



# Mechanical Design Standards

## I. Background and Overview

- A. The City's Program Standards and Procedures (PSP) are intended to be used in conjunction with the data contained in related standards and procedures. They are not intended to be used as stand alone documents. It is the responsibility of the Designer to become familiar with all the PSP documents and comply with the criteria set forth as a whole.
- B. The Mechanical Design Standards was developed to provide consistency in design criteria, materials, and products for mechanical systems. This Mechanical Design Standards is divided into the following sections:
  - II. General Requirements for Piping Systems
  - III. Valves
  - IV. Pumps
  - V. Heating Ventilating, and Air Conditioning (HVAC) Systems
- C. Piping Systems. The Designer is referred to the Master Guide Specifications for pipe materials, pipe coatings and labeling, pipeline cleaning and testing, and pipe installation requirements during construction.

## II. General Requirements for Piping Systems

- A. Pipe shall be shown on the drawings as follows:
  - 1. All piping systems shall be shown by 3-D pipe system schematic.
  - 2. Piping systems three inches and larger shall be shown by dimensioned layout of pipe runs on the drawings. Dimensions shall be shown for all pipe appurtenances
  - 3. Piping systems smaller than three inches shall be shown by:
    - a. General routing shown on the drawings with dimensions provided where the location is not intended to be determined during construction. Dimensions shall be provided at a minimum for:
      - 1) Pressure reducing valves.
      - 2) Backflow preventers.



- 3) Control valves.
- 4) Instruments.
4. All pipes shall be identified on the drawings using identification scheme set forth in Process Identification, Finishes and Labeling Design Standards.
5. All instruments located in pipe runs, regardless of pipe size, shall be shown and located to scale by dimensions on the drawings.
6. Connection details for all instruments and pipe appurtenances shall be detailed on the drawings for the specific instrument or appurtenance installed. Connection requirements for instruments and pipe appurtenances shall not be left to the Contractor to determine or coordinate.
7. All pipe appurtenances shall be drawn to scale. Layout shall accommodate all manufactures listed in the specifications.
8. Locations in pipe racks or supports for future pipes and for open spaces shall be shown and noted on the drawings.
9. Devices, hooks, eye bolts, etc. as required to lift and hoist pipe and pipe appurtenances shall be located and dimensioned on the drawings or included in a standard plan.
10. Pipe fittings as required for cleaning, flushing, and pressure testing of process pipe runs shall be shown on the drawings for pipes four inches and larger. Fitting requirements shall not be left to the Contractor to determine or coordinate.
11. Flanges for piping and valves shall be coordinated to ensure that all flanges will bolt together. The following flanges have the same diameter and drilling pattern even though the pressure ratings differ:
  - a. ANSI/AWWA C110/A21.10
  - b. ANSI/AWWA C115/A21.15
  - c. ANSI/AWWA C207, Class D and Class E
  - d. ANSI/ASME B16.1, Class 125
  - e. ANSI/ASME B16.5, Class 150



12. Insulated flanges or insulating mechanical couplings shall be used to electrically isolate portions of pipelines where cathodic protection may be installed or where periodic monitoring of corrosion is required.
  - a. Locations of insulated flanges and insulated mechanical couplings shall be indicated on the drawings.
  - b. Insulated mechanical couplings shall not be used without permission from the City Project Manager due to installation and maintenance difficulties.
  - c. For mechanical couplings, galvanized middle rings shall be used when pipe is buried and cannot be repaired or when requested by City Project Manager. Painted middle rings shall be used for all other work including interior locations and concrete encased piping.
  
13. Selection of pipe materials:
  - a. Pipe materials shall be as set forth herein in Table 2 with the information in Table 2 used to develop the Pipe Schedule in the Construction Contract Documents.
  - b. Pipe materials for services not identified in the Master Guide Specifications shall be selected by the Designer and identified to the City Project Review Team for comment thereon.
  - c. Pipe ends shall be as set forth in Table 2 with the information in Table 2 used to develop the Pipe Schedule in the Construction Contract Documents. Any deviation from the information in Table 2 shall be identified to the City Project Review Team, e.g., all ductile iron pipe shall be grooved with a flanged coupling only used with valves and appurtenances or with approval of the City Project Manager.
  
14. Pipe routing:
  - a. Pipe runs between buildings or facilities shall be routed in utility tunnels or pipe chases unless an exception is granted by the City Project Manager.
  - b. The Designer shall identify all pipe that is proposed to be buried to the City Project Review Team for approval. All buried pipe shall be routed in dedicated pipe corridors. Pipe marker tape shall be provided as indicated in the Master Guide Specifications.
  - c. Pipe runs within buildings shall be exposed and shall be routed in a uniform manner providing for a “clean” appearance and layout.
  - d. Only non-pressurized floor drains may be routed beneath buildings or facilities. No pressure piping shall be routed under building foundations.



- e. All floor drains shall be capable of being cleaned.
  - f. Pipes routed beneath floors shall be designed for access by demolition of a portion of the floor slab; they shall not be encased, but shall be routed beneath the slab and separate from the concrete floor slab.
  - g. Piping for similar systems shall have similar pipe arrangements, e.g., pumps installed in a RAS pump station should all have similar pipe arrangements at each pump to the greatest extent possible.
  - h. Minimum clearance between the pipe fitting, pipe wall, or pipe appurtenance and the floor shall be 12 inches.
  - i. Pipes within personnel access corridors or working areas shall have a minimum clearance from the bottom of the pipe, pipe fitting, or appurtenance to the floor of 7'-6". Designer shall reference the Life Safety and Maintenance Access Design Standards for access corridor requirements. Access corridors shall be shown and dimensioned on the drawings along with requirements that corridors shall remain unobstructed.
  - j. Pipes running parallel to each other and pipes crossing one another shall have sufficient clear space between them to allow easy removal of all pipe, pipe fittings, instruments, and pipe appurtenances. The requirement to verify that adequate room is provided is the responsibility of the Designer and shall not be left to the Contractor to coordinate.
  - k. Pipes shall be routed such that all instruments and appurtenances (check valves, relief valves, regulating valves, solenoid valves, etc.) are accessible at a height of not more than 6'-0" from a floor surface or an access platform. This requirement does not apply to plug or butterfly valves; plug and butterfly valves may be located in accessible overhead locations.
  - l. Isolation valves and/or zone valves shall be provided to facilitate maintenance of piping runs and pipe appurtenances. A valved vent and drain shall be provided for each pipe run between isolation valves.
  - m. Vents and drains shall be installed for every pipe run that can be isolated and for every appurtenance for maintenance. The intent of the design shall be to provide isolation of appurtenances, draining of the pipe run that is isolated, and easy removal of the appurtenance for maintenance.
15. Pipe penetrations:
- a. All pipes passing through all new walls or ceilings shall be in wall sleeves as shown in the Drawing Library.
  - b. All pipes passing through all existing walls or ceilings shall be placed in a wall sleeve appropriate for the type of wall construction. The annular space



between the pipe and wall sleeves shall be filled with material appropriate for the separation of room classifications.

- c. It shall be the responsibility of the Designer to assure that all penetrations through existing structures do not pass through existing services or structural building components without detailing requirements for modifying the existing services or building components as needed to pass the pipe through the wall, floor, or ceiling. Designer shall specify coating ends of exposed reinforcing where exposed for pipe penetrations.
- d. For existing building elements that must be cored, it is required that the Designer will investigate the area using x-ray or other non-destructive method to locate reinforcing and conduit(s). Locating reinforcing and conduits shall not be the responsibility of the Contractor.

16. Pipe and device supports:

- a. Supports shall be designed for movement from seismic loads (Seismic Zone 4), thermal loads, pressure testing. See Structural Design Standards and Building Finishes and Signage Design Standards for further details on structural and coating requirements.
- b. All vertical and horizontal supports for pipes four inches and larger shall be designed, detailed, and located on the drawings.
- c. Designer shall specify and identify support spacing, and provide typical details for vertical and horizontal pipe supports for pipes smaller than four inches. Specifications shall provide criteria for Contractor to select the appropriate pipe support and spacing. The documents shall not require design of the support system by the Contractor.
- d. Pipe supports shall be selected from those shown in the Drawing Library.
- e. Vertical pipe supports shall be as follows:
  - 1) Pipes shall be supported within pipe racks in utility tunnels, buildings, and chases to the greatest extent possible.
  - 2) Pipes not in utility tunnels, pipe racks, or chases that have a clearance between the pipe and floor of 6'-0" or less shall be supported from the floor.
  - 3) Pipes not in utility tunnels, pipe racks, or chases that have a clearance between the pipe and floor greater than 6'-0" shall be hung from an overhead ceiling or support structure.



- 4) All pipes supported from the floor that are over four inches diameter shall be supported using adjustable pipe supports. Adjustable pipe supports shall be as shown in the Drawing Library.
  - 5) Pipe racks shall be sized for all anticipated future pipes plus an allowance for additional pipes equivalent to the following. Spare space for the future pipes shall be nearest to the access corridor.
  - 6) For pipe racks containing at least one six-inch or larger ductile iron pipe, allow for all future planned pipes and two 12-inch diameter ductile iron pipes.
  - 7) For pipe racks containing four-inch or smaller pipes, allow for all future planned pipes and two eight-inch ductile iron pipes.
  - 8) Pipe racks shall be designed so that all front legs (legs facing access corridor) are removable to allow maintenance of pipes in the rack. The racks shall be designed so that they support the load when any one front leg is removed.
  - 9) Joints for pipe racks shall be designed for the full load capacity of the rack members; not just for the loads from the pipes supported therein.
  - 10) Pipe racks shall be arranged such that every pipe in the rack is readily accessible for removal and/or in-line maintenance. This applies to the pipe and all instruments and other pipe appurtenances that are part of the piping system.
- f. Horizontal pipe supports shall be provided as required by the design. Horizontal pipe supports shall be designed and located to allow easy access for removal and/or in-line maintenance of pipes and pipe appurtenances. This applies to the pipe and all instruments and other pipe appurtenances that are part of the piping system.
17. Corrosion protection:
- a. Dielectric couplings or insulated flange kits shall be used to isolate all dissimilar pipe materials in a pipe run.
  - b. Buried pipe shall have the following corrosion protection unless otherwise determined by soil testing. The intent of the listed corrosion protection requirements is to provide protection of buried pipes in well graded sands and gravels. Pipeline continuity shall allow for a cathodic protection system to be installed in the future if required due to hot soils or stray currents. The Designer shall test soils during final design to confirm that the required level of corrosion protection is adequate.
  - c. Buried ductile iron pipe shall have the joints bonded, shall be placed in polyethylene sleeves, and shall have test stations connected thereto.



- d. Buried steel pipe 18 inches and larger shall be cement mortar coated with joints coated in the field.
- e. Buried steel pipe smaller than 18 inches shall be tape coated.
- f. Buried copper pipe shall not require corrosion protection.

18. Pipe joint restraint:

- a. Pipe systems exposed to view shall have joint restraints as required by the piping system design.
- b. All buried pipe shall have restrained joints. Restrained joints shall be as set forth in the Master Guide Specifications for the applicable pipe material and service.
- c. Thrust blocks shall not be used.

19. Pipe labeling and color shall be as set forth in the Process Identification, Finishes and Labeling Design Standards. The Designer shall provide a schedule in the construction drawings that shows pipe labeling and color requirements.

20. Design shall limit the need for freeze protection when possible. Where required, freeze protection shall be designed for longevity with properly designed pipe supports with pipes separated adequately for installation of insulation and protective jacket. Also, piping systems should allow for drainage of the lines during winter months.

B. Process Piping:

- 1. Process piping for all services shall be no less than four inches.
- 2. Pipes for primary, waste activated, thickened waste activated, return activated, digested sludge, and grit piping shall not be smaller than six inches.
- 3. Entry ports and removal ports for pipe pigs shall be as shown on the details in the Drawing Library.
- 4. Where appropriate, sludge and scum pipe runs shall allow hot sludge or hot water to be circulated through the piping for cleaning.
- 5. Hot water for flushing/cleaning pipes shall be provided for all sludge and scum piping runs.
- 6. Thermal expansion should be considered when designing hot water or sludge piping.



7. An expansion joint or dismantling joint shall be installed at every pump suction and discharge piping connection to allow removal of piping for pump maintenance.
8. Flanged coupling adapters shall not be installed ahead of instruments. These should be located downstream of instruments, outside the limitations recommended by the manufacture.
9. For pipes six inches and larger, connections shall be as follows:
  - a. Connections smaller than four inches shall be made by using a pipe saddle.
  - b. Connections four inches and larger shall be made using fabricated pipe fittings.
10. Sample taps and sinks shall be provided for process pipe runs as required. Sample taps and sinks shall be as shown on the details in the Drawing Library. Sample sinks shall have W2 plant water for back flushing sample pipes and cleaning sample sinks.
11. Sample sinks shall not be piped or provided with potable water fixtures, sample and potable water sinks shall be separate.

C. Chemical Piping:

1. Chemical pipes shall not be buried.
2. Chemical pipes shall be routed in secondary containment areas to the greatest extent possible.
3. Plastic pipe for hazardous or highly hazardous chemicals that are routed outside secondary containment areas shall be double walled for containment.
4. Chemical pipes shall be routed such that leaks will not damage other pipes, equipment, or people.
5. Double walled containment pipe shall be sloped to drain into a secondary containment area. Leak detection and alarms shall be provided for chemical piping.
6. Chemical pipes for reactive chemicals shall not be routed parallel to one another.
7. All joints in plastic pipe runs shall be restrained.
8. Allowance for expansion and contraction in plastic pipe runs shall be provided by expansion joints; not by using pipe loops. Expansion joint locations shall be



determined by the Designer and shown on the drawings (applies to all pipe sizes).

D. Building Service Piping:

1. A bell-up, not smaller than four inches, shall be located adjacent to every pump, sample sink, valve with relief vent, or other piece of equipment having a seal water or waste discharge. Bell ups shall be piped to the floor drains and discharged to a sump.
2. Where applicable all buildings and facilities shall have floor drains that drain to a sump except for those containing sludge piping.
3. Buildings and facilities containing sludge piping shall have drain gutters as shown on the details in the Drawing Library. Drain gutters shall discharge to a sump.
4. Building and facility sumps shall have a duplex sump pump system.
5. Building and facility sumps shall be sized to handle seal water flows, washdown water at a minimum rate of 50 gpm, and other applicable process or sample water flows.
6. Building sumps shall be covered with open, non-slip grating.
7. All buildings and facilities shall be provided with hose faucets on the W2 plant water system for washdown. Both 1-1/2-inch and 3/4-inch hose faucets shall be provided. The number and location of hose faucets shall be coordinated with the City Project Team and the locations thereof shown on the drawings.

E. Air Supply Piping.

1. Air supply piping shall be provided with sectionalizing valves and valved air inlet connections for isolation of portions of the system for periodic testing.
2. Air piping shall be sized for the service conditions with the following minimum sizes:
  - a. Air signal: 1/4-inch outside diameter
  - b. Power air: 1/2-inch outside diameter
  - c. Air supply: 1/2-inch outside diameter
  - d. Bubbler drop pipes: 3/4-inch (Stainless Steel)
  - e. Buried piping: 3/4-inch



### III. Valves

A. The Designer is referred to Master Guide Specifications for: valve types, coatings and tagging, pipeline cleaning and testing, and installation requirements during construction.

B. General:

1. Valves shall be easily accessible from floors or access platforms to the greatest extent possible. Only plug and butterfly valves may be located overhead, above the floor by more than 6'-0".
2. Valves shall be provided in all pipe runs to isolate instruments, pipe appurtenances, and pipe runs for maintenance purposes.
3. Layout of valves shall allow sufficient space for maintenance of valve operators.
4. Valve installation shall be shown in outdoor above grade piping with the valve shown to be laid with the shaft horizontal (operator on the side of the valve) with a properly designed support for the valve operator, if required. Supports shall be shown on the drawings.
5. Valve installation shall be shown for sludge service with the valve shown to be installed per the manufacturers recommendations to reduce build-up of sludge in the valve body.
6. Valves placed in bi-directional pipes shall be capable of providing shutoff in both directions. It shall be the responsibility of the Designer to check shutoff head requirements against valve characteristics.
7. Designer shall consider operating, surge, and test pressures when selecting valve pressure requirements.

C. Valve Selection:

Designer shall select valves as required for the service. Valve manufacturer's shall be as set forth in the Master Guide Specifications. Valves shall be as follows with any deviation from this standard identified to the City Project Review Team for comment thereon.

<u>Service</u>	<u>Valve Type</u>
Primary Sludge (PS)	Plug valve
Waste Activated Sludge (WAS)	Plug valve
Thickened WAS (TWAS)	Plug valve



<u>Service</u>	<u>Valve Type</u>
Return Activated Sludge (RAS)	Plug valve
Digested sludge	Plug valve
Plant water service:	
two-inch and smaller	Ball valve
four-inch and six-inch	Resilient seated gate
Larger than six inches	AWWA butterfly valve
Potable water services:	
four-inch and smaller	Resilient seated gate
Larger than four inches	AWWA butterfly valve
Chemical service	Selected by Designer
four-inch and smaller	True union ball valve
Larger than four-inch	Selected by Designer
Sodium hypochlorite, all sizes	Diaphragm valves
Air service	Selected by Designer
Gas service	Plug valve

2. Process valves four inches and larger shall be flanged.

D. Valve Operators:

1. Where automated, control valves shall have pneumatic operators of the type set forth in the Master Guide Specifications. Hydraulic and electric operated actuators shall be identified for review by the City Project Review Team.
2. Valve operators shall be drawn to scale on the drawings. Operator drawn shall be for the largest operator specified where Contractor may select from multiple manufacturers or for the operator to be provided when a particular manufacturer is specified.
3. Designer shall place valves such that adequate space is provided on all sides of the operator for maintenance. Minimum space requirement shall be 50 percent of the operator size.
4. Valve operators shall be supported separately from the piping system unless the pipe is specifically designed and supported for loads imposed by the valve operator.



E. Manual Valve Operators:

1. Valves located 4'-0" and less above floors in horizontal pipe runs shall have the valve operator located vertically above the valve, i.e., valve shaft is vertical with operator over the top of pipe.
2. Valves located above 4'-0" above the floor in horizontal pipe runs shall have the valve operator located to one side of the pipe, i.e., the valve shaft shall be horizontal with the operator on the side of the pipe.
3. Supports for all valve operators shall be designed, detailed and shown on the drawings.
4. Chain wheels shall be provided for valves located 6'-0" or higher above the floor surface.
5. Chain loops for chain wheel operated valves shall be shown on the drawings for coordination of building layouts. Chains shall not hang in personnel access or work areas.
6. Plug and butterfly valves four inches and larger shall have gear type manual operators with hand wheels or chain wheels (no lever operated valves).

F. Automated Valve Operators:

1. The orientation of all valve operators shall be shown on the drawings to scale and the position of the local controls and manual handwheel locations noted.
2. Every automated valve shall be capable of being isolated in a piping system by manually operated valves (upstream and downstream) to allow removal of the automated valve for maintenance.

## IV. Pumps

A. The Designer is referred to Master Guide Specifications for pump specifications, painting and tagging, and installation requirements during construction.

B. General:

1. Redundancy shall be achieved through installed equipment or spare parts and should meet regulatory requirements. Redundancy provisions shall be selected by the Designer and identified to the City Project Review Team for comment thereon. Redundancy shall not require a back-up pump for each pump in a system, rather a means to provide the capacity needed. Manifold piping is desired in lieu of cross connections for pumping systems.
2. Automated controls including automated start and automated valve positioning for starting installed redundant pumps shall be reviewed for each installed pump during design with the City Project Review Team.



3. Redundant pumps shall have the same controls as the primary pump, e.g., if the primary pump has a flowmeter for flow pacing the back-up pump shall have a flowmeter and be flow paced also.
4. The Designer shall be responsible for determining pump maintenance requirements including clear space, lifting, movement, and access and making provisions therefor as needed. Devices, hooks, hoisting systems, eye bolts, etc. as required to lift and move pumps and pump appurtenances shall be shown on the drawings.
5. A clear space of not less than 3'-6" shall be provided around all sides of pumps and associated equipment for access by plant staff. Additional space shall be provided if required to maintain the pump or equipment, as required by the manufacturer. The Designer shall be responsible for checking maintenance requirements and providing the space required for maintenance activities.
6. Clear space around equipment shall not have pipe runs located therein with the exception of pump suction and discharge piping.
7. Pumps shall be set on bases as shown in the Drawing Library.
8. Pump motors shall be located in a horizontal arrangement with the pump, i.e., there shall be no vertical motor mounts over pumps.
9. Mechanical designer shall establish requirements for pump motor size, electrical designer shall prepare motor specifications.
10. Pump and motors shall be provided by the pump manufacturer. Motor requirements, including those for Variable Frequency Drives (VFD) applications, shall be specified by the Designer. Motor specifications will be in the electrical division and coordinated by the Design Team with the pump specification. Submersible motors shall be specified in the equipment specification. It shall not be the responsibility of the Contractor to coordinate motor and VFD requirements.
11. Net positive suction head shall be based on application of pumps at 150 feet above mean sea level.
12. Flow indication shall be provided for each pump.
13. Pressure gauges shall be provided at each pump to indicate suction and discharge pressures. Gauge connections to piping to be as indicated in the standard details.
14. Pump field painting shall be as set forth in the Process Identification, Finishes and Labeling Design Standards.



- C. Pump Selection:
  - 1. Manufacturer shall be selected by the Designer and identified to the City Project Review Team for comment thereon. Pump manufacturer's shall be as set forth in the Master Guide Specifications.
  - 2. Mechanical seals shall be used with the exception that packed seals shall be used on progressive cavity pumps.
  - 3. Guards shall be provided for all rotating shafts, including areas by seals.
- D. Building or Facility Sump Pumps:
  - 1. A duplex sump pump arrangement shall be provided for every building or facility.
  - 2. Sump pumps shall be as set forth in the Master Guide Specifications.
  - 3. Sump pumps shall be sized for the building or facility served and the sump volume.
  - 4. Wet wells shall be sized so that sump pumps do not short cycle during routine wash down of buildings or facilities.

## V. Heating, Ventilating, and Air Conditioning (HVAC) Systems

- A. To meet life safety requirements, all areas shall be ventilated as required by the governing building codes.
- B. Designer shall be responsible for determining air flow requirements and air flow patterns and air balance requirements, i.e., ventilating and/or exhaust locations and air flow between building floors and/or areas.
- C. All pipe corridors/tunnels or below grade facilities with personnel access shall have power ventilation.
- D. Air conditioning shall be provided for electrical and control rooms.
- E. All air conditioning units shall have an economizer and appropriately sized conditioning units shall be provided for "best" efficiency. Electrical rooms may be considered separately.
- F. HVAC equipment shall not be so oversized that it limits their ability to be energy efficient.



- G. Hot water, natural gas, and/or electricity shall be used for heating as determined during the design. The Design Team shall determine heat requirements and identify possible sources to meet the heating requirements to the City Project Review Team for comment thereon.
- H. Energy wheels shall be considered for heat recovery systems.
- I. All fans shall be designed for use at 150 feet above mean sea level.
- J. HVAC equipment shall be located at the ground level outside of buildings or facilities.
- K. HVAC equipment shall be corrosion resistant. Exterior and interior components shall be considered for their corrosion resistance.
- L. HVAC ducting shall be corrosion resistant. Corrosion resistance shall be appropriate for the application within the guidelines as follows:
  - 1. Wet well and other damp or wet locations—non-metallic or stainless steel.
  - 2. Basement and rooms—coated aluminum.
  - 3. Chemical areas—non metallic, coated aluminum, or stainless steel as appropriate for the chemical.
  - 4. Exterior ducting—stainless steal or coated aluminum.
- M. All duct runs shall be located by dimensions on the drawings. It shall not be the responsibility of the Contractor to field locate ducts.

Supports for ducts shall be located and detailed on the drawings for all ducts with an area greater than 350 square inches (about 18" x 18"). Support materials shall be as set forth in the Master Guide Specifications. Supports for ducts smaller than 350 square inches shall be provided as noted in the Master Guide Specifications. Designer shall assure that adequate space and support structure is available for all ducts.

- O. Duct and HVAC equipment supports shall be designed for Seismic Zone 4.
- P. Electrical and Control Coordination:
  - 1. Integral motor starters and disconnects for all HVAC equipment shall be specified by the Designer. Manufacturer's standard motor starters and disconnects will not be acceptable.
  - 2. Power and control conduit and wiring requirements shall be shown on the electrical drawings and be in accordance with electrical conduit and wiring requirements.
  - 3. Power and control schematics shall be shown on the electrical drawings.



4. HVAC power and control panels shall be designed and specified by the Designer and shall comply with the standards for electrical panels within the same area (reference electrical standards for panel requirements.) This includes the enclosure type, type of devices used (switches, pushbuttons, lights, etc), and internal panel requirements.
5. HVAC panels shall be labeled in accordance with the Process Identification, Finishes and Labeling Design Standards.

<b>Table 1 Service Codes</b>		
<b>ABBREVIATION</b>	<b>SERVICE</b>	<b>NOTES</b>
<b>Liquid Stream Services:</b>		
RPI	Raw Primary Influent	Interceptor sewer through the influent pump station and screens to the primary clarifier center wet well.
PE	Primary effluent	Primary clarifier troughs through primary pump station to the trickling filters or aeration basins/reactors.
TFR	Trickling Filter Recycle	Trickling filters to trickling filter effluent pump station.
TFE	Trickling Filter Effluent	Trickling filters to north plant secondary clarifier or aeration basins/reactors
NFE	North Plant Final Effluent	North plant secondary clarifier to the location where effluent from the north and south plants combine.
AE	Aeration Basin/Reactor Effluent	Aeration basins/reactors to secondary clarifiers.
SSE	South Plant Secondary Effluent	South plant secondary clarifiers to the disinfection chamber(s).
SFE	South Final Effluent	Disinfection chamber(s) to the location where effluent from the north and south plants combine.
GTOF	Gravity Thickener Overflow	
CFE	Combined Final Effluent	From the point where the effluent from the north and south plants combine to the outfall.



**Service Codes**

<b>ABBREVIATION</b>	<b>SERVICE</b>	<b>NOTES</b>
<b>Solids Stream Services:</b>		
PS	Primary sludge	
SS	Secondary sludge	North secondary clarifier sludge.
RAS	Return activated sludge	
WAS	Waste activated sludge	
TWAS	Thickened waste activated sludge	
DS	Digested sludge	
SCUM	Scum	
GRIT	Grit	
<b>Side Streams:</b>		
S	Sanitary sewer	
SS	Storm sewer	
DG	Digester Gas	

**Table 2 - Mechanical Design Standards  
Pipe Materials**

<b>Service</b>	<b>Pipe &amp; Spec. Div.</b>	<b>Lining</b>	<b>Coating</b>	<b>Joint Type</b>	<b>Notes</b>
RPI	Concrete Division 2	None	None	Carnegie shape bell & spigot w/rubber gasket	Pipe or channel as alternate.
PE	Concrete Division 2	None	None	Carnegie shape bell and spigot w/rubber gasket; restrain joints if required.	Pipe or channel as alternate
TFR, TFE, AE, SSE, SFE, & CFE	Concrete Division 2	None	None	Carnegie shape bell and spigot with rubber gasket and restrained joints.	



**Table 2 - Mechanical Design Standards  
Pipe Materials**

<b>Service</b>	<b>Pipe &amp; Spec. Div.</b>	<b>Lining</b>	<b>Coating</b>	<b>Joint Type</b>	<b>Notes</b>
TFR, TFE, AE, SSE, SFE, & CFE - aboveground	Concrete Division 2 or Ductile Iron Division 15	Cement	None	Concrete - Carnegie shape bell and spigot w/gasket and restrained joints  Ductile Iron - Bell and spigot w/gasket and restrained joints	Ductile Iron - corrosion protection required for buried installations
PS, SS, RAS, WAS, TWAS, DS, Scum, & Grit - buried	Ductile Iron Division 15	Glass	None	Bell and spigot w/gasket and restrained joints	Corrosion protection required for buried locations
S & SS	Concrete Division 2 or PVC Division 2	None	None	Bell and spigot with gasket	
Aeration Basin Air Piping - Not Submerged	Steel Div 15	None	None	Welded, flanged, or threaded.	Corrosion protection required for buried services.
Aeration Basin Air Piping - Submerged	Stainless Steel Div 15	None	None	Welded, flanged, or threaded.	
Digester Gas	Stainless Steel Div 15	None		Welded, flanged, or threaded.	
All Above	Stainless Steel Div 15	None	None	Welded, flanged, or threaded	May be considered in submerged or elevated installations for weight reduction, i.e., where a lighter weight pipe may be required. Mild steel shall not be considered.



NOTE: NRS facility water piping shall be flanged. All new piping for services noted shall have grooved couplings with rigid joints. Joints for piping within existing facilities shall match existing pipe joint types. Valves shall be flanged; no grooved coupling valves.

—End of Section—

