INFORMATION HANDOUT

For Contract No. 07-4T6404
At 07-LA-105-R14.3

Identified by
Project ID 0712000422

MATERIALS INFORMATION

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Dewatering/Filtration Upgrade I/O List

1 GENERAL

The California Department of Transportation (CalTrans) is upgrading the groundwater dewatering and treatment facility located in Paramount, Ca, just east of the intersection of the I-710 and I-105 freeways. This document describes the Programmable Logic Controller (PLC) based control system that will be implemented at the Garfield Pump House (Pump House) to monitor and control both the East Treatment System and ten dedicated Well Heads.

1.1 System Description

The I-105 Groundwater Dewatering and Treatment System (I-105 System) is designed to extract groundwater from 13 dewatering wells (ID-01 through ID-13). Currently, three of the dewatering wells (ID-01, ID-02, and ID-13) are not being used to control groundwater levels. Extracted groundwater is treated at the East Treatment System using granular activated carbon (GAC) filters prior to being discharged to the Los Angeles (LA) River. Upgrades to the I-105 System generally include upgrading the monitoring and control system for both the East Treatment System and the dewatering wells. The I-105 System's central point is the Garfield Pump House, located along the north side of I-105. The purpose of the groundwater dewatering system is to keep the groundwater level at least 3.5 feet below the roadway surface.

1.1.1 Garfield Pump House

The Garfield Pump House will contain the system's PLC based Main Control Panel (MCP) and Human Machine Interface (HMI) computer, and is collocated with the East Treatment System. The I-105 System pumps groundwater from the Well Heads to the East Treatment System where it passes through two Bag Filters (BF-01/BF-02) and six Carbon Vessel Filters (E-01 – E-06) before being discharged.

The East Treatment System portion of the control system is passive as it only monitors, records, trends and alarms based on system flows and pressures.

1.1.2 Well Heads

There are thirteen well heads dedicated to the Garfield Pump House. Well Heads ID-01 through ID-04 are located west of the Garfield Pump House and ID-05 through ID-13 are located east of the Garfield Pump House. At this time, and for this project, only ten (10) Well Heads will be integrated into the system. Well Heads ID-01, ID-02 and ID-13 are not operational and do not form part of the project scope.

A 'Well Head' consists of a Control Well and a Dewatering Well. At each Well Head, an intelligent Variable Frequency Drive (VFD) will power a 25 horsepower submersible pump located in the dewatering well. Control and Dewatering well levels, pump head pressure and

pump outlet flow are monitored locally by new instrumentation, communicated to the intelligent VFD and the information is sent to the MCP PLC located in the Pump House over the communication network.

Local Control (at each Well Head) and Remote Control (from the MCP/HMI) shall both be provided for each of the 10 active Well Heads.

2 CONTROL SYSTEM

The upgrade incorporates electrical and control upgrades for Treatment System PLC based control system. The objectives of the PLC based control system are to monitor the Treatment System, provide local and remote control of the Well Heads and to provide HMI functionality for the system with alarming, logging, trending and operator interface.

Coordination for a broadband internet service is required by the bidding contractor in cooperation with Caltrans. The HMI interface must be accessible via the broadband connection for offsite monitoring of system status.

2.1 Control System Operation

A new PLC based control system and computer based HMI will be installed in the Garfield Pump House. The PLC will monitor flow and pressure in the Treatment System and will provide remote control and monitoring of the 10 active Well Heads. In addition to monitoring and control, the control system will trend system variables, alarm when setpoints are exceeded and provide a central location for remote Well Head operation.

2.1.1 Treatment Control 'Monitoring' System

The project includes water flow and pressure monitoring, recording and trending of the East Treatment System as described below:

- Treatment System Influent Water Flow
  The control system monitors the following parameters.
  - West Influent Flow (FIQT-4401) and West Influent Pressure (PT-4401) monitor water being pumped from ID-03 and ID-04 located west of the Pump House.
  - East Influent Flow (FIQT-4601) and East Influent Pressure (PT-4602) monitor water being pumped from ID-05 through ID-12 located east of the Pump House.
- Bag Filter Pressures
  The control system will compare these two values to provide a calculated differential pressure across each filter; thereby enabling proper changing of bag filters and alarming on high differential pressure conditions.
  - Bag Filter 1 (BF-1) Infeed Pressure (PT-4501) and BF-1 Outfeed Pressure (PT-4502) monitor the water pressure associated with BF-1.

- Bag Filter 2 (BF-2) Infeed Pressure (PT-4511) and BF-2 Outfeed Pressure (PT-4512) monitor the water pressure associated with BF-2.

- GAC Vessel Backwash Water Flow
  - Flow meter (FIQT-4501) monitors influent flow from the bag filters to the carbon vessels and is used to monitor the backwash flow rate through the vessel being backwashed (E-01 or E-02).
  - GAC Vessel E-03 Flow (FIQT-4701) monitors influent flow from the bag filters to the carbon vessels and is used to monitor the backwash flow rate through GAC Vessel E-04.
  - GAC Vessel E-04 Flow (FIQT-4705) monitors influent flow from the bag filters to the carbon vessels and is used to monitor the backwash flow rate through GAC Vessel E-03.
  - GAC Vessels E-05 and E-06 Flow (FIQT-4901) monitors influent flow from the bag filters to the carbon vessels and is used to monitor the backwash flow rate through the vessel being backwashed (E-05 or E-06).

2.1.2 Well Heads

An intelligent VFD and dedicated Local User Interface (LUI), located at each Well Pump Control Station, receives process information from the local instrumentation and communicates it back to the MCP in the Pump House via the communication network. In addition, the VFD receives control signals (Off/On, Speed Reference) from the MCP in Remote Mode. Note that LUI and Human Interface Module (HIM) may be used interchangeably in the specifications and plans.

The LUI provides a local interface to the VFD and enables operators to place the VFD in Local Control Mode or Remote Control Mode, described in section 2.1.4.

The project includes replacing the Control Well and Dewatering Well level monitoring instruments, Dewatering Pump Flow instrument and Head Pressure instrument at each of the 10 active Well Head sites. Well Head ID-03 is described below, and Well Heads ID-04 through ID-12 are duplicates of ID-03, with their identification number being the only change:

- Well Water Levels
  - Control Well Water Level (LT-0301) and Dewatering Well Water Level (LT-0351) are submersible ‘pressure’ type transducers located in the wells that provide an analog signal corresponding to water level to the VFD that is communicated to the MCP.
  - Control Well Water Level Indication (LI-0301) is provided inside the VFD enclosure and provided by an analog output from the VFD.

- Dewatering Pump Pressure and Flow
  - Dewatering Pump Pressure (PT-0301) and Dewatering Pump Flow Indicating Totalizer Transmitter (FIQT-0301) provide analog signals to the VFD that are communicated to the MCP.

- In addition, Dewatering Pump Flow Indicating Totalizer Transmitter (FIQT-0301) also provides a Pulse discrete signal from the flow totalizer to the VFD, also relayed to the MCP.

2.1.3 Garfield Pump House

The Pump House will house the MCP and HMI, and serve as the interface point to the system for the broadband internet service. The new PLC based MCP will be installed in this location, along with a work table for the HMI Keyboard, Video monitor and Mouse. A 'KVM' bulkhead on the MCP provides the access point for the HMI operator interface devices.

2.1.4 Modes of Operation

Three modes of operation will be implemented for the Well Heads: Local Manual, Remote 'SCADA' Manual and Remote Automatic; each is described below:

- Local Control - Manual

  An operator must place a Well Head in Local Control via the VFD's dedicated LUI. This mode of operation allows local control of a Well Head pump by an operator located at the Well Head. It can be used for testing and also be used if communication is lost to the MCP, during a power outage at Pump House or if the PLC fails. Note this is the current mode of operation at the Well Heads.

  In Local Control, the operator has manual control to start/stop the pump and adjust its speed via the LUI. A local control well level indication display will provide feedback of the Control Well Level. When in Local Control, the VFD will send a signal to the MCP PLC indicating that it is in Local Control, its speed and when it is running or stopped. The HMI in the Pump House will display this information and warn operators viewing the HMI that a Well Head is in Local Control.

  Note that in Local Control, the MCP PLC does not have control of the Dewatering Well Pump; rather, the local LUI module is used to control operation. No process interlocks are active in Local Mode.

- Remote Control

  An operator must place a Well Head in Remote Control via the VFD's dedicated LUI Module. When in Remote Control, the VFD will send a signal to the MCP PLC indicating that it is in Remote Control, its speed, alarm/fault status and when it is running or stopped. The HMI in the Pump House will display this information.

  Once in Remote Control, the operator can select either Remote Control Manual Mode or Remote Control Automatic Mode from the HMI. Both are described below:

- Remote Control - Manual

  This mode of operation allows remote control of a Well Head pump by an operator located at the Garfield Pump House HMI. Often referred to as SCADA manual, the mode allows an operator to start/stop the pump and adjust its speed via the HMI computer.

  Note that in Remote Control Manual Mode, the PLC level control loop is disabled; however, the Dewatering Well Level permissive/interlocks are active.

- Remote Control - Automatic

  This is the recommended mode of operation of a Well Head as it adapts to changing conditions and protects the pump with the Dewatering Well Level permissive interlocks. In Remote Automatic, the MCP PLC uses Control Well Water Level as a permissive and to adjust the speed of the VFD.

  - Dewatering Well Water Level Transmitter (LT-0351) provides an interlock to operate the Dewatering Pump. Dewatering Well Water Level must be above an operator adjustable water level setpoint below road surface or the pump will not be allowed to operate.
  - Control Well Water Level Transmitter (LT-0301) provides the process variable that controls the speed of the Dewatering Pump. The PLC will adjust the pump speed to maintain the Control Well Water Level at setpoint, using a Proportional-Integral (PI) control loop.
    - Pump operation is limited to between 50% and 100% of rated Hz (60Hz).
    - Pump operation is suspended when the water level in the Control Well is sufficiently below the setpoint that operation at 50% speed is not warranted.
    - Pump operation is resumed when the water level in the Control Well rises to an adjustable setpoint and operation at or above 50% speed is warranted.

2.2 Control System Signals

Control signals originate from system instrumentation and are communicated to the MCP. Treatment System signals are monitored directly by the MCP PLC. Well Head signals are received at an intelligent VFD and communicated to the MCP PLC. In addition, the Well Head VFD receives control commands from the MCP PLC when in remote mode. Below is a summary of the external signals associated with the control system.

2.2.1 Treatment System

- West Influent Flow Rate and Flow Totalizer Pulse (FIQT-4401) – water flow from ID-03 and ID-04
    - Flow Rate:
        - Displayed on the HMI system screen, recorded and trended
        - No alarms, as flow dependent upon pump operation and speed
    - Flow Totalization:
        - Discrete signal from flow meter
        - Totalized in Main Control Panel PLC
        - Total Well Head Flow displayed on HMI system screen
- West Influent Pressure (PT-4401) – water pressure from ID-03 and ID-0-4
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as pressure dependent upon pump operation and speed
- East Influent Flow Rate and Flow Totalizer Pulse (FIQT-4601) – water flow from ID-05 through ID-12
    - Flow Rate:
        - Displayed on the HMI system screen, recorded and trended
        - No alarms, as flow dependent upon pump operation and speed
    - Flow Totalization:
        - Discrete signal from flow meter
        - Totalized in Main Control Panel PLC
        - Total Well Head Flow displayed on HMI system screen
- East Influent Pressure (PT-4602) – water pressure from ID-05 through ID-12
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as pressure dependent upon pump operation and speed
- BF- 1 Infeed Pressure (PT-4501) and BF- 1 Outfeed Pressure (PT-4502)
    - Displayed on the HMI system screen, recorded and trended
    - Used in calculation of differential pressure across BF- 1
- Calculated BF- 1 Differential Pressure (DPI-4500)
    - Displayed on the HMI system screen, recorded and trended
    - Differential Pressure Alarm High (DPAH-4500) setpoint via the HMI, annunciated and logged
- BF- 2 Infeed Pressure (PT-4511) and BF- 2 Outfeed Pressure (PT-4512)
    - Displayed on the HMI system screen, recorded and trended
    - Used in calculation of differential pressure across BF- 2
- Calculated BF- 2 Differential Pressure (DPI-4510)
    - Displayed on the HMI system screen, recorded and trended

  - Differential Pressure Alarm High (DPAH-4510) setpoint via the HMI, annunciated and logged

- Carbon Vessels E-01 and E-02 Influent Flow Rate and Flow Totalizer Pulse (FIQT-4501) - water flow from Bag Filters BF-01 and BF-02 for normal or backwash operation.
  - Flow Rate:
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as flow dependent upon pump operation and speed
  - Flow Totalization:
    - Discrete signal from flow meter
    - Totalized in Main Control Panel PLC
    - Total Well Head Flow displayed on HMI system screen

- Carbon Vessel E-03 Influent Flow Rate and Flow Totalizer Pulse (FIQT-4701) - water flow from Bag Filters BF-01 and BF-02 for normal or backwash operation.
  - Flow Rate:
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as flow dependent upon pump operation and speed
  - Flow Totalization:
    - Discrete signal from flow meter
    - Totalized in Main Control Panel PLC
    - Total Well Head Flow displayed on HMI system screen

- Carbon Vessel E-04 Influent Flow Rate and Flow Totalizer Pulse (FIQT-4705) - water flow from Bag Filters BF-01 and BF-02 for normal or backwash operation.
  - Flow Rate:
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as flow dependent upon pump operation and speed
  - Flow Totalization:
    - Discrete signal from flow meter
    - Totalized in Main Control Panel PLC
    - Total Well Head Flow displayed on HMI system screen

- Carbon Vessels E-05 and E-06 Influent Flow Rate and Flow Totalizer Pulse (FIQT-4901) - water flow from Bag Filters BF-01 and BF-02 for normal or backwash operation.
  - Flow Rate:
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as flow dependent upon pump operation and speed
  - Flow Totalization:
    - Discrete signal from flow meter
    - Totalized in Main Control Panel PLC
    - Total Well Head Flow displayed on HMI system screen

2.2.2 Well Heads

The PLC in the MCP communicates to the ten active Well Head Intelligent VFDs via DeviceNET or equivalent communication protocol, in a trunk-and-tap configuration starting at ID-03 and extending to ID-12. Due to the total length of the network trunk, a bus expander may be required at ID-08. Refer to the network communication drawing for more detail on the communication network.

Signals received from the Well Head (Where XX is 03 through 12 for each Well Head)

- Control Well Water Level (LT-XX01)
  - Displayed on the HMI Well Head screen, recorded and trends
  - Out of Range Alarm, Level High Alarm and Level High-High Alarms
  - Used as Process Variable for VFD speed control loop in Remote Automatic
- Dewatering Well Water Level (LT-XX51)
  - Displayed on the HMI Well Head screen, recorded and trends
  - Out of Range Alarm and Low Level Alarm
  - Used as permissive interlock to VFD operation in both Remote Modes
  - Interlock setpoint can be adjusted from the HMI
- Well Head Pump Head Pressure (PT-XX01)
  - Displayed on HMI Well Head screen, recorded and trends
  - Out of Range Alarm
  - Low Pressure Alarm
    - Active only when pump operating
    - Setpoint initial value (10 psi) adjustable from HMI
- Well Head Pump Flow Rate and Flow Totalization Pulse (FIQT-XX01)
  - Flow Rate:
    - Displayed on HMI Well Head screen, recorded and trends
    - Out of Range Alarm only
    - Low Flow Alarm
      - Active only when pump operating
      - Setpoint initial value (10 gpm) adjustable from HMI
  - Flow Totalization
    - Discrete signal from flow meter
    - Totalized in Main Control Panel PLC
    - Total Well Head Flow displayed on HMI Well Head screen
- Well Head Control Mode (HS-XX01) via LUI
  - Displayed on both HMI System and Well Head LUI display
  - Controlled via VFD LUI module, discrete signal
- Well Head Pump Running Status (YS-XX01)
  - Displayed on both HMI System and Well Head screens

- Well Head Pump Speed Feedback (ST-XX01)
  - Displayed on both HMI System and Well Head screens
  - Displayed on Well Head LUI for local control
- Well Head VFD Alarm Status (YA-XX01)
  - Displayed on both HMI System and Well Head screens
  - Annunciated and logged

Signals sent to the Well Head (Remote Mode Only)

- Pump Call To Run Command (YC-XX01)
  - Internal signal sent to Well Head VFD
  - Active in Remote Manual when called to run
  - Active in Remote Automatic when level control loop calls pump to run
- Pump Enabled Status (Text Display)
  - Displayed on both HMI System and Well Head screens
  - Active when pump is in Remote Automatic Mode
- Pump Speed Reference (SC-XX01)
  - Internal signal sent to Well Head VFD
  - Controlled by operator in Remote Manual Mode
  - Controlled by level control loop in Remote Automatic Mode
  - Displayed on Well Head screen in Remote Automatic Mode

Signals displayed locally in either mode (Hardwired signals):
An array of three indicator lights (White, Green, & Amber) is mounted on top of each Well Head's MCC. Contractor is required to implement the following VFD discrete output control of these lights and install/correct/replace failed or missing lights:

- Local Power On Light (JI-XX01)
  - Local Power On indicator light (white) is hardwired through a relay output on the VFD that is closed when the VFD has control power available. It is illuminated when control power is present.
  - It provides operators an external means of determining if a site is powered without opening the enclosures.
- Local Pump Running Light (YI-XX01) and Pump Run Time Totalizer (KQ-XX01)
  - Local Pump Running indicator light (Green), is hardwired through a relay output contact on the VFD that is closed when the VFD's motor is operating and not illuminated when the VFD's motor is not operating.
    - A local Run Tim Totalizer (KQ-XX01) display provides information on total hours of pump operation
  - It provides operator an external means of determining if a site's pump is running.

- Local VFD Fault/Alarm Light (YA-XX01)
  - Local VFD Fault indicator light (Amber), is hardwired through a relay output contact on the VFD that is closed when the VFD is faulted or in alarm condition and is not illuminated when the VFD is not faulted or in an alarm condition.
  - It provides operators an external means of determining if a site's VFD has faulted.
- Local Control Well Level Indication (LI-XX01) from Intelligent VFD Analog Output
  - Local Control Well Level Indication is provided for local control mode.

3 HUMAN MACHINE INTERFACE (HMI)

Please refer to the Supervisory Control and Data Acquisition (SCADA) AND PLC Specification for more detailed information on the specific hardware and software associated with the HMI PC. This section provides information on the functionality of the HMI.

Monitoring and control is provided from the HMI located in the Pump House. Remote monitoring will be provided via internet access with user name/password protection to enable remote monitoring of the system; however, no control is to be provided via remote internet access to the Pump House MCP at this time. The capability for future remote control integration must be accounted for in the design and implementation of the system, at Caltrans discretion.

3.1 HMI Screens

As a minimum, the following screens will be provided to enable operators to monitor and control the I-105 Dewatering System. Navigation must be easy and intuitive for system operators. See Appendix A for screen examples.

3.1.1 System Screen

A system overview screen showing the East Treatment System, a summary of Well Head status and a starting point for system navigation. The screen should provide the following information and functionality:

- Status
  - East Treatment System Influent Flow Rates
  - East Treatment System Influent Flow Pressure
  - Bag Filter Pressure
  - Calculated Bag Filter Differential Pressure
    - Bag Filter Differential Pressure Alarm High
  - Well Head Array
    - Control Mode (Local / Remote)
    - VFD Status (Faulted / not faulted)
    - Pump Status (Running / Stopped)
    - Pump Speed (Hz or %)
    - Control Well Level (feet below road surface)

- Control
  - Ability to adjust Calculated Differential Pressure Alarm Setpoints
    - Bag Filter Differential Pressure Alarm High Setpoint

3.1.2 Well Head Screen

An indirect addressed screen for each of the 10 active sites. The screen should provide the following information and functionality:

- Status
  - Control Mode Status (Local, Remote Manual, Remote Automatic)
  - Pump operating status (Running, Stopped, Enabled)
  - Pump operating speed (Hz or %)
  - VFD Alarm / Fault status
  - Display analog parameters: Dewatering Well Level, Control Well Water Level, Pump Head Pressure, Pump Flow Rate
  - Display totalized Well Head Flow (from totalizer pulse signal)
- Control (using individual pump control popup screens)
  - Ability to switch between Remote Manual and Remote Automatic
  - Remote Manual Controls:
    - Ability to start / stop pump
    - Ability to adjust speed in Remote Manual (50% to 100%)
  - Remote Automatic Controls:
    - Ability to Enable pump operation – level control loop
    - Ability to adjust level control loop setpoint (feet below road surface)
  - Ability to monitor Pump speed and controlling water level on each control popup

3.1.3 Historical Trend Screen

The HMI Trend screen should provide the capability to monitor all analogs monitored by the system PLC, including all flows, pressures, levels, and other system variables. The trend screen must utilize ActiveX trend objects that communicate with the site historical database and logging software. The screen should provide the following functionality:

- Trend Control
  - Add/Remove analog variables during runtime, each with distinct pen colors
  - Modify trend time scale, and vertical engineering unit scale
  - Add commonly used variables for each remote well site and the primary treatment site with the click of a single button
  - Provide real-time/historic trend status with the click of a single button, where real-time trends continually update to the most recent data, and historic trends maintain the chosen time period.
  - Ability to save commonly used trend configurations to the local hard drive for later use.

3.1.4 Alarm Screen

The HMI Alarm screen should provide the capability to monitor all current and historical alarm information. All alarms are to be logged to a database on the HMI computer for historical retrieval and off site queries. The screen should provide the following functionality:

- Ability to switch between real time active alarms (Current alarms) and a historical alarm display with a single button.
- Current Alarm status
  - Ability to acknowledge and provide operator comments to alarms appearing on the alarm display
  - Current unacknowledged alarms to be shown in red
  - Current acknowledged alarms to be shown in blue
  - Cleared, unacknowledged alarms to be shown in black
  - Cleared, acknowledged alarms not shown
- Historical Alarm status
  - Ability to show a chronological list of past alarm activity, including generation, acknowledgement, clearing, and any comments entered by operators.
  - Current unacknowledged alarms to be shown in red
  - Current acknowledged alarms to be shown in blue
  - Cleared, unacknowledged alarms to be shown in black
  - Cleared, acknowledged alarms to be shown in grey

3.2 Reporting

Reports should be generated using the supplied Report generation software, and automatically generate once a day, in the following formats:

- PDF files generated and stored in a local folder on the Industrial SCADA Server
- Web reports visible on a web server integrated into the Industrial SCADA Server.

Generation of a daily Dewatering System Status Report shall include minimum, maximum, average, monthly, and yearly data values for each pump station water levels, flow rates, as well as the flow rates and system pressures.

Appendix A: Example HMI Screens (For Reference Only)

Figure 1: System Screen

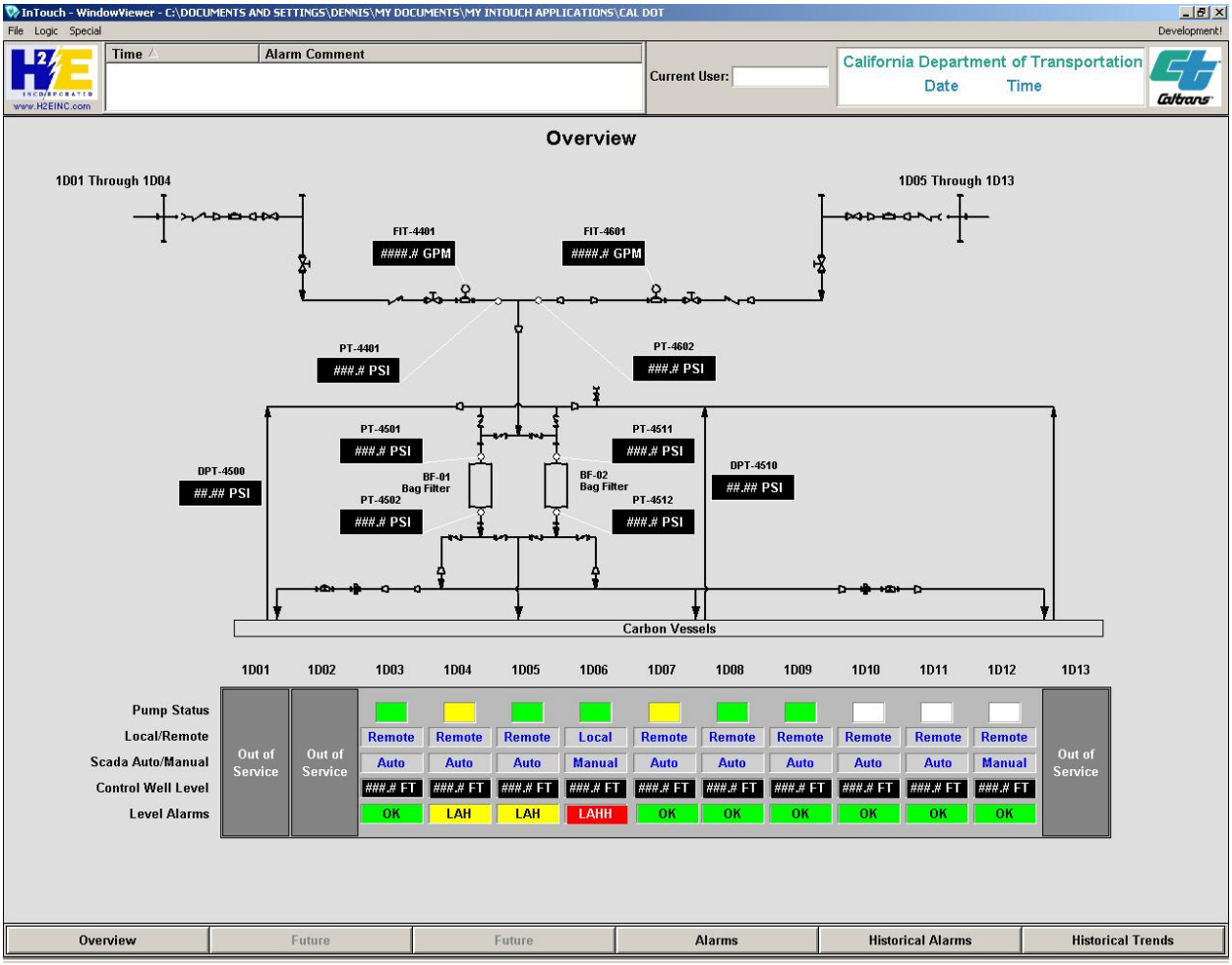


Figure 2: Well Head Screen (For Reference Only)

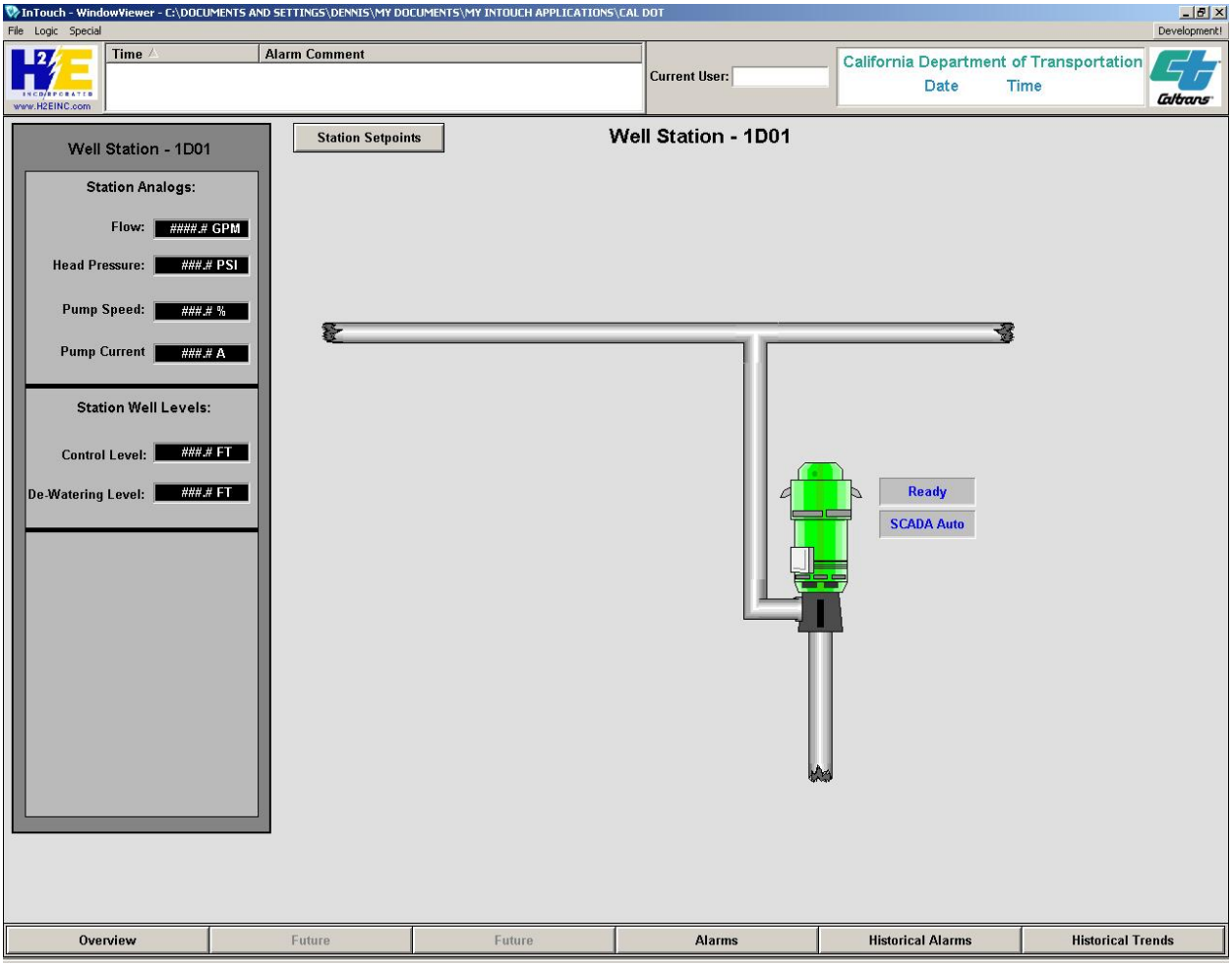
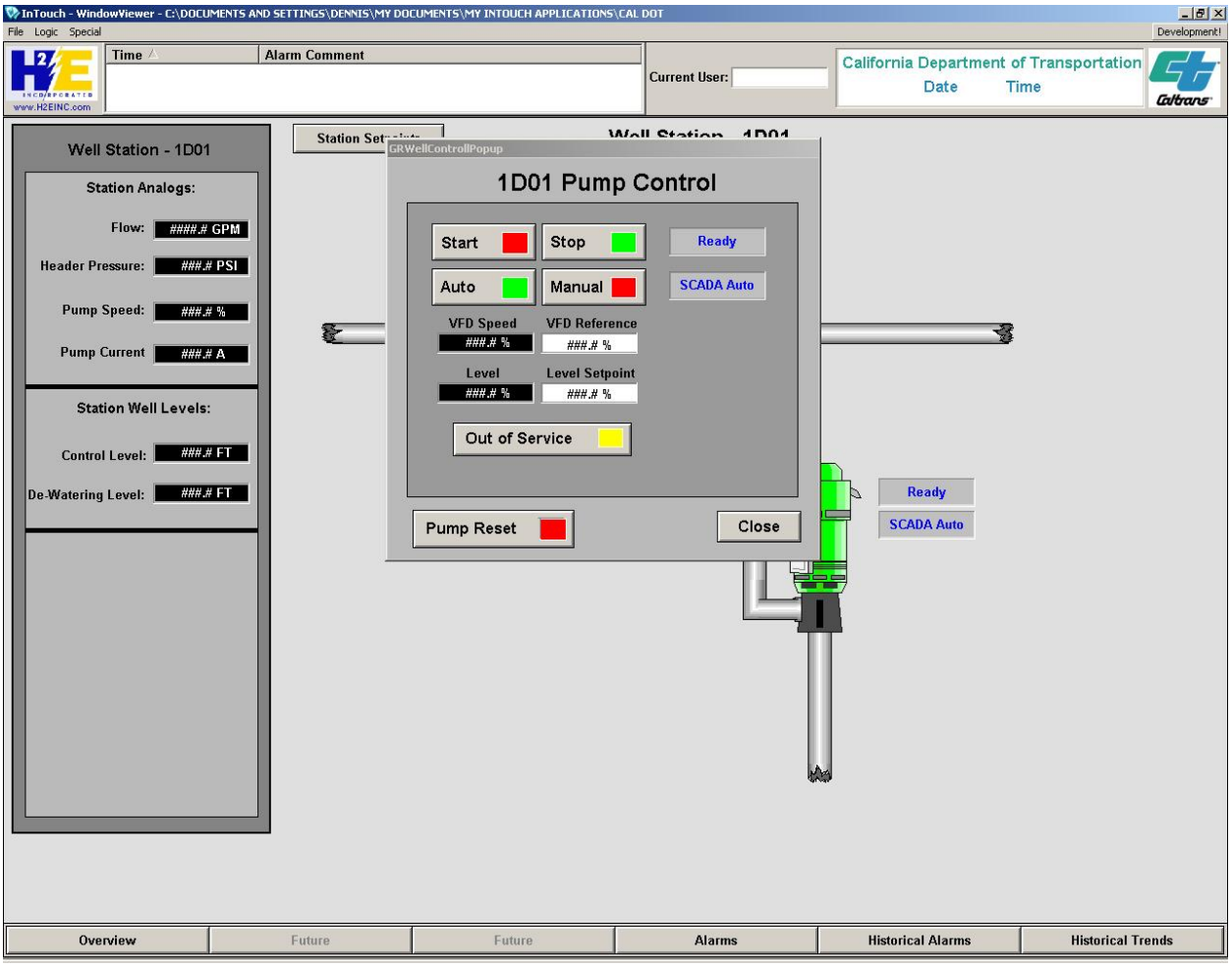


Figure 3: Pump Control Popup Screen (For Reference Only)



1 GENERAL

The California Department of Transportation (Caltrans) is upgrading the groundwater dewatering and treatment facility located in Paramount, California, just east of the intersection of the I-710 and I-105 freeways. This document describes the design for the electrical and controls aspect of this project.

1.1 Project Summary

1.1.1 General

The project includes monitoring water flow and pressure of the East Water Treatment System, as well as monitoring of 10 Well Pump Control stations, including well levels, flows, and pressures. This upgrade provides for data logging of pressure and flow rate data, local alarm generation. The system must also provide the software, hardware, and other ancillary components required to enable remote notification, system monitoring and control via a broadband internet connection. Future integration of off-site monitoring and control will occur at Caltrans discretion.

Of the thirteen existing pumping stations, 1D-01 through 1D-13, only ten stations will be upgraded. 1D-01, 1D-02, and 1D-13 are not generally used, and do not form part of this scope.

A new master PLC will be installed to control and monitor both remote well stations and treatment system process analogs as required for proper operation of the system, and a communications network installed for interface with the remote Well Pump Control station Intelligent Variable Frequency Drive(s) (VFD).

1.1.2 Summary of Work

The summary of work for the upgrade will entail the following:

1. Provide Main Control Panel (MCP) consisting of the following items, refer to EE-6 thru EE-11:
   - Industrial Ethernet Firewall with NAT/Port Blocking, and VPN capabilities (Hirschman Eagle or approved equivalent)
   - Eight-Port Industrial Ethernet Switch (N-Tron, Moxa or approved equivalent)
   - Software Auto dialer (SCADAlarm or approved equal)
   - 500 VA UPS
   - Programmable Logic Controller (PLC) meeting minimum requirements listed in the SCADA and PLC specification
   - Industrial SCADA Server, including software, meeting minimum requirements listed in the SCADA and PLC specification
   - Provide configuration of:
     - Firewall

- Ethernet Switch
- PLC to HMI communications
- DeviceNet or equivalent network Communications

2. Implement Broadband Network Access at the Garfield Pump House for remote monitoring of the control system.
   - Coordinate with CalTrans for specific information on the Broadband Network Requirements.
3. Provide installation of Main Control Panel (MCP) to include conduit, power wiring, communication wiring, and grounding.
4. Provide PLC programming based on the provided System Controls Narrative.
5. Provide configuration of the Software Auto dialer to provide E-mail and SMS notification to Caltrans personnel on power fail, PLC failure, and/or certain alarms.
6. Provide HMI programming for the screens listed and described in the provided System Controls Narrative.
7. Provide the following new instrumentation, including mounting, wiring, and terminating of field instruments listed below, refer to EE-15:
   West Influent Pressure (PT-4401)
   East Influent Flow (PT-4602)
   Bag Filter 1 Infeed Pressure (PT-4501)
   Bag Filter 1 Outfeed Pressure (PT-4502)
   Bag Filter 2 Infeed Pressure (PT-4511)
   Bag Filter 2 Outfeed Pressure (PT-4512)
8. Provide wiring and conduit from MCP to field instruments listed above and below in items 5 and 7.
9. Provide wiring and terminating of existing field instruments listed below, and verify ability of instrument to receive power, provide analog signal (Flow Rate) to the PLC and provide a discrete signal (Flow Pulse) to the PLC, refer to EE-1:
   West Influent Flow Indicating Totalizer Transmitter (FIQT-4401)
   East Influent Flow Indicating Totalizer Transmitter (FIQT-4601)
   E-01 and E-02 Flow Indicating Totalizer Transmitter (FIQT-4501)
   E-03 Flow Indicating Totalizer Transmitter (FIQT-4701)
   E-04 Flow Indicating Totalizer Transmitter (FIQT-4705)
   E-05 and E-06 Flow Indicating Totalizer Transmitter (FIQT-4901)
10. Provide wiring and conduit between MCP and Garfield Pump House MCC for DeviceNet or equivalent communications cabling and via separate conduit 120VAC control power for the MCP, refer to EE-4 and EE-5.
11. Provide the following instrumentation, including mounting, wiring, and terminating of field instruments listed below at the remote Well Sites, refer to EE-2:
    1D-03 Pump Flow Indicating Totalizer Transmitter (FIQT-0301)
    1D-03 Pump Head Pressure (PT-0301) and local indication (PI-0301)
    1D-03 Control Well Level (LT-0301)

1D-03 Dewatering Well Level (LT-0351)
1D-04 Pump Flow Indicating Totalizer Transmitter (FIQT-0401)
1D-04 Pump Head Pressure (PT-0401) and local indication (PI-0401)
1D-04 Control Well Level (LT-0401)
1D-04 Dewatering Well Level (LT-0451)
1D-05 Pump Flow Indicating Totalizer Transmitter (FIQT-0501)
1D-05 Pump Head Pressure (PT-0501) and local indication (PI-0501)
1D-05 Control Well Level (LT-0501)
1D-05 Dewatering Well Level (LT-0551)
1D-06 Pump Flow Indicating Totalizer Transmitter (FIQT-0601)
1D-06 Pump Head Pressure (PT-0601) and local indication (PI-0601)
1D-06 Control Well Level (LT-0601)
1D-06 Dewatering Well Level (LT-0651)
1D-07 Pump Flow Indicating Totalizer Transmitter (FIQT-0701)
1D-07 Pump Head Pressure (PT-0701) and local indication (PI-0701)
1D-07 Control Well Level (LT-0701)
1D-07 Dewatering Well Level (LT-0751)
1D-08 Pump Flow Indicating Totalizer Transmitter (FIQT-0801)
1D-08 Pump Head Pressure (PT-0801) and local indication (PI-0801)
1D-08 Control Well Level (LT-0801)
1D-08 Dewatering Well Level (LT-0851)
1D-09 Pump Flow Indicating Totalizer Transmitter (FIQT-0901)
1D-09 Pump Head Pressure (PT-0901) and local indication (PI-0901)
1D-09 Control Well Level (LT-0901)
1D-09 Dewatering Well Level (LT-0951)
1D-10 Pump Flow Indicating Totalizer Transmitter (FIQT-1001)
1D-10 Pump Head Pressure (PT-1001) and local indication (PI-1001)
1D-10 Control Well Level (LT-1001)
1D-10 Dewatering Well Level (LT-1051)
1D-11 Pump Flow Indicating Totalizer Transmitter (FIQT-1101)
1D-11 Pump Head Pressure (PT-1101) and local indication (PI-1101)
1D-11 Control Well Level (LT-1101)
1D-11 Dewatering Well Level (LT-1151)
1D-12 Pump Flow Indicating Totalizer Transmitter (FIQT-1201)
1D-12 Pump Head Pressure (PT-1201) and local indication (PI-1201)
1D-12 Control Well Level (LT-1201)
1D-12 Dewatering Well Level (LT-1251)

12. Provide wiring and conduit from Well Pump Control enclosures to field instruments listed above in item 8. Existing instrumentation conduit to be cleaned, verified for form, fit, and integrity, and re-used where possible.
13. Verify that conduit exist from existing MCC to wellhead cabinet ¾ and from MCC to wellhead cabinet 5/6, wellhead cabinet 7/8 and wellhead cabinet 9/10. Repair and replace as necessary.
14. Well Pump Control Station VFD installation, wiring, configuration, and programming

- Decommission existing VFD, chokes, PLC, wiring, fuses and associated materials per the provided plans to allow for updated wiring and drive installation, refer to EE-14.
    - Existing items to be preserved are as follows:
        - Existing 24VDC transducer power supply for instrument power, replace as needed depending on condition/performance of the power supply.
        - Existing Communication and Instrumentation terminal blocks
        - Existing MCC Lights, Run Time Meter (KQ-XX01), Receptacles, and Primary Circuit Breakers, and Panelboards.
        - Existing wellhead pumps and motors and any cabling between the VFD and Pump motor.
    - All existing items must be verified by the contractor for proper fit and function, and must be replaced if items are significantly worn, damaged, unsafe, or otherwise unfit for use. Existing breakers and wire sizes to be verified as compliant to applicable version of NFPA-70 National Electric Code, and replaced if found insufficient.
- Install and wire VFDs in existing Well Head MCCs 1D-03 through 1D-12 (10 total drives) per project drawings EE-12 and EE-13 and associated drawing notations.
- Configure each VFD for interface with existing Fault (YA-XX01), Drive On (JI-XX01), and Drive Running (YI-XX01) lights and the new Control Well Level indicator (LI-XX01) to be mounted in the Well Pump Control stations. Contractor to verify existing lights operate correctly, and replace and/or add lights where appropriate.
- Configure each VFD and perform drive programming for the following items:
    - Local LUI operation, including local/remote selection
        - Local control: LUI start/stop command and LUI speed control
        - Remote control: operation via DeviceNet or equivalent communication protocol from the MCP PLC, including remote start/stop commands and remote speed reference
    - Add logic to communicate the following data over DeviceNet or equivalent communication protocol between the VFD and MCP PLC:
        - Control Well Level (analog)
        - Control Well Level Display (analog output)
        - Dewatering Well Level (analog)
        - Well Head Pressure (analog)
        - Well Head Flow Rate (analog)

- Well Head Flow Totalizer Pulse
- Pump Motor Speed Feedback
- Pump Motor Running Status
- Pump Drive Alarm/Fault Status

15. Installation, configuration and commissioning of Communications Network, Refer to EE-3.

16. Perform professional evaluation of existing communication conduit between the following locations and repair or replace, if necessary.
    1D-03/1D-04MCC and Garfield Pump House
    ID-05/1D-06 MCC and Garfield Pump House
    1D-05/1D-06 MCC to 1D-07/1D-08 MCC
    1D-07/1D-08 MCC to 1D-09/1D-10 MCC
    1D-09/1D-10 MCC to 1D-11/1D-12/1D-13 MCC

17. Perform professional installation of new conduits between the MCP and MCC per EE-4 and EE-5.

18. Install and terminate new DeviceNet or equivalent communications cable between the Master PLC and intelligent VFDs through these listed conduits.
    Pump House System MCP to 1D-03/1D-04 MCC and terminate network
    Pump House System MCP to 1D-05/1D-06 MCC
    1D-05/1D-06 MCC to 1D-07/1D-08 MCC
    1D-07/1D-08 MCC to 1D-09/1D-10 MCC
    1D-09/1D-10 MCC to 1D-11/1D-12 MCC and terminate network

19. System Reporting per the System Control Narrative

    - Provide for the generation of a daily Dewatering System Status Report to include average, minimum, and maximum data values for individual pump station water levels and flow rates, as well as the flow rates and system pressures at the East Water Filters.

20. Provide operator training manual for the new control system (HMI/PLC and Well Head LUIs)

Instrument List

Proj #: 09.296.0000

Rev: C

Client: Caltrans

Date: 5/25/2012

Project: Caltrans Hwy 105 Dewatering System Upgrade

File: Instrument List.xlsx

Process Area	Instrument Type	Instrument Number	Tag Name	Description	Signal Type	Size	Mounting	Eng. Units	Scale Range		Alarm Levels		Notes
									0%	100%	L	H	
Filtration	PT	4401	PT-4401	West Influent Water Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
Filtration	PT	4602	PT-4602	East Influent Water Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
Filtration	PT	4501	PT-4501	Bag Filter 1 Infeed Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
Filtration	PT	4502	PT-4502	Bag Filter 1 Outfeed Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
Filtration	PT	4511	PT-4511	Bag Filter 2 Infeed Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
Filtration	PT	4512	PT-4512	Bag Filter 2 Outfeed Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
Filtration	FIQT	4401	FIQT-4401	West Influent Water Flow *Existing Flow meter	AI/DI	12"	Flange	gpm	30	13000			Electromagnetic, 4-20 mA flow, pulse totalizer
Filtration	FIQT	4601	FIQT-4601	East Influent Water Flow *Existing Flow meter	AI/DI	10"	Flange	gpm	30	13000			Electromagnetic, 4-20 mA flow, pulse totalizer
Filtration	FIQT	4501	FIQT-4501	E-01 and E-02 Flow *Existing Flow meter	AI/DI	8"	Flange	gpm	30	13000			Electromagnetic, 4-20 mA flow, pulse totalizer
Filtration	FIQT	4701	FIQT-4701	E-03 Flow *Existing Flow meter	AI/DI	8"	Flange	gpm	30	13000			Electromagnetic, 4-20 mA flow, pulse totalizer
Filtration	FIQT	4705	FIQT-4705	E-04 Flow *Existing Flow meter	AI/DI	8"	Flange	gpm	30	13000			Electromagnetic, 4-20 mA flow, pulse totalizer
Filtration	FIQT	4901	FIQT-4901	E-05 and E-06 Flow *Existing Flow meter	AI/DI	10"	Flange	gpm	30	13000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-03	FIQT	0301	FIQT-0301	1D-03 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-03	PT	0301	PT-0301	1D-03 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-03	LT	0301	LT-0301	1D-03 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-03	LT	0351	LT-0351	1D-03 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-04	FIQT	0401	FIQT-0401	1D-04 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-04	PT	0401	PT-0401	1D-04 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-04	LT	0401	LT-0401	1D-04 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-04	LT	0451	LT-0451	1D-04 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-05	FIQT	0501	FIQT-0501	1D-05 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-05	PT	0501	PT-0501	1D-05 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-05	LT	0501	LT-0501	1D-05 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-05	LT	0551	LT-0551	1D-05 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-06	FIQT	0601	FIQT-0601	1D-06 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-06	PT	0601	PT-0601	1D-06 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-06	LT	0601	LT-0601	1D-06 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-06	LT	0651	LT-0651	1D-06 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-07	FIQT	0701	FIQT-0701	1D-07 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-07	PT	0701	PT-0701	1D-07 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-07	LT	0701	LT-0701	1D-07 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-07	LT	0751	LT-0751	1D-07 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-08	FIQT	0801	FIQT-0801	1D-08 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-08	PT	0801	PT-0801	1D-08 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-08	LT	0801	LT-0801	1D-08 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-08	LT	0851	LT-0851	1D-08 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-09	FIQT	0901	FIQT-0901	1D-09 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-09	PT	0901	PT-0901	1D-09 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X

1D-09	LT	0901	LT-0901	1D-09 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-09	LT	0951	LT-0951	1D-09 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-10	FIQT	1001	FIQT-1001	1D-10 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-10	PT	1001	PT-1001	1D-10 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-10	LT	1001	LT-1001	1D-10 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-10	LT	1051	LT-1051	1D-10 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-11	FIQT	1101	FIQT-1101	1D-11 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-11	PT	1101	PT-1101	1D-11 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-11	LT	1101	LT-1101	1D-11 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-11	LT	1151	LT-1151	1D-11 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-12	FIQT	1201	FIQT-1201	1D-12 Water Flow	AI/DI	4"	Flange	gpm	5	1000			Electromagnetic, 4-20 mA flow, pulse totalizer
1D-12	PT	1201	PT-1201	1D-12 Well Head Pressure	AI	1/4"	NPT	psig	0	300			4-20 mA, 2-wire, 0.25% accuracy, NEMA 4X
1D-12	LT	1201	LT-1201	1D-12 Control Well Level	AI			ft.	35	0			4-20 mA, 2-wire, 025% accuracy, submersible
1D-12	LT	1251	LT-1251	1D-12 Dewatering Well Level	AI			ft.	138	0			4-20 mA, 2-wire, 025% accuracy, submersible

Caltrans I-105 Dewatering/Filtration Upgrade I/O List

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Instrument Number										
PLC	Sub Sys	Device ID	Dev. Type	Qual.	Instrument Number	Description	Subsystem	Signal Type	Action	Loop Power
PH	0	4401	PT	AI	PH0_4401_PT_AI	West Influent Water Pressure	Filtration	AI	4-20mA	Y
PH	0	4401	FIT	AI	PH0_4401_FIT_AI	West Influent Water Flow Rate	Filtration	AI	4-20mA	
PH	0	4401	FIQ	DI	PH0_4401_FIQ_DI	West Influent Water Flow Totalizer	Filtration	DI	24Vdc	
PH	0	4601	FIT	AI	PH0_4601_FIT_AI	East Influent Water Flow Rate	Filtration	AI	4-20mA	
PH	0	4601	FIQ	DI	PH0_4601_FIQ_DI	East Influent Water Flow Totalizer	Filtration	DI	24Vdc	
PH	0	4602	PT	AI	PH0_4602_PT_AI	East Influent Water Pressure	Filtration	AI	4-20mA	Y
PH	0	4501	PT	AI	PH0_4501_PT_AI	Bag Filter 1 Infeed Pressure	Filtration	AI	4-20mA	Y
PH	0	4501	FIT	AI	PH0_4501_FIT_AI	E-01 and E-02 Water Flow Rate	Filtration	AI	4-20mA	
PH	0	4501	FIQ	DI	PH0_4501_FIQ_DI	E-01 and E-02 Water Flow Totalizer	Filtration	DI	24Vdc	
PH	0	4701	FIT	AI	PH0_4701_FIT_AI	E-03 Water Flow Rate	Filtration	AI	4-20mA	
PH	0	4701	FIQ	DI	PH0_4701_FIQ_DI	E-03 Water Flow Totalizer	Filtration	DI	24Vdc	
PH	0	4705	FIT	AI	PH0_4705_FIT_AI	E-04 Water Flow Rate	Filtration	AI	4-20mA	
PH	0	4705	FIQ	DI	PH0_4705_FIQ_DI	E-04 Water Flow Totalizer	Filtration	DI	24Vdc	
PH	0	4901	FIT	AI	PH0_4901_FIT_AI	E-05 and E-06 Water Flow Rate	Filtration	AI	4-20mA	
PH	0	4901	FIQ	DI	PH0_4901_FIQ_DI	E-05 and E-06 Water Flow Totalizer	Filtration	DI	24Vdc	
PH	0	4502	PT	AI	PH0_4502_PT_AI	Bag Filter 1 Outfeed Pressure	Filtration	AI	4-20mA	Y
PH	0	4511	PT	AI	PH0_4511_PT_AI	Bag Filter 2 Infeed Pressure	Filtration	AI	4-20mA	Y
PH	0	4512	PT	AI	PH0_4512_PT_AI	Bag Filter 2 Outfeed Pressure	Filtration	AI	4-20mA	Y
1D	03	0301	FIT	AI	1D03_0301_FIT_AI	1D-03 Water Flow	1D-03	AI	4-20mA	
1D	03	0301	FQI	DI	1D03_0301_FQI_DI	1D-03 Water Flow Totalizer	1D-03	DI	120Vac	
1D	03	0301	PT	AI	1D03_0301_PT_AI	1D-03 Head Pressure	1D-03	AI	4-20mA	Y
1D	03	0301	LT	AI	1D03_0301_LT_AI	1D-03 Control Well Water Level Below Pavement	1D-03	AI	4-20mA	Y
1D	03	0351	LT	AI	1D03_0351_LT_AI	1D-03 Dewatering Well Water Level Below Pavement	1D-03	AI	4-20mA	Y
1D	04	0401	FIT	AI	1D04_0401_FIT_AI	1D-04 Water Flow	1D-04	AI	4-20mA	
1D	04	0401	FQI	DI	1D04_0401_FQI_DI	1D-04 Water Flow Totalizer	1D-04	DI	120Vac	
1D	04	0401	PT	AI	1D04_0401_PT_AI	1D-04 Head Pressure	1D-04	AI	4-20mA	Y
1D	04	0401	LT	AI	1D04_0401_LT_AI	1D-04 Control Well Water Level Below Pavement	1D-04	AI	4-20mA	Y
1D	04	0451	LT	AI	1D04_0451_LT_AI	1D-04 Dewatering Well Water Level Below Pavement	1D-04	AI	4-20mA	Y
1D	05	0501	FIT	AI	1D05_0501_FIT_AI	1D-05 Water Flow	1D-05	AI	4-20mA	
1D	05	0501	FQI	DI	1D05_0501_FQI_DI	1D-05 Water Flow Totalizer	1D-05	DI	120Vac	
1D	05	0501	PT	AI	1D05_0501_PT_AI	1D-05 Head Pressure	1D-05	AI	4-20mA	Y
1D	05	0501	LT	AI	1D05_0501_LT_AI	1D-05 Control Well Water Level Below Pavement	1D-05	AI	4-20mA	Y
1D	05	0551	LT	AI	1D05_0551_LT_AI	1D-05 Dewatering Well Water Level Below Pavement	1D-05	AI	4-20mA	Y
1D	06	0601	FIT	AI	1D06_0601_FIT_AI	1D-06 Water Flow	1D-06	AI	4-20mA	
1D	06	0601	FQI	DI	1D06_0601_FQI_DI	1D-06 Water Flow Totalizer	1D-06	DI	120Vac	

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Instrument Number										
1D	06	0601	PT	AI	1D06_0601_PT_AI	1D-06 Head Pressure	1D-06	AI	4-20mA	Y
1D	06	0601	LT	AI	1D06_0601_LT_AI	1D-06 Control Well Water Level Below Pavement	1D-06	AI	4-20mA	Y
1D	06	0651	LT	AI	1D06_0651_LT_AI	1D-06 Dewatering Well Water Level Below Pavement	1D-06	AI	4-20mA	Y
1D	07	0701	FIT	AI	1D07_0701_FIT_AI	1D-07 Water Flow	1D-07	AI	4-20mA	
1D	07	0701	FQI	DI	1D07_0701_FQI_DI	1D-07 Water Flow Totalizer	1D-07	DI	120Vac	
1D	07	0701	PT	AI	1D07_0701_PT_AI	1D-07 Head Pressure	1D-07	AI	4-20mA	Y
1D	07	0701	LT	AI	1D07_0701_LT_AI	1D-07 Control Well Water Level Below Pavement	1D-07	AI	4-20mA	Y
1D	07	0751	LT	AI	1D07_0751_LT_AI	1D-07 Dewatering Well Water Level Below Pavement	1D-07	AI	4-20mA	Y
1D	08	0801	FIT	AI	1D08_0801_FIT_AI	1D-08 Water Flow	1D-08	AI	4-20mA	
1D	08	0801	FQI	DI	1D08_0801_FQI_DI	1D-08 Water Flow Totalizer	1D-08	DI	120Vac	
1D	08	0801	PT	AI	1D08_0801_PT_AI	1D-08 Head Pressure	1D-08	AI	4-20mA	Y
1D	08	0801	LT	AI	1D08_0801_LT_AI	1D-08 Control Well Water Level Below Pavement	1D-08	AI	4-20mA	Y
1D	08	0851	LT	AI	1D08_0851_LT_AI	1D-08 Dewatering Well Water Level Below Pavement	1D-08	AI	4-20mA	Y
1D	09	0901	FIT	AI	1D09_0901_FIT_AI	1D-09 Water Flow	1D-09	AI	4-20mA	
1D	09	0901	FQI	DI	1D09_0901_FQI_DI	1D-09 Water Flow Totalizer	1D-09	DI	120Vac	
1D	09	0901	PT	AI	1D09_0901_PT_AI	1D-09 Head Pressure	1D-09	AI	4-20mA	Y
1D	09	0901	LT	AI	1D09_0901_LT_AI	1D-09 Control Well Water Level Below Pavement	1D-09	AI	4-20mA	Y
1D	09	0951	LT	AI	1D09_0951_LT_AI	1D-09 Dewatering Well Water Level Below Pavement	1D-09	AI	4-20mA	Y
1D	10	1001	FIT	AI	1D10_1001_FIT_AI	1D-10 Water Flow	1D-10	AI	4-20mA	
1D	10	1001	FQI	DI	1D10_1001_FQI_DI	1D-10 Water Flow Totalizer	1D-10	DI	120Vac	
1D	10	1001	PT	AI	1D10_1001_PT_AI	1D-10 Head Pressure	1D-10	AI	4-20mA	Y
1D	10	1001	LT	AI	1D10_1001_LT_AI	1D-10 Control Well Water Level Below Pavement	1D-10	AI	4-20mA	Y
1D	10	1051	LT	AI	1D10_1051_LT_AI	1D-10 Dewatering Well Water Level Below Pavement	1D-10	AI	4-20mA	Y
1D	11	1101	FIT	AI	1D11_1101_FIT_AI	1D-11 Water Flow	1D-11	AI	4-20mA	
1D	11	1101	FQI	DI	1D11_1101_FQI_DI	1D-11 Water Flow Totalizer	1D-11	DI	120Vac	
1D	11	1101	PT	AI	1D11_1101_PT_AI	1D-11 Head Pressure	1D-11	AI	4-20mA	Y
1D	11	1101	LT	AI	1D11_1101_LT_AI	1D-11 Control Well Water Level Below Pavement	1D-11	AI	4-20mA	Y
1D	11	1151	LT	AI	1D11_1151_LT_AI	1D-11 Dewatering Well Water Level Below Pavement	1D-11	AI	4-20mA	Y
1D	12	1201	FIT	AI	1D12_1201_FIT_AI	1D-12 Water Flow	1D-12	AI	4-20mA	
1D	12	1201	FQI	DI	1D12_1201_FQI_DI	1D-12 Water Flow Totalizer	1D-12	DI	120Vac	
1D	12	1201	PT	AI	1D12_1201_PT_AI	1D-12 Head Pressure	1D-12	AI	4-20mA	Y
1D	12	1201	LT	AI	1D12_1201_LT_AI	1D-12 Control Well Water Level Below Pavement	1D-12	AI	4-20mA	Y
1D	12	1251	LT	AI	1D12_1251_LT_AI	1D-12 Dewatering Well Water Level Below Pavement	1D-12	AI	4-20mA	Y