



Water Resources Exploration and Development

Geophysics and Salinity

Designing a Coastal Brackish Water Extraction and Treatment Project to Control Seawater Intrusion and Achieve Sustainability in the Oxnard Basin

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Staff Report

Oxnard Plain the It uh-eal-/en-**Groundwater Study**

Water Code Section 2100



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MARCH 1979 DIVISION OF WATER RIGHTS STATE WATER RESOURCES CONTROL BOARD







Figure 7. Maps showing interpreted resistivity at 30, 45, 70, and

U.S. Department of the Interior U.S. Geological Survey



SIMULATION OF GROUND-WATER/ SURFACE-WATER FLOW IN THE SANTA CLARA-CALLEGUAS BASIN, VENTURA COUNTY, CALIFORNIA

A contribution of the Southern California Regional Aquifer-System Analysis Program

Water-Resources Investigations Report 02-4136









Groun Sustainable Yield with Current GSP Projects



Groun Grou Fox Ca

WESTERN GROUNDWATER CONGRESS HOLLYWOOD : THE SEQUEL SEPTEMBER 13-15, 2021



Time to try something new, overdraft conditions persist

- Large surface water diversion and water rights permit in place
- Conjunctive use strategies and delivery systems in place
- Some State Water imports now, significant expansion unlikely
- Cities are recycling their wastewater, or have plans to
- Long-term demand reduction and efficiency programs in place

Oxnard Plain annual farm economy \$1 billion, they want to continue

Stopping seawater intrusion the biggest challenge for sustainability





Extraction barrier in the Upper Aquifer System





Contour lines: **RED** below sea level, **BLUE** above sea level **Blue lines**: Particle tracking paths Animations in yearly time step from 2020 to 2069 Two well locations with 5,000 AFY 2,500 AFY from Oxnard Aquifer 2,500 AFY from Mugu Aquifer





Geologic Cross Section N-N'

Section extends north from Laguna Point (coastal well at left)

Semi-perched aquifer is relatively thick (red upper layer)

Oxnard (pink) and Mugu (green) aquifers are highly permeable and lie flat

Hueneme aquifer (yellow) eroded away in the project area, Mugu overlies Fox Canyon aquifer (magenta) N (S) (N) N' 50,000 25 000 35.000 40,000 45.040 Stratigraph quitard

7x Vertical Exaggeration

Cross-Section N-N

Stratigraphy Aquitard Semi Perched Aquifer Mugu Aquifer Mugu Aquifer Huoterne Aquifer Fox Carryon Aquifer - basid Santa Barbara and/or other Formation Girimes Carryon Aquifer Volcanics

Section N-N' Detail and Conceptual Project Optimal Flow

Model pumping rates in Oxnard aquifer that avoid significant vertical flow down from perched aquifer

Model Mugu aquifer pumping rates to draw, over time, fresh water over area of mergence with lower aquifers









Groundwater Modeling Efforts

- Convert United's existing coastal plain groundwater model to MODFLOW-USG, calibrate solute transport (seawater)
- Evaluation of brackish groundwater extraction barrier effectiveness
 - Run and refine the density-dependent solute transport model
 - Identify extent of density wedge in the Semi-perched aquifer
 - Evaluate potential for vertical migration from the Semi-perched aquifer down to Oxnard aquifer under pumping conditions





Numerical Model Refinement

MODFLOW-NWT

MODFLOW-USG











MODFLOW-USG







Oxnard Aquifer Solute Transport

Estimated Initial Chloride Conc in 1985

Black line: 1989 Oxnard Aquifer SWI Inland Extent (USGS)

Simulated Chloride Conc in 2015





Now will run range of pumping simulations and delivery options (Prop 1 Round 2 grant)

- Vary magnitude of pumping from Oxnard and Mugu aquifers
- Navy use of project water offsets inland basin pumping
- Distribute to agricultural areas to offset pumping
- Consider other options such as injection or spreading during periods of low demand
- Assess benefits and potential impacts to basin (Hueneme Canyon)





Additional Next Steps:

- Sampling for organic contaminants in existing Oxnard and Mugu aquifer monitoring wells
- Preliminary designs for treatment process
- Brine concentration and energy recovery options
- Product water must meet potable and irrigation needs





Next Big Additional Steps:

- Construct full scale production wells in project area
- Secure discharge permit for water produced by test pumping
- Install additional monitoring wells for background water quality sampling and groundwater flow under pumping conditions

United is seeking a Prop 1 Round 3 grant for this work





Engineering work is also underway as United CIP project







US Navy support

- Provided a Letter of Support for the CA DWR Prop 1 Grant
- RDML Bolivar provided United a Letter of Support for the Project during the Feasibility Assessment
- Coordination and collaboration to ensure Project facilities not in conflict with the Navy's Current and Future mission
- If Project is feasible, NBVC and United will enter into a long-term outgrant easement (50+ years) for use of Federal Land.
- United has started work on CEQA, will support Navy with NEPA





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Questions or Comments? Thanks!

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