LIFT STATION DESIGN AND CONSTRUCTION STANDARDS

2019 - 1ST EDITION
VOLUME 2 OF 2 - STANDARD PLATES

Clark County Water Reclamation District
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CLARK COUNTY
WATER RECLAMATION DISTRICT
## CLARK COUNTY WATER RECLAMATION DISTRICT
### LIFT STATION DESIGN AND CONSTRUCTION STANDARDS, 2019 – 1ST EDITION
#### VOLUME 2 OF 2 – STANDARD PLATES

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These Lift Station Design and Construction Standards, 1st Edition, have been adopted by Resolution of their governing body as follows:

CLARK COUNTY WATER RECLAMATION DISTRICT
Adopted by Board of Trustees May 7, 2019

CLARK COUNTY WATER RECLAMATION DISTRICT
5857 East Flamingo Road
Las Vegas, Nevada 89122
(702) 668-8160 (Engineering Counter)
(702) 668-8205 (Inspections)
NOTES:
1. AT SITES WITH SINGLE ENTRY GATE (OR WHERE TURNAROUNDS FOR MAINTENANCE VEHICLES IS NOT
   PROVIDED), AND WHERE SUFFICIENT PARKING LANE IS
   NOT PROVIDED IN ROADWAY FOR MAINTENANCE VEHICLE
   SAFETY, COMPOUND MAY REQUIRE A 'BUS TURNOUT',
   (SPECIAL STATION REQUIREMENT) PER CLARK COUNTY
   STANDARDS Dwg. No. 234.1 (WITHOUT BUS
   MARKINGS/SCAFFOLD OR SHEDDER PAD)

2. 'TRIPLEX' OR 'LARGE STATIONS SHALL HAVE A SPD
   PAD (MIN) WITH A MINIMUM SIZE DIMENSION OF 20 FEET
   (40'X20' TYP).

3. 4. SELECT LIFT STATIONS REQUIRE A 'GRAV SLUMP, (SPECIAL
     STATION REQUIREMENTS) PRIOR TO THE WET WELL ICE
     STANDARDS AND COORDINATE WITH COMPO

4. ALL SITES SHALL BE SECURED WITH 8' SECURITY WALL
   AND 20' ENTRY GATE(S) AS PER STANDARD PLATES
   30-28 AND 30-29.

5. DEVELOPER SHALL CONFORM SITE DESIGN TO CLARK
     COUNTY PLANNING & ZONING REQUIREMENTS, SETBACKS,
     SPECIAL USE PERMITS AND DESIGN REVIEW
     REQUIREMENTS, INCLUDING LANDSCAPING PER TYP 10
     AND ARCHITECTURAL REQUIREMENTS OF BUILDINGS.
     SHOULDER STRUCTURES, GENDER ENCLOSURE WALLS, OR
     OTHER FACILITIES AS APPLICABLE.

7. SITE SHALL BE DESIGNED TO BE ACCESSIBLE BY A
   WORK TRUCK 2100 SERIES, HAVING DIMENSIONS OF
   12 FT TOTAL LENGTH WITH 200 IN HOLLOW RISE AND
   APPROXIMATELY 8 FEET OF TRUCK AND EQUIPMENT IN
   FRONT OF THE STEERING AXLE.

8. PAVEMENTS WITHIN THE LIFT STATION SITE SHALL BE
   ASPHALT DESIGNED TO THE DESIGN ENGINEER TO
   ACCOMMODATE TO THE COUNTERCOUNTER COUNTER
   DESIGN ENGINEER. ALL OTHER AREAS WITHIN THE LIFT STATION SITE
   SHALL BE TYPE 2 ASPHALT SURFACE.

9. SUBMERSEABLE LIFT STATIONS WILL ONLY BE CONSIDERED
   AT SMALL LIFT STATIONS, ON A CASE-BY-CASE BASIS.

ABBREVIATIONS

SS = GRAVITY SEWER
PS = PUMP STATION
FM = FORCE MAIN
TN = MAN HOLE

PLAN

SCALE: 3/4"=1'-0"
NOTES:

1. AT SITES WITH SINGLE ENTRY GATE (OR WHERE TURNAROUND FOR MAINTENANCE VEHICLES IS NOT PROVIDED), EACH MADE-SUCTION PUMPING LANE IS NOT NEEDED IN HOMESTAY FOR MAINTENANCE VEHICLE SAFETY. COMB. MAY REQUIRE A BUS TURNOUT (SPECIAL STATION REQUIREMENTS PER CLARK COUNTY STANDARD NO. 234.1 WITHOUT BUS MARKINGS/STORAGE OR SHELTER PAD).

2. TYPICAL ON LARGE STATIONS SHALL HAVE A BELT PLF PAD (MIN) WITH A MINIMUM SIDE DIMENSIONS OF 20 FEET (20'X20' TYP).

3. SELECT LIFT STATIONS REQUIRE A "GRID SLUMP" (SPECIAL STATION REQUIREMENTS) PLUS THE REY WELL. SEE STANDARDS AND COORDINATE WITH COMPO REPRESENTATIVE.

4. ALL SITES SHALL BE SECURED WITH 8' SECURITY WALL AND 20' ENTRY GADE(S) AS PER STANDARD PLATES SP-28 AND SP-29.

5. DEVELOPER SHALL COMPLY WITH CLARK COUNTY PLANNING & ZONING REQUIREMENTS, SEEPAGE, SPECIAL USE PERMITS, AND DESIGN REVIEW REQUIREMENTS, INCLUDING LANDSCAPING PER TITLE 54 AND ARCHITECTURAL REQUIREMENTS OF BUILDINGS, SHADE STRUCTURES, GENERATOR ENCLOSURE, WALLS, OR OTHER FACILITIES AS APPLICABLE.

6. SITE SHALL BE DESIGNED TO BE ACCESSIBLE BY A 'FACIL TRUCK 2100 SERIES', HAVING DIMENSIONS OF 41 FT TOTAL LENGTH WITH 36-IN WHEEL BASE AND APPROXIMATELY 8 FEET OF TRUCK AND EQUIPMENT IN FRONT OF THE STEERING AXLE.

7. PAYMENT IN THE LIFT STATION SITE SHALL BE ARRANGED TO CONFORM TO THE CONTRACTOR'S REQUIREMENTS. ALL TERMS AMONG WITHIN THE LIFT STATION SITE SHALL BE TYPE 2 AGGREGATE SURFACE.

8. SUBMITTAL LIFT STATIONS WILL NOT BE CONSIDERED AT "SINGLE" LIFT STATIONS, ON A CASE BY CASE BASIS.
SUBMERSIBLE STATION - SMALL

ISSUED: - NUMBER: SP-04
WET WELL

PLAN

ANTI-ROTATION BATTLE

FLARED PUMP INLET

END OF Ogee CURVE

INFLUENT SLUDGE GATE

INFLUENT SEWER

PUMP ROOM

TOP OF VOLUTE SHALL NOT BE HIGHER THAN LML

INFLUENT SLUDGE GATE

INFLUENT SEWER

OPTIONAL HML

BAR RACK AT 60°

HAUNCHES

HAUL

WET WELL FLOOR

HAUL

FLARED PUMP INLET

ECCENTRIC REDUCER

VANE

WET WELL

ELEVATION

OPTION "B"

(for smaller inlets)

OPTION "A"

NOTES:
1. D IS BELL RIM OUTSIDE DIAMETER
2. D IS DETERMINED BASED ON 3.5 FPS MAX INLET VELOCITY AT SUCTION FLARE AT PUMP FULL SPEED.
3. SLOPE OF WALL SHALL BE 60° MINIMUM. 45° MINIMUM
4. INLET SEWER SHALL BE CENTERED TO TRENCH
5. PROVIDE SUITABLE ROOM FOR INSTALLATION OF SLUDGE GATE
6. DESIGN SHALL CONFORM TO HYDRAULIC INSTITUTE STANDARDS.
7. L2 PER HI TABLE 6.6.6.3.2.
NOTE:
1. PROVIDE 2" X 2" ANGLED KEY WAY FOR PROPOSED COATING AT ALL TERMINATION POINTS. DETAIL 1. DO NOT DAMAGE ADJACENT LINER/COATING.
2. ABRASIVE MEDIA BLAST EXISTING COATING / LINER AND OVERLAP PROPOSED COATING. TAPE TO AVOID OVER-SPRAY. SEE DETAIL 2 FOR EXISTING PLASTIC LINER OR INCOMPATIBLE COATING REHABILITATION.
3. WHERE APPLICABLE, FILL IN JINT BETWEEN PIPE AND MANHOLE WALL.
4. ENGINEER TO LOCATE LIMITS OF COATING / LINER REHABILITATION, PROPOSED COATING TERMINATION POINT.
5. CONTRACTOR TO DETERMINE LIMITS OF COATING APPLICATION AND RESPECTIVE TERMINATION POINTS.
6. PROTECT ELASTOMERIC SEAL AND ABRASIVE MEDIA BLAST SURFACES TO BE COATED.
7. ALL COATED SURFACES SHALL BE PREPARED TO SPECIFICATION, CLEANED THOROUGHLY AND INSPECTED PRIOR TO COATING.

FLUSH PIPE MANHOLE WALL PENETRATION

EXTRUDED PIPE MANHOLE WALL PENETRATION

NEW/REHAB MH BENCH COATING

NEW MH COATING

REHAB MH COATING

MANHOLE GRADE RING ASSEMBLIES

RECESSED PIPE MANHOLE WALL PENETRATION

NOTE 1
NOTE 2
NOTE 3
NOTE 4
NOTE 5
NOTE 6
NOTE 7
NOTE 8
NOTE 9
NOTE 10
NOTE 11
NOTE 12
NOTE 13
4" SPD (3) TO WET WELL
4" x 2" PVC REDUCER
SOC x SOC
2" PVC TRUE UNION BALL VALVE
SOC x SOC
2" PVC UNION
SOC x SOC
2" PVC TRUE UNION BALL CHECK VALVE
SOC x SOC
2" FLEXIBLE COUPLING W/SSTL CLAMPS
FINISHED FLOOR (SEE PLAN)
GRATE

SPUMP AS SPECIFIED IN SECTION 02535

SECTION
NTS

SUMP PUMP PIPING

ISSUED: - NUMBER: SP-17
"LINK SEAL" VERIFY SIZE

OUTSIDE

INSIDE

CAULK ALL AROUND W/ SYNTHETIC RUBBER, TYP

VERIFY DIAMETER FOR OPENING IN VAULT WITH "LINK-SEAL" MFR RECOMMENDATIONS

SECTION

PIPE PENETRATION WALL DETAIL

ISSUED: - NUMBER: SP-18
PIPE SUPPORT TABLE - "A" TYPE (ADJUSTABLE SADDLE)

<table>
<thead>
<tr>
<th>NOMINAL PIPE SIZE</th>
<th>PIPE FLANGE SIZE</th>
<th>SUPPORTING PIPE OR FLANGE</th>
<th>A</th>
<th>B</th>
<th>C (PER WPS)</th>
<th>D</th>
<th>E</th>
<th>P</th>
<th>BOLT SIZE</th>
<th>BOLT NO</th>
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PIECE SUPPORT -
ADJUSTABLE FLOOR SUPPORT

ISSUED: -  NUMBER: SP-19
NOTE:
ALL ANCHORS SHALL BE
APPROVED BY NV PE FOR
SEISMIC APPLICATION

PIECE SUPPORT -
WALL MOUNTING PIPING
3/8" Ø x 1 1/2" SSTL WEDGE ANCHOR W/BOLT & WASHER (TYPICAL)

PIPE CLAMP (GALVANIZED)

2" MIN (BETWEEN PIPES)

2" MIN (EACH END)

SILICONE RUBBER OR NEOPRENE ISOLATING SLEEVE

1-5/8" x 1-5/8" SLOT CHANNEL (GALVANIZED)

NOTE:
ALL MATERIALS IN CORROSIVE AREAS TO BE STAINLESS STEEL 316.
**WET WELL BUBBLER MOUNTING AND PIPING DIAGRAM**

**WET WELL BUBBLER CONTROL**

**AIR PIPING DETAIL**

---

**AIR BUBBLER PIPING DIAGRAM**

- Exposed conduit shall be PVC coated GRS.
- Underground conduit shall be PVC.
- Conduit in wetwell shall be stainless steel.
- Piping used for the bubbler system to hold tubing shall be similar to conduit.

---

**PIPE SUPPORT**

- Type "SC" SSTL

---

**1/4" x 1/4" PL**

- SSTL pipe bracket
- W/ 4" SQ x 1/4" SSTL base pl.
- 4 - 3/8" x 5-1/8" SSTL epoxy adhesive anchor bolts ea. (TYP)

---

**1-1/2" x 1/4" PL**

- SSTL pipe bracket
- W/ 4" SQ x 1/4" SSTL base pl.
- 4 - 3/8" x 5-1/8" SSTL epoxy adhesive anchor bolts ea. (TYP)

---

**1/4" SSTL "U" BOLT**

- W/ SSTL NUTS & STAR LOCK WASHERS (TYP)

---

**3/4" 316 STAINLESS STEEL INSIDE WET WELL**

---

**Access Manway**

---

**To Wet Well Equipment Cabinet (See Site Piping Plan)**

---

**WET WELL**

- 1'-0"

---

**PIPE SUPPORT**

- Type "SC" SSTL

---

**3/4" A (6)**

- 316 SSTL pipe inside wet well

---

**WET WELL BUBBLER CONTROL**

---

**AIR BUBBLER PIPING DIAGRAM**

---

**nts**
FINISHED GRADE

1'-0" MIN
3'-0" MAX

GALVANIZED STEEL VENT CAP
W/ INSECT SCREEN (TYP.)

3/4" GAL. STL ALL BOLTS
THREAD (TYP. 4)

PROVIDE DAMPER PER MECHANICAL
DRAWINGS & SPECS

STL PIPE SEE MECH DWGS FOR DIAMETER
WALL FLG

3'-0" SQ x 6" CONC PAD

TRANSITION SLEEVE STYLE COUPLING

SEE CIVIL AND MECHANICAL DRAWINGS
FOR CONTINUATION AND CONNECTION TO
STRUCTURES

VENTILATION PIPING CAP DETAIL

ISSUED: - NUMBER: SP-24
VAULT ACCESS - SINGLE LEAF

ISSUED: -  NUMBER: SP-25
VAULT ACCESS - DOUBLE LEAF

ISSUED: -  NUMBER: SP-26
1. Ladder locations as shown on drawings.
2. Ladders shall be 316 stainless steel.
3. Hardware shall be 316 SS.

<table>
<thead>
<tr>
<th>Ladder &amp; Bracket Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracket Spacing</td>
</tr>
<tr>
<td>5'-0&quot; O.C. Max.</td>
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<tr>
<td>5'-0&quot; to 10'-0&quot;</td>
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<tr>
<td>10'-0&quot; to 20'-0&quot;</td>
</tr>
<tr>
<td>Over 20'-0&quot;</td>
</tr>
</tbody>
</table>

Elevation

Plan

ISSUED: -  NUMBER: SP-27
**PLAN**

- Generator Set
- Modular Type Skid Mounted Generator Set Enclosure
- Dimensions:
  - 9'0" x 9'0"
  - 18'0"
  - 5'0"

**SECTION**

- Generator Enclosure
- Generator Set
- Isolation Dampeners
- Provide Ufer Ground in Generator Pad, Bond with Generator Set and Enclosure
- Finished Grade
- 12" of Type 2

**NOTE:**
1. Example dimensions shown for large Genset size pad and reinforcing as per generator manufacturer recommendations and structural calculations.
2. Anchor bolts size & location per generator manufacturer
3. Footing shall be approved by NV PE.

**GENERATOR PAD**

**ISSUED:** -

**NUMBER:** SP-29
CONNECT TO SITE WATER SERVICE. PRESSURE TEST EXHAUST, AND LEAVE EMPTY FOR FUTURE USE.

12" MIN. FROM EACH EDGE (TOP)
2" WATER SUPPLY LINE

20.00' MIN.

DESIGN ENGINEER SHALL PROVIDE ADDITIONAL REINFORCEMENT AT LINES WITHIN 18" INT.

FOR FUTURE CONSTRUCTION, PROVIDE SUPPORT FOR WATERLINE ABOVE SLAB.

SECTION

20.00' MIN.

GAS PHASE ODOR VENT
AS PER SECTION 2.6.4, 6" DIA MIN.
NOT REQUIRED AT SMALL STATIONS

CONNECT TO WET WELL
SLOPE AT 1/12 MIN. TO WET WELL
CONNECTION FOR DRAINAGE OF FUTURE CONSTRUCTION

CONNECT TO SITE POWER JUNCTION BOX
FOR FUTURE POWER SERVICE TO ODOR PAD

4" PVC POWER
CONDUIT STUB (BLANK)

GD 1/12 MIN.
TO WET WELL

12" MIN. FROM
EACH EDGE (TOP)

STUB UP 2" PVC LIQUID PHASE
CONDUIT AND 4" POWER SUPPLY
STUBS 6" ABOVE SLAB
STRING AND CAP

PROVIDE C CHANNEL
SUPPORT FOR WATERLINE
ABOVE SLAB

STUB UP 2" PVC WATER SUPPLY 3'
ABOVE SLAB AND CAP WITH SECURE FITTING

PROVIDE BLIND PLACED CAP ON FRP GAS PHASE VENT,
3' MIN ABOVE SLAB

4" " 10" F'W.
CONTINUOUS REINFORCEMENT
PENETRATION SLEEVE TYP.

SECTION

NTS

PLAN

NTS

GENERAL NOTE:
THESE STANDARD DRAWINGS INCLUDE SPECIFIC INFORMATION FROM A PREVIOUS
DISTRICT PROJECT. THE DESIGN ENGINEER SHALL USE THE FORMAT AND
LAYOUT OF THESE DRAWINGS AS A STARTING POINT FOR UTI STATION
CONSTRUCTION DOCUMENTS. THE SPECIFICATIONS ARE SHOWN IN ORDER TO HELP
THE DESIGN ENGINEER QUALITY AND QUANTITATE THE TYPICAL REQUIREMENTS OF
DISTRICT LIFT STATIONS, PARTICULARLY TRIFLEX AND LARGE STATIONS. THE
DESIGN ENGINEER IS RESPONSIBLE FOR REVISION, ADDITION, OR DELETION OF
THESE PROJECT SPECIFIC ITEMS (SUCH AS DIMENSIONS, SCHEDULES, MATERIALS,
AND IDENTIFYING TAGS) TO MATCH THEIR INDIVIDUAL PROJECT.
NOTES:
1. SPECIAL INSPECTION (LEVEL 2) IS REQUIRED FOR THE BLOCK WALL.
2. PROVIDE A MASONRY CONTROL JOINT (MCJ) @ 24'-0" O.C. (FULL HEIGHT). SEE STRUCTURAL.
3. EXTENDS OF CONC FOUNDATION NOT TO GO BEYOND PROPERTY LINE.
4. FOOTING SHALL BE APPROVED BY NV PE.

SECTION

WALL DETAILS

ISSUED: -  NUMBER: SP-31
NOTES:
1. SHEET DRAWING & DESIGN CALCULATIONS, SIGNED & SEALED BY A NEVADA LICENSED ENGINEER ARE REQUIRED.
2. TILE ROOFING & FLASHING REQUIRED PER SPECIFICATIONS.
3. DESIGN OVERTHLOADS – SEE SPECIFICATIONS
4. PRE-FABRICATED BUILDING BY ROMEC INC. SHOWN AND SPECIFIED. SUBSTITUTIONS MUST CONFORM TO INTENT OF SPECIFICATIONS AND DRAWINGS AS SHOWN. CONTRACTOR SHALL COORDINATE ANYchan geS SO THAT ALL PROJECT REQUIREMENTS ARE MET AT NO ADDITIONAL COST.
5. SEE Specs FOR CONTRACTOR RESPONSIBILITIES IN CONSTRUCTING PANEL BUILDING SYSTEM.
6. SEE CIVIL AND ELECTRICAL SHEETS FOR CONDUIT PREFERENCES THROUGH WALLS AND FLOOR SLAB. CONDUIT SHALL NOT BE INSTALLED WITHIN (25) ONLY THROUGH PERPENDICULAR PREFERENCES
7. REINFORCEMENT & DIMENSIONS ARE MINIMUM REQUIRED FOR THE SAMPLE SIZE SHOWN. FINAL DESIGN SHALL ACCOMMODATE REQUIREMENTS PARTICULAR TO THE PROJECT
8. BUILDING TO HAVE TWO ENTRY/EXIT SIDES TO ACCOMMODATE INSTALLATION AND REMOVAL OF EQUIPMENT
9. ROOFING SHALL BE DESIGNED TO ALLOW FOR SOLAR PANEL ATTACHMENT.

ELECTRICAL BUILDING TYPICAL ARCHITECTURAL (SAMPLE DWG)
## CABLE AND CONDUIT SCHEDULES

**ISSUED:** | **NUMBER:** SP-34

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<thead>
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<th>Conduit/Conduit Size</th>
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<th>Length (ft)</th>
<th>Diameter (in)</th>
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**NOTE TO DESIGNER:**

This standard drawing includes the previous district project—design engineer shall use the drawings as a starting point for project station construction documents to express the mechanical, electrical, and hydraulic requirements as specified in the project specifications. The design engineer shall review the station plans and conduct site visits to ensure that all station design requirements are met.

The design engineer shall ensure that the drawings accurately reflect the project specifications and that all necessary information is included. The designer shall coordinate with the appropriate design professionals to address any potential issues or concerns.

All dimensions, schedules, and materials shall be reviewed and approved by the design engineer. Any changes to the drawings or specifications shall be documented and approved before implementation.

The design engineer shall be responsible for ensuring that the project is completed in accordance with the specifications and that all necessary approvals and permits are obtained.

Any questions or concerns related to the project shall be addressed by the design engineer. The design engineer shall communicate with the appropriate parties to ensure that all necessary information is provided and that the project is completed on time and within budget.
**Lighting Fixture Schedule**

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<thead>
<tr>
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<th>Type</th>
<th>Location</th>
<th>Model</th>
<th>Color</th>
<th>Wattage</th>
<th>Lumens</th>
<th>Fixtures</th>
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<tbody>
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<td>F1</td>
<td>Lobby</td>
<td>F1</td>
<td>Red</td>
<td>100</td>
<td>1500</td>
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<tr>
<td>L2</td>
<td>F2</td>
<td>Hall</td>
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**Panel L1**

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<th>Color</th>
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<th>Fixtures</th>
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<td>1500</td>
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**Panel L2**

**Panel L3**

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<th>Fixtures</th>
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<td>1500</td>
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**Panel L3**

**Panel L4**

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<th>Lumens</th>
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**Panel L4**

**Panel L5**

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<td>F2</td>
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</tbody>
</table>

**Panel L5**

**Note to Designer:**

This standard drawing includes specific information from a previous project. The design engineer shall use the format and layout of these drawings as a starting point for lift station construction documents. The specifics are shown in order to help the design engineer qualify and quantify the typical requirements of district lift stations, particularly those of large stations. The design engineer is responsible for revision, addition, or deletion of these project-specific items (such as dimensions, schedules, materials, and identifying tags) to match their individual project.
NOTE TO DESIGNER:
THIS STANDARD DRAWING INCLUDES SPECIFIC INFORMATION FROM A PREVIOUS DISTRICT PROJECT. THE DESIGN ENGINEER SHALL USE THE FORMAT AND LAYOUT OF THESE DRAWINGS AS A STARTING POINT FOR LIFT STATION CONSTRUCTION DOCUMENTS. THE SPECIFICS ARE SHOWN IN ORDER TO HELP THE DESIGN ENGINEER QUALIFY AND QUANTIFY THE TYPICAL REQUIREMENTS OF DISTRICT LIFT STATIONS, PARTICULARLY TRIPLEX AND LARGE STATIONS. THE DESIGN ENGINEER IS RESPONSIBLE FOR REVISION, ADDITION, OR DELETION OF THESE PROJECT SPECIFIC ITEMS (SUCH AS DIMENSIONS, SCHEDULES, MATERIALS, AND IDENTIFYING TAGS) TO MATCH THEIR INDIVIDUAL PROJECT.
STANDARDIZE CCWRD CONTROL SYSTEM

Ultrasonic level
- Siemens Milltronics
- Endress & Hauser
- Pulsar

Magnetic Flow meters
- Endress & Hauser
- Krohne
- Badger

Actuators
- Rotork
- Rexa

VFDs
- Toshiba
- Rockwell / Allen Bradley

PLC
- Allen Bradley MicroLogix 1100
- Allen Bradley ControlLogix L72
- Telemetry Radios
- G.E. MDS-SD9 or I-net2
- Sierra Wireless LS300

Typical duplex pump station control system description, indicators & instrumentation:
- Primary wetwell level system -- bubbler level system with adjustable auto-purge and remote manual purge controls
- Secondary wetwell level monitoring system -- ultrasonic
- Magmeter flowmeter for real-time and flow totalization
- Micrologix 1100 PLC
- GE- MDS -- SD9, Inet II or Sierra Wireless cell modem/radio (based on location)
- High-level float-- used to run the pumps directly from the MCC if the PLC faults; provides discrete alarm to PLC input for monitoring
- Intrusion alarm -- monitors hatches, doors, etc.; provides discrete alarm input to PLC for monitoring
- Drywell flooding alarm float
- Phase failure relay -- monitors incoming power; provides discrete alarm input to PLC for monitoring
- UPS with external failure / bypass detection circuitry with discrete alarm input to PLC for monitoring UPS failure
- Pump motor overload trip monitoring
- Pump seal minders
- Power Monitor -- typically GE PQM II
- Generator run status and alarm monitoring
- Check valve position switches and pump "airlock" monitoring
- Outlet manifold pressure indicating transmitter
- Pump run status monitoring
- Pump on and off cycle time monitoring
- Ventilation Blower Run Status monitoring
- Ventilation Air Flow Switch monitoring
- Telemetry success percentage display
- PLC heartbeat and clock display status
- Compressor low-pressure alarm switch
- Force main pressure transmitter
- Intrusion alarms on all hatches, doors, equipment with indication to SCADA
- Control cabinet internal analog temperature indication
- Properly sized PLC cabinet cooler if needed based on environment

Each individual lift station control system is designed to run independently of the Districts other lift stations and main telemetry system to assure continuity of operations in the event of telemetry outages.

Under normal circumstances, full station remote monitoring and control shall be available from District SCADA computer workstations / clients via telemetry.

This includes the ability to remotely:
- place pumps into manual control mode
- start and stop pumps remotely
- bypass check valve limit switches to clear detected airlock conditions
- modify lead, lag and stop level setpoints
- modify alarm setpoints
- control and place a particular pump in a manual lead condition and disable automatic alternation
- remotely purge the bubbler system and change purge timing and parameters

Other aspects Of the system:
- The PLC shall alternate the pumps every fill / pump-down cycle
- PLC flow totalization of flow for present day and previous day will be done in the PLC and available for SCADA system retrieval.
- The PLC will additionally calculate flow based on level start / stop set points. wet-well diameter and pump run /lapse times to estimate station flow during outages of the magnetic flow meter.
- All alarm conditions shall be available on the remote SCADA telemetry for staff notification.
- All system status shall be available on remote SCADA telemetry for monitoring and historization.

DISTRICT OPERATION PHILOSOPHY FOR WET WELL LEVEL INDICATION AND CONTROL

Standard two pump lift stations use a bubbler system connected to the PLC for primary level indication and control. A high level float serves as the activation for the emergency backup system. The float sits in water so it connects to an intrinsically-safe barrier relay that activates a timer relay that pulls in both pump contactors for a preset interval that will bring the wet well level down without causing a low wet well condition. An alarm indication is also sent to the PLC.

There are several lift stations where we have an alternative analog level system in addition to the bubbler level systems. If a new lift station were to have a secondary analog level system, the preference would be radar since it does not suffer the transducer condensation problems that can occur with ultrasonic level systems in a high-humidity environment. This double level system is on a case by case basis and usually is applied to high-flow systems. If a new lift station were to have a secondary analog level system, the preference would be radar since it does not suffer the transducer condensation problems that can occur with ultrasonic level systems in a high-humidity environment. This double level system is on a case by case basis and usually is applied to high-flow stations or remote service area sites.

As long as stations are designed / retrofitted to handle present and future flows, a bubbler level system as primary level indication and a high level float as emergency backup system is sufficient.
PLC standard base unit – Allen Bradley MicroLogix 1100 – model 1763-L16DWD

a. Model 1762-IF4 (Four channel isolated analog input module – one or two as required based on instrumentation provided.)

b. Model 1762-IQ16 (sixteen channel discrete input module – one or two as required based on monitored points.)
1762-IF4
MicroLogix 1100
4 CH ANALOG INPUT MODULE

SLOT 1
- CH0+
  - BUBBLER WETWELL LEVEL
  - IN 0-A
- CH0-
  - BUBBLER WETWELL LEVEL
  - IN 0-A
- CH1+
  - PLC CABINET TEMPERATURE
  - IN 1-A
- CH1-
  - PLC CABINET TEMPERATURE
  - IN 1-A
- CH2+
  - FORCE MAIN 1 DISCHARGE FLOW
  - IN 2-A
- CH2-
  - FORCE MAIN 1 DISCHARGE FLOW
  - IN 2-A
- CH3+
  - FORCE MAIN 1 DISCHARGE FLOW
  - IN 3-A
- CH3-
  - FORCE MAIN 1 DISCHARGE FLOW
  - IN 3-A

1762-IQ16
MicroLogix 1100
16 PT. 24 VDC SINK/SOURCE INPUT

SLOT 2
- OCCOM
- IN0
  - UPS FAIL STATUS (VOLTAGE MONITOR)
  - 0.2/0
- IN1
  - DRYWELL SUMP HIGH LEVEL
  - 0.2/1
- IN2
  - DRYWELL HATCH CLOSED (INTRUSION)
  - 0.2/2
- IN3
  - BLOWER RUN STATUS
  - 0.2/3
- IN4
  - BUBBLER COMPRESSOR LOW PRESSURE
  - 0.2/4
- IN5
  - SURGE SUPPRESSOR
  - 0.2/5
- IN6
  - GENERATOR RUN STATUS
  - 0.2/6
- IN7
  - GENERATOR FAULT ALARM
  - 0.2/7
- IN8
  - GENERATOR WARNING ALARM
  - 0.2/8
- IN9
  - ATS STANDBY STATUS
  - 0.2/9
- IN10
  - PUMP 1 HIGH TEMP
  - 0.2/10
- IN11
  - PUMP 1 HIGH MOISTURE
  - 0.2/11
- IN12
  - PUMP 2 HIGH TEMP
  - 0.2/12
- IN13
  - PUMP 2 HIGH MOISTURE
  - 0.2/13
- IN14
  - LEAD/IDAG PUMP START FLOAT
  - 0.2/14
- IN15
  - VAULT VALVE INTRUSION
  - 0.2/15

ALLEN BRADLEY MICROLOGIX 1100

SAMPLE LIFT STATION CONTROL SCHEMATIC/PLC WIRING
(SAMPLE SHOWN IS FOR A 2 PUMP STATION) (SHEET 3 OF 4)
Telco/DSL or Cable Ethernet

Modern

Firewall

PLC

Cell modem (Back up communication)

Ethernet Switch
### Liftstation I/O

<table>
<thead>
<tr>
<th>Type</th>
<th>I/O Point</th>
<th>Tag</th>
<th>Description</th>
<th>Scale</th>
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<td>JA_0102</td>
<td>Lift Station Phase status 0=Failed</td>
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<td>MLA_0210</td>
<td>Pump 1 overload status 1=Overload</td>
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<td>Pump 1 system status 1=System</td>
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<td>DI</td>
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<td>ZSL_0210</td>
<td>Pump 1 check valve status 1=Closed</td>
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<td>I:0/4</td>
<td>MLN_0210</td>
<td>Pump 1 Run status 1=running</td>
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<td></td>
<td>DI</td>
<td>I:0/5</td>
<td>MLA_0220</td>
<td>Pump 2 overload status 1=Overload</td>
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<td>MLK_0220</td>
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<td>LSHH_0040</td>
<td>Wetwell high level status 1=High level</td>
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<td>DO</td>
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<td>MD_0210</td>
<td>Pump 1 run command 1=Start</td>
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<td>DO</td>
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<td>MD_0220</td>
<td>Pump 2 run command 1=Start</td>
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<td>O:0/2</td>
<td>MD_BLOWER</td>
<td>Blower run command 1=Start</td>
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<td>DO</td>
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<td>MD_0001</td>
<td>Bubbler Purge command 1=purge</td>
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<td>DO</td>
<td>O:0/4</td>
<td>MD_0040</td>
<td>UPS Fault Reset 1=Reset</td>
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<td>DO</td>
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<td>1762-IF4</td>
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<td>Bubbler wetwell level 0-160 Inches</td>
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<td>Force Main 2 Discharge Flow</td>
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<td>HS_0001P</td>
<td>UPS Bypass Status 1=Bypassed</td>
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<td>DI</td>
<td>I:2/1</td>
<td>LSHH_0001D</td>
<td>Drywell sump high level status 1=Alarm</td>
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<td>MLN_0204</td>
<td>Scrubber blower run status 1=Running</td>
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<td>PSL0001</td>
<td>Bubblerlow pressure status 1=low</td>
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<td>XS_0001</td>
<td>Surge suppressor status 0=Failed</td>
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<td>DI</td>
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<td>MLN_0101</td>
<td>Generator run status 1=running</td>
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<tr>
<td></td>
<td>DI</td>
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<td>MA_0101</td>
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<td>DI</td>
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<td>YA_0101</td>
<td>Generator warning alarm 1=running</td>
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<td>YA_0501</td>
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<td>TAH_0210</td>
<td>Pump 1 high temp 1=High</td>
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<tr>
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<td>DI</td>
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<td>MAH_0210</td>
<td>Pump 1 high moisture 1=high</td>
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<td>LAH_0040</td>
<td>Lead/Lag pump start float 1= float start</td>
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<td>HS_0301</td>
<td>Valve vault intrusion 1= intrusion</td>
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<td>LAH_0308</td>
<td>Valve vault high level float 1=high</td>
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<td>I:3/14</td>
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<td>PIT_0302</td>
<td>Force Main 1 discharge pressure</td>
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<td>PIT_0303</td>
<td>Force Main 2 discharge pressure</td>
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<td>AI</td>
<td>I:4.2</td>
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<td>AI</td>
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Sample Lift Station UPS Cabinet Layout

EATON EATS115 Automatic Transfer Switch

Hoffman - Pentair #A20R208 HCLO Enclosure w/ A20P20 Panel, APM/#3RL014 Panel Mount Kit, & APMK3RL014 Enclosure Mount Kit

To Load

Eaton 5P750 UPS Unit X

Hubbell DRUB20 Recept

Hoffman - Pentair #AVK33 Louver Vent Kit (typical of 2)

Sample UPS Cabinet Layout

Note: UPS should not be in PLC cabinet but located nearby in an enclosure with ventilation similar to the UPS cabinet
Valve Stem Position vs. Applied Control Signal
3-Way Ball Valves

Control Signal Distribution

Positive Signal Selection Switch

Terminal 2

Port 2

AC Hot

AC Neutral

130/110 VAC

0/20 mA

AC Neutral

Terminal 3

Port 3

Positive Signal Selection Switch

Terminal 1

Port 1

AC Hot

AC Neutral

130/110 VAC

0/20 mA

AC Neutral

Whitey 142 Series Type ACX Electric Ball Valve Actuators

MS-142ACX

For use on 3-way ball valves