



ENGINEERING DEPARTMENT

UTILITY FACILITIES DESIGN GUIDELINES

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CHAPTER 1

GENERAL PROJECT REQUIREMENTS

1-1 INTRODUCTION

A. Purpose and Intent

The City of Peoria currently has an array of utility facilities in operation with varying operational characteristics. Additional utility facilities and upgrades to existing utility facilities will continue to be proposed for design and construction per the City of Peoria master planning documents. The Utility Facilities Design Guidelines includes design criteria, site improvement requirements, construction requirements and operational characteristics of utility facilities to be owned and operated by the City of Peoria Public Works-Utilities Department.

This document is not intended to be a procedural manual for obtaining permits from the agencies or entities issuing such permits. A list of permits typically required is included in this chapter. Refer to the permit guidelines of each agency for specific requirements of the agency issuing each permit.

The users of this document are anticipated to be:

- *City of Peoria personnel;*
- *State, County, and other applicable agencies;*
- *Private Developers, Developer's Design Consultants;*
- *City Consultants for Capital Improvement Projects (CIP); and*
- *Professional Engineers and Surveyors*

These guidelines apply to utility facilities projects to be owned and operated by the City of Peoria, privately constructed municipal facilities located within the City service area and upgrades to existing facilities.

The content of the Utility Facilities Design Guidelines is intended to be used in such a manner that results in a project that is easily maintainable and operationally cost effective.

B. Design and Construction Standards

Design and construction is to comply with the Utility Facilities Design Guidelines and the applicable sections of other design and construction standards listed below.

- City of Peoria Infrastructure Design Guidelines;
- City of Peoria Supplemental Standard Details;
- M.A.G. Standard Specifications and Details;
- ADEQ Engineering Bulletin Number 10, "Guidelines for the Construction of Water Systems,"
- Any other applicable Government/ Utility/Agency requirements.



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C. Definitions

For purposes of this document, the following definitions apply.

1. *Acceptance*: The process by which the City officially assumes responsibility for a facility. All required design, technical review, inspection, permits, testing, training, and record documents must be completed to the satisfaction of the City prior to acceptance. A Final Letter of Acceptance (FLOA) is issued when all requirements have been met.
2. *Design Engineer*: A design professional licensed in the State of Arizona who is responsible for one or more of the design and construction activities related to the proposed facility including: design reports, engineering plans, specifications, Operation and Maintenance manuals, and Construction Administration.
3. *Utility Facilities*: Water, wastewater and, or reclaimed water project designed, built, or installed to serve a specific function within the City of Peoria. Typical Utility Facilities include: well sites, lift stations, pressure reducing stations, booster stations, reservoirs, water treatment plants, water reclamation facilities, wastewater treatment plants or any combination of the above.

1-2 SUBMITTALS

The design and post design submittals required for Utility Facilities projects are described below.

A. Project Design Submittals:

All Utility Facilities projects are required to provide 30%, 60%, 90%, and 100% design submittals. Submit to Engineering Department, Engineering Division through the Engineering Permit Counter. Each submittal will include a summary of response to comments from the previous submittal. Include all required items for each submittal as partial submittals will not be accepted. In general the Engineering Department will require three (3) paper copies and appropriate electronic (PDF, Word, and AutoCAD) of final deliverables. All professional documents shall be sealed in accordance with the Rules of the Arizona State Board of Technical Registration.

1. 30% Design Documents

Background data, records, and reports will be collected from the City, consultants, and private utility companies in order to support the design. Information collected will include all available maps, records, right-of-way information, GIS data, as-built plans, reports, utility information, geotechnical reports, existing survey information, computer model data, appropriate Master Plan and current updates, the City's General Plan; and other data pertinent to the work to be performed. Provide potholes to determine utility locations on existing facility sites. Require contractors to pothole to verify utility locations after Blue Stake and prior to construction.

Design Concept Report (DCR)

The design concept report will include a conceptual site plan, design criteria for all aspects of the design (pipeline, pump station, reservoirs, treatment process, etc.), process and instrumentation diagrams (P&ID's), conceptual construction cost estimate, operating control strategies, material and instrumentation preferences, site electric power requirements and overall project schedule.



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Topographic and Boundary Survey

The survey is necessary to adequately complete the design, file permit applications, and provide control and reference points for construction layout at the Project Site. As a minimum, property lines, topographic information, location of existing structures, and an American Land Title Association (ALTA) survey are to be included. All survey work must be performed using current City of Peoria datum and benchmark information. Perform necessary aerial and ground survey work to establish horizontal and vertical ground control and to provide topographic information for all existing conditions and features throughout the project limits. Location of existing structures, property lines, drainage ways, and easements will be shown. Existing facilities and structures will be located by survey as necessary to support the design.

Geotechnical Report

A geotechnical investigation including soil borings, rock cores, and auger probing is necessary to adequately characterize the project site, complete the design and estimate earthwork requirements for construction. The report will be sealed by a registered Engineer in the State of Arizona. The following information will be included in the Geotechnical Report:

- Vicinity map of project limits.
- Plot map-showing location of borings.
- Boring logs.
- Detailed descriptions of surface and subsurface conditions.
- Summary of laboratory tests performed and test results. Typical testing should include grain size and distribution, moisture, plasticity, compaction, direct shear, soil bearing capacity, R-value and shrink/swell testing.
- Summary of geotechnical recommendations for backfill and bedding of underground utilities, trench criteria, borrow material gradation requirements, foundation support, bearing capacity, pavement replacement, site development, material stability, slope stability, site preparation, grading procedures, and corrosion potential.

Traffic Impact Study

A traffic impact study will be required for projects that are adjacent to arterial streets that will involve lane closures that could impact local traffic patterns during construction.

Noise Impact Study

A noise impact study may be required for facilities located adjacent to residential areas where it is likely that the City allowable noise levels may be exceeded. Provide sound attenuation as needed.

Drainage Report

A final drainage report will be required according to the requirements of Chapter 4 of the Infrastructure Design Guidelines.

30% Drawings and Specifications

Drawings submitted at this stage are conceptual. Drawings should include the cover sheet, general notes, site plan, and all plan view sheets. Sections and details of significant features should also be included. Specifications should include an outline of all Divisions and sections to be used for the project.



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2. 60%, 90% and 100% Design Documents

60% Drawings and Specifications

Drawings submitted at this stage provide sufficient level of detail of significant project components and systems. Drawings should include the cover sheet, general notes, site plan, and all plan view sheets, sections and details and all profile sheets. Specifications should include all Divisions and sections to be used for the project. There should be sufficient information included to present the design intent clearly.

90% Drawings and Specifications

The 90% drawings and specifications will incorporate the review comments of the 60% documents. Drawings and specifications submitted at this stage are complete and ready for agency and permitting authority review.

100% Drawings and Specifications

The 100% design documents will incorporate the review comments of the 90% submittal.

Basis of Design Report

A Basis of Design Report is required for the 60%, 90% and 100% submittals. At each submittal the Basis of Design Report should be revised based upon refinements in the design. The report should address applicable items listed below and as outlined in the specific Utility Facilities Chapter in this document.

- Facility sizing to account for low flows and development phasing
- ADEQ Bulletin parameters
- Electrical power source
- Hydraulic analysis
- Force main sizing
- Total Dynamic head and system head curves
- Wet-well sizing
- SCADA and control strategy

Engineer's Opinion of Probable Cost (EOPC)

An EOPC is required for the 60%, 90% and 100% submittals. At each submittal the EOPC should be revised based upon refinements in the design. The EOPC is to include items such as land acquisition, permits and fees, engineering services, consulting services, excavation and grading, paving, utilities, utility relocation, equipment, structures, HVAC, mechanical and electrical, miscellaneous appurtenances, contingency, applicable allowances and contractor overhead and profit. Also provide estimated operating costs, maintenance costs, and equipment replacement schedule and associated costs.

Public Involvement Report

A Public Involvement Report is required at the 60% submittal. The City will review site specific and project specific conditions related to each facility to determine what reasonable measures need to be taken to fulfill the City's Public Involvement Requirements. The report should describe the proposed public involvement activities and the scheduling for each activity. Some examples of "Public Involvement" include: Informational Construction Hotlines, project signs, public meetings, door hangers, etc.

Project Schedule

Provide a comprehensive schedule with the 60%, 90% and 100% submittals, which demonstrates the timeline for design and construction of the project. At a minimum, the



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project schedule should identify the following:

- Critical path items (clearly labeled)
- Key project milestones
- Permitting
- Design and construction activities
- Inspections/Testing
- Commissioning / start up
- Training
- Date of Final Completion/City acceptance
- Any other pertinent events that may impact the project, as requested by the City reviewer.

B. Post Design Submittals

1. Operation & Maintenance (O&M) Plan

An O&M Plan will be required at the conclusion of construction activities. The O&M Plan (Manuals) should contain operating, maintenance, and repair information from the manufacturer's submittals to be provided by the project builder. Provide the final narrative description of the operation of the completed facility, and a complete description of the start-up and shut-down procedures. Include vendor cut sheets, software documentation, appropriate graphics, recommended maintenance procedures and spare parts lists to be provided by the project builder.

Paper Copies: Bind the paper copy of the O&M Manual in 3-ring binders indexed with tabs according to major process designations arranged in the sequence of the treatment process. Submit first draft to City for review prior to startup. Submit the review paper copy of the O&M manual to Maricopa County Environmental Services Department (MCESD) for approval no later than two (2) months after startup completion. Submit Final O&M Manual to Peoria no later than (1) month following approval by MCESD. Provide two (2) paper copies in 3-ring binders of the Final O&M Manual.

Electronic Copies: Provide an electronic O&M Manual for the facility utilizing the electronic O&M Manual system selected by Peoria. Provide two (2) complete electronic copies on two (2) sets of disks. Electronic manuals shall be in Adobe Acrobat's Portable Document Format (PDF), and shall be prepared at a resolution between 300 and 600 dots per inch (dpi), depending on document type. Optical Character Recognition (OCR) capture shall be performed on these documents. OCR settings shall be performed with the "original image with hidden text" option in Adobe Acrobat Exchange.

2. Record Drawings/ As-Built Requirements

Comply with Chapter 7 of the Infrastructure Design Guidelines and as described below. A Record Drawing is prepared in CAD and contains the Registrant's revisions to the drawings based on constructed conditions (RFI clarifications, field sketches, and scope additions/deletions) in addition to the construction markings provided by the project builder. Record Drawings represent the combined knowledge of Designer, Contractor and Inspectors for the benefit of the City of Peoria and are to be prepared by the Design Firm of Record. A "Record Drawing" will be used for facility maintenance and future project modifications.



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3. Instrumentation and Electrical Drawings

Provide laminated single side 11" x 17" record drawings of all instrumentation and electrical improvements inside the designated electrical cabinet at each site.

4. Summary of Warranty Information

Provide a summary of all warranty information for each item specially warranted by each vendor. The warranty information should be contained in a separate document that references each item and where the detailed warranty information is located within the O&M Manual. Provide two paper copies in 3-ring binders and two disks containing the electronic version.

1-3 PROJECT PERMITTING

Determine City, state, local, and federal permits and environmental clearances required for the project that will impact the design process. Construction permits are generally secured by the constructor. Prepare the necessary applications and provide technical input as required in securing these permits. Provide Peoria with information regarding the approximate time for agency review of each permit application, and any special requirements that could delay this process (e.g., public hearings). Revise and make the necessary corrections to the permit applications until permit approval is granted. In addition to the permits required by the City of Peoria, the following permits and approvals are typically required to be addressed during design.

A. Maricopa County Environmental Services Department (MCESD)

Prepare, submit and secure the Approval to Construct from MCESD. Conduct a formal review meeting with an MCESD representative and submit pre-final drawings, specifications, and the Basis of Design Report for their review and comments. Respond to review comments from MCESD and incorporate necessary revisions into the drawings and specifications. Prepare and submit a completed application for "Approval to Construct" certificate including final drawings and specifications to MCESD for their approval. Upon completion of construction prepare and submit an Approval of Construction (AOC) application along with all required supporting documentation to MCESD.

B. Cultural Resources

A Class III cultural resources survey of the Project Site may need to be conducted to achieve environmental clearances for the site.

C. NEPA

Prepare documentation to support the preparation of a categorical exclusion level document (letter) under the National Environmental Policy Act (NEPA) process if necessary.

D. Arizona Game and Fish (Endangered Species)

Use the Arizona Game and Fish Department (AGFD) Online Environmental Review Tool to obtain information from the Statewide Heritage Management Database. This database provides species lists that are indicative of current and historic records near the project. Utilize the Environmental Review On-line Tool at <http://www.azgfd.gov/hgis/>.



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E. Arizona Department of Environmental Quality (ADEQ)- SMART NOI-Construction Stormwater General Permit

Refer to the website: <https://az.gov/webapp/noi/smartnoi/menu.do>

F. Clean Water Act Section 404/401 Permitting

When site specific conditions necessitate a 401/404 permit from the Corps of Engineers, a copy of the application/findings and a letter of approval will be required prior to acceptance of the 100% plans.

G. Maricopa County Rule 310 Permit

As applicable, a copy of the 310 permit must be submitted with the SWPPP and Grading Plans prior to issuance of the Grading permit. The Rule 310 permit number must be included on the cover sheet of the SWPPP.

H. United States Fish and Wildlife (USFWS)

Access the United States Fish and Wildlife (USFWS) list to obtain information of federally listed species that may potentially occur in Maricopa County and provide specific project guidance.

I. Native Plant Survey

A Native Plant survey may be necessary if the project activities involve disturbance of undeveloped land. If protected native vegetation exists within the project area, prepare the Notice of Intent to Clear Land for the project through the Arizona Department of Agriculture. Adhere to the requirements of the City of Peoria adopted Desert Lands Conservation Overlay (DLCO) District (Article 14-22B) and Landscape Requirements (Article 14-35). Article 14-22B; This ordinance applies to all lands north of Pinnacle Peak Road that contain a Natural Feature or Protected Native Plant. A Native Plant Preservation Plan must be approved and a Native Plant Permit issued (from the Community Development Department) prior to any plant removals or establishment of the temporary plant nursery.

J. Preliminary Initial Site Assessment

If hazardous materials or spills are suspected, prepare a Preliminary Initial Site Assessment (PISA). Should hazardous materials become identified, such studies escalate into Phase I, Phase II, and Phase III Environmental Site Assessments (ESA). These more intense studies often result in mitigation that could include remediation, before construction begins.

1-4 PUBLIC INVOLVEMENT

Public Involvement is generally required for projects near neighborhoods, or projects that will impact traffic. The approved Public Involvement Report should be followed. Such measures may include handouts, maintaining a hot line and conducting various public information meetings.

Public Information Meetings: Conduct meetings to allow information to be shared in the planning process with the goal to achieve consensus of the design concept. Assist the City in the preparation of visual aids and handouts for the meetings. The general intent of the public meetings will be to receive input from the potentially affected public as to their concerns and desires relative to the acceptability of the design concept and potential construction impact.



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CHAPTER 2

WASTEWATER LIFT STATIONS

2-1 GENERAL INFORMATION

A. Design Criteria

The design criteria for wastewater lift stations in the City of Peoria are to be in conformance with the requirements outlined in Chapter 1 and the following:

1. The approved edition of the Peoria Wastewater Master Plan. Directions for obtaining a PDF copy of the approved edition of the Wastewater Master Plan is on the website at <http://www.peoriaaz.gov/NewSecondary.aspx?id=1443>
2. Site specific conditions that may impact design, construction and operation of the improvements.

B. Major Components

Wastewater lift stations will be required to have the following major components as more fully described in this chapter. Generally regional lift stations have an average daily capacity of one million gallons per day (mgd) and more.

- Completely fenced and secured site
- Above ground Equipment and Enclosure
- Wet well
- By-pass pumping connection
- Standby Power Generation System
- Power Quality Monitoring
- Instrumentation and Control including SCADA, PLC and RTU
- Site security system
- Pre-treatment screening or grinding
- Odor control
- Sound Attenuation
- Bridge Crane for submersible pumps

2-2 TECHNICAL REQUIREMENTS

A. Site Improvements

1. Site Size

The site should be sized to accommodate all improvements with adequate access for maintenance vehicles including liquid vacuum trucks with accessories. The site dimensions should be 50' by 50' or larger as needed.



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2. Access Road/Driveway

An access road or driveway is to be provided from the paved public road to the wet well. Vertical and horizontal alignment must meet the requirements of the City vehicle anticipated to use the site. Slopes greater than 10% will not be allowed. Outside the site wall the paved surface is to be 20' minimum wide concrete pavement to the site gate. Inside site wall provide AC pavement for access and general parking. All pavement used for maintenance vehicles is to be designed for AASHTO H-25 loading. Provide appropriate access, traffic analysis for maintenance and operations.

3. Access Gate

Provide double swing gate and service gate per Peoria Standard Detail PE-102. A slide gate may be required if conditions warrant. All gates must be able to achieve full open position. A site sign meeting City standards will be placed on the gate.

4. Perimeter Fence Wall

All wastewater lift stations should have a site perimeter wall, minimum 8-feet high or higher as security requirements dictate. The wall will be constructed using reinforced concrete masonry units (CMU). The architectural treatment of the wall is to be approved by the City. In general, painting of the wall will be the minimum requirement. Paint applied must be resistant to graffiti and provide easy removal of any damage caused by vandals. Stucco will not be allowed.

5. Site Surfacing

All interior site areas not landscaped are to be paved with 3" thick decomposed granite, 1/4" minus, Madison Gold DG.

6. Landscaping

Provide landscaping compatible with surrounding areas as approved by the City. Landscaping will be required on the outside of the perimeter fence wall. Landscaping shall not be placed within the site unless specifically required by permit.

7. Lighting

Exterior lights are to be provided to adequately light the site for safety, security and operations. The lights are to be shielded to prevent unwanted light from reaching residential areas. Minimum lighting is to be controlled by day/night sensors. Motion detectors will control full site lighting.

8. Potable Water

A 2" potable water service with hose bibs is to be installed at the site near the wet well for liquid vacuum truck access.

9. Electrical Service

Coordinate with electrical service provider for electrical service to site for ultimate lift station capacity. Electrical service to the site is to be underground. Provide for electrical service to pump motors, instrumentation and control, water metering, lighting and future



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control capabilities. A minimum of 20% additional electrical capacity is to be provided for future expansions.

10. Site Security System

Provide a site security system meeting the City Standards. Security components provided must include a minimum of one intrusion key switch located at the main entrance of the site capable of arming and disarming the system. Intrusion sensors must be installed on all gates and equipment doors and motion sensors installed in various locations at the site as required. All sensors once activated should have the ability to activate local and remote alarms. The site should also include a combination of fixed and PTZ cameras with the ability to record site activity on a provided local or remote digital video recorder. The sensors, cameras and recorder must be able to integrate to the existing City of Peoria security system. Locks and other hardware per Public Works – Utilities Department standards should be used to secure all cabinets, doors and gates as needed.

11. Bypass Pumping Connection

Provide an emergency bypass pump connection on the discharge header to include an isolation plug valve and quick disconnect 6" cam lock(s). The piping will include necessary fittings, plug valves and check valves to prevent any backflow to the permanent lift station pumps and be sized to convey maximum daily flows.

12. Pre-treatment

Provide pre-treatment such bar screens, solids grinder as necessary to remove anticipated solids. Pre-treatment equipment will be installed in a separate chamber upstream of the wet well.

13. Site Piping

Color code and label equipment and piping, per Public Works-Utilities Department Standards; include flow direction arrows on piping.

14. Bridge Crane

A bridge crane will be required for submersible pumps in regional lift stations. Other similar permanently affixed lifting devices may be allowed.

B. Force Main

1. Material

Force mains are to be constructed of an approved material per Peoria Standard Detail PE-101.

2. Alignment

Force mains shall have minimum cover of 48" from finished grade. The pipes are to be designed such that a continuous upward slope is achieved from the outlet of the lift station. Combination air/ vacuum valves are required at high points. Force mains shall terminate in a manhole constructed with smooth flow transition. The interior of the



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manhole is to be epoxy lined with an approved product.

3. Surge Analysis

A surge analysis evaluating transient pressures due to water shutoff and startup is to be performed. The force main and its appurtenances are to be designed to withstand transient surge pressures.

C. Wet Well

1. Structure

Wet wells are to be circular pre-cast reinforced concrete or other approved material. Grout Fillets are to be provided in wet well base with 12" radius minimum. The interior of the wet well is to be epoxy lined with an approved product. Provide reinforced concrete top slab with access hatch. Rectangular wet wells may be necessary for larger lift stations. When rectangular wet well is used a bridge crane shall be provided for safely lifting and removing the pumps.

2. Size

The wet well is to be minimum 8' diameter with a maximum depth of 36'. For smaller lift stations a 6' diameter wet well may be acceptable. The wet well operating volume is to be determined based upon the peak hourly flow and minimum hourly flow and the pump manufacturer's recommended start/ stop frequency. The size is to be such that the sewage does not become septic.

3. Appurtenances

Pipe supports/anchors to wet-well wall and guide-rails, lifting cables and all hardware is to be stainless steel 316 or approved alloy.

4. Access Hatch

Provide lockable aluminum access hatch of sufficient size to allow access and removal of all equipment from the wet well. The hatch is to be designed for AASHTO H-20 loading.

D. Equipment

1. Pumps

Three submersible non-clog solids handling pumps are to be installed for regional lift stations, Flyght or approved equal. Grinder pumps may be required in certain applications. For smaller package lift stations of 1 mgd or less capacity two submersible pumps may be installed with a third pump provided as a spare. The lift station is to be capable of delivering the design flow rate with the largest pump out of service. Pump impellers shall rotate clockwise when viewed from the motor end. Pumps are to be equipped with guide-rail and pump discharge elbow assemblies. The pump casing and impeller is to be cast iron with replaceable stainless steel wear rings to maintain sealing efficiency.



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2. Motors

Motors are to be premium efficiency with Class F insulation. All hardware is to be stainless steel. The stators shall include thermal switches to monitor temperature of the windings. Leakage sensors are to be provided to detect the presence of water in the housing. Motors shall operate at 460 volt, 3 phase, 60 Hz, 1780 rpm maximum. Use approved cable glands or NEMA 4X locking cord plugs on the pump motor electrical supply cord for up to 30 amp service to allow removal of pumps without removing cabling from conduit seal. The plugs are to be installed on the cable near the wet well such that if the pump is to be removed, the plug lock can be twisted to enable removal of the pump. Provide dedicated cable supports at top of wet well.

3. Pump / Motor Controls

The motor control center (MCC) shall include solid state starters, variable frequency drives (VFD's) for each installed pump. Provide run time (hour) meter for each motor. Liquid level controls and sensors are to be Endress Hauser Water Pilot pressure transducer and/or Multitrode segmented rod or approved equal. The segmented rod is to be installed inside a 6" diameter PVC pipe (stilling well) attached to the wet well. A programmable logic controller (PLC) meeting City standards is to be provided.

4. Flowmeter

A magnetic flowmeter is to be installed on the pump discharge force main in a vault outside the wet well. The City standard flow meter manufacturer is Endress Hauser.

5. Odor Control

An active odor control system is required. Provide odor control with automatic chemical injection, location and type as approved by City. A passive odor control system may be acceptable initially; however the system is to be designed for a future retrofit of an active system which will be required when residential construction occurs within 300 feet of the lift station.

6. Emergency Shower/Eyewash

Provide emergency eyewash and shower as needed to meet safety requirements. Each system is to have a showerhead, wash valve, flow regulator and all piping including anti-scald device. The system is to be pre-plumbed and pre-wired.

7. Standby Power Generation System

Provide standby power generation system as described in these guidelines. An automatic transfer switch is to be included. Alternatively for non-critical sites a portable generator connection may be allowed.

8. Instrumentation and Control

Provide programmable logic controller (PLC), remote telemetry unit (RTU) and supervisory control and data acquisition (SCADA) systems meeting City standards as described in these guidelines.



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9. *Equipment Housing*

Electrical equipment (PLC, RTU and SCADA, pump MCC) is to be installed in above grade weather resistant enclosures. The housings are to be climate controlled to maintain ambient room temperature of 70° F. Provide sun shades as necessary. A pump-fail light beacon alarm is to be installed on top of the MCC housing.



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CHAPTER 3

PRESSURE REDUCING STATIONS

3-1 GENERAL INFORMATION

A. Design Criteria

The design criteria for pressure reducing stations in the City of Peoria are to be in conformance with the requirements outlined in Chapter 1 and the following:

1. The approved edition of the Peoria Water System Master Plan. Directions for obtaining a PDF copy of the approved edition of the Water System Master Plan is on the website at <http://www.peoriaaz.gov/NewSecondary.aspx?id=1443>
2. Site specific conditions that may impact design, construction and operation of the improvements.

B. Major Components

Pressure reducing stations will be required to have the following major components as more fully described in this chapter. PRV Stations can be designed as above or below ground (grade) facilities. When adequate site area is available above ground installations are preferred due to safety, ease of access, and maintenance. As a result, the proposed layout of PRV Stations will require an evaluation on a case-by-case basis and agreement by the City prior to design development.

- Completely fenced and secured site (above grade station)
- Above ground Equipment and cover (above grade station)
- Underground concrete vault (below grade station)
- Equipment in vault (below grade station)
- Instrumentation and Control including SCADA, PLC and RTU
- Site security system (above grade station)
- Vault security system (below grade)

3-2 TECHNICAL REQUIREMENTS

A. Site Improvements

1. Site Size

The site should be sized to accommodate all improvements with adequate access for maintenance vehicles including crane trucks with accessories. The site dimensions should be 50' by 50' or as needed for above ground stations. For below grade stations the site is to be configured in such a manner as to allow access to the vault and its contents.



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2. Site Location

All stations should typically be located outside of the 100 year floodplain. However, if this is not possible, appropriate measures such as raising the finished grade elevation and providing flood proof electrical and mechanical equipment should be implemented.

3. Access Road/Driveway

An access road or driveway is to be provided from the paved public road to the equipment and or vault. Vertical and horizontal alignment must meet the requirements of the City vehicle anticipated to use the site. Slopes greater than 10% will not be allowed. Outside the site wall the paved surface is to be 20' minimum wide concrete pavement to the site gate. Inside site wall provide AC pavement for access and general parking. All pavement used for maintenance vehicles is to be designed for AASHTO H-25 loading. Provide appropriate access, traffic analysis for maintenance and operations.

4. Access Gate

For above grade stations provide double swing gate and service gate per Peoria Standard Detail PE-102. A slide gate may be required if conditions warrant. All gates must be able to achieve full open position. A site sign meeting City standards will be placed on the gate.

5. Perimeter Fence Wall

All above grade stations should have a site perimeter wall, minimum 8-feet high or higher as security requirements dictate. The wall will be constructed using reinforced concrete masonry units (CMU). The architectural treatment of the wall is to be approved by the City. In general, painting of the wall will be the minimum requirement. Paint applied must be resistant to graffiti and provide easy removal of any damage caused by vandals. Stucco will not be allowed.

6. Site Surfacing

All site areas not landscaped are to be paved with 3" thick decomposed granite, 1/4" minus, Madison Gold DG.

7. Landscaping

Provide landscaping compatible with surrounding areas as approved by the City. For above grade stations, landscaping will be required on the outside of the perimeter fence wall. Landscaping shall not be placed within the site unless specifically required by permit.

8. Lighting

For above grade stations, exterior lights are to be provided to adequately light the work area for safety, security and operations. The lights are to be shielded to prevent unwanted light from reaching residential areas. Minimum lighting is to be controlled by day/night sensors. Motion detectors will control full site lighting. For below grade stations interior lights are to be provided that are water resistant and protected from flooding.



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9. Potable Water Service

For above grade stations provide a standard 1" potable water service to the site. At least one standard hose bib should be provided.

10. Sewer Service

For above grade stations provide sewer stub and 6" sewer service to the site.

11. Electrical Service

Coordinate with electrical service provider for electrical service to site for instrumentation and control, water metering, lighting and future control capabilities. Electrical service to the site is to be underground. A solar power system may be considered for monitoring purposes only and not relied upon for station control.

12. Site Security System

Provide a site security system meeting the City Standards. Security components provided must include a minimum of one intrusion key switch located at the main entrance of the site or underground vault capable of arming and disarming the system. Intrusion sensors must be installed on all gates and equipment doors.

For above grade systems install motion sensors in various locations at the site as required. All sensors once activated should have the ability to activate local and remote alarms. The site should also include a combination of fixed and PTZ cameras with the ability to record site activity on a provided local or remote digital video recorder. The sensors, cameras and recorder must be able to integrate to the existing City of Peoria security system.

Locks and other hardware per Public Works – Utilities Department standards should be used to secure all cabinets, doors and gates as needed.

13. Flood Alarm (below grade stations)

A flood alarm is to be installed in below grade stations to notify operations of a flooding event occurring in the station. Alarm notification is to be by SCADA and an above grade warning light.

14. Site Piping

Color code and label equipment and piping, per Public Works-Utilities Department Standards; include flow direction arrows on piping.

B. Vault (below grade stations)

1. Structure

Vaults are to be rectangular pre-cast reinforced concrete. For large vaults, cast in-place reinforced concrete will be allowed. The exterior of the vault shall be coated with a bitumastic coating suitable for underground burial. Provide reinforced concrete top slab with access hatches as described below. Provide reinforced concrete floor slab.



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2. Size

The largest standard precast vault available is a 24 ft long x 10 ft wide vault. A PRV 8" in diameter with a full-size bypass will fit in a 10 ft wide vault but there will be little room available for operation and maintenance personnel. Design shall include layouts with bypass configurations based upon PRV and associated piping diameters. The vault is to be minimum 8' wide with a maximum depth of 10' to the inside of bottom of the vault.

3. Appurtenances

Pipe supports are required for all major components. Provide anchors to vault wall as required. All hardware is to be stainless steel 316 or approved alloy.

4. Access Hatch

Provide two lockable aluminum access hatches of sufficient size to allow access and removal of all equipment from the vault. In roadways utilize traffic rated manhole lids of appropriate size. The hatches and lids are to be designed for AASHTO H-20 or higher loading as traffic conditions dictate.

C. Equipment

1. Pressure Reducing Valve (PRV)

Provide PRV as manufactured by Bermad, or approved equal. PRV size should be based upon pipeline velocities and corresponding pipe flow rates. A PRV will exhibit damaging cavitation at velocities below 6 ft/sec and, in general, a wide open PRV will only provide a 15 psi pressure reduction across its surface. Design is to be such that the minimum differential pressure is approximately 6 to 7 psi and velocity across the valve is 6 ft/sec to 15 ft/sec during normal operation or as recommended by the manufacturer. This corresponds to a 3:1 pressure reduction across the face of the valve, i.e. 100 psi upstream to 33 psi downstream. In stations where the differential across the valve approaches the 3:1 ratio, a second PRV is to be used in series to help achieve the required differential. Provide anti cavitation trim. For constant flows an orifice plate will be allowed to limit cavitation.

2. PRV Controls

Provide EVA-1 three way electronically controlled valve actuator and three way valve Type 564 as manufactured by BadgerMeter, Inc. Hydraulic solenoid controlled actuators that provide equal control function will be allowed. Provide selectable pressure sustaining function and check valve function.

3. Strainer

An inline strainer is required to prevent debris from fouling the main and bypass PRV and causing valve failure.

4. PRV Bypass

A main PRV bypass will be required for all PRV stations. It will consist of a smaller PRV around the main PRV configuration. PRVs bypass are typically designed to



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accommodate daily low flow conditions, while the main PRV accommodates fire flow or other high flow demands.

5. Flowmeter

A magnetic flowmeter is to be installed with an adequate length of straight run pipe either upstream or downstream to facilitate the connection of a portable ultrasonic meter. The flow meter will be sized for a velocity range to match that of the main PRV. The City standard flow meter manufacturer is Endress Hauser.

6. Pressure Gauges and Tubing

Two pressure gauges are to be located where they can be read near the entrance to the station. All tubing to be 1/4" stainless steel. Compression fittings to be used only at station valves, gauges, and control boxes. General station routing; all stainless steel tubing should be mandrel bent and form-to-fit in the field.

7. Pressure Relief Valve

A pressure relief valve is required when the differential pressure between zones is equal to or exceeds 80 psi. It is to be installed on the downstream side of the main PRV and designed to engage when pipeline pressure exceeds an acceptable limit. It is to be designed to discharge to the ground surface with appropriate drainage capabilities.

8. Isolation Valves

Isolation valves are to be installed for full operator access in above grade stations. Isolation valves should be installed inside the vault for below grade stations. For below grade installations with limited space, they may be installed below grade as a direct bury valve, outside the vault.

9. Air Vents

Below grade installations shall have air vents at opposite ends of the vault. One vent inlet should be within 6" of the ceiling and the other vent inlet should be within 12" of the floor.

10. Instrumentation and Control

Provide programmable logic controller (PLC), remote telemetry unit (RTU) and supervisory control and data acquisition (SCADA) systems meeting City standards as described in these guidelines. PRV stations shall have remote monitoring capability and be designed for future control retrofit capabilities. Provide 30 I/O slots with the following:

- 1) Inlet Pressure Indication (x1)
- 2) Discharge Pressure Indication (x1)
- 3) Pressure Setpoints (High/Low) (x4)
- 4) RTU Enclosure Intrusion Alarm (x1)
- 5) RTU Enclosure Temperature Indication (x1); External thermostat to control AC unit; internal thermostat to run fan (set to minimum)
- 6) Motion Sensor (x1)
- 7) Vault High Water Level Alarm (x1)
- 8) Two (2) Badger Controllers (2 power feeds and 2 telemetry returns)



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- 9) Solenoid Valves (x6) Each Badger equipped with three (3) solenoid valves for reverse flow across the Bermad if needed.

11. *Equipment Housing*

Electrical equipment (PLC, RTU and SCADA) is to be installed within a single above grade weather resistant enclosure. The housing is to be climate controlled to maintain ambient room temperature of 70° F. Provide sun shade as necessary.



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CHAPTER 4

WATER PRODUCTION WELLS

4-1 GENERAL INFORMATION

A. Design Criteria

The design criteria for water production wells in the City of Peoria are to be in conformance with the requirements outlined in Chapter 1 and the following:

1. The approved edition of the Peoria Water System Master Plan. Directions for obtaining a PDF copy of the approved edition of the Water System Master Plan is on the website at <http://www.peoriaaz.gov/NewSecondary.aspx?id=1443>
2. ANSI/AWWA A100, Standard for Water Wells, latest edition.
3. ANSI/AWWA E101, Vertical Turbine Pumps, latest edition.
4. Site specific conditions that may impact design, construction and operation of the improvements.

B. Major Components

City of Peoria Wells will be required to have the following major components as more fully described in this chapter.

- Completely fenced and secured site
- Above ground Equipment and cover
- Well head pump, motor
- Well casing and screen
- Standby Power Generation System
- Power Quality Monitoring
- Instrumentation and Control including SCADA, PLC and RTU
- Site security system
- Chlorination system
- Sound Attenuation

4-2 TECHNICAL REQUIREMENTS

A. Site Improvements

1. Site Size

The site should be sized to accommodate all improvements with adequate access for maintenance vehicles including crane trucks with accessories. The site should be approximately 1/3 acre or larger as needed for facilitating the maintenance of well equipment including a lay down area for pump removal and for future treatment and storage facilities.



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2. Site Location

All sites should typically be located outside of the 100 year floodplain. However, if this is not possible, appropriate measures such as raising the finished grade elevation and providing flood proof electrical and mechanical equipment should be implemented.

3. Access Road/Driveway

An access road or driveway is to be provided from the paved public road to the equipment and or vault. Vertical and horizontal alignment must meet the requirements of the City vehicle anticipated to use the site. Slopes greater than 10% will not be allowed. Outside the site wall the paved surface is to be 20' minimum wide concrete pavement to the site gate from the street. In remote areas an ABC roadway designed for AASHTO H-20 loading may be allowed. Inside site wall provide AC pavement for access and general parking. All pavement used for maintenance vehicles is to be designed for AASHTO H-25 loading. Provide appropriate access, traffic analysis for maintenance and operations.

4. Access Gate

Provide double swing gate and service gate per Peoria Standard Detail PE-102. A slide gate may be required if conditions warrant. All gates must be able to achieve full open position. A site sign meeting City standards will be placed on the gate.

5. Perimeter Fence Wall

All well sites should have a site perimeter wall, minimum 8-feet high or higher as security requirements dictate. The wall will be constructed using reinforced concrete masonry units (CMU). The architectural treatment of the wall is to be approved by the City. In general, painting of the wall will be the minimum requirement. Paint applied must be resistant to graffiti and provide easy removal of any damage caused by vandals. Stucco will not be allowed.

6. Site Surfacing

All interior site areas not landscaped are to be paved with 3" thick decomposed granite, 1/4" minus, Madison Gold DG.

7. On Site Storm Water Detention

On site storm water detention is to be designed with sufficient volume to handle all onsite storm water generated by a 100 year 2 hour storm event. The system shall have an overflow that discharges to a public storm drainage system when the storm water detention system is full or not functioning.

8. Well Purge System

Well purge system is to be designed to handle purge flows for minimum 24 hours. Provide routing calculations with the drainage report. Onsite well purge water should remain on site and not be allowed to discharge to the public storm drainage system under normal operating circumstances. Provide a drywell and or basin for this purpose. The purge water retention system may be combined with the storm water retention system or basin as long as it functions as required. Erosion protection is to be provided on all sides



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of any such basins. Purge water retention is to be designed with sufficient volume to handle 3 to 5 well casing volumes of well purge water or greater volume as necessary for well startup twice per day. As a minimum the well purge volume should be no less than the equivalent of 15 minutes of well pump run time.

9. Landscaping

Provide landscaping compatible with surrounding areas as approved by the City. Landscaping may be required on the outside of the perimeter fence wall. Landscaping shall not be placed within the site unless specifically required by the city.

10. Lighting

Exterior lights are to be provided to adequately light the site for safety, security and operations. The lights are to be shielded to prevent unwanted light from reaching residential areas. Minimum lighting is to be controlled by day/night sensors. Motion detectors will control full site lighting.

11. Potable Water Sample Station

Provide two potable water sampling stations.

- i. Provide sampling station shall be located at the well discharge head.
- ii. Provide sampling station shall be located at the well point of entry (POE) into the distribution system. Contact Utilities Department to determine location.

Service Water Connection: Provide 1" service water connection at the site distribution system discharge pipe.

12. Electrical Service

Coordinate with electrical service provider for electrical service to site for well pump motor, instrumentation and control, water metering, lighting and future control capabilities. Electrical service to the site is to be underground. A minimum of 20% additional electrical capacity is to be provided for future expansions.

13. Site Security System

Provide a site security system meeting the City Standards. Security components provided must include a minimum of one intrusion key switch located at the main entrance of the site capable of arming and disarming the system. Intrusion sensors must be installed on all gates and equipment doors and motion sensors installed in various locations at the site as required. All sensors once activated should have the ability to activate local and remote alarms. The site should also include a combination of fixed and PTZ cameras with the ability to record site activity on a provided local or remote digital video recorder. The sensors, cameras and recorder must be able to integrate to the existing City of Peoria security system. Locks and other hardware per Public Works – Utilities Department standards should be used to secure all cabinets, doors and gates as needed.



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14. Site Piping

Color code and label equipment and piping, per Public Works-Utilities Department Standards; include flow direction arrows on piping.

B. Equipment

1. Well Pumps

Pumps are to be vertical turbine, line shaft barrel, oil lubricated. Pumps shall rotate counter clockwise when viewed from the motor end. Pumps shall meet the applicable requirements of the Hydraulic Institute Standards. The pump shaft is to be type 416 stainless steel, maximum section length of 20 ft. The pump bowl casings are to be class 30 grey iron with bronze bearings. Bowl interiors are to be coated with vitreous enamel. Impellers are to be enclosed cast bronze, pump impellers shall be an approved alloy suitable for the water being pumped, ASTM B148 C958 nickel aluminum bronze or better. All necessary foundation bolts and hardware are to be type 316 stainless steel. Column pipe is to be ASTM A53 Grade B schedule 40. The oil tube is to be ASTM A53 Grade B Schedule 80. Provide 2" diameter sounding tube schedule 40 stainless steel pipe. Provide submersible level transmitter and cable.

2. Motors

Motors are to be premium efficiency with Class F insulation. All hardware is to be stainless steel. The stators shall include thermal switches to monitor temperature of the windings. Motors shall operate at 460 volt, 3 phase, 60 Hz, 1780 rpm maximum.

3. Pump / Motor Controls

The motor control center (MCC) shall include solid state starters and variable frequency drives. Provide run time (hour) meter for each motor. Constant speed drives will be allowed if flow conditions can be maintained efficiently and the well pumps into a storage tank and not directly into the distribution system. A programmable logic controller (PLC) meeting City standards is to be provided.

4. Pump Control Valve (PCV)

Pump control valves, with check valve function are required on the discharge head of all well pumps. Flow control valves may also be required as necessary to regulate flow. Well pumps are required to include PCV's to attenuate surges and check valves to prevent reverse flow.

5. Flowmeter

A magnetic flowmeter is to be installed with an adequate length of straight run pipe either upstream or downstream to facilitate the connection of a portable ultrasonic meter. The flow meter will be sized for a velocity range to match that of the booster station. The City standard flow meter manufacturer is Endress Hauser.



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6. Pressure Gauges and Tubing

Two pressure gauges are to be located on above ground piping where they can be read near the access to the equipment. All tubing to be ¼" stainless steel. Compression fittings to be used only at station valves, gauges, and control boxes. General station routing; all stainless steel tubing should be mandrel bent and form-to-fit in the field.

7. Isolation Valves

Isolation valves (os&y) are to be installed for full operator access to all pumps, PCV's, flow meters and other major equipment.

8. Emergency Shower/Eyewash

Provide emergency eyewash and shower as needed to meet safety requirements. Each system is to have a showerhead, wash valve, flow regulator and all piping including anti-scald device. The system is to be pre-plumbed and pre-wired.

9. Standby Power Generation System

Provide Standby power generation system as described in these guidelines. An automatic transfer switch is to be included. Alternatively for non-critical sites a portable generator connection may be allowed.

10. Instrumentation and Control

Provide programmable logic controller (PLC), remote telemetry unit (RTU) and supervisory control and data acquisition (SCADA) systems meeting City standards as described in these guidelines.

11. Equipment Housing

Electrical equipment (PLC, RTU and SCADA, pump MCC) is to be installed in above grade weather resistant enclosures. The housings are to be climate controlled to maintain ambient room temperature of 70° F. Provide sun shades as necessary.

C. Chlorination System

Provide automatic chlorine feed system that will maintain the appropriate chlorine residual. The system will have the capability to be controlled either manually or automated by setting flow rate, and or residual. The system shall include gas feeder, chlorine detectors, control panel, gas manifold, valves, smart valve(s), residual analyzer, scales and gas mask. The system is to be Regal Model 216 or approved equal. The chlorine feed system shall use potable water from a source providing chlorinated water at a concentration of no more than 5 mg/liter. Residual sample return lines will discharge directly into the top of the onsite reservoir.

A two chamber chlorine building with separate storage area will be required with vehicular access for loading and unloading chlorine cylinders. Where remote analyzers are required provide a separate suitable building. Provide sunshades for vulnerable equipment.



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All leak detectors that have a digital chlorine concentration digital display shall be placed in the chlorine building so that display can be seen and read from the viewing window on the Chlorine Building. For any building that this is not possible, a remote digital display shall be mounted such as it can be viewed from the viewing window.

Underground chlorine piping shall be installed with approved tracer wire and marking tape.

D. Well Casing and Screen

The casing is to be .312 wall thickness, 18" diameter stainless steel grade 304 or 316 depending on water chemistry. High strength low alloy (HSLA) ASTM 606 Type 4, may also be considered for the casing when water chemistry is compatible. The well screen is to be stainless steel. Casing and screen is to be manufactured by Roscoe Moss Company.

Provide Final report per AWWA A100 4.7.11 including plumbness and alignment test and video survey of final well casing installation.



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CHAPTER 5

BOOSTER STATIONS/ RESERVOIRS

5-1 GENERAL INFORMATION

A. Design Criteria

The design criteria for booster stations and reservoirs in the City of Peoria are to be in conformance with the requirements outlined in Chapter 1 and the following:

1. The approved edition of the Peoria Water System Master Plan. Directions for obtaining a PDF copy of the approved edition of the Water System Master Plan is on the website at <http://www.peoriaaz.gov/NewSecondary.aspx?id=1443>
2. ANSI/AWWA E101, Vertical Turbine Pumps, latest edition.
3. ANSI/AWWA D110, Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks, latest edition.
4. ANSI/AWWA D100, Welded Steel Tanks for Water Storage, latest edition.
5. Site specific conditions that may impact design, construction and operation of the improvements.

B. Major Components

Booster stations will be required to have the following major components as more fully described in this chapter. In some instances booster stations will have reservoirs on the same site and be included in the project. Reservoirs will be required when the booster station is located on the pressure zone boundary, the supply water originates in a lower zone or it is located on a well site. Booster stations do not need to be enclosed in a building unless site constraints dictate the need for an enclosed facility. When adequate site area is available non-enclosed installations are preferred due to safety, ease of access, and maintenance. As a result, the proposed layout of booster stations will require an evaluation on a case-by-case basis and agreement by the Engineering Department prior to design development.

- Completely fenced and secured site
- Above ground Equipment and cover (non-enclosed station)
- Building Enclosure (enclosed station)
- Standby Power Generation System
- Power Quality Monitoring
- Instrumentation and Control including SCADA, PLC and RTU
- Site security system
- Chlorination System
- Reservoir (if included)
- Sound Attenuation



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5-2 TECHNICAL REQUIREMENTS

A. Site Improvements

1. Site Size

The site should be sized to accommodate all improvements with adequate access for maintenance vehicles including crane trucks with accessories. The site dimensions should be such that all site components and necessary facility functions are accommodated. It is not uncommon to have sites one to five acres in size. The larger site sizes may be necessary to accommodate water storage reservoirs.

2. Site Location

All stations should typically be located outside of the 100 year floodplain. However, if this is not possible, appropriate measures such as raising the finished grade elevation and providing flood proof electrical and mechanical equipment should be implemented.

3. Access Road/Driveway

An access road or driveway is to be provided from the paved public road to the equipment and or vault. Vertical and horizontal alignment must meet the requirements of the City vehicle anticipated to use the site. Slopes greater than 10% will not be allowed. Outside the site wall the paved surface is to be 20' minimum wide concrete pavement to the site gate. Inside site wall provide AC pavement for access and general parking. All pavement used for maintenance vehicles is to be designed for AASHTO H-25 loading. Provide appropriate access, traffic analysis for maintenance and operations.

4. Access Gate

For above grade stations provide double swing gate and service gate per Peoria Standard Detail PE 102. A motorized slide gate may be required if conditions warrant. All gates must be able to achieve full open position. A site sign meeting City standards will be placed on the gate.

5. Perimeter Fence Wall

All booster station and reservoir sites should have a site perimeter wall, minimum 8-feet high or higher as security requirements dictate. The wall will be constructed using reinforced concrete masonry units (CMU). The architectural treatment of the wall is to be approved by the City. In general, painting of the wall will be the minimum requirement. Paint applied must be resistant to graffiti and provide easy removal of any damage caused by vandals. Stucco will not be allowed.

6. Site Surfacing

All interior site areas not landscaped are to be paved with 3" thick decomposed granite, 1/4" minus, Madison Gold DG, or color as approved.

7. Landscaping

Provide landscaping compatible with surrounding areas as approved by the City.



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Landscaping will be required on the outside of the perimeter fence wall. Landscaping shall not be placed within the site unless specifically required by permit.

8. Lighting

For above grade stations, exterior lights are to be provided to adequately light the work area for safety, security and operations. The lights are to be shielded to prevent unwanted light from reaching residential areas. Minimum lighting is to be controlled by day/night sensors. Motion detectors will control full site lighting. For below grade stations interior lights are to be water resistant and protected from flooding.

9. Potable Water

At least one potable water hose bib connection is to be provided.

10. Electrical Service

Coordinate with electrical service provider for electrical service to site for ultimate booster station capacity. Electrical service to the site is to be underground. Provide for electrical service to pump motors, instrumentation and control, water metering, lighting and future control capabilities. A minimum of 20% additional electrical capacity is to be provided for future expansions.

11. Site Security System

Provide a site security system meeting the City Standards. Security components provided must include a minimum of one intrusion key switch located at the main entrance of the site capable of arming and disarming the system. Intrusion sensors must be installed on all gates and equipment doors and motion sensors installed in various locations at the site as required. All sensors once activated should have the ability to activate local and remote alarms. The site should also include a combination of fixed and PTZ cameras with the ability to record site activity on a provided local or remote digital video recorder. The sensors, cameras and recorder must be able to integrate to the existing City of Peoria security system. Locks and other hardware per Public Works – Utilities Department standards should be used to secure all cabinets, doors and gates as needed.

12. Site Piping

Color code and label equipment and piping, per Public Works-Utilities Department Standards; include flow direction arrows on piping.

B. Building (enclosed stations)

1. Structure

Building design will comply with City of Peoria Building Safety Department requirements as stipulated in the building permit. The structure must provide adequate access to the equipment and piping via garage doors and overhead hatches. Lifting capabilities for larger and heavier equipment is to be provided. Bridge cranes or access to portable cranes meet this requirement. Buildings are to be climate controlled.



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2. Size

The building size will be determined by the design. It should be large enough to house all pumps, piping, controls, electrical equipment, standby engine generator(s), chlorination equipment, SCADA equipment, etc. Some components may be installed in separate structures if approved. There must be adequate room for operation and maintenance personnel to perform maintenance and replacement of equipment.

3. Appurtenances

Pipe supports are required for all major components. Provide anchors to walls as required. All hardware is to be stainless steel 316 or approved alloy.

C. Equipment

1. Pumps

A minimum of two booster pumps are required. An additional small jockey pump may be necessary to maintain low flows. The booster station is to be capable of delivering the design flow rate with the largest pump out of service. Pumps are to be vertical turbine, line shaft barrel. Horizontal split case pumps may be allowed if conditions warrant. Pumps shall rotate clockwise when viewed from the motor end. The pump shaft is to be stainless steel. The pump casing is to be cast iron and the impeller an approved alloy of aluminum bronze or nickel-aluminum bronze. The packing box shall utilize a mechanical seal. Each pump bowl shall have a replaceable stainless steel wear rings to maintain sealing efficiency. Pumps manufactured by Aurora, Grundfos, Peerless, Fairbanks Morse, and National Pump are acceptable.

2. Motors

Motors are to be premium efficiency with Class F insulation. All hardware is to be stainless steel. The stators shall include thermal switches to monitor temperature of the windings. Motors shall operate at 460 volt, 3 phase, 60 Hz, 1780 rpm maximum.

3. Pump / Motor Controls

The motor control center (MCC) shall include solid state starters, variable frequency drives for every pump. Provide run time (hour) meter for each motor. Constant speed pumps will be allowed if flow conditions can be maintained efficiently. A programmable logic controller (PLC) meeting City standards is to be provided.

4. Pressure Reducing Valve (PRV)

Some booster stations include PRV's to allow for water flow from high zones to low zones. Refer to the chapter on PRV's for those requirements.

5. Pump Control Valve (PCV)

Pump control valves, with check valve function are required on the discharge head of all booster pumps. Flow control valves may also be required as necessary to regulate flow. Booster pumps are required to include PCV's to attenuate surges and check valves to prevent reverse flow.



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6. Flowmeter

A magnetic flowmeter is to be installed with an adequate length of straight run pipe either upstream or downstream to facilitate the connection of a portable ultrasonic meter. The flow meter will be sized for a velocity range to match that of the booster station. The City standard flow meter manufacturer is Endress Hauser.

7. Pressure Gauges and Tubing

Two pressure gauges are to be located on above ground piping where they can be read near the entrance to the station. All tubing to be ¼" stainless steel. Compression fittings to be used only at station valves, gauges, and control boxes. General station routing; all stainless steel tubing should be mandrel bent and form-to-fit in the field.

8. Isolation Valves

Isolation valves (os&y) are to be installed for full operator access to all pumps, PRV's, flow meters and other major equipment.

9. Emergency Shower/Eyewash

Provide emergency eyewash and shower as needed to meet safety requirements. Each system is to have a showerhead, wash valve, flow regulator and all piping including anti-scald device. The system is to be pre-plumbed and pre-wired.

10. Standby Power Generation System

Provide Standby power generation system as described in these guidelines. An automatic transfer switch is to be included.

11. Instrumentation and Control

Provide programmable logic controller (PLC), remote telemetry unit (RTU) and supervisory control and data acquisition (SCADA) systems meeting City standards as described in these guidelines.

12. Equipment Housing

Electrical equipment (PLC, RTU and SCADA, pump MCC) is to be installed in above grade weather resistant enclosures. The housings are to be climate controlled to maintain ambient room temperature of 70° F. A single enclosure housing all components is preferred. Provide sun shades as necessary.

D. Chlorination System

Provide automatic chlorine feed system that will maintain the appropriate chlorine residual. The system will have the capability to be controlled either manually or automated by setting flow rate, and or residual. The system shall include gas feeder, chlorine detectors, control panel, gas manifold, valves, smart valve(s), residual analyzer, scales and gas mask. The system is to be Regal Model 216 or approved equal. The chlorine feed system shall use potable water from a source providing chlorinated water at a concentration of no more than 5 mg/liter. Residual sample return lines will discharge directly into the top of the onsite reservoir.



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A two chamber chlorine building with separate storage area will be required with vehicular access for loading and unloading chlorine cylinders. Where remote analyzers are required provide a separate suitable building. Provide sunshades for vulnerable equipment.

All leak detectors that have a digital chlorine concentration digital display shall be placed in the chlorine building so that display can be seen and read from the viewing window on the Chlorine Building. For any building that this is not possible, a remote digital display shall be mounted such as it can be viewed from the viewing window.

Underground chlorine piping shall be installed with approved tracer wire and marking tape.

E. Reservoir

Provide below grade or partially buried pre-stressed concrete reservoir. Steel reservoirs will be allowed in remote areas where below ground tanks are not feasible. The reservoir sizing is to be as shown in the applicable master planning document.

1. Below Grade Reservoir

Provide prestressed concrete tank meeting the requirements of AWWA D 110 Type III. The tank will be provided with an active mixing system suitable for the tank volume to reduce or eliminate disinfection byproducts (DBP). The tank will be provided with separate filling line, overflow pipe, emptying line and a drainable sump. Provide appropriate screened air vents.

2. Above Ground Steel Tank

Provide welded steel tank meeting the requirements of AWWA D 100. The tank will be provided with an active mixing system suitable for the tank volume to reduce or eliminate disinfection byproducts (DBP). The tank will be provided with separate filling line, overflow pipe, emptying line and a drainable sump. Provide appropriate screened air vents. Provide an impressed current automatic cathodic protection system meeting the requirements of AWWA D104. Passive systems meeting the requirements of AWWA D106 with automatic control may be allowed if equivalent performance can be demonstrated.



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CHAPTER 6

INSTRUMENTATION AND CONTROL

6-1 GENERAL INFORMATION

A. Design Criteria

The design criteria for programmable logic controllers (PLC's) remote telemetry units (RTU's) operator interface terminal (OIT) and the Supervisory Control and Data Acquisition (SCADA) system in the City of Peoria are to be in conformance with the requirements outlined in the other Chapters in these guidelines that identify SCADA requirements and the following:

1. Applicable NEMA Standards.
2. Applicable IEEE Standards.
3. Site specific conditions that may impact design, construction and operation of the improvements.
4. 2005 City of Peoria SCADA Programming Standards as periodically updated.

B. Overview

1. Standard Power System
2. Reservoir Fill Valves
3. Well Pumps
4. Booster Pumps
5. Storage Reservoirs
6. Pressure Regulator Valves
7. Surge Tanks
8. Programmable Logic Controller
9. Power Monitoring
10. Intrusion Fire Protection
11. Chlorination System
 - Well pumps that fill a reservoir
 - Well pumps that pump directly into distribution
 - Reservoir sites
 - Metering sites
 - Booster pumps station sites
 - PRV sites
12. Provide sunshades for all exposed instruments and digital LCD gauges.

C. Major Components

A listing of typical major components required at remote sites is shown below. The list is shown in part to establish minimum requirements, subject to update as the City renews its standards. All components shall meet current City standards.



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1. PLC/RTU
 - Modicon M340 automation platform
 - Unity Pro XL software with Ifix embedded graphic screens
2. Fiber Optics. Connect to existing City network if available within 500 feet of site.
3. Radio
 - iNET-II radio communications and Unity Pro-software.
 - Provide a radio path survey to verify adequate communication for sites that rely on radio communications.
4. Network Switch
 - Cisco Industrial Ethernet 3000
5. Communications Protocol. Modbus digital.
6. OIT. Technical Marketing Manufacturing Inc. (TMMI) model iFIX XPE used to monitor and control electrical and process equipment.
7. Outdoor Video Security Cameras
 - IQeye Sentinel Alliance Pro H.264 Megapixel IP Dome Camera
 - IQeye Sentinel Megapixel Outdoor IP Camera
8. Outdoor Motion Sensors
 - Pyramid XL High Security Version
9. Digital Video Recorder
 - DVR. Echo 67 FW with DVI-D.
10. Key Switch including a sounder and strobe light at each site.
11. Power Quality Monitoring (PQM)
 - Provide power quality monitoring per IEEE Standard 1159-1995. IEEE Recommended Practice for Monitoring Electric Power Quality.
12. Flow Meter
 - Endress Hauser Promag 53W with Modbus RS 485 output board and Ethernet Gateway.
13. Well lineshaft oil lubrication controller
 - Dripmaster EDD-4C as manufactured by Hoffman & Hoffman.



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CHAPTER 7

STANDBY POWER GENERATION SYSTEM

7-1 GENERAL INFORMATION

A. Design Criteria

The design criteria for standby power generation systems in the City of Peoria are to be in conformance with the requirements outlined in the other Chapters in these guidelines that identify standby generators and the following:

1. Applicable NEMA standards.
2. Site specific conditions that may impact design, construction and operation of the improvements.

B. Major Components

1. Standby Power Generation system; standby diesel/ natural gas generator, skid mounted with vibration isolators, Rated full electrical load plus 30% motor starting allowance
2. Automatic transfer switch (ATS) with phase detector,
3. Approved sound attenuated weather resistant enclosure; max 75 dBA as measured 27' from the sound enclosure and max 65 dBA as measured 50 feet from the property line. The enclosure will have at least three access hatches to allow maintenance of major components.
4. Critical grade silencer to meet the above sound attenuation requirements, constructed of stainless steel, installed inside the enclosure.
5. Diesel: Base mounted diesel fuel storage tank with leak detection, fuel volume sensor, compatible fuel port and vents, sized for 12 hours usage at full rated load.
6. Natural Gas: As approved by City.
7. Battery rack with starting batteries, cable and charger.
8. Digital control panel integrated with site PLC and SCADA. Include intrusion alarm, engine hours, fuel level, other operating functions and transfer switch position.