WASTEWATER LIFT STATION

DESIGN STANDARDS

July, 2007

WASTEWATER LIFT STATION DESIGN STANDARDS

TABLE OF CONTENTS

III. FINAL DESIGN, CONTRACT DOCUMENTS AND CONSTRUCTION

IV. REFERENCE DRAWINGS

SECTION I. GENERAL

A. Introduction

This Chapter of the Public Works Design Manual outlines the design requirements for public and private sanitary wastewater lift stations. Upgrades or modifications to existing wastewater lift stations shall meet these standards to the extent practical. These standards are not applicable to a single residential structure with four or fewer independent residences.

The wastewater lift station design standards include design criteria and Standard Drawings. Standard Drawings can be found in the supplement to the Design Manual. The design standards generally apply to wastewater lift stations pumping up to 5.0 million gallons per day (MGD). Design of wastewater lift stations with greater than 5.0 MGD capacity shall be considered on case-by-case basis, with special requirements as determined by the City of Reno.

These standards are intended to guide the engineer in the design of wastewater lift stations. The City of Reno reserves the right to modify or waive any design standard for a particular application. Any deviations from these design standards will require justification to and the approval of the City of Reno prior to construction.

When a development project requires a wastewater lift station, a pre-design meeting shall be held with the design engineer and the City of Reno to determine the design parameters, including tributary area and design period. The pre-design conference is described in detail in Section III.

In order to improve communication between the City and the design engineer during the design and construction of wastewater lift stations, the phrase “City of Reno” as used in this document means the City of Reno Community Development Department. Unless otherwise directed, all correspondence and requests for information must be made through this office. The Community Development department shall route submittals and requests for information to the Public Works Director, Sanitary Engineer, Sewer Maintenance Supervisor or others as appropriate.

B. List of Abbreviations

CC&Rs	Covenants, Codes and Restrictions
CFR	Code of Federal Regulations
Gal	Gallons

gpm	Gallons per Minute
IEEE	Institute of Electrical and Electronics Engineers
LPI	Lightning Protection Institute
MGD	Million Gallons per Day
NEC	National Electric Code
NPSHA	Net Positive Suction Head Available
NPSHR	Net Positive Suction Head Required
OSHA	Occupational Safety and Health Administration
PVC	Polyvinyl Chloride
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
WTS	Water Technical Sheets

C. Applicable Regulations and References

Wastewater lift stations must satisfy the regulations of agencies having jurisdiction. Wastewater lift stations, at a minimum, shall conform to this document and the Guidance Document WTS 14 for Wastewater Lift Station Design as prepared by the Nevada Division of Environmental Protection. Other regulations governing facilities and construction shall be adhered to, including regulations published by the Occupational Safety and Health Administration, the National Fire Protection Association, National Electric Code, and others as applicable. Reference documents include the Design of Wastewater and Storm water Pumping Station, Manual of Practice FD-4 as published by WEF, PVC Pipe Design manual published by Uni-Bell, Ductile Iron Pipe Design manual published by DIPRA, Hydraulic Institute Standards and the Recommended Standards For Wastewater Facilities, 1990 Edition (10 State Standards).

SECTION II. DESIGN CRITERIA

A. Flow

Wastewater lift stations shall be designed to accommodate the projected peak hour flow rate. The design flow rate for the wastewater lift stations shall consider current and projected peak flow rates and wastewater composition. Peak design flow rates shall be per the City of Reno Public Works Design Manual Chapter IV – Sanitary Sewers.

1. Planning Period/Growth Rate

Wastewater lift stations shall, at minimum, be designed to accommodate a 50-year planning period for the major components including the wet well, pump station layout (shall be appropriately sized for pumps and piping necessary for the 50 year planning period) and force main. Initially, the pumps furnished shall be designed to satisfy flows projected to occur over a 20 year planning period. Appropriate growth rates utilized for the planning period shall be submitted and approved by the City. Temporary wastewater lift stations shall be designed to the same standards as permanent lift stations however, the planning period may be reduced as allowed by the City.

2. Existing and Projected Flow rates

Wastewater lift stations shall be designed to pump the flow for existing and future developments. In developed areas, population shall be determined by house count and non-domestic user inventory with allowances made for remaining undeveloped tributary areas. In undeveloped areas population densities and per capita flows shall be as established in agreement with the City of Reno Community Development Department. The drainage basin shall be the hydrographic basin for the area and may include areas outside the City limits. Flow contributions outside the City limits shall be determined by using the appropriate governing authority's population densities in combination with the City of Reno's occupancy rates and wastewater flow rates as specified in Chapter IV – Sanitary Sewers.

3. Composition

Wastewater composition can vary widely depending upon the proportion of design flow generated by non-domestic users. Non-domestic user wastewater composition shall be investigated. Adequate consideration and necessary provisions shall be taken to ensure that wastewater lift station equipment and materials are suitable for the anticipated composition of wastewater.

B. Downstream Impacts

1. Chapter IV – Sanitary Sewers

Contributing flows from the proposed lift station shall be included in the required sewerage analysis as defined in Section 4 of Chapter IV – Sanitary Sewers. The contributing design flows shall include an investigation of the projected flows rates throughout the planning period and with the growth rates projected.

2. Trunk or Interceptor Reduction

Trunk or interceptor peak reduction factors as specified in Chapter IV – Sanitary Sewers are not allowed when the flow is pumped from a wastewater lift station. Actual wastewater lift station peak flow rates shall be utilized

3. Impacts on Downstream Lift Stations

The sanitary sewerage report shall include a detailed analysis of the impacts on any downstream wastewater lift station caused by the increased flow rates generated by the proposed wastewater lift station. The potential need for downstream improvements will be identified at the pre-design meeting. The flow rates investigated shall be for the 20 year planning period. The cost for required modifications or upgrades to any downstream lift stations shall be borne by the development generating the increased flows.

C. Siting

Wastewater lift station site selection is dependent on a number of factors, including: topography, access, availability of power supply, floodplain, site drainage, land use, aesthetic and odor concerns, overflow potential and impact to the environment. All of these factors shall be considered when selecting the lift station site.

1. Topography

Sewers tributary to wastewater lift stations commonly dominate site selection. Adjacent drainage areas potentially served by the wastewater lift station must also be considered. Wastewater lift station site selection shall also be compatible with suitable site access, and soil capability with respect to land grading in conjunction with site development.

2. Access

All wastewater lift stations shall be sited to allow access by all-weather surface roads capable of accommodating a WB-50 design vehicle. The wet well shall be located so that it is directly accessible to a 35’ Vactor type truck with the nose of the vehicle over the wet well. Whenever possible, provisions shall be

made for entry into traffic nose first. Site slopes or grades must be adequate to accommodate low-hanging hose reels on vactor trucks.

3. Floodplain

Wastewater lift stations shall be sited to remain operational and permit access during a 100-year return frequency flood. Lift station top slab, wet well rims and related vault lid elevations shall conform to the City of Reno Flood Hazard Ordinance.

4. Land Use

Lift station sites shall conform to land use regulations for which the property is zoned and adhere to setbacks required under such zoning. Approved variances may be required for situations not adhering to the City of Reno Zoning Ordinance.

5. Aesthetics and Noise

Natural screening and remoteness of the site should be a primary element of site selection wherever possible. Where pump stations are sited in proximity to developed areas, predominant wind direction for potential odor dispersion and building aspects such as generator exhaust and noise and ventilation fan noises shall be considered and minimized. Similarly, building setbacks shall be considered to provide minimal impact to neighboring properties. Landscape screening may be required as directed by the City of Reno.

6. Odors

The Engineer shall assess the effect of odor on adjacent land use and workers at the facility. Every effort shall be made in site selection to reduce potential odor pollution. Wind direction, duration and intensity are all important considerations that must be evaluated.

7. Protection from Vehicle Impact

Sanitary wastewater lift stations, when located adjacent to high speed roads, heavily traveled roads or in areas otherwise susceptible to vehicular impact shall be designed with impact mitigation devices to protect the lift station equipment from errant vehicles. In addition, turnouts to allow City vehicles to safely access the site may be required.

8. Overhead Clearance

Adequate overhead clearance shall be provided over the entire wastewater lift station site so that maintenance equipment does not interfere with overhead utilities or structures. In general wastewater lift stations should not be sited where existing overhead interferences exist.

9. Ownership

Wastewater lift stations, regardless of ownership, shall be constructed to the City of Reno's standards. The wastewater lift station site shall be large enough in size to accommodate the required features specified in the design manual as well as future upgrades. Land requirements for future improvements, if justified, will be specified on a case by case basis by the City of Reno.

D. Site Improvements

Wastewater lift stations must be designed and constructed with the necessary improvements to ensure adequate and reasonable access, security, drainage and maintainability.

1. Access Road

Wastewater lift stations shall be constructed with adequate access for maintenance vehicles including vactor trucks with low-hanging hose reels. Road structural sections shall be designed to support the vehicular loadings as specified in Chapter 1 – Streets of the Public Works Design Manual.

All paved surfaces at the lift station site shall be designed for the expected vehicular and equipment loadings but shall not have a structural section of less than 4 inches of asphalt and 6 inches of base as specified in Chapter 1 – Streets of the Public Works Design Manual.

2. Perimeter Fence and Gates

All wastewater lift stations must have a minimum 6 foot high perimeter fence surrounding the lift station site designed to discourage unauthorized access. Fencing materials shall be approved by the Community Development Department and shall be designed for high winds. A 3 foot wide man-gate as well as double 8 foot wide (16 foot total) swinging gates shall be provided for access to the site. A 16 foot sliding gate may be allowed in lieu of the swinging gates if circumstances warrant. All gates must be capable of achieving full open position, including sliding gates. All posts shall be steel set in concrete.

3. Potable Water

A potable water yard hydrant shall be installed at the lift station site near the wet well. The hydrant shall have a threaded spigot for a standard garden hose.

4. Grading

Wastewater lift station site grading shall be designed to prevent local ponding and to provide positive drainage away from structures. The site shall be graded so as to not create a low-point in relation to the adjoining properties. On-site cross slopes should be limited to no greater than 4 percent away from the structures. Storm runoff from the lift station site shall be designed in compliance with Chapter II – Storm Drainage of the Public Works Design Manual.

5. Landscaping

All wastewater station sites shall be screened as appropriate for the surrounding Development. Landscape design and materials shall meet the same requirements for landscaping as required by the conditions of approval for the project. Landscaping shall not be done within the site but shall surround the perimeter of the site or as required by Community Development Department. Variations to the minimum requirements may be allowed with the approval of the Community Development Department.

6. Lighting

Exterior lights shall be provided to adequately light the equipment area. The lights shall be appropriately shielded to prevent "spillage" on to neighboring properties. Exterior lift station lighting shall be fitted with day/night sensors for automatic on-off operation and shall also be fitted with manual on-off switches.

Work lighting shall be installed in all cabinets and over the wet well and shall operate on manual on-off switches.

E. Hydraulics

Wastewater lift stations shall be designed to satisfy the hydraulic conditions of the planned facility. The friction head shall be determined as accurately as possible taking into account all pipe and minor losses. Pump/system curves shall be shown for individual and combined simultaneous pump operation. The pump/system curve calculation may be performed utilizing any accepted

hydraulic equation. The design calculations shall be submitted in the preliminary design report along with all design assumptions, limitations and restrictions. The Engineer shall include in the calculations the net positive suction head available (NPSHA) as well as the net positive suction head required (NPSHR) to assure cavitation will not occur.

F. Force Main

1. Size and Velocity

The force main shall be sized to produce a fluid velocity of no less than three (3) feet per second and no more than six (6) feet per second. Potential for expansion of the lift station through the planning horizon shall be considered when sizing the force main.

2. Horizontal Location

Force mains shall be located within the public rights-of-way or in appropriate easements. Appropriate clearances between other utilities shall be provided for as specified by the governing agencies. The horizontal location of the force main shall be identified with buried tracer wire and locator tape marked "SEWER". The location of all angle points and valve locations shall be submitted to the City of Reno in Nevada State Plane (ground) coordinates. Typical force main trench detail is shown in Standard Drawing R-246.

3. Materials

All pipe utilized for force mains shall be pressure rated pipe. Acceptable force main materials are high density polyethylene, polyvinyl chloride and ductile iron (bagged).

4. Profile

Force mains shall have a minimum depth of cover of 4 feet as measured from the proposed finish grade to the top of pipe. A continuous upward slope from the lift station to the discharge point is required. In the event that a high point cannot be avoided, and as allowed by the City, a wastewater air release and air/vacuum valve shall be installed in a vault. At major low-points a manually controlled drain valve shall be installed in a manhole to allow for cleaning or draining.

5. Separation Distance

Sanitary sewer force mains paralleling water mains that are less than three feet below the water main shall have a minimum of 10 feet of horizontal clearance from the waterline. Force mains that are more than three feet below a parallel water main must maintain a minimum of six feet of horizontal clearance. At perpendicular crossings the force main shall be placed below the water main a minimum of 18" vertically. For purposes of determining pipe separation, the distance indicated shall be the smallest outside diameter-to-outside diameter distance. These requirements are minimums that may be superseded by the City on a case-by-case basis.

6. Appurtenances

a. Air Release and Air/Vacuum Release Valves

The Engineer shall provide an economic analysis comparing the installation of air release and air/vacuum release valves against the installation of deeper force main piping. The economic analysis shall take into account the installation and maintenance costs associated with the air release and air/vacuum release valves. Air release and air/vacuum release valves shall be specifically designed for wastewater service and be sized per the manufacturer's recommendations. Air release and air/vacuum release valves shall be required at the following locations:

- Profile highpoints (when allowed)
- At pumps on the discharge pipe as close as possible to the check valve

The air and vacuum release valves will be contained in a vault and vented above ground. A manually controlled isolation valve shall be installed between the force main and the air release or air/vacuum release valves.

b. Drain Valves

When required by the City the design engineer shall include at least one force main dewatering connection at the lift station and dewatering connections at other major force main low points. Drains shall generally include a plug valve installed on a tee and drain piping to an existing sewer manhole or to a separate manhole that can then be pumped by City personnel.

c. Additional Appurtenances As Required

The City may require additional appurtenances at sanitary sewer lift stations and force mains on a case-by-case basis.

7. Water Hammer

A water hammer (surge) analysis studying the force main and the related wastewater lift station shall be performed and submitted to the City for review and approval. Water hammer shall be evaluated for the normal operation of the pump station as well as for a power outage while the pump(s) are running. The modulus of elasticity of the pipe material shall be considered when evaluating water hammer effects and cyclic loadings. At a minimum the following should be addressed in the surge analysis:

1) Transient pressures due to water hammer and the effect of these pressures on the entire system.

2) Cyclic loading of the force main.

3) Investigation of the pipeline profile to determine the possibility of water column separation.

4) Reverse rotation characteristics of the pumps.

5) Shut-off characteristics of all proposed pump control valves (if allowed), including check valves.

6) Substantiation for the use of surge control valves and other surge protection devices, when necessary, listing recommended size and computed discharge pressures.

The potential impact of water hammer shall be evaluated with special consideration given to cyclic loadings that are inherent in wastewater force mains. All elements of the piping system must be designed to withstand the maximum water hammer in addition to the static head and cyclic loading. A safety factor of 1.5 shall be used when determining the adequacy of all piping system components with regard to withstanding system pressure.

The City of Reno may allow the use of a surge control device in lieu of strengthening piping system components. The decision to allow such a device shall be based on a life-cycle cost comparison.

8. Force Main Termination

Exposed walls of a structure required at the junction of force mains and gravity

sewers must be constructed or protected with acid resistant materials. This applies to all surfaces exposed to the atmosphere above the wastewater. The flow transition from the force main to the gravity sewer shall be smooth and non turbulent.

G. Wet Well

Wet wells shall be considered a hazardous environment, classified as NEC Class I, Division I for explosive gases. Wet wells shall be designed and constructed to be as hazard free as possible, and corrosion-resistant materials shall be used throughout. All materials and equipment used in wet wells shall meet NEC Class I, Division I standards, with the exception of control floats. No junction boxes shall be installed in the wet well. Float cables and bubbler tubes shall be placed in a covered chase that shall extend from the control panel to the wet well. The chase shall include a removable cover for ease of service. The chase shall extend into the wet well 12" and have one 1-3/4 inch diameter hole and one 2-inch diameter hole in the bottom for bubbler pipe and float cable access to the wet well.

1. Structure

Whenever practical wastewater lift station wet wells shall be constructed of precast reinforced concrete and shall be circular. Wet wells that are installed below the groundwater table shall be adequately designed to prevent flotation without the use of hydrostatic pressure relief valves. Wet well size and depth shall be as required to accommodate the influent sewer, provide for adequate pump suction pipe or pump submergence as recommended by the pump manufacturer and to provide adequate volume to prevent the excessive cycling of pumps. Partitioning the wet well to help accommodate future growth requirements is allowed, however, the design of any partition must be approved by the City of Reno.

a. The required wet well working volume shall be calculated to optimize pump operation to meet peak hour flow and minimum hour flow. The design engineer shall consider the diurnal nature of wastewater flow as well as the pump manufacturer's recommendations regarding pump start frequency when determining the wet well volume. Every effort will be made to prevent wastewater in the wet well from becoming septic. The wet well shall contain adequate vertical room for level sensing adjustments above and below the design levels.

b. Minimum inside width shall be 5 feet, however, retention time, pump configuration and access may require a larger structure.

c. Primary high water alarm shall be set to wet well influent invert. A redundant high water alarm float shall be installed six inches above the primary high water alarm.

d. Minimum elevation difference between control elevations - 12 inches

2. Interior Linings and Waterproofing

Wet well interior walls and ceiling shall be lined with a material that is suitable for immersion wastewater service. The lining shall be completely resistant to hydrogen sulfide and sulfuric acid. The liner shall be easily cleanable and sufficiently durable that it can be washed with a high pressure water hose. The liner shall be light in color. Materials used for interior liners shall be subject to the approval of the City of Reno prior to installation.

Wet wells that are anticipated to be below the groundwater table shall also have a waterproofing system installed on the exterior of the wet well. Regardless of the elevation of the water table, all joints in the concrete and all penetrations through the concrete shall be grouted with non-shrink grout on both sides of the joint or penetration.

3. Access

Wet well access shall be through a top slab opening with aluminum hatch cover and frame. The top slab access hatch shall be sufficiently large to remove all equipment from the wet well, but in no case smaller than 36 by 36 inches. All access hatches shall be torsion assisted and all components shall be non-corrosive. Removable safety railings shall be provided around the access hatch in accordance with OSHA regulations.

4. Floor Sump

Each wet well shall contain a sump immediately underneath the inlet pipe to help assist in trapping large items to prevent them from entering the pumps and/or piping and to provide a dedicated area for cleaning. The sump shall be a minimum of 2 feet wide and 12 inches deep. An allowed alternative to a sump in the wet well is the use of an independent 60” diameter manhole located just upstream of the proposed wet well that contains a sump 12” below the invert elevations.

5. Floor Slopes

Wet wells shall have sloping sides to form a hopper at the bottom of the wet well in all areas outside of the dedicated sump. Slopes shall be approximately 1 horizontal to 1 vertical. Square corners should be avoided. The flat portion of the wet well floor shall be minimized.

6. Level Control System

Wet well liquid levels shall be controlled by a continuously run bubbler system with a redundant back up float switch for a high water alarm. These systems within the wet well shall be located to minimize the turbulent influences of flow into the wet well on the control of liquid level. Bubbler systems shall be manual purging and shall have a pressure gage. Pressure transducer or other similar types of level control systems may be used in lieu of the standard bubbler system with the approval of the City of Reno.

7. Odor Control

It should be assumed that a collection system upstream of the pump station with a greater than two-hour detention time and/or greater than 2 hour force main detention time will require some form of odor prevention/mitigation measures. Additionally, odor analysis shall consider the average and maximum detention time in the wet well. Analysis shall be submitted to the City of Reno for approval.

H. Approach Manhole

A 60-inch diameter approach manhole shall be constructed upstream of all wet wells. The approach manhole shall be located within the site fencing of the lift station and shall serve as a common point of connection for all sanitary sewer pipes tributary to the pump station. A single pipe shall extend from the approach manhole to the wet well. The approach manhole shall have a 36-inch diameter cover with a removable 24-inch diameter insert cover.

I. Pump Selection

The type of wastewater pump required by the City shall be determined by the required pump motor horsepower. Wastewater lift stations may be either custom built-in-place or engineered package systems with submersible or self priming centrifugal pumps.

Wastewater pumps shall be centrifugal non-clog solids handling pumps designed

specifically for handling raw, unscreened domestic sanitary wastewater. All wastewater pumps shall rotate clockwise as viewed from the motor end. Pump motors shall operate on 460 volt, 3 phase, 60 Hz electrical service and at a speed no higher than 1780 rpm. If 460 volt service is not readily available 208 volt 3-phase power is acceptable. The pump motor horsepower selected shall be sufficient to prevent motor overload over the entire range of the pump performance curve and consideration shall be given to de-rating the motor horsepower while operating at higher elevations. Wastewater pumps and motors shall be suitable for continuous duty.

Proper pump selection is critical and applications where pumps must operate near their shutoff head or run-out conditions shall be avoided.

1. Submersible Pumps

Submersible style pumps are contained in a wet well. Generally, submersible pumps will be allowed when the required individual pump horsepower does not exceed 20 HP under build out conditions. Lift stations that are proposed with submersible pumps with motors larger than 20 HP must be reviewed and approved by the City of Reno. Custom built-in-place stations and engineered package stations shall be engineered to meet the requirements of the Public Works Design Manual as well as current industry standards. Submersible wastewater pumps contained in wet wells shall be equipped with guide rail and pump discharge elbow assemblies installed in the wet well.

Pump volute, impeller and motor housing shall be of cast iron construction. The pump volute casing and impeller shall be fitted with replaceable stainless steel wear rings to maintain sealing efficiency between the pump volute and impeller. Submersible wastewater pumps shall be fitted with leakage sensors for detecting the presence of water in the oil and/or stator housing. Submersible wastewater pumps shall feature stainless steel guide rails and automatic cast iron discharge connection elbow system permanently installed in the wet well. The motor shaft shall be a single piece heat-treated high strength alloy steel or high strength stainless steel having a tapered end with keyway to receive the impeller. All nuts, bolts and screws shall be stainless steel. The motor shall be Class F insulated (minimum) and sealed from the pump by independent double mechanical seals. The upper and lower mechanical seal shall run in an oil chamber. The upper seal shall be a stationary tungsten-carbide seal with rotating carbon ring. The lower seal shall be one stationary and one positively driven rotating tungsten-carbide ring. All mating surfaces where watertight sealing is required shall be machined and fitted with a rubber O-ring. All stators shall incorporate thermal switches in

series to monitor the temperature of each phase winding. The machining of mating surfaces shall provide metal to metal bearing on sealing surfaces without crushing the O-ring.

2. Self Priming Centrifugal Pump

This type of wastewater pump will generally be required for lift stations requiring pump motors greater than 20 HP. Self Priming Centrifugal Pump Stations may be engineered packaged pump stations where the design parameters permit the use of a factory built pump station; otherwise custom built-in-place stations shall be considered, and shall be engineered to meet the requirements of Public Works Design Manual as well as current industry standards. Self priming centrifugal pump lift stations shall be located at grade whenever possible or below grade when the net positive suction head requirements govern the pump elevation.

The pump shall be of standard cast iron construction with ductile iron impeller, oil lubricated mechanical seal, and shall include casing wear rings to maintain sealing efficiency between the wear ring and impeller faces. The pump and motor shall be provided with a fabricated steel motor/pump base. Impellers shall be able to pass a minimum 3-inch diameter solid. The City may require other pump materials to suit a particular application. Self priming centrifugal wastewater pumps shall be specifically designed for continuous operation in air.

3. Other Pumps

In special circumstances due to extraordinary wastewater composition, rehabilitation of an existing installation or other reasons, the City shall be consulted to determine the acceptability of other pump types before the wastewater lift station design commences.

J. Wastewater Lift Station

Standard Drawings for Wastewater Lift Stations are shown in the supplemental drawings available from the City of Reno. These reference drawings in conjunction with the Public Works Design Manual provide the design engineer with the minimum requirements for construction drawing preparation and submittal to the City of Reno.

Wastewater lift station structures, equipment systems, piping, controls, force main and accessory systems must be engineered according to these guidelines. To fulfill the intent of these guidelines, the Engineer must exercise judgment to use the special knowledge relating to project site characteristics and conditions of service (e.g. head,

flow, force main length) particular to the wastewater lift station design under development.

All wastewater lift stations shall have multiple pumps. Wastewater lift stations shall be capable of delivering the design flow rate with the largest pump out of service. Wastewater lift station design shall permit individual pump maintenance while maintaining the station in operation. Suction and discharge piping must be supported rigidly at or near the pump connections. Supports shall be designed and placed to avoid vibration.

Wastewater lift stations shall be designed to provide suitable environments for operating and maintaining pumping equipment and piping systems. Configuration of pump components shall promote safe access and adequate space for equipment and valve maintenance.

1. Submersible Lift Station

   a. Pump Removal

      The wastewater lift station must be designed so that the pumps and related equipment can be removed from the wet well with a vehicle mounted crane or other lifting device.

2. Self Priming Centrifugal Pump Wastewater Lift Station

   a. Structure

      Above grade stations are preferred, however, below grade stations will be allowed when the net positive suction head (NPSH) requirements necessitate a lower pump elevation. Above grade structures shall have a finished concrete floor with floor drains and be housed in an easily removable, pre fabricated fiberglass enclosure unless otherwise directed by the City of Reno. Below grade pump stations shall be reinforced concrete and shall extend at least 6 inches above finished grade.

      When a pump station is anticipated to be below the groundwater table it shall be adequately designed to prevent flotation and the exterior shall be waterproofed with a coating system. Pump vault interiors shall have a smooth, easy to clean light coating finish. Pump vault depth and size shall be adequate to provide proper suction lift from the wet well and provide sufficient space for maintenance and removal of all equipment.

b. Access

Equipment and personnel access to above grade stations shall be through doors in the fiberglass enclosure. Personnel access to below grade stations shall be by a dedicated stairway and access door. Equipment access in vaults shall be provided through a top slab opening with aluminum hatch cover over each pump. The top slab access hatch shall be of sufficient size to permit the removal of an assembled wastewater pump or any other station component. Minimum hatch size shall be 36 by 36 inches. Removable safety railings shall be provided around all access hatches.

The wet well and access hatch shall be positioned so that a truck mounted crane can lift equipment out of the pump station vertically. Any enclosure must removable to allow direct access to the equipment. If a permanent building is constructed over the pumps a sufficiently large roof hatch must be installed to allow for the lifting of pump station equipment through the roof.

c. Lighting

The interior of pump stations, whether at grade or below grade, shall have a lighting system specifically designed to provide illumination best suited for the station layout which may include suspended, wall, or ceiling mounted. Energy efficient fluorescent fixtures are preferred. Lighting shall be at levels adequate for routine service inspections and maintenance activities.

d. Ventilation

Pump stations shall be provided with a separate ventilating system and shall be sized to provide a minimum of 10 air changes per hour. Ventilation systems shall be capable of matching inside air temperature to outside air and shall automatically begin operation once inside air temperature reaches 90° F. In addition to manual control, time clock operation of the ventilating fans shall be provided. Ventilation shall be accomplished by the introduction of fresh air into the pump station under positive pressure. The air shall be filtered to remove debris and minimize particulates inside the lift station. The fans shall automatically come on whenever the light switch is turned ON.

e. Heating

Thermostatically controlled electric unit heaters shall be provided to maintain a minimum temperature of 55 degrees in the pump stations. Heating systems shall provide adequate space temperature for maintenance personnel in cold weather and protection from freezing.

f. Net Positive Suction Head

The Engineer shall perform a net positive suction head available (NPSHA) analysis and include this information in the pre-design report. The NPSHA shall be calculated for the expected design flows and shall exceed the pump manufacturer's Net Positive Suction Head Required (NPSHR) requirements by an added margin of safety of not less than 5 feet.

g. Potable Water Supply

Potable water shall be provided to all self priming centrifugal pump wastewater lift stations. As a minimum, all lift stations shall have a bury hydrant in the lift station yard. Potable water supply shall be provided through an air gap as required by Washoe County District Health. The potable water system shall be metered as required by the governing water authority and shall be either manually controlled or fully automated as directed by the City of Reno.

K. Piping Systems

1. Pump Station Piping

Pump suction piping velocity should be within the range of 4 to 8 feet per second with 6 feet per second being optimal. Pump discharge piping shall be sized to provide velocities in the range of 4 to 8 feet per second. Pump suction pipes shall be designed with a gradual slope from the opening upward to the pump. Individual suction pipes are required for each pump. Pump suction piping design and installation shall not permit the accumulation of air in the suction piping or induce excessive turbulence in the pump suction area. Long radius suction piping bends shall be used whenever possible and eccentric reducers are to be used with flat side up to prevent formation of air pockets. All wastewater pumps shall be provided with casing drains with ball valve shut-offs installed either on the pump suction elbow or on the suction line between the pump and suction isolation valve. Take-off nipples shall be Schedule 80 stainless steel. Pipe nipples must not be installed in a tapped hole in piping.

Use either a welded-on "thread-o-let" connection or service saddle.

2. Valves

Each wastewater pump shall have isolation valves to permit the removal or maintenance of the pumps and check valves without affecting the operation of remaining pumps. Isolation valves shall be non-lubricated plug valves. Plug valves shall be 100% port opening. 4 to 6 inch plug valves shall be quarter turn to open. Larger plug valves shall have geared operators with hand wheels. Plug valves shall be positioned so that when closed, the valve body is isolated from the actively flowing portion of the piping system. Plug valves if installed horizontally shall be positioned so that when the valve is opened, the valve plug shall be at the top of the body. Each pump shall have a high quality swing check valve with an external swing arm. Check valves must be installed horizontally.

3. Bypass Pumping

Wastewater lift stations shall have additional pipe, valves, fittings and couplings as necessary to permit bypassing of the lift station including the wet well and pumps. The provisions shall include the approach manhole, a valve on the gravity inlet line to the wet well to shut off flow to the wet well, and bypass piping including an isolation valve, check valve and quick connect cam lock fitting enabling the temporary pump to pump directly into the existing force main. Bypass pumping Schematic is shown on Standard Drawing R-240 and the valving is shown on Drawing R-245.

4. Recirculation Piping

Every lift station shall have provisions for re-circulating the influent back into the wet well for the purpose of scouring solids and to assist in breaking up the scum layer so that these materials can then be pumped out into the force main. The recirculation may be accomplished via additional piping or through valving integral to the wastewater pump. .

5. Flow Metering

A dedicated magnetic type flow meter that includes instantaneous rate of flow and totalization shall be provided for on all wastewater lift stations. Flow metering shall be included in the SCADA system. Installation of the meter shall be as recommended by the meter manufacturer.

6. Pressure Gauges

Pressure gauges shall be liquid filled direct reading 4-½ inch dial with a ½-inch connection. All gauges shall include an oil isolation diaphragm for isolation of the gauge from the wastewater. Gauge connection ports shall be included on all pump discharge mains and suction lines. The connection port shall include a coated service saddle or welded thread-o-let for tapping of the main, Type 316 stainless steel nipples, a stainless steel spring return ball valve to the closed position, and a ½-inch Swagelok "QF" series female NPT stem with protector cap.

The location and orientation of all pressure gages shall be approved by the City prior to construction.

L. Vaults

Precast concrete vaults shall have an interior coating designed to protect against corrosion from hydrogen sulfide gas. When high groundwater is anticipated exterior waterproofing system must be installed and the vault designed to resist buoyancy. Vaults shall extend 6 inches above grade and shall have hatches with spring-doors to access the vaults.

Valve vaults shall have a float-controlled submersible sump pump located in a sump. The sump pump shall have capacity to handle anticipated maximum system flow from seepage and infiltration and routine piping and pump maintenance and shall discharge into the wet well. All pump vaults shall be provided with a float switch emergency alarm system to protect the pump vault from flooding in the event of sump pump failure. Each sump pump shall have dual check valves installed on the discharge piping to protect the pump vault from backflow from the wet well.

M. Emergency Station Operation

To ensure that utility power or equipment failures do not cause sewer system overflows, provisions to maintain wastewater pump station including standby power and emergency storage shall be made.

1. Stand-By Power

A diesel engine emergency electric generator shall be provided for all wastewater lift stations. The unit shall be sized to allow simultaneous starts and operation of the required pumps in addition to the auxiliary loads, and to start lag pumps while the lead pump is running with a maximum voltage dip of 20%. An automatic transfer switch shall be provided to switch to emergency

power on a power failure or a drop in any phase voltage to 70 percent of line voltage. Diesel engine powered generators require a fully automatic 3-phase resistance element 2-step load bank rated at 50% of the generator KW rating. The load bank shall be energized when the generator load is less than 50% load and de-energized when the load is above 50%. An aboveground double containment fuel tank shall be provided for diesel fuel. The generator shall be housed outside in a weatherproof enclosure that is painted in an earth tone. The fuel tank shall be the smallest available size to give a 24-hour fuel supply at full load for the generator size provided and shall be equipped with a thermostatically controlled emersion heater. The generator shall meet the City of Reno sound requirements as delineated in Title 8 of the Reno Municipal Code.

2. Emergency Storage

Emergency storage capacity shall be provided to hold a minimum of 1 hour of peak hour design flow. The wet well, collection system and emergency storage containment can all serve as the emergency storage provided that the 1 hour requirement is met without a spill occurring. Additional storage time may be required by the City based on the potential for environmental contamination or other factors. The emergency storage requirement may be required on up-grades to existing wastewater lift stations as directed by the City. The emergency storage must be available above the high water alarm elevation in the wet well and must be continuously available without the need for an operator to switch valves or diversions. If a dedicated overflow storage tank is required, it shall be lined with asphalt, concrete, high density polyethylene or PVC. Dual pipes shall be in place to allow flow to travel to and from the wet well and the emergency storage basin. The return pipe from the emergency storage basin to the wet well shall include a plug valve that is in a normally closed position and shall be located near the bottom of the emergency storage basin. The emergency storage basin shall have a smooth floor sloped to the drain pipe with a minimum slope of 1%. The emergency storage tank shall have a minimum of 2 manholes to provide access from the surface. The manholes shall be a minimum of 36-inches in diameter with a removable 24-inch diameter insert.

N. Electrical

1. Power Requirement

The electric service shall be 208 or 480Y 3 Phase. The service shall be sized to allow all station fixtures, equipment and all pumps to operate together. Motor starters greater than 10 HP shall be soft start and soft stop.

2. Lift Station Control Panel

The Control Panels shall be enclosed in NEMA 4X enclosure panels painted white if located outdoors and shall include adequate space for mounting of the bubbler controls and instrumentation as required. All switches, breakers and wires shall be clearly marked or labeled. Standard control panel layout for 2 or more pumps shall be provided with the following section of panels:

- Power company metering and main breakers
- Automatic transfer switch
- Circuit beakers and starters for unit heaters, portable pump, main wastewater pumps, fans, compressors, etc., station power transformer and 240/120V 1ø panelboard.
- Flow recorder and pump controls including cycle counters and running time clocks.
- Solid-state reduced voltage starters for constant speed main wastewater pumps.

3. Convenience Receptacles

120 volt, 1-phase receptacles shall be provided within the pump station buildings. One GFCI duplex outdoor weatherproof convenience outlet shall be provided.

4. Portable Generator Connection

Pump station buildings shall have an exterior mounted panel with provisions for Hubble 4100 portable generator connection. Power from a portable generator can be delivered to the automatic transfer switch at the emergency generator connection lugs for stations so equipped.

5. Energy Conservation

Energy efficient motors shall be provided for all pumps.

6. Lightning and Surge Protection

a. Transient voltage surge suppression rated at 80 KA minimum shall be provided at the service entrance. Installation shall be in accordance with 2002 NEC article 285.

O. Telemetry

1. Remote Terminal Units

a. General

Remote terminal units (RTU's) shall be as specified for lift stations when directed by the City of Reno and provided for by the developer. The City will provide the Engineer with information on how the existing control master system screen displays are to be updated, what reports, if any, need to be updated by information received from the additional RTU's, current manufacturers and model numbers of equipment and existing software in use by the City. All equipment and software must be compatible with the City's existing SCADA system.

The construction of the lift station shall include necessary funding to have the necessary programming changes made to the control master system. These changes shall be performed by a City selected contractor.

b. Battery backup

The telemetry system shall have a battery back up with 2 hours reserve.

c. RF Path Study

An RF path study shall be performed as part of the project design effort. Generally a clear line of site to Peavine Mountain will provide an adequate path of communication. The RF path study shall be used to verify communications reliability between the proposed RTU location and the existing control master unit or the nearest radio communications hub. The City will furnish any information it may have, which may be applicable to the project. Repeaters may be required if a clear path to Peavine Mountain can not be established.

2. Telemetry

A 950 MHz radio will be used to transmit signals between the RTU's and the City's control center. Where spread spectrum radio cannot be used a communication method shall be determined in consult with the City of Reno.

3. RTU Equipment

RTU equipment currently approved by, and in use in the City is Motorola

MOSCAD system. The contractor shall purchase the equipment required for the project after approval is obtained from the City of Reno.

P. Minimum Architectural Standards

Above grade structures may be required to meet minimum architectural standards as specified in the CC&Rs or as directed by the Community Development Department.

Q. Security Systems

Where required by the Sanitary Engineer security systems shall be included at the wastewater lift station. The security systems shall include intrusion, fire and environmental hazard systems at the site or as directed by the Sanitary Engineer.

R. Confined Space Considerations

It is the desire of the City of Reno to eliminate confined space entries whenever possible. If a confined space cannot be avoided, the design of the lift station shall incorporate features to minimize the dangers of the confined space. The City of Reno shall review and approve design drawings and specifications for any confined space prior to construction.

S. Miscellaneous

1. Coatings and Painting

All exposed construction materials and equipment except that constructed from stainless steel, aluminum and PVC shall be field painted or have some other form of field-applied protective coating. Factory finished items do not require field painting if the factory finish conforms to the specified paint system and color. Painting unfinished materials shall be in accordance with the specification. Paint and other coatings shall be utilized as necessary to prevent corrosion, extend wear or promote easy to clean surfaces. Paint and coating systems used at wastewater lift stations must exhibit superior durability. All paint and coating systems shall be reviewed and approved by the City.

2. Fall Protection

Temporary and permanent fall protection for all floor and wall openings in the

lift station shall be in accordance with the requirements of the latest edition of OSHA 29 CFR, Chapter XVII. Fall protection includes, but is not limited to railings, toeboards, screens, covers, hatches, grills, slats and fences. A socket shall be provided and mounted to an appropriate engineered base for the use of a City provided “uni-hoist”.

3. Signage

A facility sign shall be provided at the facility that includes the facility name, address and 24 hour emergency telephone number. The sign shall be baked aluminum with a green finish and white reflective letters approximately 18 inches x 24 inches.

SECTION III. DESIGN, CONTRACT DOCUMENTS AND CONSTRUCTION

A. Preliminary Design Report

The preliminary engineering report will include, at a minimum, the description of design criteria to be utilized, preliminary flow computations, design calculations, calculated system curves, water hammer (surge) protection analysis/recommendation, identification of right-of-way requirements, number of property owners involved, listing of permit requirements, geotechnical investigation and cost estimate based on unit costs for major elements of work. In addition, the following design criteria shall be developed:

- Site Development
- Structural Design
- Architectural Design
- Hydraulic Analysis
- Mechanical Design
- Electrical Design
- Instrumentation and Process Control
- Corrosion Control
- Odor Control
- Noise Control

The hydraulic analysis shall include calculation of the system curve. The system curve shall be plotted on the pump curve with the operating point identified. Every effort shall be made to select a pump that operates at its best efficiency point. Peak and average flows shall be considered when selecting the appropriate pump. Pump manufacturer data sheets shall also be included in the preliminary design report submission.

If the pump station is being designed with built-in expansion capability, an economic analysis shall be submitted that identifies the life cycle cost of:

1. Adding a third, equal sized pump to operate in parallel
2. Upgrading the existing pumps with larger impellers and motors
3. Replacing the two existing pumps with two new pumps

The analysis shall consider capital costs as well as the operational costs of the lift station. Design assumptions (e.g. cost of electricity, cost of money) shall be determined in consultation with the City of Reno.

The Preliminary Design Report shall be submitted to the City for review and approval.

B. Design Conference

After submission of the preliminary design report a design conference will be held. The conference shall include:

1. The City of Reno - Sewer Maintenance, Sanitary Engineering and Community Development
2. The Design Engineer
3. The property owner/developer

Representatives from the City of Sparks or Washoe County may be present if the lift station could potentially serve property in those jurisdictions.

C. Final Design Documents

The final design may be completed after the design conference, incorporating any comments received. The final design documents will include construction drawings on 24 inch x 36 inch paper and technical specifications for the equipment. All design drawings must be drawn to a scale found on a common engineer's or architect's scale. Multiples of 10 and one-tenth for the engineering scales (e.g. 4 and 400 scale) are also acceptable. The final design documents shall contain the design criteria including the different combinations of pump flow rates and total dynamic head and shall be submitted to the City of Reno for approval.

D. Pre-Construction Conference

A pre-construction conference shall be held prior to the commencement of any construction on the wastewater lift station. As a minimum, the design engineer, the general contractor, construction inspector, City of Reno sanitary engineering and City of Reno sewer maintenance shall be present at the pre-construction conference.

E. Commissioning and Acceptance

Prior to wastewater lift station acceptance by the City of Reno a thorough inspection and operational check of the station is required. The design engineer shall submit a proposed start-up check list to the City prior to the completion of construction. The start-up shall include:

1. Confirm static and dynamic pressures
2. Confirm all alarms, remote control capability and reporting functions
3. Calibration of level controls
4. Confirm operation of lift station under auxiliary power

Once the start-up procedure is finalized the start-up will be scheduled. The following are required to be present at the start-up:

1. The engineer in responsible charge of the lift station design
2. The electrical and instrumentation engineer
3. The mechanical engineer
4. The general contractor superintendent
5. A representative from the electrical contractor
6. A representative from the instrumentation contractor
7. A representative from the mechanical contractor
8. The pump manufacturer's representative
9. A representative from the City of Reno Sewer Maintenance Section
10. A representative from the City of Reno Sanitary Engineering Section

The installation of mechanical and electrical equipment in accordance with these design standards requires, upon completion and prior to final inspection, testing to insure the standards are met and to maintain quality control. Pump testing to include pumping rate and pressure for each pump and combination thereof, electrical testing procedures which apply to all electrical equipment, and load bank testing procedures which apply to all standby generators shall be provided. The wastewater lift station will not be accepted by the City of Reno until all components are tested individually and as a complete system. If one component fails it shall be repaired or replaced and re-tested. Once the individual component is operating properly the entire system shall be re-tested to assure the system as a whole is operating properly.

Flow tests shall be conducted that allow each pump to cycle 10 times. The test shall be run so that the pumps cycle continuously as if in permanent operation. While conducting the test flow rates shall be recorded through the use of a flow meter or through the measuring of levels in the wet well. The discharge pressures from each pump shall also be recorded during the test. The contractor will be required to supply test water if on-site water or sewage is not available.

Ground resistance testing shall be performed for ground systems using the fall of potential method. Ground resistance test services shall be provided by a fully trained and equipped testing company such as Electrotest Inc., General Electric, Cutler Hammer – Eaton Corporation. Testing by the contractor will not be accepted.

The test shall be complete enough to be conclusive and to insure proper operation. This shall be certified in test reports submitted to the Engineer.

Test shall be nondestructive and procedures used shall be approved by the Engineer. Generally testing shall comply with the procedures outlined in "Westinghouse

Engineering Service Standard Scopes of Work (SSW)" July 23, 1993 and "Insulation Testing by D.C. Methods" and "Earth Resistance Testing".

F. Documentation

Prior to acceptance of the lift station the contractor shall deliver to the City three copies of the following:

1. Record drawings for all components of the lift station
2. As-built control schematics
3. As-build wiring diagrams
4. Pump specifications, test data and manufacturers O&M manuals
5. Generator equipment data and manuals
6. Mechanical and electrical component lists
7. Keys or entry tools for all vaults
8. Contact Information for all warranties.

G. Warranty

All sanitary sewer lift stations shall include a one-year warranty against defects in workmanship and materials. The one-year time frame shall begin once the City has made final acceptance. Items that require repair under the one year warranty period shall be covered under an additional one year warranty after the repair is made.

Any warranty claim shall be acknowledged by the responsible party a course of action determined with one week of the initial notification.

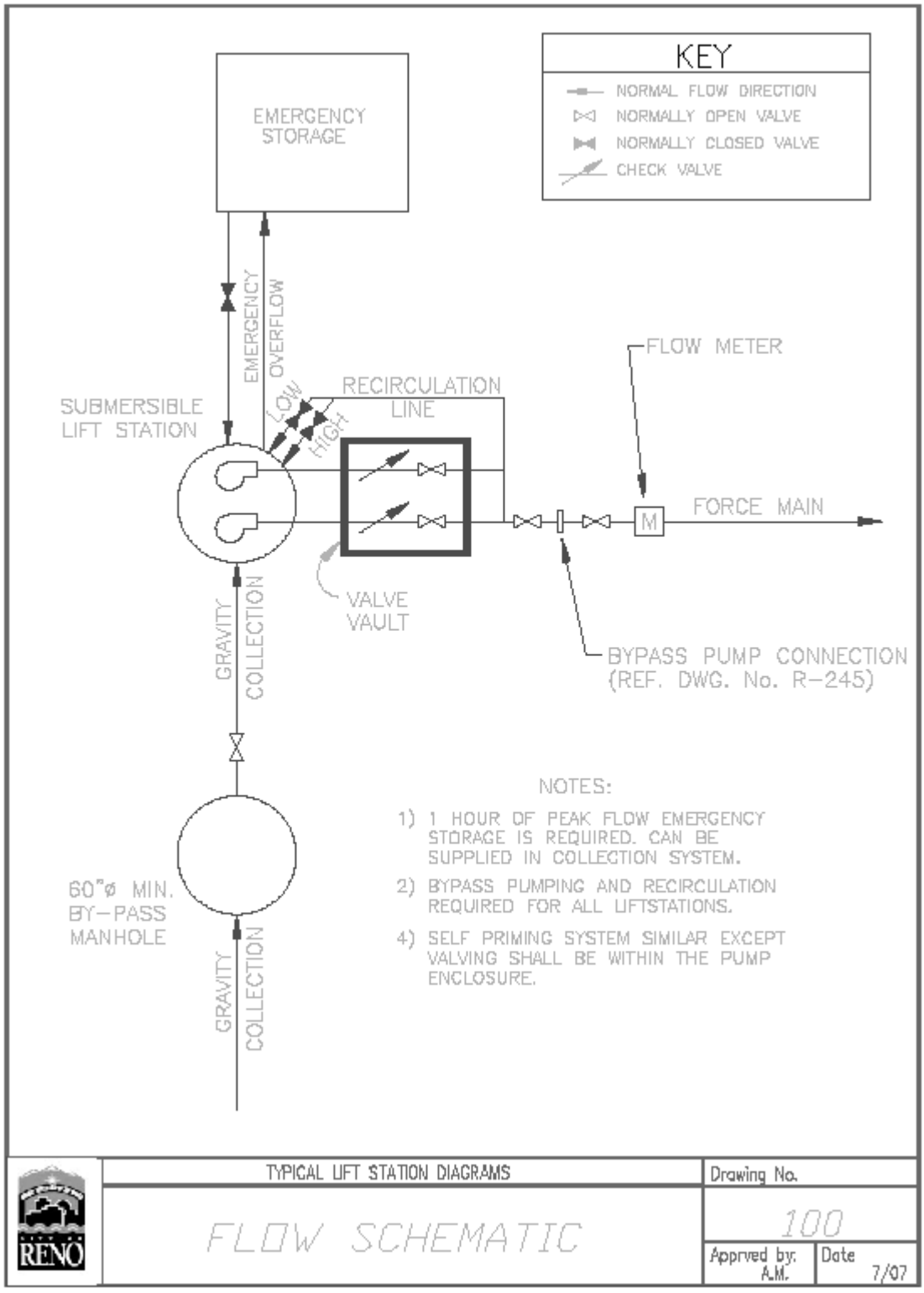
H. Instruction of City Personnel

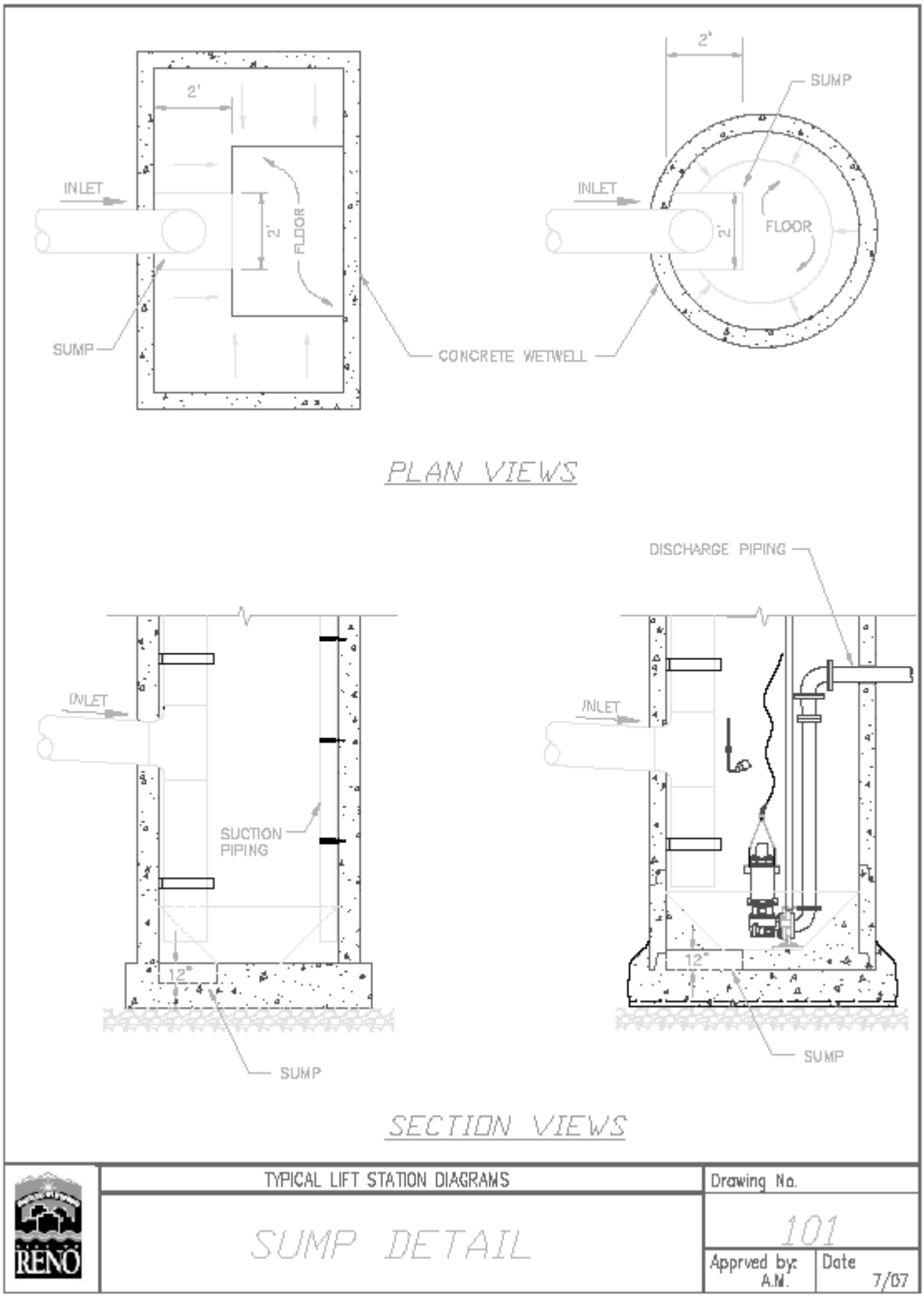
City personnel shall receive training from factory authorized representatives of the major equipment to include, but not necessarily be limited to, the pumps, pump controls and generator. The training shall be performed prior to acceptance of the lift station by the City.

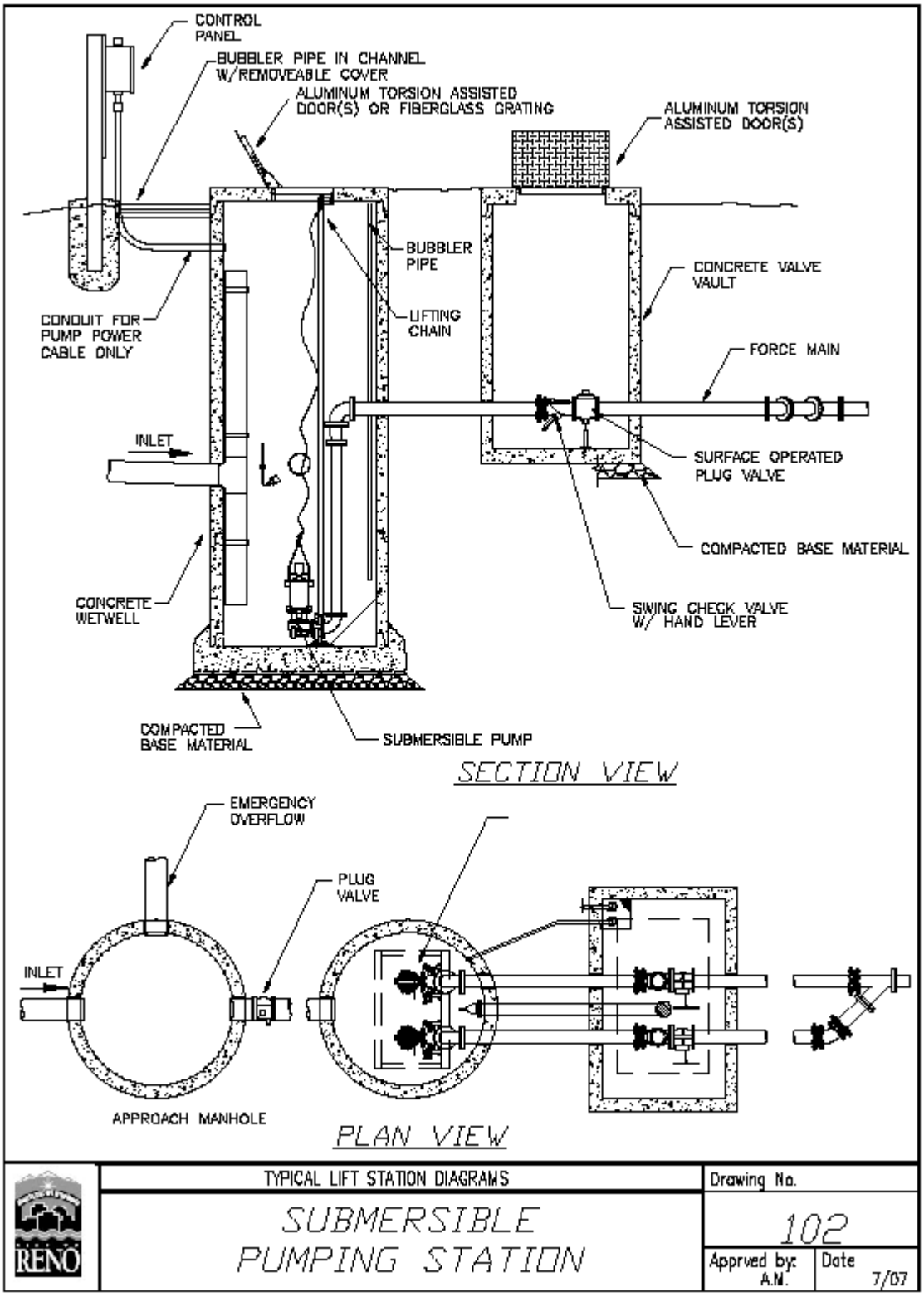
SECTION IV. TYPICAL LIFT STATION DIAGRAMS

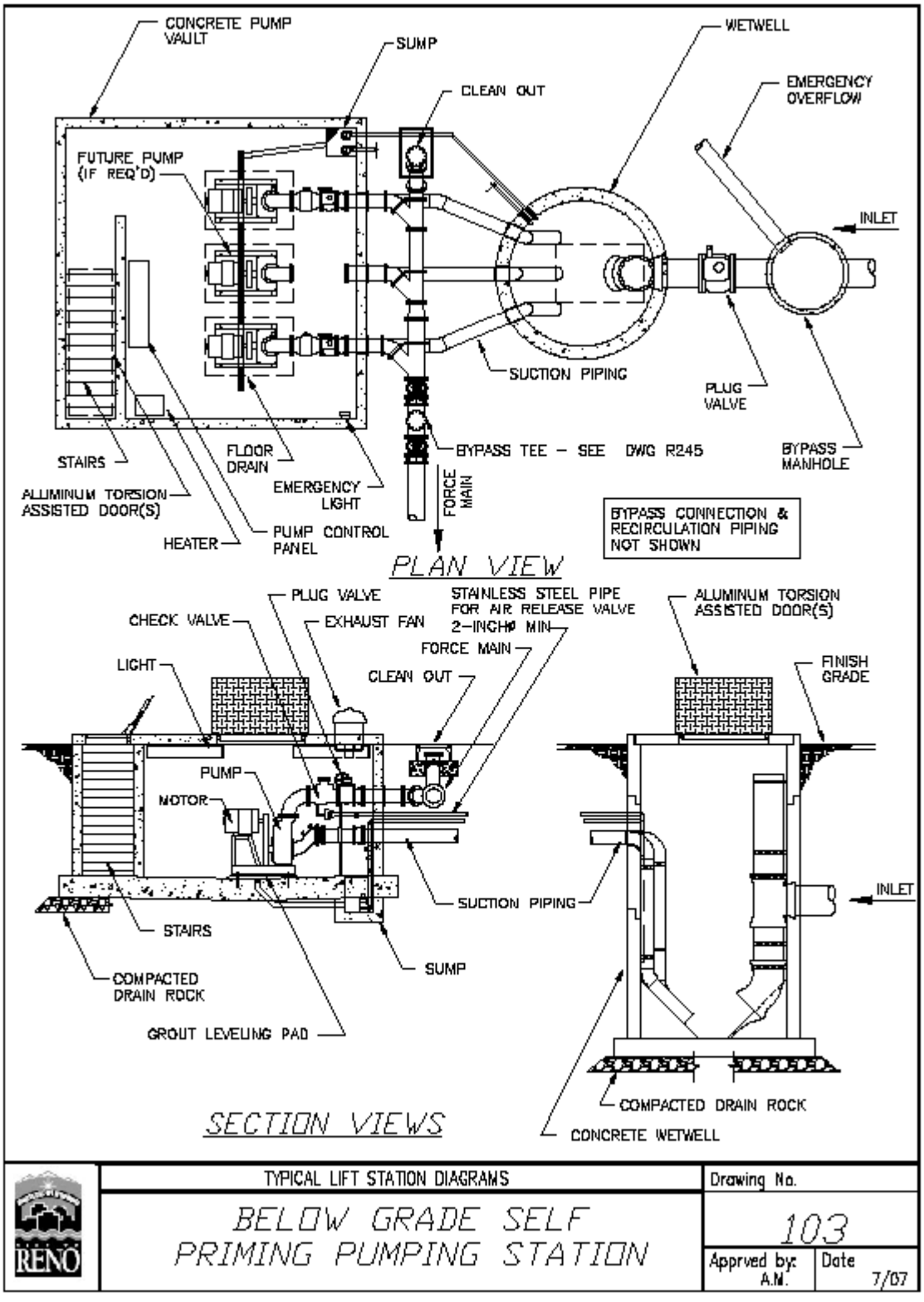
The following drawings are intended to illustrate the requirements delineated in the design standards. They are not to scale, do not show all lift station components and should be taken to be conceptual. Each lift station will require an independent site analysis to identify the best configuration for the required components.

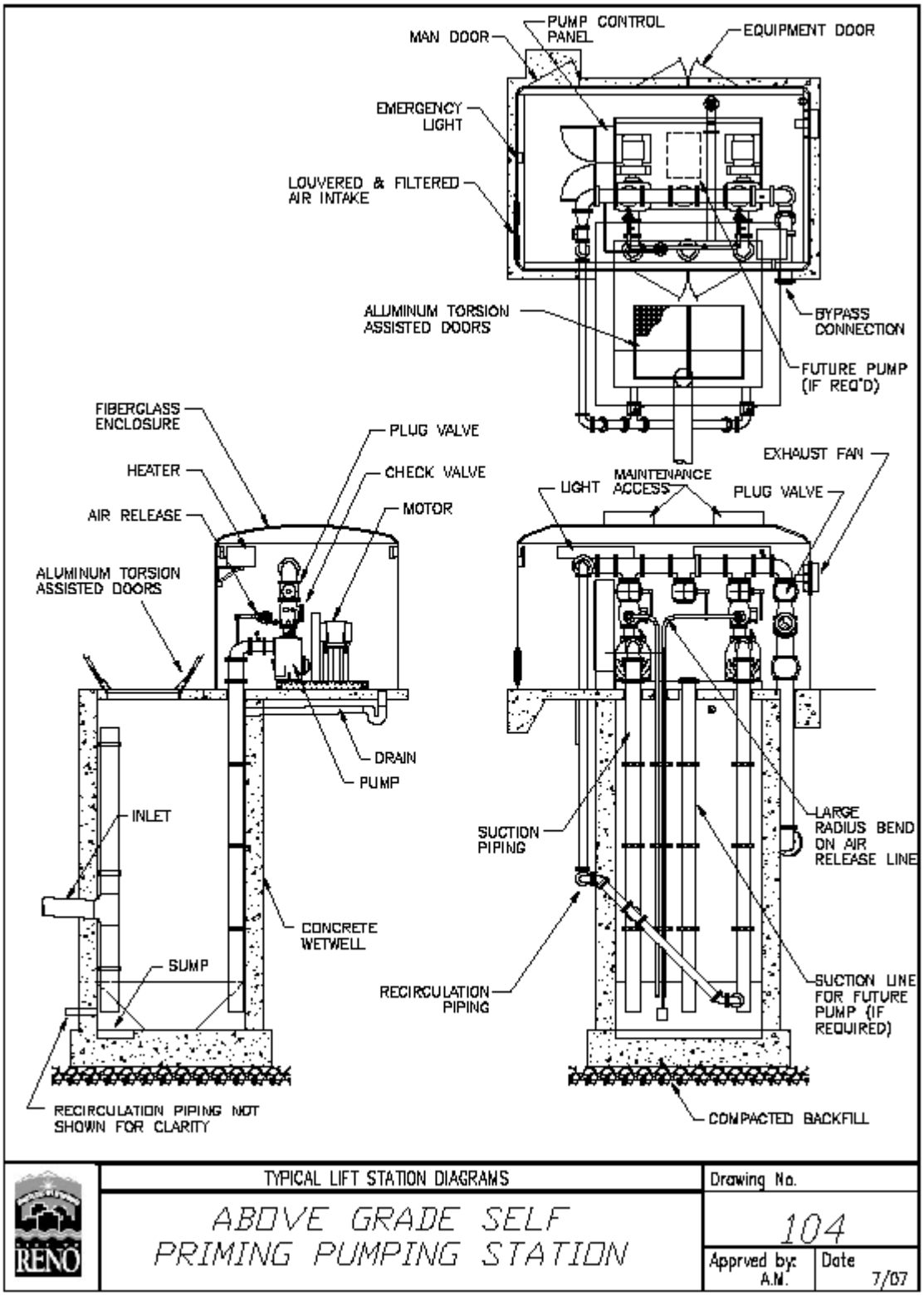
The pre-design conference will address the general site layout and required deviations from these conceptual configurations will be determined at that time for the specific project under consideration.


KEY
NORMAL FLOW DIRECTION
NORMALLY OPEN VALVE
NORMALLY CLOSED VALVE
CHECK VALVE
EMERGENCY STORAGE
EMERGENCY OVERFLOW
SUBMERSIBLE LIFT STATION
LOW
HIGH
RECIRCULATION LINE
FLOW METER
M
FORCE MAIN
VALVE VAULT
BYPASS PUMP CONNECTION (REF. DWG. No. R-245)
GRAVITY COLLECTION
60"ø MIN. BY-PASS MANHOLE
GRAVITY COLLECTION
NOTES:
1) 1 HOUR OF PEAK FLOW EMERGENCY STORAGE IS REQUIRED. CAN BE SUPPLIED IN COLLECTION SYSTEM.
2) BYPASS PUMPING AND RECIRCULATION REQUIRED FOR ALL LIFTSTATIONS.
4) SELF PRIMING SYSTEM SIMILAR EXCEPT VALVING SHALL BE WITHIN THE PUMP ENCLOSURE.
RENO
TYPICAL LIFT STATION DIAGRAMS
FLOW SCHEMATIC
Drawing No.
100
Approved by: A.M.
Date 7/07

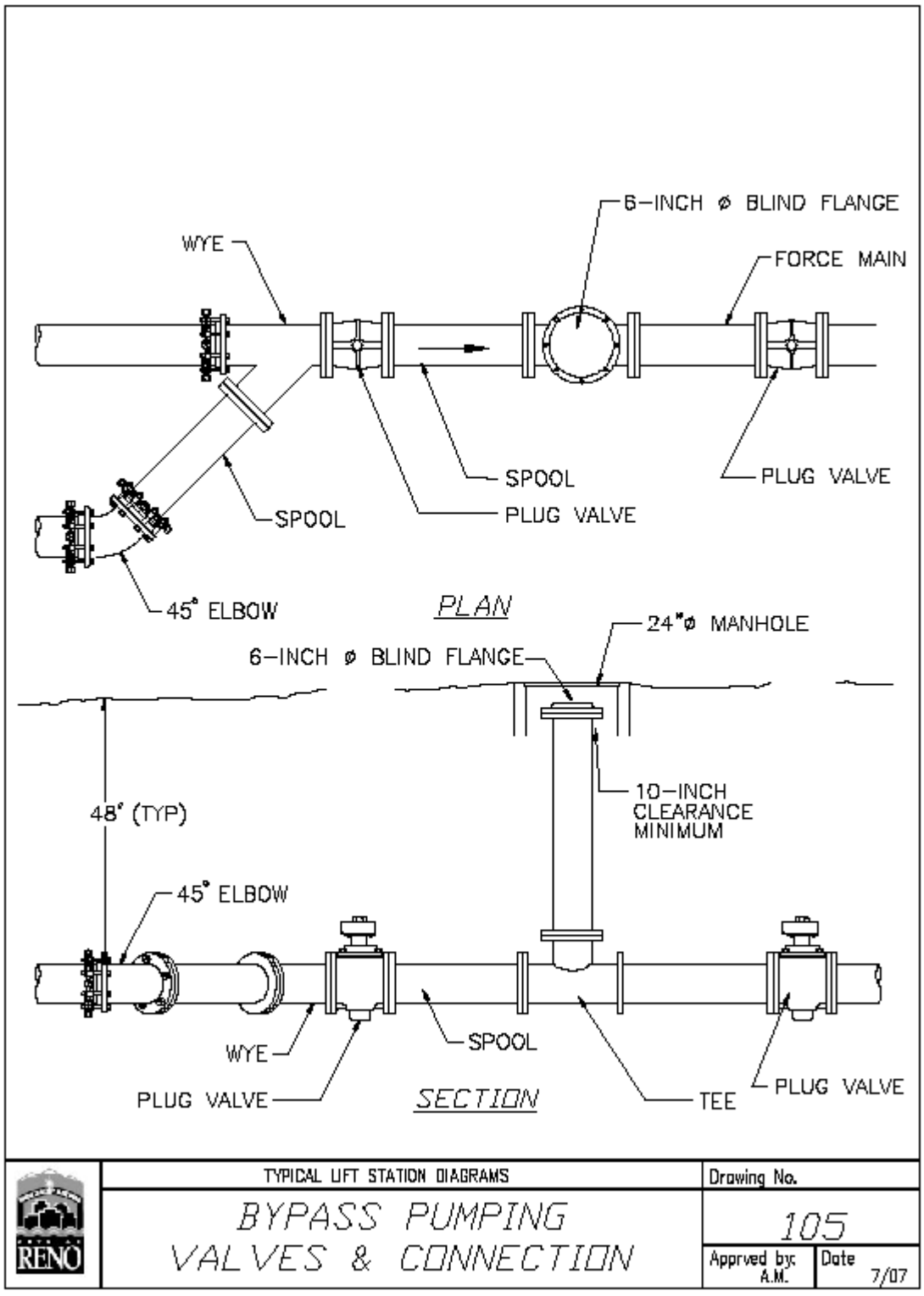

2'
INLET
2'
FLOOR
SUMP
CONCRETE WETWELL
2'
SUMP
INLET
2'
FLOOR
PLAN VIEWS
DISCHARGE PIPING
INLET
SUCTION PIPING
12"
SUMP
INLET
12"
SUMP
SECTION VIEWS
TYPICAL LIFT STATION DIAGRAMS
SUMP DETAIL
Drawing No.
101
Approved by: A.M.
Date 7/07


CONTROL PANEL
BUBBLER PIPE IN CHANNEL W/REMOVEABLE COVER
ALUMINUM TORSION ASSISTED DOOR(S) OR FIBERGLASS GRATING
ALUMINUM TORSION ASSISTED DOOR(S)
BUBBLER PIPE
CONCRETE VALVE VAULT
CONDUIT FOR PUMP POWER CABLE ONLY
LIFTING CHAIN
FORCE MAIN
INLET
SURFACE OPERATED PLUG VALVE
COMPACTED BASE MATERIAL
CONCRETE WETWELL
SWING CHECK VALVE W/ HAND LEVER
COMPACTED BASE MATERIAL
SUBMERSIBLE PUMP
SECTION VIEW
EMERGENCY OVERFLOW
PLUG VALVE
INLET
APPROACH MANHOLE
PLAN VIEW
TYPICAL LIFT STATION DIAGRAMS
Drawing No.
SUBMERSIBLE PUMPING STATION
102
Approved by: A.M.
Date 7/07

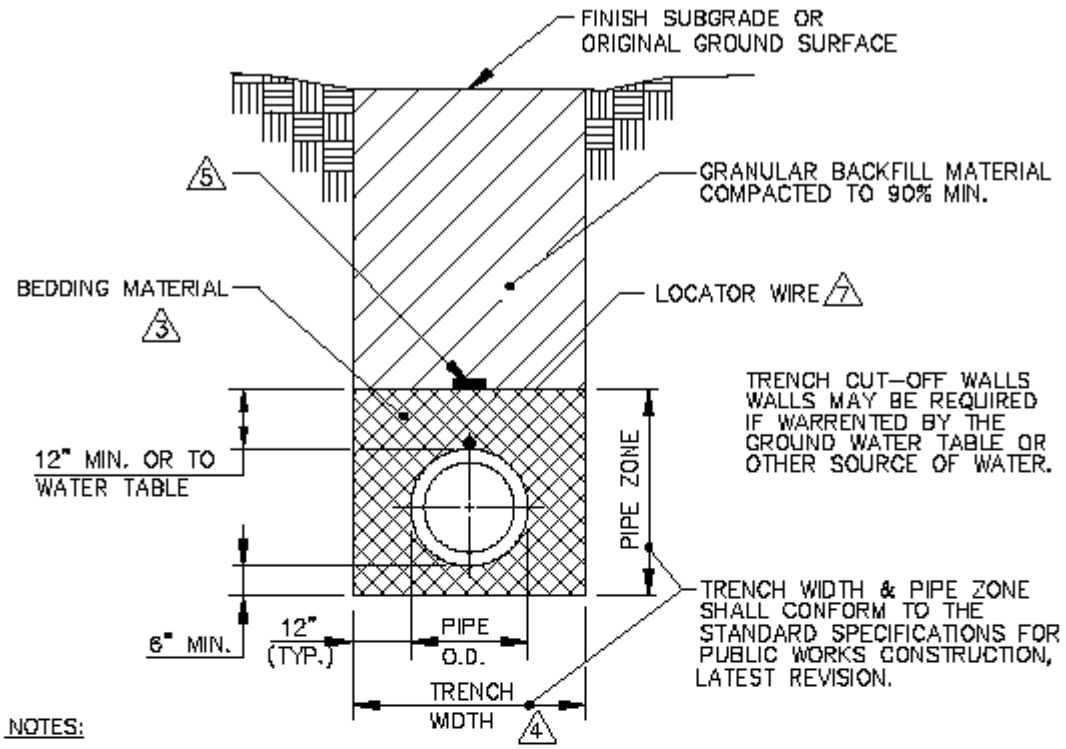

CONCRETE PUMP VAULT
SUMP
CLEAN OUT
WETWELL
EMERGENCY OVERFLOW
FUTURE PUMP (IF REQ'D)
INLET
SUCTION PIPING
PLUG VALVE
BYPASS TEE – SEE DWG R245
BYPASS MANHOLE
STAIRS
FLOOR DRAIN
EMERGENCY LIGHT
FORCE MAIN
ALUMINUM TORSION ASSISTED DOOR(S)
HEATER
PUMP CONTROL PANEL
BYPASS CONNECTION & RECIRCULATION PIPING NOT SHOWN
PLAN VIEW
PLUG VALVE
STAINLESS STEEL PIPE FOR AIR RELEASE VALVE 2-INCH∅ MIN
ALUMINUM TORSION ASSISTED DOOR(S)
CHECK VALVE
EXHAUST FAN
FORCE MAIN
FINISH GRADE
LIGHT
CLEAN OUT
PUMP
MOTOR
SUCTION PIPING
INLET
STAIRS
SUMP
COMPACTED DRAIN ROCK
GROUT LEVELING PAD
COMPACTED DRAIN ROCK
CONCRETE WETWELL
SECTION VIEWS
TYPICAL LIFT STATION DIAGRAMS
Drawing No.
BELOW GRADE SELF PRIMING PUMPING STATION
103
Approved by: A.M.
Date 7/07



	TYPICAL LIFT STATION DIAGRAMS	Drawing No.
RENO	ABOVE GRADE SELF PRIMING PUMPING STATION	104
		Approved by: A.M. / Date 7/07



	TYPICAL LIFT STATION DIAGRAMS	Drawing No.
RENO	BYPASS PUMPING VALVES & CONNECTION	105
		Approved by: A.M. / Date 7/07



NOTES:

1. CONSTRUCTION IN THE CITY'S RIGHT-OF-WAY MUST BE DONE IN CONFORMANCE WITH RENO MUNICIPAL CODE SECTION 12.08.010 – 12.08.120 (STREET EXCAVATION) AND SECTION 6.11.010-6.11.090 (ENCROACMENTS). WORK IN THE STATE RIGHT-OF-WAY WILL REQUIRE AN ENCROACHMENT PERMIT ISSUED BY THE NEVADA DEPARTMENT OF TRANSPORTATION.

2. ALL MATERIALS AND INSTALLATION PROCEDURES SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST REVISION.

3. FORCE MAIN BEDDING MATERIAL SHALL BE CLASS "A", "B", OR "C", COMPACTED TO 90% MINIMUM. BACKFILL SHALL BE GRANULAR MATERIAL COMPACTED TO 90% MIN.

4. ALL EXCAVATIONS SHALL CONFORM TO THE LATEST O.S.H.A. REQUIREMENTS. SHORING OR SLOPED CUT MAY BE NECESSARY, BUT THERE WILL BE NO PAYMENT FOR ADDITIONAL EXCAVATION, BEDDING, BACKFILL, OR SHORING.

5. INSTALL IDENTIFICATION TAPE MARKED "FORCE MAIN"

6. FORCE MAIN SHALL HAVE A MINIMUM OF 4' OF COVER MEASURED FROM PROPOSED FINISH GRADE TO TOP OF PIPE

7. TRACER WIRE SHALL BE #14 AWG. TEST STATIONS SHALL BE CONSTRUCTED EVERY 1000 FEET. TEST STATIONS SHALL HAVE A MINIMUM OF 3 FEET OF COILED WIRE.

	TYPICAL LIFT STATION DIAGRAMS	Drawing No.	
RENO	FORCE MAIN TRENCH	106	
		Approved by: A.M.	Date 7/07