

Slant Well Desalination Feedwater Supply

Comparison Between
Dana Point Test Slant Well and
CEMEX Test Slant Well

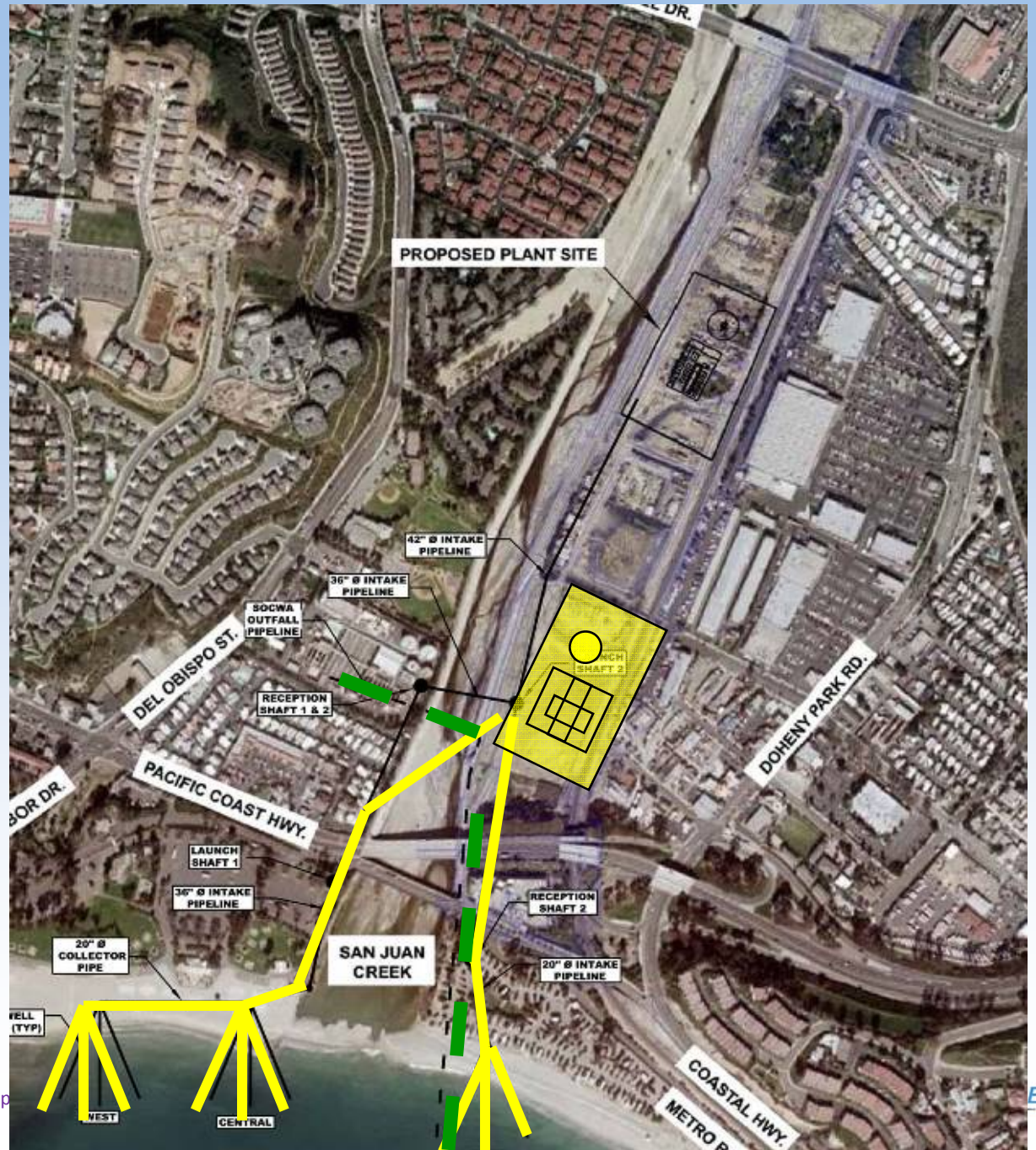
CalAm

9-Oct-14



Doheny Ocean Desalination Project Dana Pt.

Project Location & Layout
30 mgd
9 slant wells
7 active 2 stdby



TEST SLANT WELL DRILL SITE



TEST SLANT WELL

Dana Pt.

Cemex

Drilling Method:

Dual Rotary Drilling Rig

same

Angle :

23 degrees

19 degrees

Type:

Uniform Diameter casing and screen

Telescoping
Larger Pumphouse

Completed Length:

350 ft

760 ft

Well Screen:

220 ft

475 ft

Length of Blank Casing:

130 ft

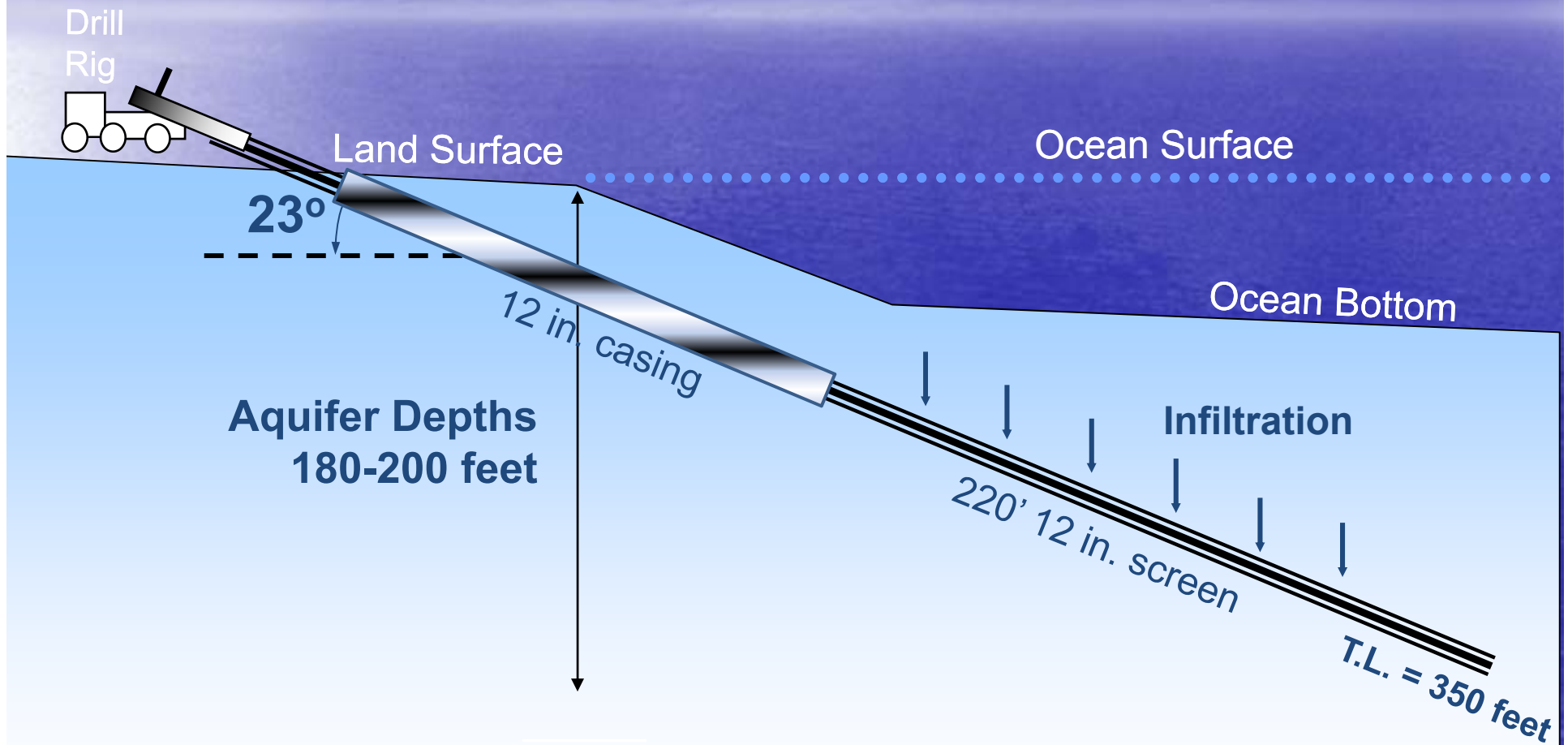
345 ft

Casing and Screen:

12 in. ID

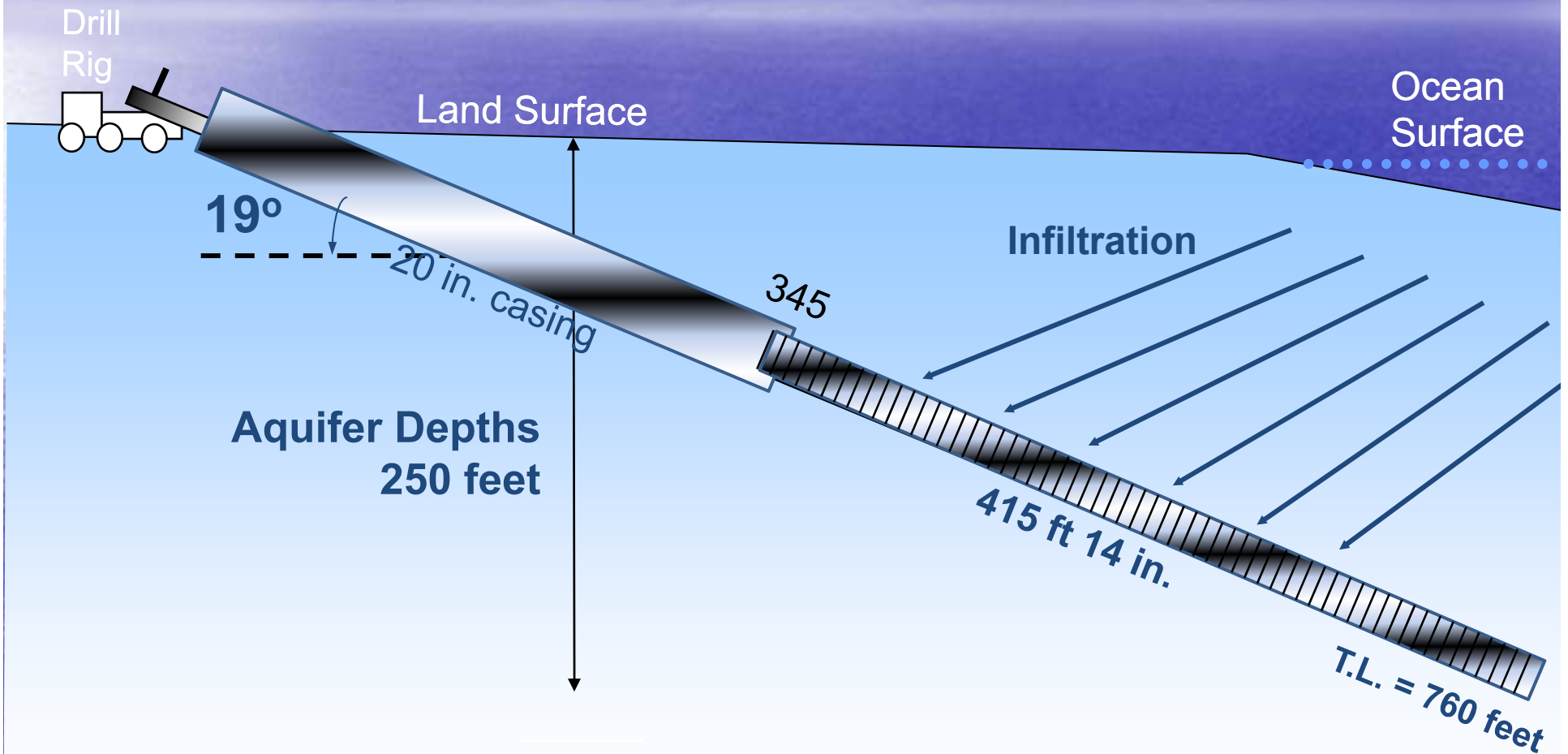
14 in & 20 in. ID

Dana Point Test Slant Well



* The small 12" pumphouse casing prevented full development of the well (1.5 x the design capacity)

CEMEX Test Slant Well



* Larger test well casing allows full development of the well (1.5 x the design capacity) unlike Dana Point well

Comparison in Design and Performance Dana Pt. and CEMEX

Project	Well Length ft	Casing diam. Length In. / ft	Screen diam. Length In. / ft	Initial Discharge Rate and Specific Capacity	Final Discharge Rate and Specific Capacity	Start and Ending TDS mg/L	On Shore Groundwater Impacts
Dana Pt.	350 ft	12 in./130 ft	12 in./220 ft	2,000 gpm 69 gpm/ft	2,000 gpm 47 gpm/ft	2,500 / 17,000	Minimal
CEMEX	760 ft	20 in./345 ft	14 in and 20 in. 475 ft	2,500 gpm 90 gpm/ft (estimated)	2,500 gpm 90 gpm/ft (estimated)	26,000 / 32,000+	Negligible

Comparison in Geology Dana Pt. and CEMEX

Project	Exploratory Boreholes	Aquifer Thickness	Material Type	Water Quality (starting level)	Full Scale Feedwater Requirement	Full Scale Project Wells	Percentage Ocean Water from Full Scale System
Dana Pt.	Yes	180–200 ft	Sands, gravels, and cobbles	Brackish 2,500 mg/L	30 mgd	9 total 7 active 2 standby	95%
CEMEX	Yes	250 ft	Mostly Sands and fine gravels	Saline 26,000 mg/L	24.1 mgd	10 total 8 active 2 standby	96%+

Comment on the Decline in Specific Capacity at the end of the two year pumping test

- Due to limited funding, the Dana Point Test Slant Well was designed as a uniform 12-inch diameter well casing and screen without a larger diameter pumphouse casing.
- Consequently, the largest diameter submersible pump that could be installed in the well was a 10-inch pump with a capacity of 2,200 gpm
- Industry standard practice is to develop a well at 1.5 x the design discharge rate
- This would have required a pump capable of 3,300 gpm for a Q of 2,200 gpm
- The well was developed at 1,700 gpm.
- The decline in specific capacity was expected due to incomplete initial development.
- The Dana Pt. full scale wells will have a telescoping design with a larger diameter pumphouse casing as does the CEMEX well
- This will allow for full development of the well and minimize losses in performance

Appendix

Dana Point Photos

TEST SLANT WELL DRILL SITE



DANA POINT – TEST SLANT WELL

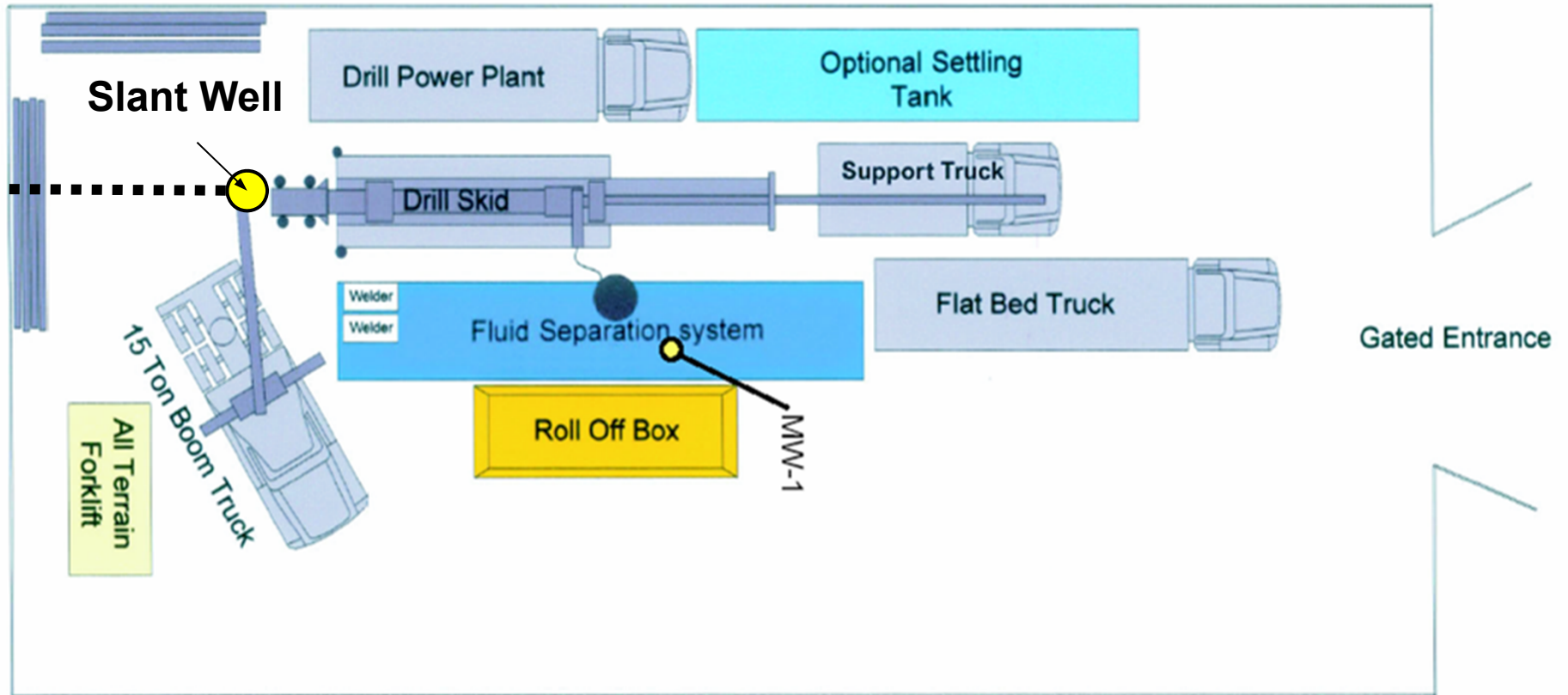


DRILLING SITE ON DOHENY BEACH





CONSTRUCTION FOOTPRINT



0 ft.
6 ft.
10 ft.
20 ft.



← Ocean

Dana Point Slant Well Equipment Footprint
130 X 60 Chain Link Fenced

DRILLING HOLES FOR THE ANCHOR PIPES



SLANT WELL CONSTRUCTION



DUAL ROTARY DRILL RIG





SLANT WELL CONSTRUCTION 24 IN. OUTER CASING



WELDING THE SHOE ON THE 24 IN. CASING



12 IN. 316L STAINLESS STEEL CASING & SCREEN



INSTALLING THE 12 IN. 316L SS SCREEN



WELDING SCREEN JOINTS



24 IN./20 IN./12 IN. CASING/TREMIE PIPE





PASSIVATION OF WELD JOINTS



GRAVEL PACKING



• INSTALLING THE FILTER PACK BY PUMPING UNDER PRESSURE



WITHDRAWING THE 20 IN. TEMPORARY CASING



WELL DEVELOPMENT







DISCHARGE WATER DIFFUSER PIPE



SLANT WELL IS BURIED UNDER THE BEACH SAND



30 MGD FEED WATER SUPPLY



(7) Production Slant Wells 3,000 gpm each – 1,000 ft Lineal

(2) Standby Wells