Construction Dewatering

Rain for Rent

2018

Presented By:

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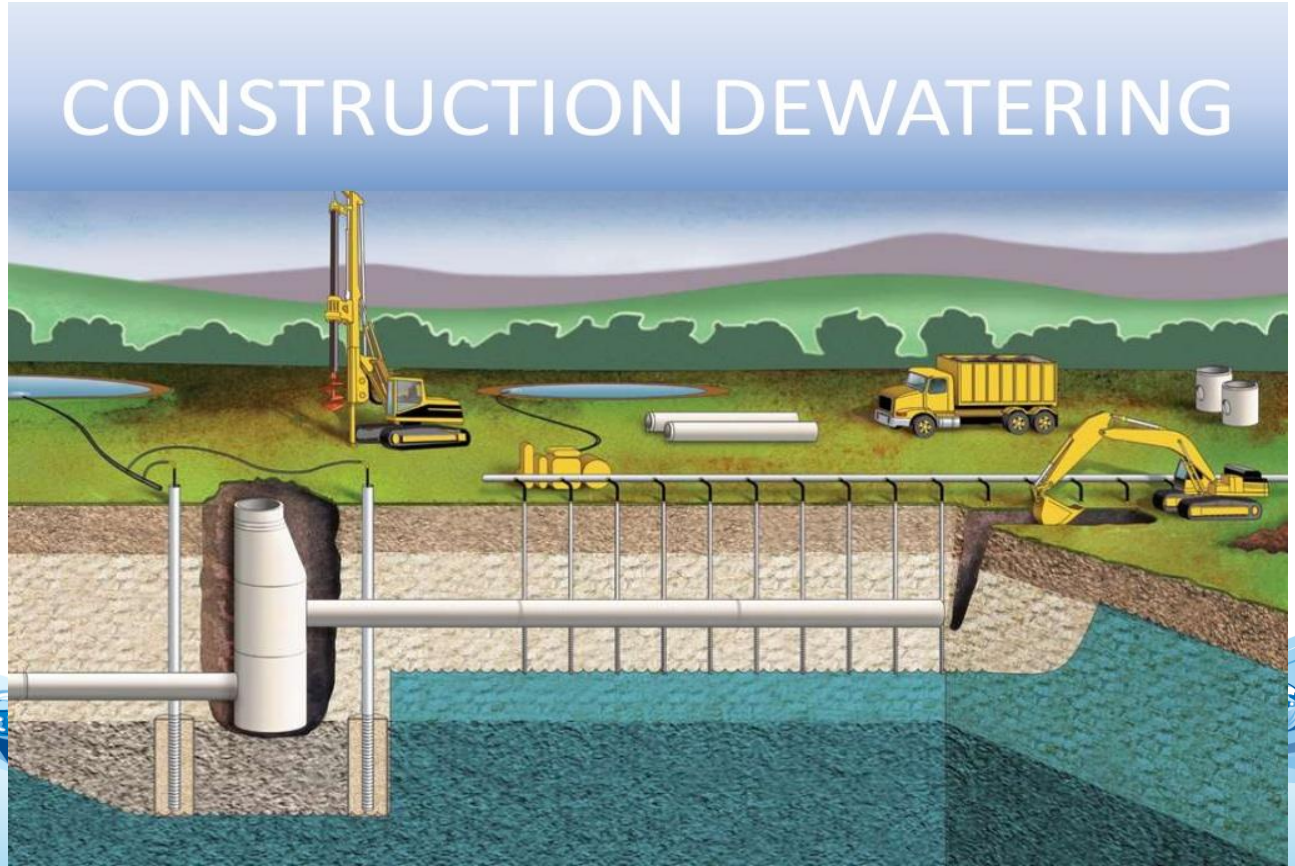
Agenda

- Introduction
- Overview of Dewatering
- Gathering Key Information
- Dewatering Methods and Design Process
- Case Studies
- Questions

Dewatering

There are two main groups of groundwater control techniques:

- Methods that use low permeability cut-off walls and other barriers to exclude water from the excavation
- Methods that control groundwater by pumping from sumps or wells (known as construction dewatering)



Information required

- Potential sources of recharge
  - i.e. rivers, creeks, canals, lakes, etc.
- Potential geotechnical impacts
  - Soil settlement in the immediate vicinity of nearby structure
  - Groundwater contamination (nearby landfill)

Information required

- Site elevation and size
- Excavation Depth
  - Desired Dry-Depth (typically 2-3 feet below the excavation)
- Soil description
- Groundwater elevation
- Time allotment for pre-drainage
  - Typically dewatering systems require a minimum 1 to 3 weeks before substantial draw-down is achieved

Information required

- Boring Logs
- Geotechnical Report
- Soils Report
- Water quality/testing results for discharge permit.

Dewatering – Wellpoint & Deep Well

Treatment

Treatment

Wellpoints

- Soil Types: Fine to coarse
- Effective for stratified soils
- Hydrology: High and low conductivity | adjacent and remote recharge
- Header Pipe: 6 inches or larger
- Approximately 60 to 80 points per pump
- Header pipeline should not exceed 500 to 700 feet in length

Wellpoints

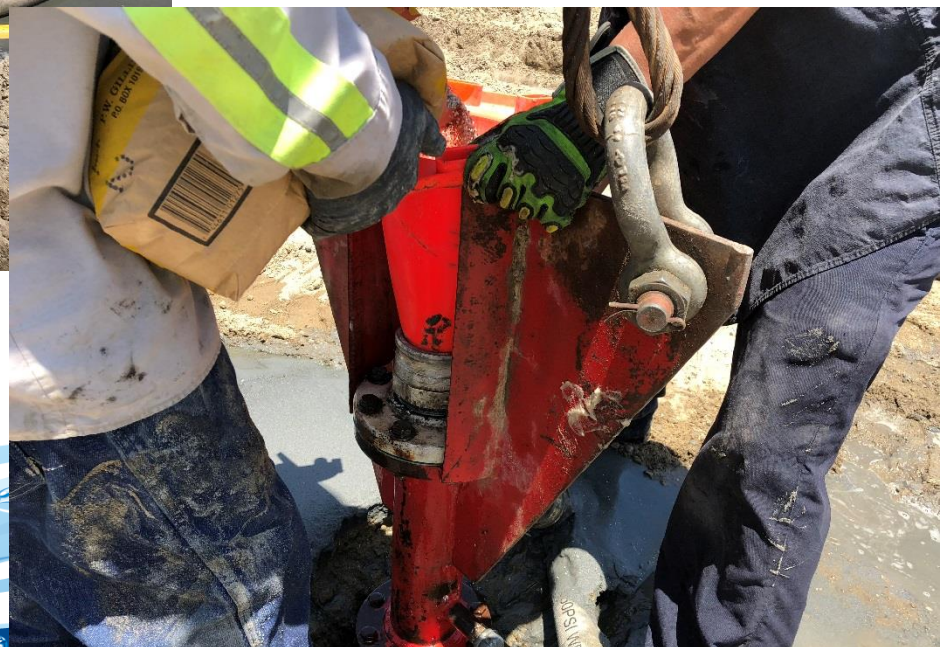
- Excavation Depths: < 20 feet @ sea-level
- Typical Spacing: 6 to 12 feet
- Flow per point: <0.1 to 20 gpm
- System flow rate: low to a few thousand gpm
- At times well-point must be sand packed

Wellpoint Installation and Operation

- Requires excavator, jetting pump, and PVC wellpoint
- May require backhoe
- Drilling may be required in dense soils
- Individual wellpoints need to be carefully adjusted ("trimming" or "fine-tuning")

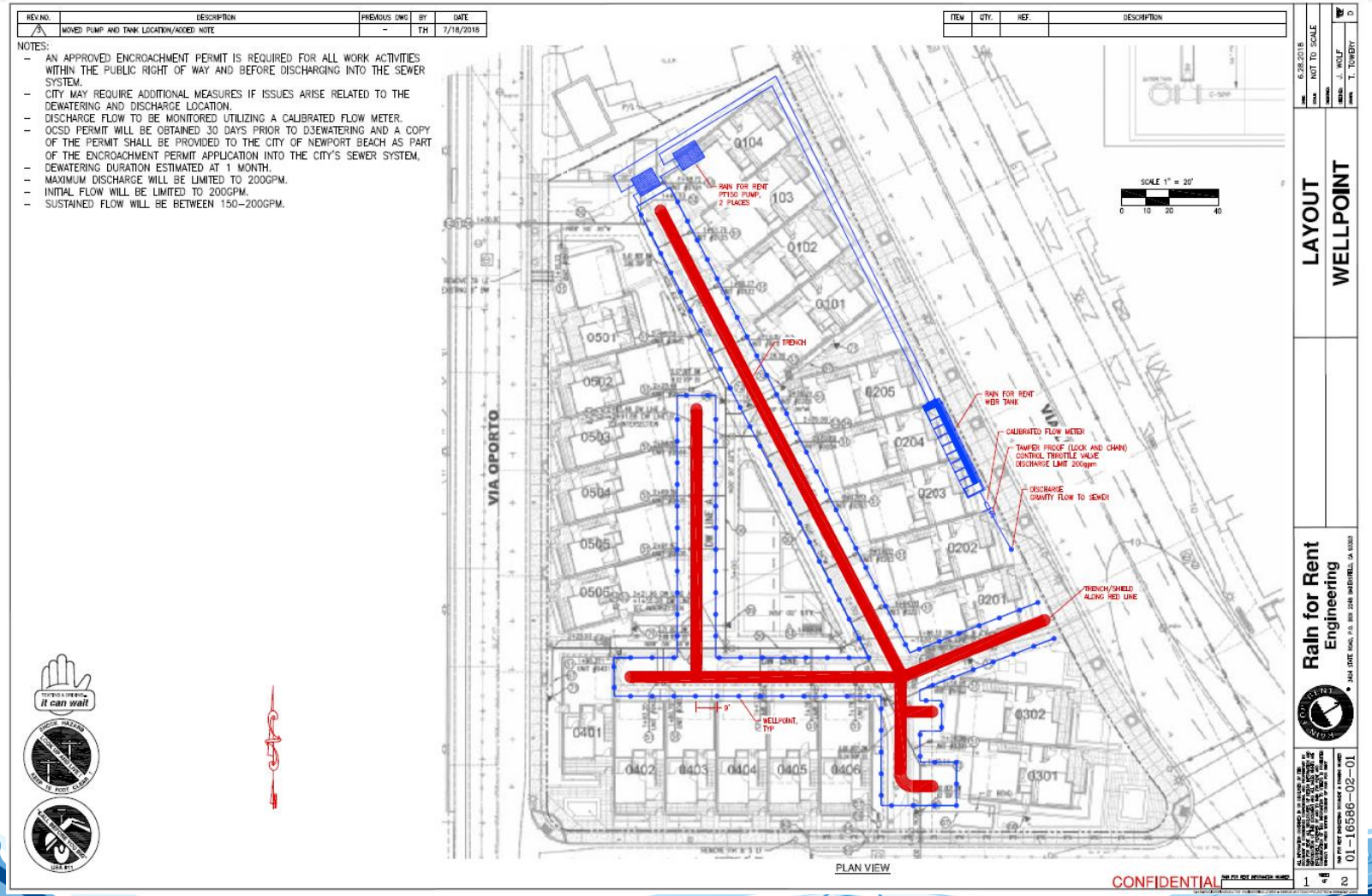
Jetting

Jetting

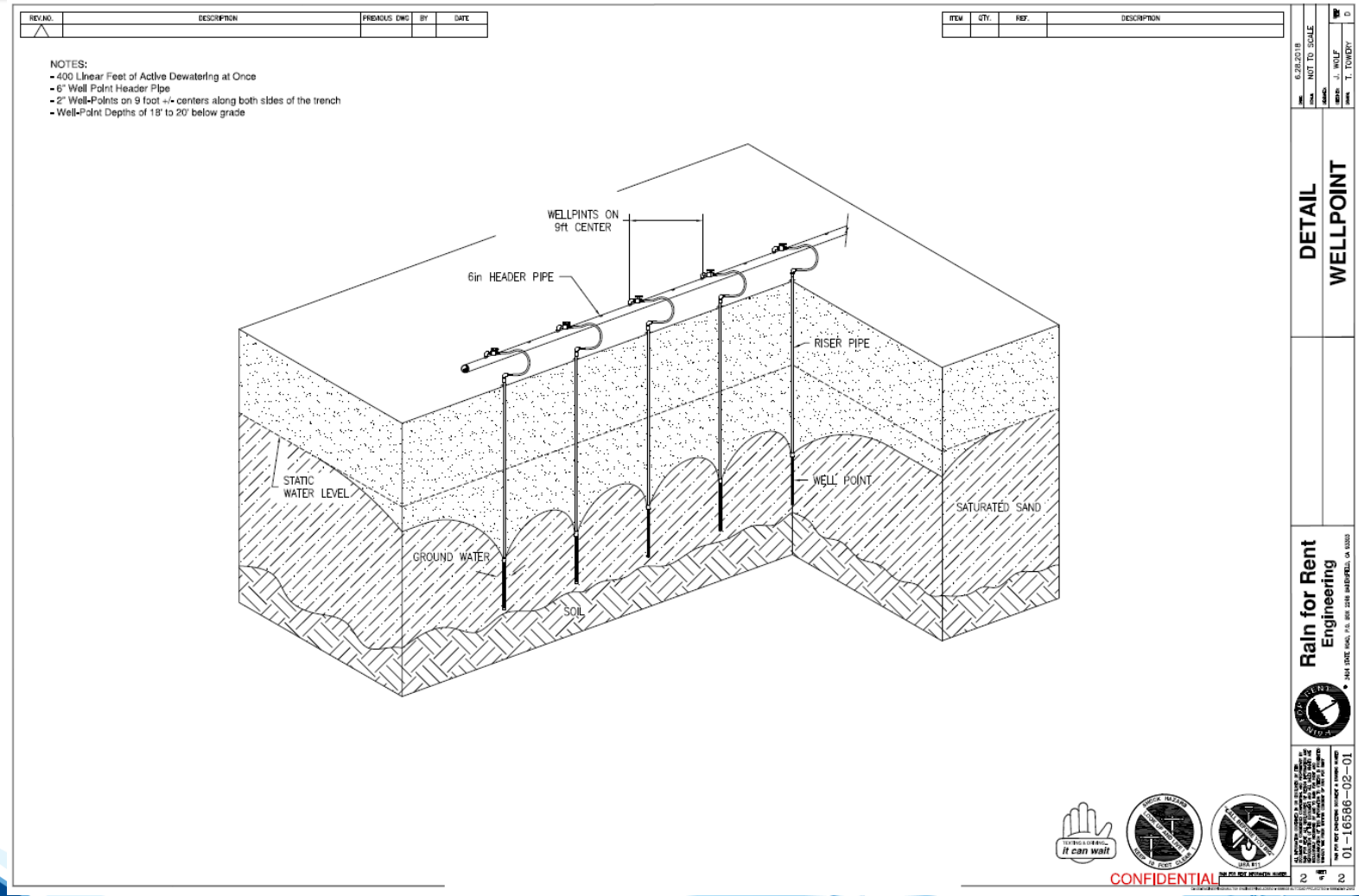


Jetting Video

Wellpoint design



Wellpoint design



Wellpoint

Wellpoint

Deep Well Dewatering

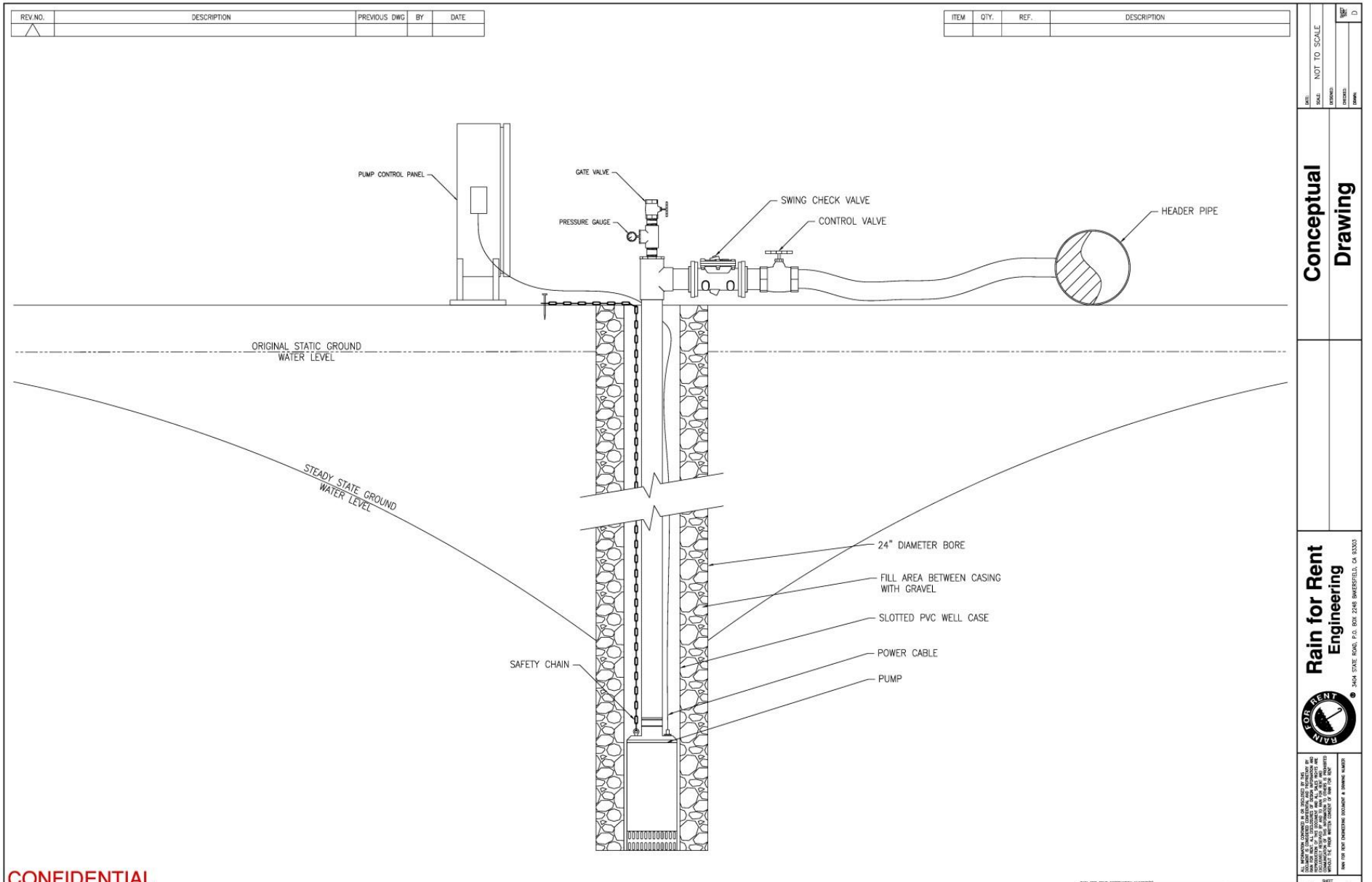
- Soil Types: performs best in clean sands and gravel | typically poor in fine and clayey soils
- Can be effective in stratified soils
- Best when recharge is remote
- Individual deep wells need to be carefully adjusted (“trimming” or “fine-tuning”)
- Timetable: Slow drawdown

Deep Well Dewatering

- Excavation Depths: Shallow to several hundred feet
- Typical Spacing: Approx. 50 feet
  - Full Range: 30 to 200 feet
- Flow per well: <0.1 to thousands of gpm
- System flow rate: low to tens of thousands of gpm
- Typically 8 to 12inch diameter casings
- An electric submersible pump is installed in each well.

Drilling

Deep Well


REV.NO.
DESCRIPTION
PREVIOUS DWG
BY
DATE
ITEM
QTY.
REF.
DESCRIPTION
PUMP CONTROL PANEL
GATE VALVE
PRESSURE GAUGE
SWING CHECK VALVE
CONTROL VALVE
HEADER PIPE
ORIGINAL STATIC GROUND WATER LEVEL
STEADY STATE GROUND WATER LEVEL
24" DIAMETER BORE
FILL AREA BETWEEN CASING WITH GRAVEL
SLOTTED PVC WELL CASE
POWER CABLE
PUMP
SAFETY CHAIN
Conceptual Drawing
NOT TO SCALE
Rain for Rent
Engineering
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Power Distribution

Generator or Power Source

Master 1

Master 2

Master 3

Control Panels

Control Panels

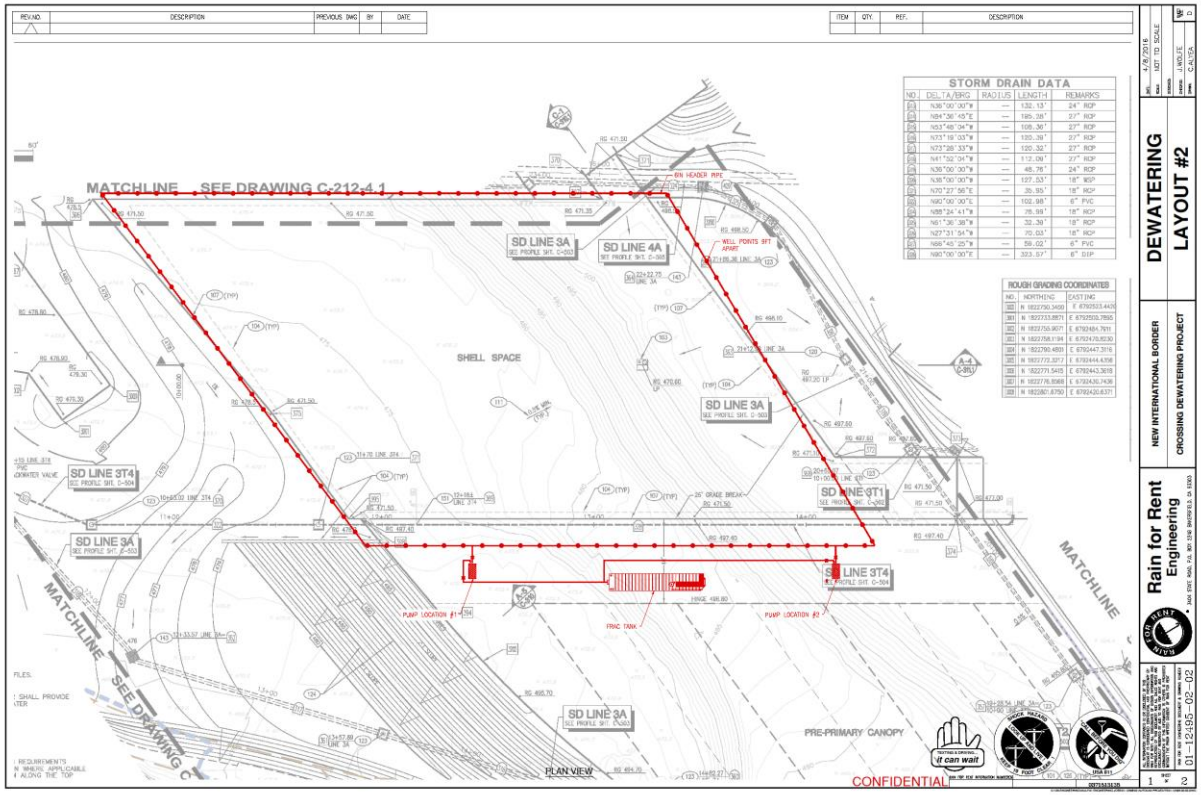
Control Panels

Which Method is Best for Your Site?

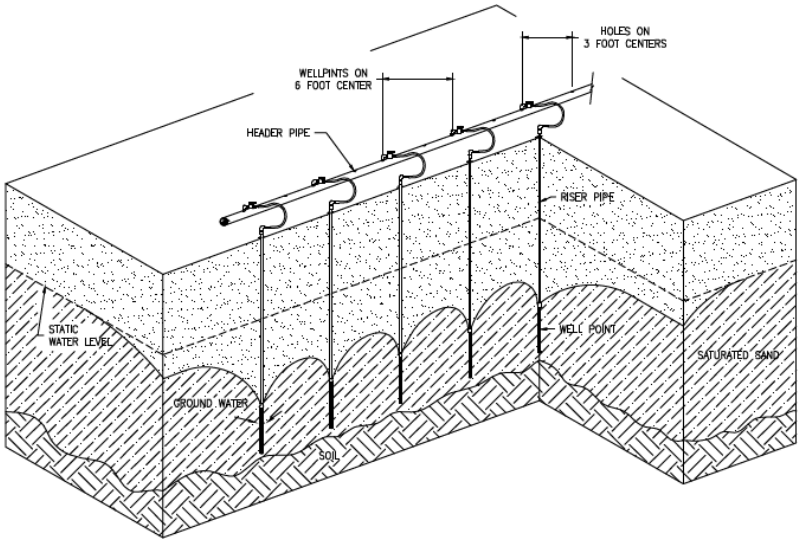
Wellpoints vs. Deep Wells		
	Wellpoints	Deep Wells
Soil Types		
Fine grained (silts and clayey sands)	Good	Poor to Fair
Stratified soils	Good	Poor to Fair
Wellgraded sands and gravel	Good	Good
Impermeable soils/rock at subgrade	Fair to Good	Poor to Fair
Recharge		
Close	Good	Poor
Distant	Good	Good
Conductivity		
High (i.e. clean sands/gravels)	Good	Good
Low (i.e. silts, clayey sands, etc.)	Good	Poor
Site		
Confined (cramped)	Poor	Ok
Excavation depths of 17 feet or less	Ok	Ok
Excavations exceeding 17 feet	Benching / Tiered System	Ok
Timetable (drawdown)		
Quick	Ok	Poor
Slow	Ok	Ok
Characteristics		
Typical Spacing	3 to 12 ft	50 to 100 ft
Flow Ranges per point/pump	>1 to 20 gpm	>1 to thousand of gpm
System Flow Rate	a few to thousands of	a few to tens of

Case Study 1 (Wellpoint Dewatering)

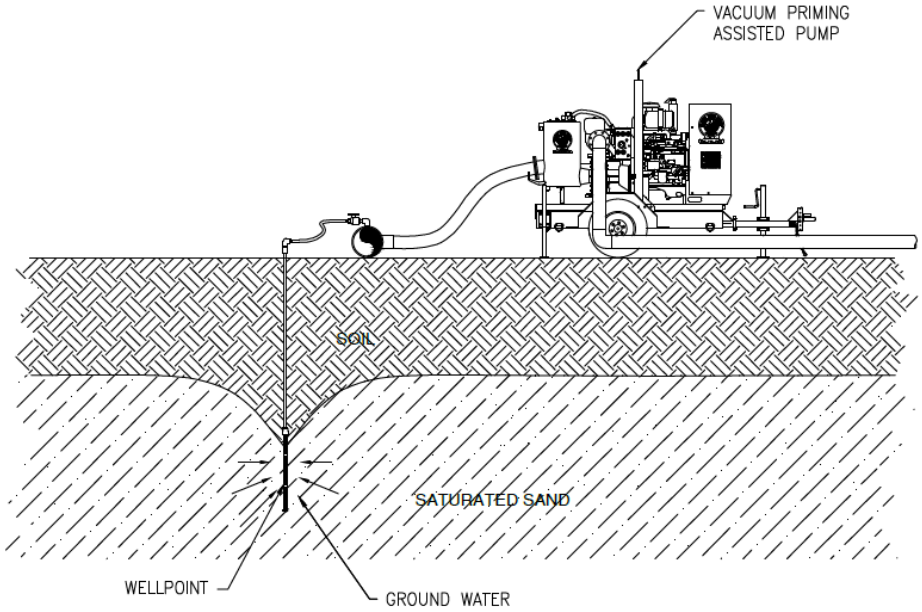
- **Dewatering Perimeter:**
  375 feet by 200 feet
- **Desired Dry-Depth:**
  8 feet below grade
- **Groundwater Depth:**
  2.5 feet
- **Soil Type:**
  Sand with silt
- **Drawdown Time:**
- 2 to 4 weeks
- **Project Length:**
  3 Months



Wellpoint Detail



INSTALLED DETAIL



ELEVATION VIEW

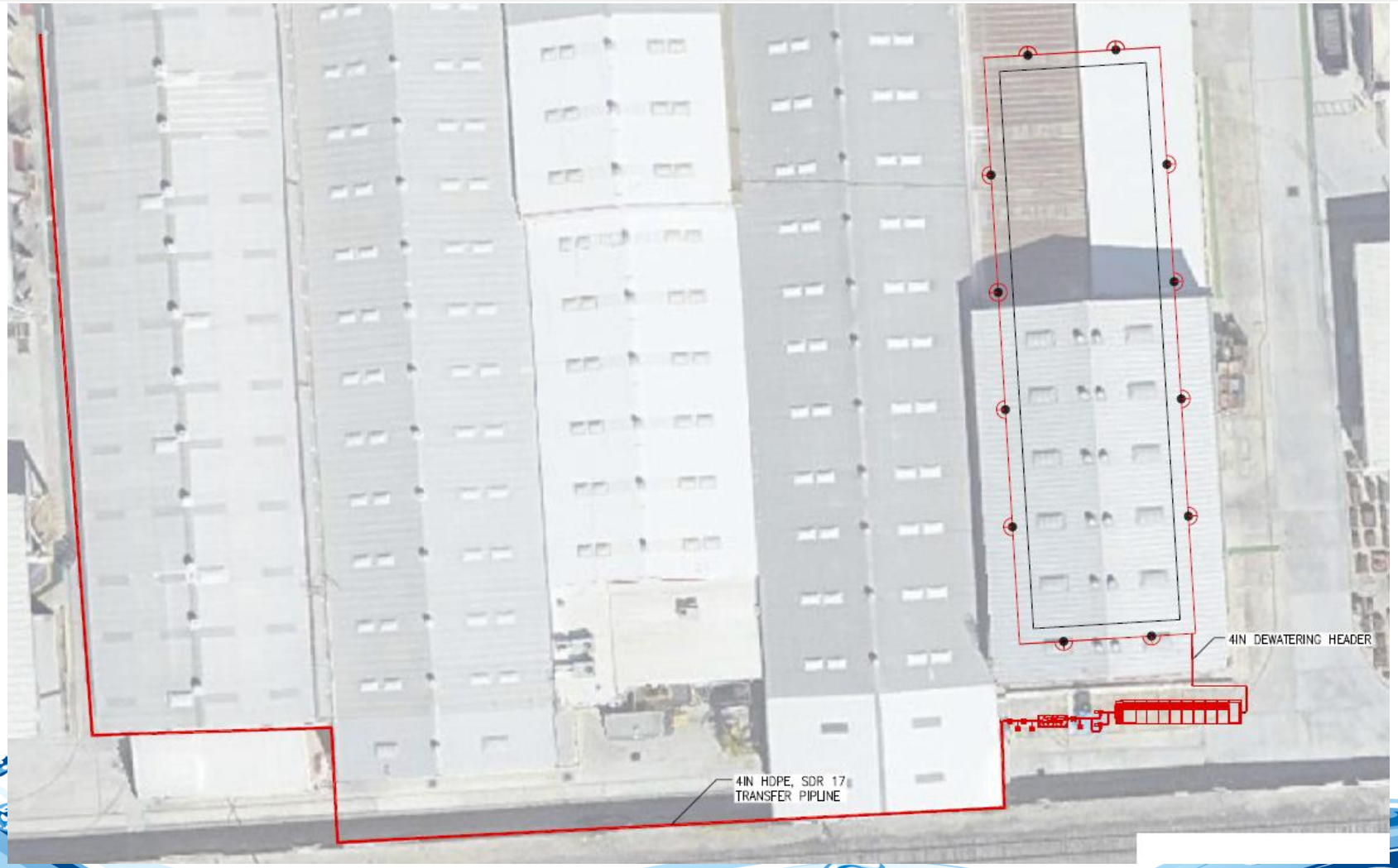
Case Study 1

Case Study 1

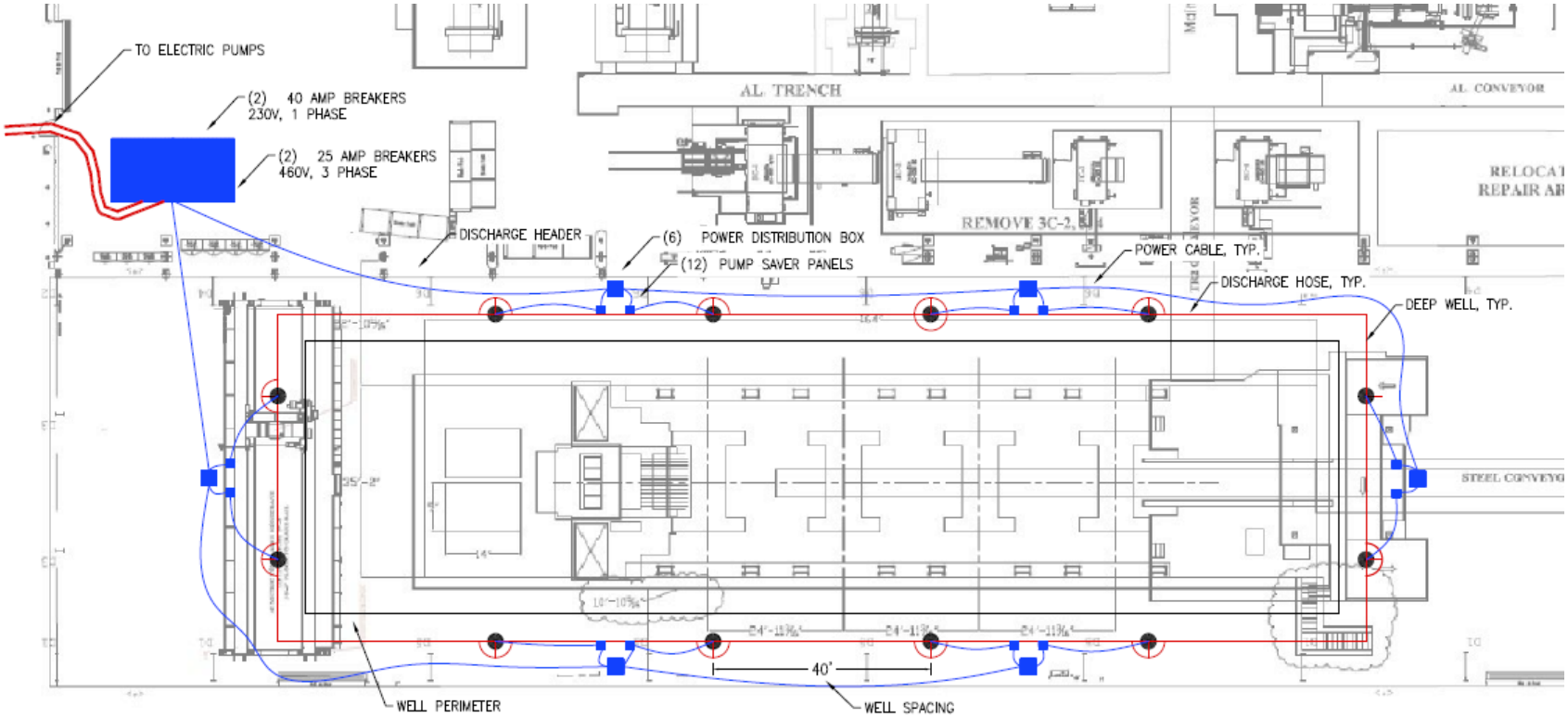
Case Study 1 (Project Summary)

- **Pumps:** two (2) primary Vacuum Pumps
- **Wellpoints:** 94 jetted to 18 feet below grade
- **Header Pipe:** 6”
- **System Flow Rate:** 500 – 600 gpm
- **Excavation Depth:** 4 feet
    - Desired dry-depth of 8 feet below grade
- **Max Draw Down:** 10 feet below grade

Case Study 2 (Deepwell)



Detailed Layout



Pump Test

5.0 HYDRAULIC CONDUCTIVITY FIELD TESTING

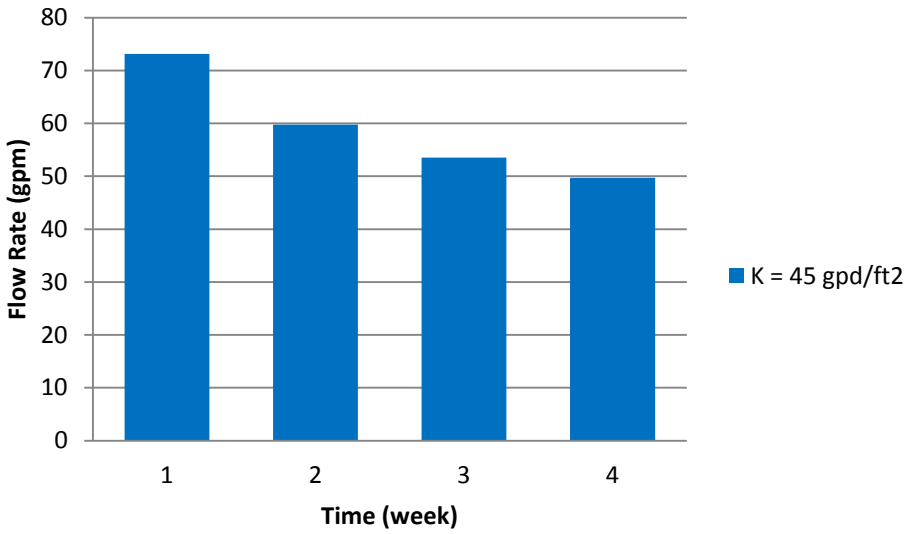
Test Boring B-1 was drilled using an 8-inch outside diameter hollow stem auger and an additional observation well was drilled 10 diameters away (80 inches) from B-1 and was extended to a depth of 30 feet. After drilling and sampling, Test Boring B-1 was converted into a temporary well. Slotted pipes (2-inch diameter) were installed inside the borings and the annular space was backfilled with clean sand.

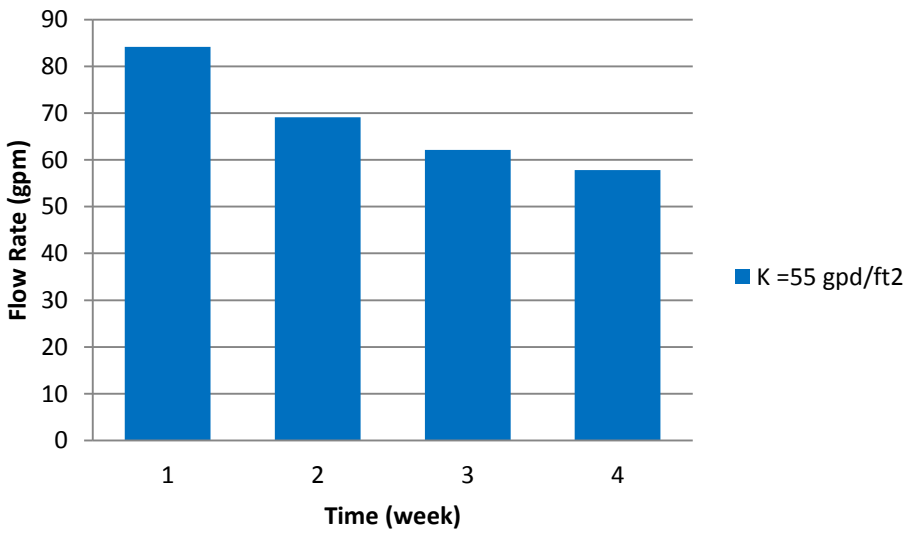
In order to evaluate the hydraulic conductivity of the site soils, two (2) pump tests were conducted within Test Boring B-1 and the drawdown in the observation well was also recorded. An initial static groundwater elevation was recorded within the test boring and then a Grundfos Redi-Flo2 pump was placed inside the screen pipe about 2 feet above the bottom of the temporary well (B-1). A Solinst Levelogger F100 was then placed inside the pipe above the pump. The pump was run simultaneously with the levelogger until the groundwater elevation was lowered to about 25 feet from the finish floor slab. The pump was then turned off and the time for the water rise to its original static groundwater elevation was recorded. The water level drawdown within the nearby observation well was also recorded following drawdown within Test Boring B-1 and indicated only minimal drawdown (0.5 and 0.6 feet) at a distance of 80 inches.

The field data was transferred to a computer using Solinst Levelogger 4.0 and analyzed using AquiferTest™2016.1 software. Conductivity values were calculated utilizing the analytical method developed by the Bouwer and Rice Method. A hydraulic conductivity value of 2.1×10^{-3} and 2.6×10^{-3} cm/sec were obtained for the two tests. The hydraulic conductivity results and the time versus recharge plots for the tests generated using the AquiferTest™ software are included within Appendix A.

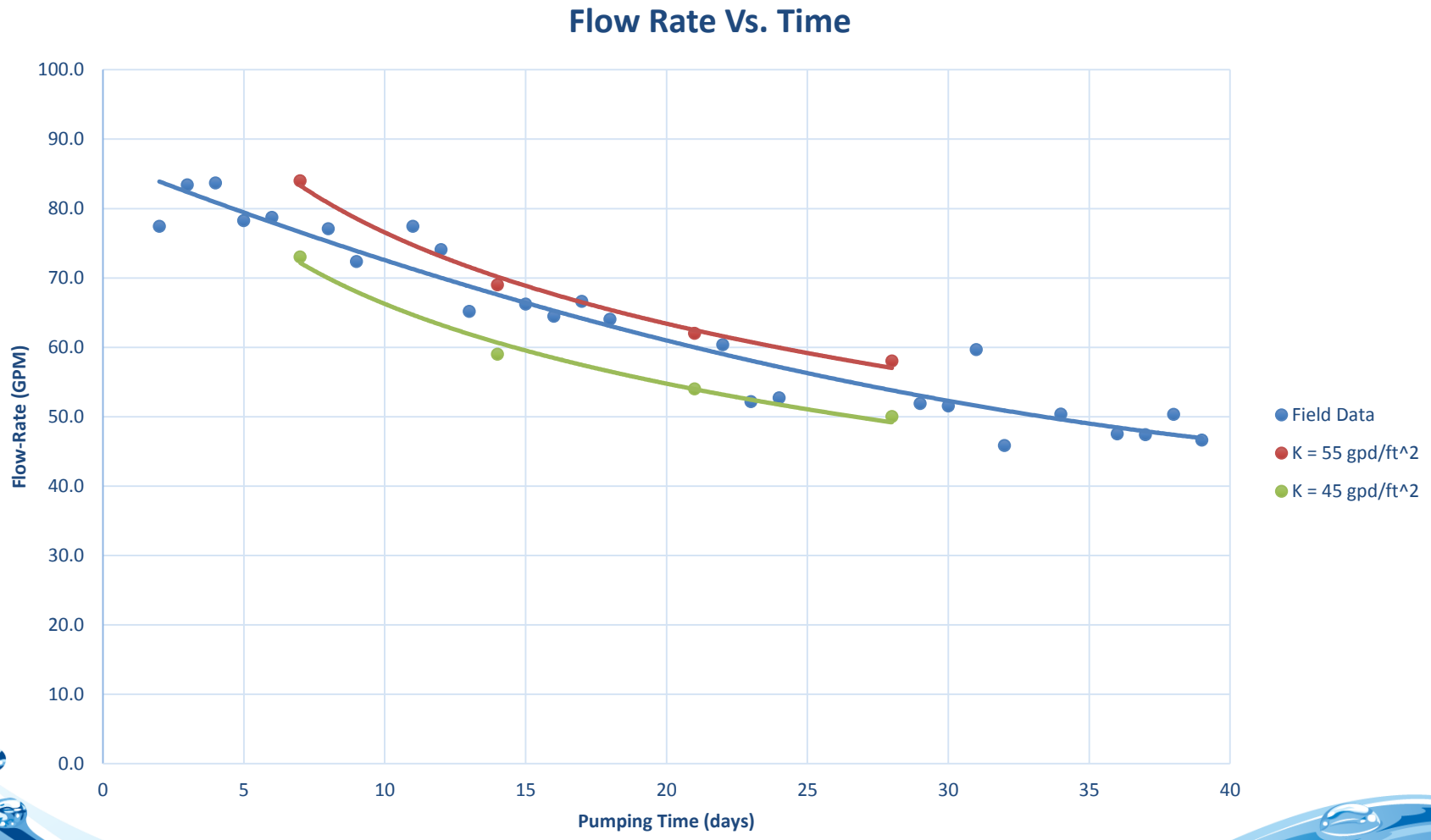
Please note that the calculated values represent the hydraulic conductivity of the shallow aquifer materials directly adjacent to the well screen, and may not represent overall aquifer conductivity. Additionally, the effect of disturbing native soil during drilling of the borehole prior to monitoring well installation may influence the hydraulic conductivity values.

Calculations





Calculations Vs. Field Data Comparison



Project Summary

- **Pumps: Twelve (12) 1/2HP Submersible Pumps**
- **Deep Wells: 24 inch bore with 8 inch casing**
  - Depth: Approximately 45-50 feet below grade
- **Header Pipe: 3”**
- **System Flow Rate: 85 to 45 gpm**
- **Excavation Depth: 20 feet +/-**
  - Desired dry-depth of 23 feet below grade
- **Customer successfully installed foundations in the dry**

Questions