: ASME A112.21.2M.
    2. Body: Lacquered stainless steel with sump.
    3. Strainer: Removable cast iron dome with vandal proof screws.
    4. Accessories: Coordinate with roofing type as required.

C. Roof Drain (RD-2): Overflow type.
    1. Same as RD-1, with 2" min. height water dam.

2.8 PARAPET DRAINS

A. Manufacturers:
    1. Jay R. Smith Mfg. Co. / Morris Group International
    2. Zurn Industries, LLC / Rexnord Corporation.
    3. MIFAB, Inc.

B. Lacquered cast iron body with flashing clamp collar and nickel bronze grate.

2.9 CANOPY AND CORNICE DRAINS

A. Manufacturers:
    1. Jay R. Smith Mfg. Co. / Morris Group International
    2. Zurn Industries, LLC / Rexnord Corporation.
    3. MIFAB, Inc.

B. Lacquered cast iron body with flashing clamp collar and nickel bronze flat strainer.

2.10 SPECIAL PURPOSE DOWNSPOUT COVER

A. Manufacturers:

1. **Jay R. Smith Mfg. Co. / Morris Group International**
2. **Zurn Industries, LLC / Rexnord Corporation.**
3. **MIFAB, Inc.**

B. Product Description: Brass or Stainless steel with stainless steel mesh liner, vandal proof lock nut, and pipe clamp.

2.11 DOWNSPOUT NOZZLES

A. Manufacturers:

1. **Jay R. Smith Mfg. Co. / Morris Group International**
2. **Zurn Industries, LLC / Rexnord Corporation.**
3. **MIFAB, Inc.**

B. Product Description: Nickel or Polished bronze body and round wall flange with straight bottom section and screened outlet.

2.12 AREA DRAINS

A. Manufacturers:

1. **Jay R. Smith Mfg. Co. / Morris Group International**
2. **Zurn Industries, LLC / Rexnord Corporation.**
3. **MIFAB, Inc.**

B. Area Drain (AD-1): Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

C. Area Drain (Trench Drain) (AD-2): Lacquered cast iron ductile iron or stainless steel; with drainage flange, heavy duty grate 6 inches 12 inches wide, 12 inches 24 inches long, dome strainer, end plates with gaskets; end, middle or bottom outlet.

2.13 EXTERIOR PLANTER DRAINS

A. Manufacturers:

1. **Jay R. Smith Mfg. Co. / Morris Group International**
2. **Zurn Industries, LLC / Rexnord Corporation.**
3. **MIFAB, Inc.**

B. Lacquered cast iron body with sump.

C. Strainer: Removable polyethylene dome with stainless steel screen.

D. Accessories: Membrane flange and membrane clamp with integral gravel stops.

2.14 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.

B. Downspout Boots:

1. Description: ASTM A48/A48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Description: ASTM A74, Service class, hub-and-spigot, cast-iron soil pipe.

C. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.

D. Overflow Outlet:

1. Stainless steel type 304 with hinged perforated cover similar to J.R. Smith 1775, vandal proof.

2.15 FLASHING MATERIALS

A. Copper Sheet: ASTM B152/B152M, 12 oz./sq. ft. thickness.

B. Zinc-Coated Steel Sheet: ASTM A653/A653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.16 CLEANOUTS

A. Exterior Surfaced Areas (CO-1): Round or square cast nickel bronze access frame and non-skid cover.

B. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.

C. Interior Finished Floor Areas (CO-3): Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round square depressed cover with gasket to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas (CO-4): Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.

E. Interior Unfinished Accessible Areas (CO-5): Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.17 SUMPS

A. Manufacturers:

1. **Pro-Cast Product Inc.**
2. **Jensen Precast.**
3. **Zoeller Company.**

B. Water-tight, factory fabricated; reinforced fiberglass or concrete; sleeved inlet, outlet and vent openings, and any other sidewall openings for pipe connections.

C. Cover shall be cast iron, airtight and have integral seals, gaskets and bushings, sized for sump access.

D. Exterior locations shall have hinged and lockable traffic weight covers.

2.18 SEDIMENT INTERCEPTORS

A. Manufacturers:

1. **Jay R. Smith Mfg. Co. / Morris Group International**
2. **Zurn Industries, LLC / Rexnord Corporation.**

B. Sediment Interceptor: Epoxy coated cast iron, Stainless steel or Precast concrete body and secured cover with removable stainless steel sediment bucket.

2.19 SUMP PUMPS

A. Manufacturers:

1. **PACO / Grundfos CBS, Inc.**
2. **Zoeller Company.**

B. Pump Type: Vertical centrifugal, direct connected, duplex arrangement.

C. Casing: Cast iron volute with radial clearance around impeller, inlet strainer, slide away couplings.

D. Impeller: Cast iron; open non-clog, keyed to stainless steel shaft.

E. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

F. Bearings: Oil lubricated bronze sleeve spaced maximum 48 inches and grease lubricated ball thrust at floor plate.

G. Drive: Flexible coupling to vertical, solid shaft ball bearing electric motor.

H. Sump: Steel cover plate with steel curb frame for grouting into sump with inspection opening and cover, and alarm fittings.

I. Controls (Duplex): Float operated mechanical alternator with float rod, stops, and corrosion resistant float to alternate operation of pumps. Cut-in second pump on rising level or lead pump failure. Furnish separate pressure switch high level alarm with transformer, alarm bell, and standpipe, and extra set of wired terminals for remote alarm circuit and emergency float switch with float rod, stops, and corrosion resistant float to operate both pumps on failure of alternator. Provide NEMA 250, Type 1 enclosure.

2.20 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:

1. **PACO / Grundfos CBS, Inc.**
2. **Zoeller Company.**

B. Pump Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body and oil filled motor chamber.

D. Impeller: Cast iron; closed, stainless steel.

E. Bearings: Ball bearings.

F. Sump: Fiberglass steel or concrete, basin with steel cover plate.

G. Accessories: Oil resistant cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

I. Integral level controls with separate level alarm.

J. Controls: Motor control panel containing across-the-line electric motor starters with ambient compensated quick trip overloads in each phase with manual trip button and reset button, circuit breaker, control transformer, electro-mechanical alternator, hand-off-automatic selector switches, pilot lights, high water alarm pilot light, reset button and alarm horn. Furnish mercury switch liquid level controls, steel shell switch encased in polyurethane foam with cast iron weight for pump on (each pump), pump off (common), and alarm. Provide NEMA 250, Type 1 enclosure.

2.21 BUILDING AUTOMATION SYSTEM INTERFACE

A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:

1. On-off status of each pump.
2. Alarm status.
3. Pump failure.

2.22 ALARM PANEL

A. Remote-mounted alarm panel shall consist of a single NEMA 1 enclosure complete with 3 indicating lights, reset buttons, alarm horn or bell and silencing switch. Lights shall be normally dim-glow and shall change to full-glow and sound the alarm under any of the following conditions:

1. Power failure to the pump control panel.
2. High water condition.
3. Simultaneous two pump operation.
4. Failure of either pump.

B. Coordinate location and wiring of alarm panel with electrical contractor

C. Wiring diagrams:

1. Furnish and turn over to LAWA, complete wiring diagrams showing full details of the factory wiring.

2.23 CONTROL PANEL

A. Combination unfused disconnect switch and across-the-line magnetic starter with overload protection for each phase leg, for each pump.

1. Under voltage protection.
2. 120 volt control circuit transformer, fused on primary, and grounded on secondary, with automatic transfer between each pump's incoming supply in the event of failure or shutdown of power supply to any pump. Connections to pump incoming supplies shall be made downstream of controller disconnect devices.

3. Momentary contact push buttons marked MANUAL, for bypassing automatic control when held in (JOGGING).
4. Automatic electric alternator (four lead units).
5. Moisture sensing audible and visual alarm.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. Field verify that connection to existing piping systems sizes, locations, and invert are as required.

F. Establish elevations of buried piping with not less than allowed per code.

G. Establish minimum separation of from other piping services in accordance with code.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
3. Galvanized steel pipe, drainage fittings, and threaded joints.
4. Grooved end galvanized malleable iron fittings and bolted clamp type malleable iron couplings with rubber sealing gaskets for grooved end pipe equal to Victaulic Style 75 or 77.
5. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Aboveground, storm drainage piping NPS 8 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

3. Steel pipe, drainage fittings, and threaded joints.
4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Underground storm drainage piping NPS 6 and smaller shall be the following:

1. Extra-heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
3. Galvanized steel pipe, drainage fittings, and threaded joints.
4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Underground, storm drainage piping NPS 8 and larger shall be the following:

1. Extra-Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel and heavy-duty shielded, cast-iron couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized steel pipe, pressure fittings, and threaded joints.
3. Grooved-end galvanized steel pipe, grooved-joint system fittings and couplings, and grooved joints.

G. Underground storm drainage force mains NPS 4 and smaller shall be the following:

1. Galvanized steel pipe, pressure fittings, and threaded joints.
    a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical joints.
    a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
3. Pressure pipe couplings if dissimilar pipe materials or piping with small difference in OD must be joined.

3.3 PIPING INSTALLATION

A. Install seismic restraints on piping as required.

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers as required.

C. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

D. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A674 or AWWA C105.

E. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A674 or AWWA C105.

F. Install underground, ductile-iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A674 or AWWA C105.

G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

H. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.

I. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A674 or AWWA C105.

J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 2 percent downward in direction of flow for all piping.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

M. Install force mains at elevations indicated.

N. Install engineered controlled-flow storm drainage piping in locations indicated.

O. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Hubless piping shall be installed in a rigid, linear and plumb system without any deflection at the joints either horizontally or vertically. The system shall be supported and secured to the building structure to prevent movement induced by a ten-foot head of water and its associated thrust forces.

1. When horizontal hubless CI piping is suspended in excess of 18 inch by means of non-rigid hangers, provide sway bracing to prevent horizontal movement.

2. For all horizontal hubless CI piping 5-inch and larger, provide sway bracing to prevent horizontal movement at every branch opening and change of direction by securing to building structure, or provide pipe clamps and rodding across coupling.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports - Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.

c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports as required.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6: 60 inches with 3/4-inch rod.

5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

3.5 PIPING SPECIALTIES INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping.
4. Locate at base of each vertical storm drain riser.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

E. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

F. Install roof drains at low points of roof areas and where indicated according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.
3. Coated cast iron body roof drains with an inside caulked bottom outlet, except as noted and in accordance with ANSI A112.21.2.

4. For liquid membrane roofs, use four inch wide flange, for built up membrane roofs, a combined flashing flange and gravel stop; and, for steel or precast decks, a deck clamp.
5. Where insulation is applied over a structural roof deck, provide an extension collar with weep holes.
6. For IRMA type roofs, 4 inch high, brass gravel guard, 16 inch diameter perforated with 1/4 inch holes.
7. Provide tops of drains for decks and canopies with a bronze, nickel bronze, statuary bronze finish.

G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

I. Install manufactured, gray-iron downspout boots at grade with top 12 inches above grade. Secure to building wall.

J. Install cast-iron soil pipe downspout boots at grade with top of hub 12 inches above grade.

K. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.6 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.8 SUMP PUMP INSTALLATION

A. Install sump pumps according to applicable requirements in ANSI/HI 1.4.

B. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.

C. Set submersible sump pumps on basin or pit floor. Make direct connections to storm drainage piping.

D. Install sump pump basins and connect to drainage piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement. Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.

E. Support piping so weight of piping is not supported by pumps.

3.9 START UP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify sump basin is clear and no large debris before pump start up.

B. Start pumps without exceeding safe motor power:

C. Test and adjust controls and safeties.

D. Remove and replace damaged and malfunctioning components.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sump pump system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.10 TRAINING

A. Provide minimum of 12 hours (3 shifts total) classroom and hands on training to LAWA Maintenance personnel. Notify LAWA 72 hours in advance.

END OF SECTION 22 14 00