



MOUNT PLEASANT WATERWORKS

DESIGN STANDARDS MANUAL

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1 – GENERAL

SERIES 1000: PURPOSE AND INTENT

The purpose of this Manual is to establish uniform minimum standards for the design of construction projects within the service area for Mount Pleasant Waterworks (MPW). This manual is intended to supplement and to be used in conjunction with MPW Standard Technical Specifications, MPW Standard Construction Details and with requirements set forth by applicable codes, laws and ordinances of this jurisdiction, recognized industry standards, good engineering practice and specific program needs. Omission of reference in these guidelines does not relieve responsibility for compliance with these requirements.

The standards established by this Manual are applicable to all new development. While it may not always be feasible to apply these standards to reconstruction or upgrading of existing infrastructure due to limitations imposed by existing structures, ownership, and land use, these standards will be applied to the extent that legal, economic and environmental considerations allow.

It should be noted that deviations from the minimum standards set forth in this manual may be granted on a case by case basis upon approval by MPW. Such deviations shall be based upon specific detailed situations that are clearly justified resulting in preferable environmental impacts and such deviations are not detrimental to the public welfare, or injurious to property or improvements in the surrounding area.

SERIES 1005: GENERAL DESIGN GUIDELINES

All water and wastewater extensions shall be extended to property lines whenever possible.

- Gravity wastewater lines shall be terminated with a manhole
- Water lines shall be terminated with a fire hydrant

1005-1: Typical Easements Required

Easement Type	Minimum Width
Wastewater Main	20 ft
Water Main	15 ft
Water & Wastewater Mains	25 ft

2 – WASTEWATER COLLECTION AND PUMP STATION DESIGN CRITERIA

SERIES 2000: COLLECTION AND FORCEMAIN SYSTEMS

2005: Pipe Size, Velocities and Changes in Pipe Size

2005-1: Force Mains

Force mains carrying raw domestic sewage shall be at least four (4) inches in diameter. Low pressure force mains that follow grinder pump systems or solids interceptor tanks shall be at least two (2) inches in diameter.

All joints shall be restrained

Low pressure force mains shall not tie into force mains larger than six (6) inches in diameter.

Velocity in force mains shall be at least two (2) feet per second at design flow. However, lower initial velocities may be permitted if provisions to maintain a flushing velocity are made.

2005-2: Gravity Lines

No gravity sewer main shall be less than eight (8) inches in diameter. In cases where the flow and number of taps are limited to less than ten (10) percent of the design capacity of the receiving sewer line, and the line cannot be reasonably extended, the use of six (6) inch diameter lines may be considered.

All gravity sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than two (2) feet per second, based on Manning's formula using an n value of thirteen thousandths (0.013). Slopes slightly less than those required for the two (2) feet per second velocity, when flowing full, may be permitted. Such decreased slopes shall only be considered where the depth of flow shall be three tenths (0.3) of the diameter or greater for average flows. Whenever such decreased slopes are selected, the design engineer shall furnish design computations of the anticipated flow velocities of average and peak flows. The calculations shall indicate the actual velocity in the sewer lines at the proposed slope and the actual velocity at the required slope in order to achieve two (2) feet per second, when flowing full. The pipe diameter and slope shall be selected to obtain the greatest practical velocities to minimize settling problems. Oversized sewers shall not be approved to justify using flatter slopes.

Excluding service connections less than fifty thousand (50,000) gpd, sewer connections to gravity sewer lines shall be constructed such that the internal angle of deflection is equal to or greater than ninety (90) degrees, including connections at manholes.

When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient.

All new lines shall be run at maximum depth and match existing inverts.

2010: Recommended Minimum Slopes

Sewers shall be designed with a uniform slope and in straight alignment between manholes. The following minimum slopes are recommended:

Nominal Sewer Size (inches)	Minimum Slope (feet per 100 feet)
Services Laterals (6ö)	1.00
8	0.40
10	0.28
12	0.22
14	0.17
16	0.14
18	0.12
24	0.08
30	0.058
36	0.046
42	0.037

Sewers on twenty (20) percent slopes or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

- a. Not over thirty six (36) feet center-to-center on grades twenty (20) percent and up to thirty five (35) percent;
- b. Not over twenty four (24) feet center-to-center on grades thirty five (35) percent and up to fifty (5) percent; and
- c. Not over sixteen (16) feet center-to-center on grades exceeding fifty (50) percent.

Each section of sewer pipe shall be specified to be laid to the appropriate line and grade, as designed, working in the upstream direction with the bell laid upgrade.

2015: Depth

All sewers shall be constructed with a minimum of three (3) feet of cover. If ductile iron pipe is used, cover may be less than three (3) feet if approved.

2020: Valves

When force mains serving individual residences (and other similar situations) connect to the primary force main serving the area, a check valve shall be placed on the individual customer's force main.

An automatic air release valve shall be placed at high points in the force main sewer to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains. Combination air release vacuum valves are not allowed.

Gate valves shall be used on all force main projects unless specifically authorized by MPW's Engineering Department.

Valves with operating nuts greater than three (3) feet deep shall have valve nut extenders provided by the valve manufacturer bringing the operating nut to within two (2) feet of finished grade.

2025: Separation Requirements

There shall be no physical connections between a public or private potable water supply system and a wastewater system, or appurtenance thereto which would permit the passage of any wastewater or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a gravity wastewater line or manhole.

Sewer lines, manholes, pump stations, force mains, and wastewater treatment facilities shall be located more than one hundred (100) feet from a public water supply well. Sewer lines, manholes, pump stations, and force mains shall be located at least twenty (20) feet from any other potable well.

When sewers are proposed adjacent to any existing or proposed potable water supply facilities the following requirements apply:

1. **Horizontal Separation:** Wastewater lines shall be laid at least ten (10) feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the appropriate reviewing agency may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the wastewater line closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the wastewater line and at an elevation so the bottom of the water main is at least eighteen (18) inches above the top of the wastewater line. The above requirements apply to either gravity wastewater or force mains.
2. **Crossing:** Wastewater lines crossing water mains shall be laid to provide a minimum vertical distance of eighteen (18) inches between the outside of the water main and the outside of the wastewater line. This shall be the case where the water main is either above or below the wastewater line. The above requirements apply to all gravity wastewater mains or service laterals and force mains.

The crossing shall be arranged so that the wastewater line joints shall be equidistant and as far as possible from the water main joints. Where a water main crosses under a wastewater line, adequate structural support shall be provided for the wastewater line to prevent damage to the water main.

3. **Special Conditions:** When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the wastewater line shall be designed and constructed as follows:
 - a. Maximize the distances between the wastewater lines and the potable water mains and the joints of each;
 - b. The pipe materials shall be equal to water pipe and shall be pressure tested to assure water tightness prior to backfilling;
 - c. Allow enough distance to make repairs to one of the lines without damaging the other.

2030: Surface Water Crossings

Surface water crossings, whether over or under water, present special problems. MPW shall be consulted before plans are prepared. The following guidelines shall be used as a minimum:

- a. Underwater crossings shall include a minimum of two (2) feet of cover. Only fused pipe joints will be allowed for underwater crossings.
- b. Above water crossings, when crossing fifteen (15) feet in width, the pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.
 1. The pipe material and joints must be designed appropriately. Provide DIP with mechanical joints.
 2. Valves shall be located on each side of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.

2035: Service Laterals and Wyes

2035-1: Service Laterals

Service laterals shall be installed where required to provide a connection from the gravity wastewater line to all lots. Wastewater service laterals shall terminate at the property line, unless otherwise directed. Service lines to houses shall be four (4) inch schedule 40 minimum. If less than eighteen (18) inches of cover is provided underneath driveways or storm drains, or if less than thirty-six (36) inches of cover is provided underneath drainage ditches or swales, service lines shall be ductile iron pipe (DIP). Transition from PVC to DIP shall be made with gasketed, PVC slip-on transition couplings. Fernco or MJ couplings are not approved.

Service laterals from the main to the property line shall consist of 6" diameter DIP lined with 40 mils Protecto 401 or PVC and conform to the requirements of the technical specifications. A service wye shall be installed at the end of each service lateral and plugged in a manner to allow for air testing. The depth of a service shall be a minimum of thirty-six (36) inches below finished grade, and a maximum of sixty (60) inches. Service laterals must be provided with cleanouts spaced not more than seventy-five (75) feet apart. Vertical stacks shall be provided for service connections and shall be terminated with a cleanout, installed at finish grade level, and fitted with a concrete collar, which incorporates a cast-iron cap. The concrete collar shall be set at the proper grade so that the cast iron cap does not rest on the threaded PVC cleanout cap.

Service laterals shall be connected at manholes whenever possible and installed so the crown of the wastewater lines and service laterals are the same elevation. Where services enter manholes at a height of two (2) feet or more above the main line, an inside drop shall be brought down to the bench. A 45-degree bend shall be placed on the end of the drop and cast into the bench to make a smooth transition to the invert.

2035-2: Wyes

Wye branches shall be installed in gravity wastewater lines as required. Branches that are not used immediately shall be capped as specified by the manufacturer.

If the work consists of the construction of a wastewater line that is to replace an existing wastewater line, all of the existing service lines shall be connected to the new line by a method approved by MPW prior to construction.

Wyes shall be installed in gravity wastewater line so as to properly serve each existing house and each vacant lot facing or abutting the street or alley in which the wastewater line is being laid, and at such other locations as may be designated by MPW. The Engineer, before backfilling, shall determine the exact location of each connection.

Wyes shall be of the same material and strength as the main line on which they are installed.

2040: Manholes

2040-1: Minimum Size and Thickness

The minimum size and wall thickness of the manhole riser sections shall be:

Wastewater Line ID	Manhole ID	Minimum Wall Thickness
Less than 15 in.	4 ft.	5 in.
16 in. to 27 in.	5 ft.	5 in.
30 in. to 45 in.	6 ft.	6 in.
Greater than 48 in.	8 ft.	8 in.

Cone sections shall have a minimum wall thickness of eight (8) inches at their top. The minimum manhole access diameter shall be 24 inches.

Base sections shall be made with bottoms cast monolithically. The minimum thickness of the bottom shall be six (6) inches for manholes four (4) feet in diameter and eight (8) inches for manholes with a five (5) or six (6) foot diameter.

õDoghouseö style manholes shall not be allowed.

2040-2: Location and Spacing

Manholes shall be installed at the following:

- at the end of each line;
- at all changes in grade, size, or alignment;
- at all intersections;
- at distances not greater than four hundred (400) feet for gravity wastewater lines fifteen (15) inches or less, and five hundred (500) feet for gravity wastewater lines eighteen (18) inches to thirty (30) inches. Greater spacing may be permitted in larger wastewater lines. Clean outs may be used only for special conditions and shall not be substituted for manholes.

Manholes will be designed to lie in dirt areas when possible, as opposed to concrete or asphalt areas.

Force mains tying into manholes shall enter the manhole at the invert, unless approved by MPW.

Manhole top elevations shall be greater than or equal to the fifty (50) year flood plain elevation, unless watertight covers are provided.

All connections to existing MPW manholes or collection systems must be made in the presence of an MPW Inspector. All new holes in existing manholes shall be core drilled. A rubber gasket and/or link seal shall be used to seal core hole.

2040-3: Drop Manholes

The use of drop manholes shall not be allowed unless approved by MPW.

2040-4: Manhole Coatings

MPW will require 100% calcium aluminate lined manholes for areas subject to high levels of hydrogen sulfide gas, where a force main discharges into a wet well, or in any installation where corrosion of any structure may be expected. If a corrosion-proof coating is required, all exposed surfaces and structures, including walls and underside of top slab, riser piping, and metallic influent piping inside wet well shall be protected.

When a force main connects to a gravity manhole, a 100% calcium aluminate lining is required on the connection manhole and the next two (2) manholes downstream.

When tying into a gravity interceptor, a 100% calcium aluminate lining is required on the two (2) upstream manholes.

2045: Leakage

All gravity sewers shall be designed and specified such that the leakage outward (exfiltration) or inward (infiltration) shall not exceed two hundred (200) gallons per inch of pipe diameter per mile per day. An air test may be utilized in lieu of an infiltration/exfiltration test, if approved.

Design and construction of force mains shall be such that they satisfy a leakage test in accordance with American Water Works Association (AWWA) Standard C600.

2050: Pipe Identification and Detection

All wastewater mains shall be adequately identified by color coding pipe.

Pipe color coding will be as follows:

Application Pipe	Color Code
Wastewater System	White, green or brown
Wastewater Forcemain	White, green or red

All wastewater mains which are installed by the open-trench method, regardless of piping material, shall also include the installation of an electronically or magnetically detectable tape. The tape shall be designed to last as long as the pipe it is installed over, even in adverse soils.

All PVC Force Main and HDPE piping, shall also include the installation of a tracer wire. The tracer wire shall be taped to the top of the pipe with standard duct tape during the pipe laying operation. Prior to final acceptance the tracer wire's proper function shall be verified.

2055: Grease Traps

In accordance with MPW Guidelines for the Fats, Oils, Grease and Solids (FOG) Removal Program, all facilities dealing with food preparation, automotive/mechanical repairs, or any operation involving grease by products are required to obtain an annual FOG Interceptor Discharge Permit.

Plumbing plans must be submitted to MPW for approval before construction begins. MPW will not provide service to the facility until the grease trap has passed inspection and issued an approved FOG Interceptor Discharge Permit. Wastewater from garbage grinders, exterior mop sinks or extremely hot industrial type dishwashers (above 140 deg F) should not be discharged to grease traps.

Grease traps shall be adequately sized to remove grease from the wastewater stream prior to treatment and in accordance with Section 3.3 of MPW's Guidelines for FOG Removal Program.

The recommended size of external grease traps is 1,000 gallons, however under no circumstances should exterior grease traps be less than 500 gallons. The minimum flow rate of all grease traps, internal and external is 25 gpm.

The minimum size of oil/water separators is 1,000 gallons.

It is the responsibility of the owner to assure grease traps are operated and cleaned regularly to prevent the escape of appreciable quantities of grease.

In the event MPW wastewater lines become blocked with grease due to an improperly maintained or faulty grease trap, MPW shall recover all costs incurred for corrective measures from the owner.

Refer to the MPW Guidelines for FOG Removal Program for all requirements including the application and renewal process.

2060: Miscellaneous

All connections to existing MPW manholes or collection systems must be made in the presence of an MPW Inspector. All new holes in existing manholes shall be core drilled. A rubber gasket and/or link seal shall be used to seal core hole.

All single family or multi-family units must be served with an MPW acceptable sanitary wastewater collection system. No more than two single family or multi-family units may be connected to one six (6") inch lateral service. Six (6") inch or four (4") inch collection systems will not be allowed, unless specifically approved by MPW and SCDHEC.

All sanitary wastewater lines shall be installed outside of pavement area when possible and within the road right-of-way.

No wastewater line of any type shall be allowed to pass through any storm drainage structure without prior approval of MPW.

Casing pipes shall be installed at the following:

- a. Highway crossings as directed by SCDOT, or:
- b. As designated by MPW

MPW will only consider for operation and maintenance wastewater systems installed:

- a. Within the boundaries of the MPW service area.
- b. Systems meeting the requirements of these criteria and installed in a manner acceptable to MPW.

No system shall be put into service until MPW issues a letter of willingness to operate and maintain the system, and SCDHEC permits the system for operation.

It is the contractor and/or the contract plumber's responsibility to check the As-Built Drawings and physically locate the service lateral.

MPW allows domestic wastewater only.

SERIES 2100: PUMP STATIONS

2105: General

The design of wastewater pump station shall be in accordance with SCDHEC, R.61-67, Standards for Wastewater Facility Construction, latest edition; compliance with all applicable requirements of Section 67.300 C, Pump Station shall be mandatory.

Pump stations shall be designed to be fully operational during flooding to the twenty five (25) year flood elevation. Pump station structures and equipment shall be protected from physical damage by flooding to the one hundred (100) year flood elevation. An asphalt access road at a minimum shall be provided to the pump station.

An emergency operation plan on the wastewater pump station(s) shall be provided. For areas determined to be environmentally sensitive (e.g., shellfish harvesting areas, designated recreational waters, or primary source water protection areas located in close proximity), more extensive plans and equipment may be required, including on site auxiliary power or an approved equivalent plan. The effect of power outages where the pump station serves sources such as businesses that would not be able to operate otherwise may also be evaluated. The plan shall include one of the following methods showing how the pump station(s) shall be designed to provide continuous operability in the event of a power failure, natural disaster, etc.:

- a. An on-site standby generator, either permanently installed with capability to operate automatically or skid/trailer mounted types with appropriate connections provided.
- b. Connecting the pump station to two (2) separate utility substations, with an automatic switching feature.
- c. Providing sufficient capacity, in the wet well, above the pump on level, to contain the wastewater that may be generated during the longest power outage of the last five (5) years. A letter shall be submitted from the utility company that serves this pump station with electricity stating the longest power outage, in the service area of the pump station, which occurred during the last five (5) years, excluding a catastrophic storm.
- d. Provide a method to pump around the pumps and control panel by using a by-pass pump and providing a way to pump into the force main downstream of the check valve.
- e. Provide a transfer switch for a portable generator and demonstrate that the utility owns adequate generators and could reasonably respond during a power outage.
- f. Industrial facilities need to provide back-up power as specified above unless the industrial facility can show that their processes stop in the event of a power outage and that enough storage is available until power is restored, so an overflow shall not occur. Design calculations or other information shall be provided for justification.

Pump stations shall have an alarm system (e.g., audible and visible high water alarm, centralized automated alarm system). The alarm system shall be designed to function if power is not available for any pump.

All pump stations to have SCADA systems

In all pump stations a backup battery pack shall be required in the control panel of the pump stations so that in the event of a power outage the audible/visible high water alarms and/or automatic dialing system shall still be activated.

Wet well flotation calculations shall be submitted to MPW for review and approval prior to submission of shop drawings for the wet well to be installed. Flotation analysis shall assume the wet well to be empty and the ground water table to be at proposed finished grade.

2110: Design Flows

Refer to the *Guidelines for Development* when determining flow loadings to a pump station.

2115: Wet well

2115-1: Minimum Size and Thickness

The minimum allowable wet well diameter shall be eight (8) feet, unless otherwise approved by MPW.

The wet well foundation slab or precast base section shall be placed upon a minimum compacted base course of eighteen (18) inches of SCDOT No. 57 crushed granite. All over excavated insitu subgrade soils shall be backfilled with either additional compacted granite or 4,000 psi (28 day) concrete as directed and approved by MPW. Wet well foundation slabs or precast base sections shall not be placed until MPW has inspected and approved the base course aggregate.

The top of the slab and the wet well vent shall be a minimum of one (1) foot above the FEMA 100-year flood elevation for the site, or special flood proofing considerations will be required. All pump station wet well top slabs located below an elevation one (1) foot above the FEMA 100-year flood elevation shall be equipped with flood proof hatches.

The design fill time and minimum pump cycle time shall be considered in sizing the wet well. The effective volume of the wet well shall be based on design average flow and a filling time not to exceed 30 minutes. When the anticipated initial flow tributary to the pumping station is less than the design average flow, provisions should be made so that the fill time indicated is not exceeded for initial flows.

Wet well storage volume for cycle timing shall be based upon the ultimate pump station service area build-out average daily flow (ADF) conditions. Wet well operating cycle volume shall be sufficient to limit total daily pump run time to a maximum of eight (8) hours at build-out ADF.

Hatches shall be of the specific clear opening sizes indicated for each specific pump station as shown on the drawings.

2115-2: Depth Based on Control Elevations

The depth of the wet well shall be set to accommodate the following level control system parameters, or as directed by MPW:

- a. The PUMP OFF level shall be set to provide the minimum pump impeller submergence specified by the pump manufacturer, but in no case lower than the top of the volute casting.
- b. The LEAD ON or LAG ON differential shall be set a minimum of one (1) vertical foot.
- c. The High Water Telemetry Alarm elevation shall be set a minimum of one (1) vertical foot above the LAG ON elevation.
- d. The on-site Audible Alarm and Warning Light elevation shall be set a minimum of six (6) inches above the High Water Telemetry Alarm elevation.
- e. The lowest influent sewer invert elevation shall be set a minimum of six (6) inches above the on-site Audible Alarm elevation.

2115-3: Miscellaneous

The pump station wet well shall be ventilated. The vent shall be constructed of a weather durable material.

MPW will require 100% calcium aluminate linings in all wet wells. All exposed surfaces and structures, including walls and underside of top slab, riser piping, and metallic influent piping inside wet well shall be protected. The method of providing a corrosion-proof structure and the sub-contractor who will be performing this specialized work shall be submitted to the MPW Engineering Department for approval.

Where wastewater force mains from other pump stations are approved by MPW to enter wet wells, an approved, flanged end (FE) DIP, vented drop pipe and securely anchored discharge elbow shall be installed within the wet well to minimize turbulence and sewage aeration. Influent force main drop pipes and discharge elbows shall be designed to limit influent force main velocities to a maximum of four (4) feet per second. Flow shall also be discharged in a manner to minimize adverse flow impact upon pumps. Where force mains are proposed to directly discharge into wet wells as indicated above, MPW shall reserve the right to require a non-compensatory larger wet well diameter to provide additional maintenance access clearance and influent turbulence reduction. The wet well shall have a corrosion-resistant coating as discussed above.

Influent gravity sewers shall be equipped with Reliner Bowls to minimize wet well aeration and turbulence.

The access hatch and hook for hoisting cable shall be surface mounted to the top of wet well. The hatch shall be flood proof with an internal grate for fall protection.

Steps shall not be used in wet wells.

2120 – Pump Design

Cycle time calculation for average daily flow and peak flow shall be no more than four (4) cycles/hour and eight (8) cycles/hour, respectively. Certification should be provided that the motor and control circuit will permit eight (8) cycles/hour.

Wet well cycle timing and pump control elevation settings shall provide a minimum of three (3) minutes pump run time between cycles at the average daily flow rate.

At least two (2) submersible pumps shall be provided. Pumps shall be designed to handle peak flow with the largest pump out of service and shall be capable of passing a three (3) inch spherical solid. Pump suction and discharge piping shall be at least four (4) inches in diameter.

Motors shall be non-overloading over the entire pump range.

For pump stations with duplex pumps, each pump shall be designed to operate in a lead lag sequence and be on an alternating cycle. For pump stations with more than two (2) pumps, alternate designs may be considered.

A shutoff valve and a check valve shall be located on the discharge line from each pump outside of the wet well. The check valve shall be located between the shutoff valve and the pump.

2125: Flow Meter Design

Magnetic Flow Meters shall be provided to measure the discharge flow from the pump station. Flow meter shall be of the flanged design with a liner and liner protector suitable for raw wastewater and an integral electronics unit. Signal output from the flow meter shall be a 4-20 mA current signal proportional to the flow. A local flow totalizer shall be provided in the meter.

The meter shall be sized to maintain a fluid velocity of 2 ft/sec minimum. A full-pipe size flow meter is preferred, however if necessary to attain proper fluid velocity, a smaller meter, with appropriate reducer/increaser shall be provided.

Installation shall be per manufacturer's recommendations to ensure accurate readings

The flowmeter shall be provided with a sun shield to provide easy viewing of the digital output. Refer MPW Standard Technical Specifications, Section 16310, for additional requirements.

2130: Site Considerations

Pump station sites shall be a minimum of fifty (50) feet square in size, fronting on an all-weather publicly maintained roadway or having approved alternate access. A weather durable sign with a twenty four (24) hour emergency telephone number shall be located at a conspicuous point on the fence.

Refer to MPW Standard Detail WW-21: Pump Station: Site Plan for site requirements.

All pump station sites shall be fenced. For chain link fencing requirements, refer to MPW Standard Detail WW-32. For wood stockade fencing requirements, refer to MPW Standard Detail WW-33.

The entire site shall be covered with a weed barrier of 8 mil black polyethylene. The weed barrier shall extend one (1) foot outside the fence line. A 6-inch layer of F.L.B.C. compacted to 100% of the maximum dry density (Modified Proctor) shall be applied over the polyethylene sheeting. A two (2) inch thick layer of asphalt shall be applied to the site. The asphalt shall extend one (1) foot outside the fenced area.

A power pole shall be located outside the fenced area and should be located in such a manner so the electric meter can be easily read from outside the fenced area. All power lines within the site shall be underground. No overhead power line will be allowed to cross the site.

The site shall be serviced by an asphalt road constructed above the twenty-five (25) year flood elevation. Road and site drainage shall be included and approved by appropriate agency.

Adequate lighting for the interior of the fenced area of the site shall be provided with a switch at the control panel on a separate circuit.

A yard hydrant supplied by a three-quarter (3/4) inch potable water supply with a standard curb stop and a SCDHEC-approved reduced pressure (RP) backflow preventer must be installed inside the fence.

2135: Odor Control

MPW may require an odor control process at any pump station which may generate odors. Odors can be caused by any condition which may encourage the formation and release of hydrogen sulfide gas including a force main discharge into a wet well, low wastewater flow and resulting extended detention times, or other conditions. The odor control unit shall be approved by MPW prior to installation.

2140: Electrical

Licensed electrician shall perform all electrical work. All installations shall be in accordance with National Electrical Code. Electrical permit shall be applied for at Town of Mount Pleasant Building Department.

Refer to Division 16 of MPW Standard Technical Specifications and MPW Standard Details for all electrical requirements.

The design Engineer shall submit a detailed pump station design package to MPW Engineering Department for approval. This package shall consist of, as a minimum, pump station design calculations, pump curves (showing design operating point), manufacturer's cut sheets for ALL pump station components including control panel components, and complete, detailed electrical schematics showing ALL installed electrical components. Incomplete submittal packages will be returned without review. The Engineer's pump station design shall reflect proper consideration for pump operating efficiency and future upgrade capability.

All pump stations shall be provided with three (3) phase electrical power. Single phase powered pump stations shall not be approved.

2145: Instrumentation and Controls

General:

The pumping station shall be provided with an instrumentation and control system to allow remote monitoring and control over the pumping station. Each pumping station shall be provided with a Programmable Logic Controller (PLC) for control and monitoring. The PLC shall also communicate to the central SCADA system via the existing radio telemetry system.

Programmable Logic Controller (PLC):

Pumping Stations PLCs should be provided with sufficient computing capacity and memory to accommodate all required programs plus expansion capacity. Physical Input/Output capacity shall be provided to monitor all required signals, plus an additional spare capacity of 25% of each signal type. The PLC shall be installed in a separate enclosure from the motor starter equipment.

Local Operator Interfaces shall be provided for selected stations.

Instrumentation:

Each station shall be equipped with the following types of instrumentation:

- Wet well Level Measurement by Ultrasonic Level Technology
- Backup level control and monitoring via float switches (High and Low level, High Alarm)
- Pumping Station Discharge Flow via Magnetic Flowmeter
- Force Main Pressure Sensor
- Cabinet Temperature Sensor/Alarm switch
- Intrusion Switches for Pump Control Panel and PLC Panel

Control Panel:

Control panels shall be NEMA 4X, Type 316 Stainless Steel construction.

The PLC shall be mounted in a separate enclosure from the Motor Starter Panel.

Power Distribution:

See Division 16 of MPW Standard Technical Specifications for description of electrical feed to panel, including generator receptacle mounted on the side of the Motor Starter Panel. Motor Starter panel shall include a receptacle for portable generator connection and an associated breaker/disconnect to connect generator power and disconnect normal power. A Phase/Voltage monitor and lightning arrestor shall be provided on the main power distribution lines in the panel.

A suitably sized control power transformer shall be provided to supply 115 VAC control power to the motor starter panel and the PLC panel..

Single Speed Pumps - Motor Starters:

Motor Starters shall be NEMA type starters, heavy duty industrial design with electronic overload protection.

Single Speed Pumps - Soft Starts:

Motors rated at 20 HP or larger shall be provided with Soft Start Motor Controllers. Soft Start controllers shall be provided with automatic bypass contactor function.

Variable Speed Pumps – Adjustable Frequency Drives:

Regional Pumping Stations and other selected pumping stations shall be provided with AFDs. Maintenance bypass contactors shall be provided for motors rated at 50 HP and smaller.

Air conditioned enclosures shall be provided for AFD applications.

Miscellaneous Components:

Refer to Division 16 of MPW Standard Technical Specifications for additional guidance on miscellaneous panel equipment, such as switches, terminal strips, relays, etc.

Control Overview

Standard Duplex Pump Station (Fixed Speed Pumps):

The primary control for the station shall be PLC based control, running a lead/lag algorithm. The lead/lag algorithm will incorporate runtime accumulation and pump alternation to equalize run times. Lead and Lag pump start and stop setpoints shall be configured to be operator adjustable from an Operator Interface Terminal or from the SCADA system.

Backup control will be provided by High and Low alarm floats. When the High Water Level alarm float is activated, PLC control is overridden and both pumps are started. The pumps will continue to run until the Low Level float is activated.

When the High Alarm float is activated, the local audible and visible alarm will be activated.

An automatic pump station drawdown test program will be incorporated into the PLC programming.

The PLC program will be configured to allow SCADA system operators to remotely take pumps out of service and to place a pumping station in "Maintenance Disable", where all pumps are taken out of service. A timer shall monitor the Maintenance Disable mode and provide a high priority SCADA alarm if the pump station is in the Maintenance Disable mode for longer than the allowable time.

Standard Triplex Pump Station (Variable Speed Pumps):

The primary control for the station shall be PLC based control, running a wet well level control algorithm with lead/lag capability. The lead/lag algorithm will incorporate runtime accumulation and pump alternation to equalize run times.

When the wet well level exceeds the Wet well Operating Level setpoint, the lead pump will start at minimum speed. Speed will adjust to control wet well level. As the lead pump reaches 100% speed and wet well level reaches the lag pump call setpoint, the lag pump will start.

The lead and lag pumps will ramp to match speed output to control wet well level.

Operator adjustable setpoints will include Wet well Operating Level, Lead and Lag pump start and stop setpoints shall be configured to be operator adjustable from an Operator Interface Terminal or from the SCADA system.

Backup control will be provided by High and Low alarm floats. When the High Water Level alarm float is activated, PLC control is overridden and two pumps are started at a preset speed. The pumps will continue to run until the Low Level float is activated.

When the High Alarm float is activated, the local audible and visible alarm will be activated.

An automatic pump station drawdown test program will be incorporated into the PLC programming.

The PLC program will be configured to periodically run the pumps at full speed to allow for rag and grit removal from the wet well. The time between full speed runs and duration of these runs shall be an operator adjustable setpoint.

3 – WATER DISTRIBUTION DESIGN CRITERIA

SERIES 3000: WATER DISTRIBUTION

3005: Design Pressures

All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The minimum pressure in all water mains under conditions of maximum instantaneous demand shall be twenty-five (25) pounds per square inch at the customer's tap. Twenty (20) pounds per square inch at any tap is acceptable when fire flows or flushing flows are provided in excess of maximum peak hourly flow. The normal working pressure in the distribution system shall be approximately 60 psi.

3010: Pipe Size, Depth and Material

The minimum size of water mains for providing fire protection and serving fire hydrants shall be 8-inch diameter (6-inch on dead ends). Larger size mains will be required as necessary to allow the withdrawal of the required flow while maintaining the minimum residual pressure previously specified. **MPW shall have final determination of water main sizing.** Water lines servicing buildings with fire protection sprinkler systems shall be sized to provide adequate pressure for the system per manufacturer's recommendations.

No line extensions shall be made to an existing line when the existing line does not meet the minimum pressure and flow requirements stated above.

Depth of cover shall be as follows (regardless of backfill):

- a. For all pipe material installed by open cut, the depth of cover shall be a minimum of three (3) feet and a maximum of four (4) feet below finished grade.
- b. If, to avoid conflicts with storm drains or other utilities, it is necessary to reduce the depth of cover to less than three (3) feet, ductile iron pipe shall be used for the affected length of pipe, and an additional length of DIP installed before and after the length of reduced-cover pipe. The transition to DIP shall be made with DIP MJ sleeves or bends. All planned transitions to DIP shall be clearly shown on the approved drawings.
- c. Minimum acceptable depth of cover when installing DIP shall be eighteen (18) inches.
- d. Water lines shall not be installed until finished grade is completed and certified by a professional land surveyor. Installation of the water line shall not be permitted until the certification is submitted and approved by an MPW inspector.
- e. For water mains installed by trenchless methods (Horizontal Directional Drill), the depth of cover requirements listed in a) above shall apply, unless a deeper installation is required at a road crossing by SCDOT. An exception to this requirement may be made if the water main is a main transmission main for which there are no plans for future taps or extensions.

Material selection for water mains is as follows:

- a. Six (6) inch to twelve (12) inch: C-900 or C-905 PVC
- b. Fourteen (14) inches or larger: Ductile iron or PVC, as directed by MPW.
- c. MPW retains the right to require ductile iron for any pipe to be installed in commercial areas, within primary road right-of-ways or as deemed in the best interest of the utility.

3010-1: Service Taps

All water service taps shall be a minimum of one size smaller than the water main being tapped unless the water main being tapped is a part of a looped water distribution system. In these cases the water service tap can be the same size as the main being tapped but cannot be larger. If the tap size required is the same size as the main being tapped, a MJ tee will be required.

Direct taps larger than two (2) inches will not be allowed.

MPW reserves the right to stipulate the maximum size tap available off of any water main regardless of the main size and configuration, if it is deemed in MPW's best interest to do so.

MPW will not allow any service taps on any transmission mains.

3015: Fire Protection

Systems design shall be such that fire flows and facilities are in accordance with the requirements of MPW, Mount Pleasant Fire Department (MPFD) and the State Insurance Services Office (ISO). Water lines serving fire hydrants shall be six (6") inches minimum. Larger size mains will be required as necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure as determined by MPW. Systems shall be designed to provide for fire flow demands that are 1,000 gpm or greater.

3020: Fire Hydrants

Hydrants shall be provided at each street intersection and at intermediate points between intersections as recommended by the State Insurance Services Office (ISO) and local fire departments having jurisdiction. Fire hydrants shall be located in accordance with MPFD requirements which states within 300 feet of any structure (as accessible by MPFD fire trucks) or within 150 feet if any structure containing a sprinkler system. Otherwise, hydrants spacing shall be reviewed by MPW and shall never exceed a spacing of 1000 feet.

For standard six (6) inch diameter hydrants, the design flow shall not be less than 1000 gpm over and above peak hourly flow. Standard hydrants shall not be placed on systems using only hydropneumatic storage. Hydrants shall not be connected to lines not designed to carry fire flow.

The hydrant lead shall be a minimum of six (6) inches in diameter. A hydrant control valve shall be installed in all hydrant leads. Services shall not be installed on the hydrant lead.

No privately owned fire hydrants will be permitted.

For hydrant drains, a gravel pocket or dry well shall be provided unless the natural soils will provide adequate drainage. Hydrant drains shall not be connected to or located within ten (10) feet of sanitary sewers.

3025: Looping and Dead Ends

Dead ends shall be minimized by looping all mains whenever possible to provide increased reliability of service and reduced headloss. All lines serving fifteen (15) residents or more shall be looped unless approved otherwise by MPW, or in a cul-de-sac. A line that dead ends on a cul-de-sac shall should not follow around the outside of the edge of road, but installed in a straight line across and terminate with a fire hydrant.

All looped lines shall match the size of the existing lines that are being tied into.

Looping and valve locations shall be such that an interruption of service due to a water main break will put no more than 800 feet of main or more than two fire hydrants out of service while maintaining adequate flows and pressure in the remaining portion of the system.

Where dead-end mains occur they shall be provided with a fire hydrant if flow and pressure are sufficient or with a blow-off for flushing purposes. Flushing devices shall be sized to provide flows, which will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any wastewater or stormwater line.

Temporary dead end main lines, which will be extended at a later date, shall have an in-line valve installed and an additional ten (10) feet of pipe for every inch of pipe diameter, and a hydrant on the end. For example, the termination of an eight (8) inch main shall consist of an eight (8) inch valve and eighty (80) additional feet of pipe, with a hydrant on the end.

3030: Valves, Air Release Valves and Chambers

Sufficient isolation valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500-foot intervals in commercial areas and at not more than one block or 800-foot intervals in other areas. In line valves shall be located at each fire hydrant. MPW shall have final determination on the number and location of valves. All mainline tees shall have three (3) valves.

Mains shall be designed to minimize high points. At high points in water mains where air can accumulate, provision shall be made to remove the air by means of an air release valve. Automatic air release valves shall not be used in situations where flooding of the manhole or chamber may occur. Air valves shall be selected based on the size of the water main. Air valves shall be detailed on the design drawings and approved by MPW.

Chambers, pits or manholes containing valves, blow-offs, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or wastewater line. Such chambers or pits shall be drained to the surface of the ground, where they are not subject to flooding, or to absorption pits underground.

3035: Backflow Prevention and Metering

Any extension to the MPW water system must be constructed in a manner that eliminates the possibility of back-flow of water from the non-approved system into the active MPW system and provides the ability to meter water use. To achieve this, either one of the following methods shall be used (refer to Construction Details W-02 & -03):

- a. The new section of water main shall be installed with an air gap of three (3) feet between the new pipe and the existing stub out or wet tap. The new main shall have a temporary threaded cap with appropriate fittings installed at the end of the new pipe that is closest to the proposed connection point of the existing system. All temporary connections must be inspected and approved by an MPW inspector before being put in use. All water entering the new main shall flow through an MPW-approved backflow preventer and meter connected to a fire hydrant or other source of water on the approved MPW system. The final connection to the MPW system shall not be completed until a SCDHEC Permit to Operate has been issued for the new section. Final connection will consist of the installation of a spool piece and MJ sleeve(s) supplied and installed by the Contractor. In the case where there are multiple connection points to the MPW system within a project, an air-gap shall be provided at each location.
- b. At the beginning of construction, a temporary backflow preventer and meter (both approved by MPW) shall be supplied and installed by the Contractor in-line between the tapping valve, or stub-out, and the water extension. The backflow preventer shall be tested and certified by a SCDHEC licensed tester and the test results provided to MPW prior to being placed into operation. The Engineer shall determine the size backflow preventer required that achieves a 2.0 feet/sec. scouring velocity during flushing for a given size of pipe. Once the SCDHEC Permit to Operate has been issued for the new section, the backflow assembly shall be removed by the Contractor and replaced with a spool piece and MJ sleeves(s). Any other connection points to the MPW system shall be provided with the air gap described in section a. above. All temporary backflow installations shall be inspected and approved by a MPW inspector before being placed into operation.

Regardless of which method is used, a representative of the MPW shall inspect the final connection prior to back-filling the excavation.

In the case of a water project that has multiple connection points with the MPW system, the MPW Engineering Department will determine the optimum location for a single water-supply connection. Final tie-in to all other connection points shall only be made after the Permit to Operate is issued.

Backflow preventers on fire lines are required to have detector checks unless metered.

Permanent backflow preventer, installed as part of a service extension, shall be in accordance with MPW's Cross-Connection Control Program Guidelines.

Preferred sized residential meter is 5/8". Any residential meters greater than 5/8" shall be reviewed and approved by the MPW Water Department.

3040: Cross Connection Control

For all non-residential installations, a Cross-Connection Questionnaire must be completed and returned to MPW. MPW will provide evaluation and/or inspection of plans in order to determine the type of backflow preventer, if any, that will be required. Reduced pressure backflow prevention devices shall be required for any service where toxic materials are used or where positive protection for the public water supply is required. Typical applications include hospitals, medical and dental laboratories, mortuaries, industrial plants, dry cleaners, irrigation systems, or as determined by MPW. Any water supply project involving the use of a reduced pressure backflow preventer or double check valve assembly will not be given final approval for operation until the backflow prevention devices have been tested by a SCDHEC certified tester and test results submitted to MPW.

No piping systems which by-pass an installed backflow preventer shall be allowed under any circumstances.

High hazard category cross-connections shall require an air gap separation or an approved reduced pressure back-flow preventer.

Reduced pressure principal back-flow prevention assemblies may not be installed in any location subject to possible flooding, and shall not be installed in any pits or vaults regardless of the drainage capabilities.

All piping up to the inlet of the back-flow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.

Backflow preventers must be on the SCDHEC list of approved backflow prevention devices, and shall be installed in a manner approved by MPW and in accordance with local plumbing codes and all applicable requirements of the SCDHEC State Primary Drinking Water Regulations.

For residential protection, the Water Department will also install a Residential Dual Check Valve for the customer. The customer shall be aware that the installations of a residential dual check valve results in a potentially closed plumbing system within the residence. As such, the owner may need to provide for thermal expansion within their closed system, i.e., pressure relief valves and/or the installation of thermal expansion devices.

For further information on the testing and installation requirements of backflow preventers, refer to MPW's Cross-Connection Control Program Guidelines.

3045: Separation Requirements

Parallel Installation:

Water mains shall be laid at least 10 feet horizontally from any existing or proposed wastewater line. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a wastewater line, provided that the water line is laid in a separate trench or on an undisturbed earth shelf located on one side of the wastewater line at such an elevation that the bottom of the water main is at least eighteen (18) inches above the top of the wastewater line.

Perpendicular Crossings:

Water mains crossing wastewater lines shall be laid to provide a minimum vertical distance of eighteen (18) inches from the outside of the wastewater line. This shall be the case where the water main is either above or below the wastewater line. At crossings, one full length of ductile iron water pipe shall be located so both joints will be as far from the wastewater line as possible. Special structural support for the water and wastewater pipes may be required. Where a water pipe is laid under a storm drain there must be a minimum of eighteen (18) inches of clearance. A twenty (20) foot joint of DIP shall be centered under the storm water line. In cases where eighteen (18) inches of clearance is not obtainable, MPW and SCDHEC may approve special provisions such as concrete encasement or casing.

Special Conditions:

MPW must specifically approve any variance in separation when it is impossible to obtain the specified distances above. To be considered, an alternative design shall, as a minimum, comply with part R.61-58.4 (D)(12)(c) of the SCDHEC State Primary Drinking Water Regulations. Any alternative design shall:

- a. Maximize the distance between the water main and sewer line and the joints of each.
- b. Use materials that meet the requirements of R.61-58.4 (D)(1) of the SCDHEC State Primary Drinking Water Regulations.
- c. Allow enough distance to make repairs to one of the lines without damaging the other.

Force Mains:

There shall be at least a ten (10) feet horizontal separation between water mains and wastewater force mains. There shall be an eighteen (18) inch vertical separation at crossings.

Wastewater and Storm Drainage System Interference:

No water main shall pass through or come in contact with any part of a wastewater manhole, storm drainage pipe or structure.

Drain Fields and Spray Fields:

Potable water lines shall not be laid less than 25-feet horizontally from any portion of a wastewater field or spray field.

Surface Water Crossings:

Surface water crossings, whether over or under water, present special problems. MPW shall be consulted before plans are prepared. The following guidelines shall be used as a minimum:

- a. Underwater crossings shall include a minimum of two (2) feet of cover. Only fused pipe joints will be allowed for underwater crossings.
- b. Above water crossings, when crossing fifteen (15) feet in width, the pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.
 - The pipe material and joints must be designed appropriately. Provide DIP with mechanical joints.
 - Valves shall be located on each side of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.
 - A blow-off shall be provided on the side opposite the supply service sized in accordance with R.61-58.4 (D)(7) of the SCDHEC State Primary Drinking Water Regulations.
 - Blow-offs shall not be directed toward creeks or other water bodies without proper precaution being taken to de-chlorinate prior to discharge.

3050: Water Line Locations

Utility lines specified shall designate whether in easements (subdivision or commercial property) or designate the right-of-way (SCDOT primary or secondary road).

When possible, all water lines shall be located in dedicated road right-of-ways and on the opposite side of the road from the wastewater line. Water lines shall not be installed under asphalt or sidewalks when in road right-of-ways unless approved by MPW, SCDOT and/or the Town of Mount Pleasant.

Water lines installed in areas where future road expansion is a possibility shall be in a dedicated utility easement.

Water services which will serve a single residential lot shall branch off the main using a polyethylene tubing service a minimum of one (1) inch in diameter.

Water services which will serve two (2) adjacent residential lots shall branch off the main using a polyethylene tubing service one and one-half (1-½) inches in diameter.

For water services larger than one and one-half (1-½) inches, and for multiple-meter applications, refer to the applicable construction detail.

All water services shall be extended to within a foot of the property line.

Locate water service laterals at the opposite side of the property from the wastewater service laterals.

Water lines will not be approved on the back property line or sidelines unless exclusive easement and access is granted and it is determined by MPW staff to be in the best interest of MPW to accept said exclusive easement.

Water lines shall not be located in surface water or wetlands, unless approved by OCRM, US Army Corps of Engineers, and MPW.

3055: Pipe and Valve Identification and Testing

All potable PVC and DI water mains shall be color coded blue.

All water mains that are installed by the open-trench method, regardless of piping material, shall also include the installation of an electronically or magnetically detectable tape. The tape shall be designed to last as long as the pipe it is installed over, even in adverse soils.

All water main installations, regardless of piping material, shall include the installation of a tracer wire. Prior to final acceptance the tracer wires proper function shall be verified.