CHAPTER 3

WATER PUMPING STATIONS, WELL HOUSES AND WATER TOWER DESIGN

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3.1 Introduction

This Chapter includes the criteria and guidelines for designing water pumping stations, well houses and water towers in St. Mary's County. All new water pump stations, well houses and water towers shall incorporate GREEN technology when possible.

To the extent practical, designs shall conform to the design standards given herein as well as the latest publication of the "Recommended Standards for Water Works" (Ten-State Standards). The design standards shall be applied to design conditions in a careful and thoughtful fashion. Deviations from the design standards must be brought to the attention of the Chief Engineer. Requests for waivers of either the design manual or Ten-State Standards must be justified to the Chief Engineer, in writing, from an engineering evaluation standpoint and include consideration of life cycle costs and ease of maintenance. Approval or denial of the waiver request will be by return letter signed by the Chief Engineer.

3.2 Regulations

Water pumping stations shall comply with all relevant guidelines issued by the Maryland Department of the Environment (MDE). Buildings shall comply with applicable International Building Code (IBC) and St. Mary's County building codes as well as permitting requirements of the St. Mary's County Department of Land Use and Growth Management. Other regulations governing facilities and construction shall be adhered to, including regulations published by the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), National Electric Code (NEC), Maryland Plumbing Code and others as applicable.

3.3 Permits and Approvals

See Chapter 1 in this manual for applicable permit requirements. In addition, for any above ground structure, the Designer shall make all applications for and obtain the required building and grading permits prior to bidding of the project.

3.4 Design Phases

A. Engineering Report

The Engineering Report shall include the description of design criteria to be utilized, preliminary flow computations, design calculations, calculated system curves, surge protection analysis/recommendation, identification of land acquisition and easement requirements, number of property owners involved,

listing of permit requirements, and cost estimate based on unit costs for major elements of work. In addition, the following design criteria shall be developed:

1. Site Development (identify any conflicts with county agency requirements, identify conditions and requirements necessary for development).

2. Conflicts with Existing Utilities.

3. Structural Design.

4. Architectural Design (evaluate compatibility with surrounding community).

5. Complete Hydraulic Analysis (Pump and system curves, design conditions, operating scenarios). The analysis shall include 24 and 48 hour extended period simulations of the water distribution system performance using average day demand, maximum day demand and peak hour demand for both current and full development, including fire flow.

6. Pump Selection (type of pumps, number of pumps, size of pumps for initial and ultimate design conditions).

7. Pump Controls (constant or variable speed controls, on/off controls, telemetering, etc.).

8. Power Requirements (availability, cost to provide service, etc.).

9. Corrosion Control.

10. Noise Control.

11. Secondary Power Supply.

12. Construction Timeline.

13. Once the Engineering Report has been approved by the Chief Engineer, design of the facilities may proceed. Milestone submittals of design plans and specifications shall be made at 30%, 60%, 95% and Final Design.

B. Design Plans & Specifications

At a minimum, the following information shall be supplied at the milestone submittals:

30% Submittal: Site Plan, Design Schematics (showing station layout and major equipment), Specification Table of Contents

60% Submittal: Complete civil, mechanical and structural design plans and preliminary technical specifications

95% Submittal: Complete design for all disciplines including electrical and architectural plans and details. Complete specifications including front end documentation. This phase should represent complete, bid-ready contract documents from the Designer.

Final Design: The 95% Submittal with the Chief Engineer's final comments incorporated.

C. Cost Estimate

At each formal submittal and at the conclusion of the design process, the Designer shall prepare a detailed cost estimate for the pumping station. This estimate shall be developed for each major category of work including civil, mechanical, electrical, structural, architectural work and contingent cost.

3.5 Hydraulic Computations

A. Planning Period

Water pumping station design conditions shall, at minimum, accommodate a 20-year planning horizon. For all pumping stations, consideration shall be given to future upgrading flexibility necessary to accommodate design conditions beyond the normal planning horizon. This is especially important for larger stations.

B. Maximum and Average Day Demands

Water pumping stations shall be designed to pump the flow at the pressure determined by house count and non-domestic user inventory with allowances made for remaining undeveloped areas. Population densities and per capita demands shall be as established by facility plans or in their absence, in agreement with the Chief Engineer. Institutional, commercial and industrial demands shall be determined by a study of the establishment. The Chief Engineer shall be consulted for future domestic and non-domestic land use and population densities. A service area map and tabulation of the design flow shall appear on the plans. The map and tabulations shall show initial and ultimate service areas.

C. Hydraulic Analysis

Water pumping stations must satisfy the hydraulic conditions of the system. A complete hydraulic analysis of each water pumping station is required. During the study phase, the Designer shall consult with the Chief Engineer for the requirements of the hydraulic analysis. At a minimum, the Designer shall perform 24 and 48 hour extended period computer simulations using average day demand, maximum day demand and peak hour demand for both current and full development conditions. Fire flows shall be analyzed during maximum day rate for both initial and full development conditions.

The hourly demand ratios used in the 24 and 48 hour extended period simulations for average day demand and maximum day demand shall be based on actual MetCom average day demand and maximum day demand records, or as directed by the Chief Engineer. Hourly demand ratios shall be calculated by dividing each hour's water demand by that day's average hourly water demand. The highest hourly ratio experienced during the maximum day demand is the peak hour demand ratio for that water pressure zone. The hourly demand ratios may differ between water pressure zones. During the extended period simulations, all water pressure zones shall be connected to allow modeling of pumping station suction pressures and storage tank refill rates. Fire flows shall be modeled as a single event assuming a maximum day demand ratio of 1.0 and a 2-hour fire event at the flow rates listed in Table 2.1 with all water storage facilities assumed empty for an isolated or stand-alone system.

The hydraulic analysis shall be presented in a clear, logical and easy to understand format and shall relate to the proposed construction drawings. If construction drawings are not available at the time of the analysis then to scale drawings shall be prepared with street names to locate the proposed system.

D. Design Flow Rate and Pressure

The design flow and pressure for water pumping stations shall meet the following requirements during the 24 and 48-hour extended period computer simulations:

Maximum Day Demand:	35 psi minimum at curb
Peak Hour Demand:	35 psi minimum at curb
Maximum Day Rate + Fire Flow Rate:	35 psi minimum at curb

E. Pump and System Curves

The Designer shall show pump and system curves on the plans to scale. System curve characteristics for each design condition shall be determined by the Hazen-

Williams formula for piping head loss in conjunction with the MetCom water model.

The pump selection shall be reviewed for both the initial and maximum design year conditions.

The following pump and system curves shall be shown on the plans:

1. System Curve for Maximum Day Demand for the design year.

2. System Curve for Average Day Demand for the design year.

3. System Curve for Average Day Demand for the initial year of station operation.

4. Pump Curve for single pump operation and multiple pump operation where station has three or more pumps.

In addition, the Designer shall list next to the curves the pump design criteria including pump motor horsepower, efficiency, NPSHR at design points and RPM. Pump and system curves shall be shown for new water main conditions.

F. Number of Pumps

Water pumping stations shall be capable of pumping the maximum day demand with the largest single pump out of service.

G. Pump Selection Criteria

Avoid applications where pumps must operate in an adverse area of their performance curve. Design for maximum efficiency at the operating point. Examples would be pumps operating at very low flows and high heads, near shutoff heads or "runout" conditions. These conditions can result in excessive hydraulic loading or cavitation damage to impellers, casings and shafts, rapid bearing and mechanical seal wear and high vibration. Under no circumstances shall a pump be specified operating outside of its recommended range.

H. Variable Frequency Drives (VFDs)

VFDs or other methods approved by the Chief Engineer may be used to achieve minimum flow conditions below the full speed operating range of the pumps.

I. Water Hammer

The potential impact of water hammer shall be evaluated. If the combined effects of static head and water hammer do not exceed the weakest piping system component working pressure by a safety factor of 1.1, no special provisions need to be included to control water hammer. Where the maximum water hammer pressure exceeds the weakest piping system component working pressure by a safety factor of 1.1, the Designer shall strengthen those elements affected, re-evaluate pipe size and velocities or select an appropriate device to control water hammer. Hydraulically operated, time adjustable pump check service valves and spring type, oil-cushioned elbow hydraulic surge relief valves are the preferred choices of the Commission for controlling the effects of water hammer. No pressure vessel/surge tank type devices will be acceptable. The decision to strengthen piping system components instead of utilizing a water hammer control device or different pipe size shall be based upon a life cycle cost economic comparison.

3.6 Design Criteria for Water Pumping Stations

All water pumping stations shall be of the type in which the structures are formed and poured on site (cast-in-place concrete construction) with a masonry superstructure or pre-cast structure. The pumps, piping, controls, and electrical gear shall be housed in a single building. The emergency generator may be included or under separate nearby cover.

Water pumping stations shall be designed as long-term (greater than 20 years) facilities and shall include room for anticipated expansion. Where available, the electric power provided shall be 240 volts and 3 phase but as a minimum shall be 208 volts and 3 phase.

Designers are encouraged to utilize energy and maintenance saving materials including, but not limited to, skylights, low or no-maintenance landscaping.

A. Site Design

1. Location: Water pumping stations shall be located as far as possible from populated areas. Natural screening and remoteness of the site shall be primary elements of site selection wherever possible. Where pump stations are sited in proximity to developed areas, the architecture shall be compatible with the surrounding area. Building aspects such as generator exhaust and ventilation fan noises shall be considered. Similarly, building setbacks shall be considered to provide minimal impact to neighboring properties.

2. Land Acquisition: Land required for pumping stations, including necessary vehicular access routes to an existing or proposed public roadway shall be owned in fee simple by the Commission. As part of this process, a boundary survey of the property is required together with a record plat and a metes and

bounds description of the parcel unless otherwise approved by the Commission's Attorney. In determining the space requirements for the facility, particular attention should be given to the width provided for the access road to insure adequate space for grading and drainage within the access road right-of-way. Sufficient room shall be provided for future maintenance of wells, tanks, towers, and generators. Vehicle access shall be provided with adequate turning radii for well rigs, truck-mounted cranes and other large equipment that might be expected to be on site.

3. Topography: Adjacent areas potentially served by the water pumping station must also be considered. Water pumping station site selection shall also be compatible with suitable site access and soil capability with respect to land grading in conjunction with site development. Existing contours and other topography shall be shown for the entire site including a 100-foot minimum width outside of the proposed property boundary. Contour interval shall be two-foot, unless otherwise approved by the Chief Engineer.

4. Floodplain: Water pumping stations shall be sited to remain operational and permit access during a 100-year return frequency flood. The pumping station top slab elevation shall be set a minimum of three-feet above the 100-year floodplain elevation. The access road shall be above the 10-year return flood level.

5. Wetlands: Avoid direct impacts wherever possible and minimize impacts to wetland buffer areas. Buffer areas include 25 feet beyond non-tidal wetlands.

6. Grading: Water pumping station grades shall prevent local ponding, provide positive drainage away from structures and generally be limited to no greater than 4 percent slopes. Stone surfaces around paved areas shall provide proper site drainage at slopes of 10 percent or less. Land grading outside of the water pump station perimeter fence shall not exceed 3 to 1 slopes; 4 to 1 slope maximums are desirable. Lesser slopes wherever possible are preferred. Site grading design shall be compatible with slope stability for the soils encountered. Slope stabilization shall be appropriate for the degree of slope and soil conditions. The use of retaining walls on or adjacent to the water pumping station site is not permitted. Access drive slopes shall be a maximum of 7 percent at any point along the centerline of the drive.

7. Sediment Control: A sediment control plan shall be provided in accordance with the Subdivision Regulations.

8. At least two test borings shall be taken at the building location to determine soil types, rock, water table elevations, soil bearing values, etc. Standard penetration tests shall be taken at intervals not to exceed five (5) feet. Borings shall be taken to a depth of not less than fifteen (15) feet below the bottom of

the proposed structure. Borings shall be taken deeper as necessary, depending on soil conditions.

9. Landscaping: Landscaping shall meet County requirements for buffers.

10. Site Security: Pumping station sites shall be fenced with black vinyl coated chainlink fencing, black vinyl coated post and black hardware, and a 12-foot wide double leaf locking gate for vehicle access. Three strands of barbed wire on angled barb arms shall be included for a total height of eight feet (six feet of fabric with three strands of barbed wire). In predominately residential areas the fence may be eight feet high fabric without barbed wire with the approval of the Chief Engineer. Additional property line fencing may be required as determined by the Chief Engineer. The pumping station building shall have exterior lighting controlled by motion detectors. The pumping station doors shall be 16-guage steel with locks keyed as specified by the Chief Engineer. The building shall be provided with an entry alarm connected to the station SCADA system.

11. Paving: Pumping station sites shall have a paved access road and a minimum of two parking spaces. The access road shall have sufficient room and turn-around area, if turn around area is required by the Chief Engineer, to allow access by maintenance trucks. The turning area in a pumping station site shall have a minimum radius of 48 feet. The turning area may be outside of the fenced area but must be on a Commission parcel. Pumping station access roads shall be used exclusively for pumping station maintenance and access.

12. Station Sign: A permanent sign shall be provided at each pumping station stating the Station Name, Street Address and Emergency Telephone Number. The sign must meet St. Mary's County 911 addressing system.

B. Structures

1. Pumping Station Design/Architectural Standards: Pumping stations shall be architecturally compatible with surrounding structures and shall not have slate roofs. Pumping stations shall be of pre-cast concrete walls and concrete roof or shall be pre-cast concrete and shall be designed to be vandal-proof. Wood or asphalt shingles are not permitted. There shall be no exposed woodwork on the outside of the building. All exterior woodwork shall have a vinyl or aluminum coating. The pumping station shall have a lightning protection system. Provisions shall be made in the structure for traversing bridge cranes of adequate capacity to facilitate the removal of pumps, motors, valves and all other related heavy equipment. Doors shall be bulletproof and constructed of heavy duty metal with deadbolts and locks keyed to the Commission standard.

Exterior lights shall be vandal proof, wall-mounted, energy-efficient controlled by motion detectors and an on-off switch. Pumping stations shall be provided with outside non-freeze hose bibbs. Ventilation openings shall be protected with aluminum louvers with birdscreens. Buildings must comply with applicable IBC and St. Mary's County building codes and the latest revisions thereof.

a. Pump Room

Pumps and piping shall be located at grade with parallel suction and discharge headers. Pumps shall be of the horizontal style placed on individual concrete bases. Floor shall be sloped to floor drains piped to a sump. Each water pump shall have a floor drain located next to it. Pump baseplate drains shall be piped to adjacent floor drains. A building sump with sump pump with piping leading to the nearest sewer shall be provided, if a sewer is available. The pump room shall be furnished with a service sink with both hot and cold water, and inside hose bibb.

All electrical and control equipment shall be located at least three (3) feet above the floor.

b. Generator Area

A separate generator area shall be provided for housing the emergency generator and fuel tank. The generator slab/ floor shall be located a minimum of three (3) feet above the 100-year flood elevation. If the generator is in a room, it shall have a roll-up metal garage door for access and shall be equipped with a floor drain located outside the fuel spillage containment area, piped to the building sump. The generator area shall be supplied with hose bibb, hose rack and 50 feet of rubber hose.

Alternatively, the generator may be in a separate, self-contained enclosure.

2. Heating and Ventilation: The pump, control and generator rooms shall be heated by electric unit heaters with integral thermostats sized to maintain a minimum inside temperature of 55 degrees Fahrenheit. Ventilation shall be by means of wall or ceiling mounted exhaust fans with backdraft dampers operated by thermostats and freezestats and intake louvers with motor operated dampers.

Ventilation shall be designed for a minimum of six (6) air changes per hour. Each room shall have a dedicated exhaust fan(s). Ventilation shall be sufficient to remove heat generated by the pump motors and controls. Provisions shall be made to ensure against condensation forming on controls and other major items of equipment.

C. Equipment

1. Yard Valves: Yard valves shall be buried resilient seat gate valves complying with the Standard Specifications with operating nut and roadway valve box at grade.

2. Station Bypass: Water pumping stations shall be provided with bypass connections in the form of two (2) fire hydrants, one on each of the suction and discharge lines of the station. Hydrants shall be labeled suction and discharge, respectively. The hydrants shall be located adjacent to the parking area and shall be no more than 50 feet apart for easy setup of temporary pumps for pump around capability so that the tower can be emptied or filled.

3. Interior Piping: All interior water piping shall be ductile iron, thickness Class 53, with flanged fittings. Flanges shall be integrally cast on pipe or factory assembled screwed-on with proper bonding compound. Manifolds shall include flexible couplings for ease of installation and removal and also for expansion and contraction of the piping system. Arrangement of piping and equipment within the station should be made with adequate space for maintenance, repair and removal or replacement of equipment, as well as to safeguard personnel working in the station. Piping shall be adequately supported. Control and instrumentation piping shall be copper or stainless steel. Chemical feed piping shall be clear PVC.

4. Interior Valves: Each water pump shall have isolation valves to permit the removal or maintenance of the pumps without affecting the operation of the remaining pumps. Isolation valves shall be resilient seat gate valves. Valves larger than 6-inch shall have geared operators with handwheels. Handwheels shall be marked with an open arrow. Each pump shall have a hydraulically operated, time adjustable pump check service valve to prevent backflow through inoperative pumps. In accordance with the criteria for water hammer control, pump check service valves shall be of the type and strength required to eliminate water hammer damage. Surge relief valves shall also be provided on the suction and discharge headers of the station and piped to the nearest public sewer with an air gap, where available.

5. Pressure Gauges: Pressure gauges for direct reading of line conditions shall be placed on both the suction and discharge of each pump, on the main discharge header piping after the last pump, and on the suction header as it enters the building. Pressure gauges shall be oil-filled type, have a minimum 3½-inch diameter face and be equipped with snubbers. Accuracy shall be to within 0.5% of pressure. Pressure gauges shall have a range such that the normal operating pressure is near the middle of the gauge.

6. Flow Metering: All water pumping stations shall have a venturi type flow meter utilizing differential pressure for reading flow or impeller type meters. Accuracy shall be within 0.5% of flow range. All flow meters shall be placed in accordance with the manufacturer's recommendations.

7. Transfer Pumping Units: All water pumps shall rotate clockwise as viewed from the motor end. Pump bearings shall have a minimum 100,000 hours ABMA-10 bearing life. Pump motors shall operate on, 3 phase, 60 cycle electrical service and at a speed no higher than 1780 rpm. Pump discharge velocities shall be between 5 and 15 feet per second. Pump inlet pressure shall be maintained at a sufficient level to avoid cavitation. Pump motor horsepower shall be sufficient to prevent motor overload under all possible conditions. Water pumps and motors shall be suitable for continuous duty. All pumps shall be factory witness tested and approved prior to shipment. Water pumps shall meet the requirements of the Hydraulic Institute for vibration. Pumps shall be one of the following types:

    - In-Line Split Case (Horizontal)
    - End Suction (Horizontal)

    The pump casing/volute, impeller, seal housing and motor housing shall be of cast iron construction. Impeller shall be cast iron or bronze. The pump's casing and impeller shall be fitted with replaceable hardened bronze or stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the Chief Engineer's option, other pump materials may be required to suit a particular application.

    Pumps shall have the following additional features:

    a. Stainless steel shaft.

    b. NSF approved fusion bonded epoxy coating (interior).

    c. Flexible shaft coupling and removable OSHA-compliant shaft guard.

    d. Mechanical shaft seals cooled and lubricated by the pumped fluid.

    e. Premium efficiency motors shall be specified (where commercially available) for all three-phase pump motors.

D. Electrical and Controls

1. Electrical Design: All electrical designs and components shall be in strict accordance with all applicable St. Mary's County Codes. Electrical design shall be such that phase out protection shall be provided so that the power will automatically switch off in the event of a loss of any one phase. The electrical plans shall include, but not be limited to, the following:

    a. Complete plan layout indicating all conduit, wire sizes and equipment locations including lighting and other appurtenances. Incoming electrical service on the pumping station site shall be underground and within concrete encased conduits.

    b. Complete plan layout showing motor control center (MCC), size and location of all motor starters, circuit breakers and automatic transfer switch (ATS).

    c. Installation details of equipment that are wall mounted or suspended from the ceiling, or otherwise required for clarity.

    d. Single line diagrams incorporating all electrical components required for operation of the facility.

    e. Complete lighting schedule noting model, size, location and installation data as well as appurtenances. Vandal-proof exterior lighting shall be provided.

    f. Complete control and telemetry diagrams.

    g. Elevation of control panels with equipment and mounting dimensions and notes identifying each component.

    h. Complete circuit breaker schedule indicating size and identifying each circuit.

    i. Ventilation schedule noting fan size, operating conditions, location, model, installation data, etc. The ventilation schedule shall also outline louver data including size, material, fixed or motorized.

    j. Secondary power facilities and alarm equipment shall be designed so that they may be manually activated for periodic maintenance checks to ensure proper operation.

    k. Provide a legend of all symbols used for the above.

2. Lightning and Surge Protection: The Designer shall provide lightning and surge protection at the water pumping station. The lightning and surge protection shall comply with the latest editions of all applicable codes and standards.

3. Backup Power: All water pumping stations shall be provided with emergency generators or a secondary independent power feed with automatic transfer switches. Emergency generators shall be sized to provide full station operation. Emergency generators shall be diesel driven with fuel storage on the underside of the generator in a belly tank if practical or in a separate storage tank. Fuel spillage protection shall be provided. Tank size shall be suitable for 24-hours of generator operation at full load. When emergency generators are located inside the pumping station building, they shall be mounted on vibration isolators, with a fuel tank fill connection to the outside. Generator engine exhaust shall be provided with a critical grade silencer and piped to the outside of the generator room. Generator exhaust shall face away from nearby neighbors. If this is not possible, a baffle wall shall be constructed in front of the generator exhaust to deflect the noise.

   The generator shall be fueled by natural gas. If natural gas is unavailable and a new service cannot be obtained, propane may be used. If either natural gas or propane is not feasible, a diesel fuel-powered generator shall be provided.

4. Controls & Alarms: The pumps shall be controlled by one of the following means depending on the service for which the station is intended:

   - Tank Level
   - Pressure
   - Flow Rate

   Tank Level controlled stations employ the use of pressure transducers to turn pumps on and off depending on level in a water storage tank.

   Pressure controlled stations employ the use of pressure transducers to turn pumps on and off to maintain a desired system pressure. The controller shall turn pumps on and off, and vary speed as necessary, to maintain adequate discharge pressure out of the station.

   Flow Rate controlled stations employ the use of flow meters to turn pumps on and off to maintain a desired flow rate.

   All water pumping stations shall have high discharge pressure and low suction pressure pump cut-out switches that will shut all pumps down regardless of operating mode if either of the two settings are encountered. An alarm signal to the SCADA system shall be transmitted for either of the two conditions.

Stations may be designed with more than one method of control depending on the specific requirements of the service area. For example, a Tank Level controlled station may also be designed with a pressure control system to enable that station to maintain a certain pressure in the system when the tank is out of service. The method of station control shall be approved by the Chief Engineer prior to design.

All stations shall have smoke and carbon monoxide detectors and alarms. SCADA base and tower shall be provided at each site.

5. SCADA: At a minimum, the following shall be provided at each pumping station:
    a. Pump On (each pump)
    b. Pump Fail Alarm (each pump)
    c. High Tank Level Alarm (for Tank Level controlled stations)
    d. Low Tank Level Alarm (for Tank Level controlled stations)
    e. Low Suction Pressure
    f. High Discharge Pressure
    g. Loss of Primary Power
    h. Generator/Secondary Power On
    i. Building Intrusion Alarm
    j. Pump Control Valve Failure
    k. Telemetry Failure
    l. Antenna Tower

    The Chief Engineer shall specify the method of communications and the specific brands of hardware and software to be used. A minimum of five (5) spare inputs and five (5) spare outputs shall be provided with the telemetry system. The Chief Engineer may require additional telemetry and SCADA communications at a particular station.

    The Designer shall obtain from the Chief Engineer any information necessary for proper system communication, which may be applicable. RTUs shall be programmable logic controller (PLC) based as complimentary to the Commission's SCADA system. TCU's may also be required.

E. Painting and Coating

All exposed piping, pump equipment and appurtenances shall be epoxy painted. Painting systems and colors shall be submitted to the Chief Engineer for approval. All interior walls of the pumping station building that are above grade shall be painted. Interior walls that are below grade shall be left unpainted.

F. Disinfection

All piping, pumps and appurtenances shall be disinfected prior to placing in service in accordance with applicable AWWA standards.

G. Miscellaneous

1. Operations and Maintenance Manual: Three (3) complete operations and maintenance manuals shall be provided for each pumping station. Manuals should contain approved shop drawings, catalog cut sheets, description of operation including various control sequences or any other special operational details incorporated in the pumping station design, equipment model and serial numbers, installation instructions, maintenance schedules, list of recommended spare parts, warranties, names and telephone numbers for local equipment representatives, for each item of equipment.

3.7 Production Wells:

A. General

The design professional is directed to Section 02555 “Production Wells” of MetCom’s Standard Specifications for Construction, and the following:

1. General well appurtenances - The following well appurtenances are required:

    a. A pitless adapter shall be provided.

    b. A sampling tap shall be provided for raw water sampling within the well house piping.

    c. Adequate control switches, etc., for the pumping equipment shall be provided.

    d. A water meter is required to determine water production for each well and the meter shall be located upstream of the well blow-off.

e. The well casing shall extend at least 12 inches above the concrete floor or apron surrounding the well and above the 100-year floodplain elevation.

f. Adequate support for the well pump and drop pipe shall be provided.

g. Each well casing shall be equipped with a drawdown gauge, airline, and appurtenances for measuring the change in the elevation of the water level in the well and a conduit for level transducer from the well to the well house.

h. Wellhead protection shall be provided.

2. Submersible pumps: Where a submersible pump is used, the top of the casing shall be effectively sealed against entrance of water under all conditions of vibration or movement of conductors or cables.

3. Discharge piping: The discharge piping shall be provided with separate means to pump (blowoff) water of unsatisfactory quality to a point away from the groundwater source and toward the stormwater management system, but shall not be directly connected to a sewer. The discharge line shall:

   a. Have control valves located above the pump well house floor,

   b. Be protected against freezing,

   c. Be valved to permit testing and control of each well,

   d. Have watertight joints.

   e. Have all exposed valves protected,

   f. Have erosion protection at the point of waste discharge.

4. Well apron surrounding the well shall meet the following requirements:

   a. Be of good quality concrete with adequate reinforcement,

   b. Be a minimum of six inches in thickness,

   c. Extend a minimum of three feet in all directions from the well,

   d. Slope at least 1/4 inch per foot towards a screened four-inch floor drain to atmosphere.

3.8 Potable Water Storage Facilities

A. General

The materials and designs used for finished water storage structures shall provide stability and durability as well as protect the quality of the stored water. Steel and concrete structures shall follow the most current available American Water Works Association standards concerning steel and concrete tanks, standpipes, reservoirs, and elevated tanks except as may be modified herein.

1. Location of finished water storage facilities

    a. The bottom of ground level reservoirs, storage tanks and standpipes should be placed a minimum of one foot above the 100-year flood elevation.

    b. Buried tanks are not permitted.

    c. The site shall be large enough to permit construction of the facility, maintenance for painting and have a right-of-way to the nearest public road.

    d. All sites shall have electrical service providing a minimum of 208 volts/3 phase, or 240 volts/3 phase where available, service or as required by the Chief Engineer.

2. Obstructions to air navigation

    a. For structures within a 3 nautical mile radius of a public-use airport, the design professional shall be governed by the latest revision of COMAR Paragraph 11.03.05.05; shall contact the MAA Office of Regional Aviation Assistance, telephone 410-859-7064; and shall complete Federal Aviation Administration (FAA) Form 7460-1 as required by Part 77 of the Federal Air Regulations and deliver the completed form to the MAA.

    b. For structures within a 4 nautical mile radius of a military airport submit to the FAA.

3. Safety - The safety of employees shall be considered in the design of the storage structure. As a minimum, such matters shall conform to pertinent building codes, laws, and regulations of the area where the storage structure is constructed.

    a. Ladders, ladder guards, balcony railings, and safe location of entrance hatches shall be provided.

b. Elevated tanks with riser pipes over eight inches in diameter shall have protective bars over the riser opening inside the tank.

c. Ladders must meet the minimum requirements of OSHA 29 CFR Part 1910.

d. Requirements for safety belts, fall protection cables and harnesses shall be included in the specifications.

e. Lighting, pumps and cathodic protection system equipment shall meet the requirements of the National Electric Code. Lights shall be LED.

4. Grading - The area surrounding a ground level structure shall be graded in a manner that will prevent surface water from standing within 50 feet of the structure.

5. Drainage for roof or cover - The roof or cover of the storage structure should be well drained, but downspout pipes shall not enter or pass through the reservoir.

6. Drains

   a. No drain on a water storage structure shall have a direct connection to a sewer or storm drain.

   b. All finished water storage structures shall be equipped with separate drains discharging to the atmosphere. Drainage of finished water storage structures to the distribution system through inlet/outlet piping shall not be allowed.

7. Freezing - All finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which will interfere with proper functioning.

8. Internal catwalk - Every catwalk over finished water in a storage structure shall have a solid floor with raised edges so designed that shoe scrapings and dirt will not fall into the water.

B. Storage Tanks

1. Types of tanks permitted:

   a. Ground level shall be glass-lined steel bolted tanks, with an external level gauge.

   b. Steel, multi-leg tanks shall be used for volumes less than 100,000 gallons.

c. Welded steel, single pedestal spheroid elevated tanks shall be used for 100,000 to 1,000,000 gallons.

d. Composite concrete/steel tanks shall be used for any tank greater than 1,000,000 gallons.

e. All tanks must meet the latest AWWA standards.

f. All tanks shall provide a mounting system for cellular antennas.

g. Exceptions to the above must be given in writing by the Chief Engineer

2. Welded steel tanks - Design shall follow the provisions of AWWA Standard D100, "Welded Steel Tanks for Water Storage" modified as follows:

   a. Tanks should be designed for Seismic Zone 0.

   b. All permanent attachments to the tank shall be made prior to the hydrotest.

   c. The alternative design basis presented in AWWA D100 will not be used unless approved by the Chief Engineer.

   d. Aluminum dome roofs shall be used only by approval of the Chief Engineer.

   e. Tanks shall be provided with remote level sensing and recording equipment with telemetry to the MetCom Operations Office.

   f. The design professional will specify that the Contractor will furnish at a minimum, the information listed in AWWA D100, Forward, Paragraph III.B.1. or III.B.2. as appropriate.

   g. Silt stops are not required for welded steel tanks.

   h. Disinfection shall be performed by the contractor.

3. Factory-coated bolted steel tanks - Design shall follow the provisions of AWWA Standard D103, "Factory-Coated Bolted Steel Tanks" modified as follows:

   a. Tanks shall be designed for Seismic Zone 0.

   b. Coatings for bolted tanks are usually proprietary, and each tank manufacturer is different. The coating shall, therefore, be a consideration in the selection of a manufacturer.

c. Foundations shall be installed by the Contractor.

d. Foundation selection in AWWA D103, Section 11.4, shall be based on site soil conditions.

e. Aluminum dome roofs shall be used only by approval of the Chief Engineer.

f. Silt stops are not required for factory-coated bolted steel tanks.

g. Tanks shall be provided with remote level sensing and recording equipment with telemetry to the MetCom Operations Office.

h. Disinfection will be performed by the contractor in accordance with Section 3.8 E-1 of this manual.

i. The design professional will specify that the Contractor will furnish, at a minimum, the information listed in AWWA D103, Forward, Paragraph IV.

C. Coatings and Linings for Steel Tanks

Selection of coating and lining systems for steel tanks shall follow the provisions of AWWA Standard D102, "Coating Steel Water Storage Tanks", modified as follows:

1. Use outside coating system No. 6 except the dry film thickness (DFT) of the system selected should be a minimum of 9 mils.

2. Use inside coating system No. 2, Paint 2, except the dry film thickness (DFT) of the system selected should be a minimum of 13 mils.

3. Roller application is the preferred method of application.

4. Dry film thickness (DFT) is the preferred method to determine acceptability.

5. The design professional shall specify that the contractor submit an affidavit of compliance that all materials and work comply with the applicable requirements of AWWA Standard D102.

6. The design professional shall list in the project specifications all federal, state and local regulations regarding environmental issues.

7. The design professional shall specify that the contractor will furnish for approval submittals for the coatings manufacturer, application method, materials, and material safety data sheets.

D. Cleaning

All finished water storage facilities shall be cleaned to remove all dirt and loose materials prior to disinfection of the structure. Only potable water shall be used to clean and rinse the water storage facilities. All equipment including brooms, brushes, spray equipment, and workmen's boots shall be disinfected before they are used to clean the storage facilities.

E. Disinfecting and Testing

1. Disinfection - All potable water storage facilities shall be satisfactorily disinfected in accordance with AWWA Standard C652, Chlorination Method 1, using calcium hypochlorite, prior to being placed in operation. The disinfection of the storage facilities shall be repeated until it is determined, by bacteriological testing, that the water is free of coliform bacteria.

2. Testing - Testing of the water following disinfection shall be performed in accordance with AWWA Standard C652.

F. Cathodic Protection

If, at the direction of the Chief Engineer, cathodic protection is required the design shall follow the provisions of AWWA Standard D104, "Automatically Controlled, Impressed Current Cathodic Protection for the Interior of Steel Water Tanks", modified as follows:

1. The design professional shall retain the services of a NACE International (National Association of Corrosion Engineers) certified corrosion engineer to design the cathodic protection system.

2. The design professional shall specify that the contractor shall furnish an affidavit of compliance for all applicable provisions of AWWA D104.

3. The design professional shall use the Type A - IR drop-free potential measurement system.

4. Long life anodes with a minimum life of 20 years shall be specified.

5. The anode suspension system shall be a buoyant spider-type rope system with a design life of 20 years, minimum.

G. Flexible Membrane Lining and Floating Cover Materials

Design shall follow the provisions of AWWA Standard D130, "Flexible-Membrane-Lining and Floating-Cover Materials for Potable Water Storage", modified as follows:

1. The design professional shall specify that the contractor furnish an affidavit of compliance for all installed materials.

H. Distribution Storage

1. Pressure variation - The maximum variation between high and low water levels in finished water storage structures which float on a distribution system should not exceed 30 feet. Large diameter, shallow depth reservoirs are preferable over small diameter, deep depth reservoirs.

2. Level controls - Adequate controls shall be provided to maintain levels in distribution system storage structures at all times.

    a. A telemetering system and recording equipment should be provided, to MetCom's Operation Office, for the transmission and recording of storage levels in the distribution system.

    b. Altitude valves or equivalent controls may be required for subsequent structures on the system.

    c. Overflow, low level and pump malfunction warnings or alarms should be transmitted to the MetCom Operations Office.

3. Pressure tanks - Pressure tanks shall not be used for distribution storage systems. Pressure tanks may be used for small community systems if approved by the Chief Engineer.

4. Hydropneumatic tanks for small systems and ground storage tanks shall be sized to provide a usable volume equivalent to a minimum of two hours of domestic demand