

# Confirm Water Sweep Dimensions and Extent

Case study: DeepLook EM technology accurately images fluid flow on a reservoir scale for ADCO

## Challenge

Determine waterflood movement on a reservoir scale to avoid override.

## Solution

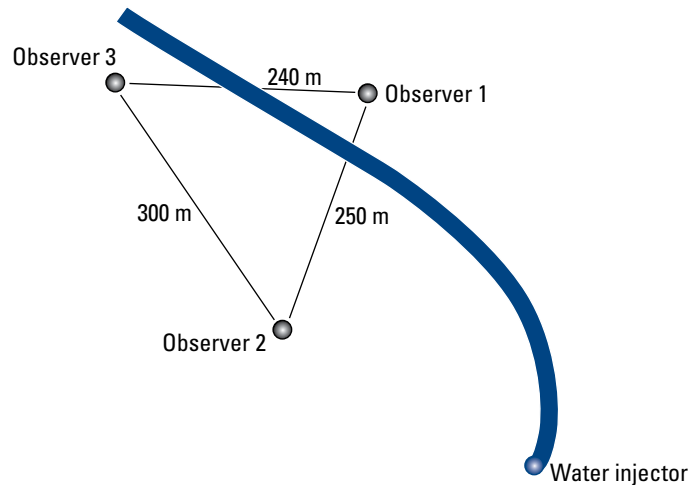
Monitor fluid displacement using DeepLook-EM\* reservoir-scale resistivity images.

## Results

Used time-lapse survey results to correct flow simulation model for accurately projecting sweep movement and guiding injection strategy.

## Insufficient resolution and coverage for monitoring

Uneven sweep (water override) was occurring in a prolific UAE field operated by Abu Dhabi Company for Onshore Oil Operations (ADCO). But lateral coverage with conventional logs and the vertical resolution of subsurface seismic surveys were insufficient for monitoring interwell fluid flow. What was missing was measurement of the flood movement in the areas between wells. The limited dataset in turn impeded prediction of the water front dimensions and extent generated using stochastic flow simulation.



*The DeepLook-EM transmitter and receiver tools were run in pairs of observer wells to monitor water injection.*

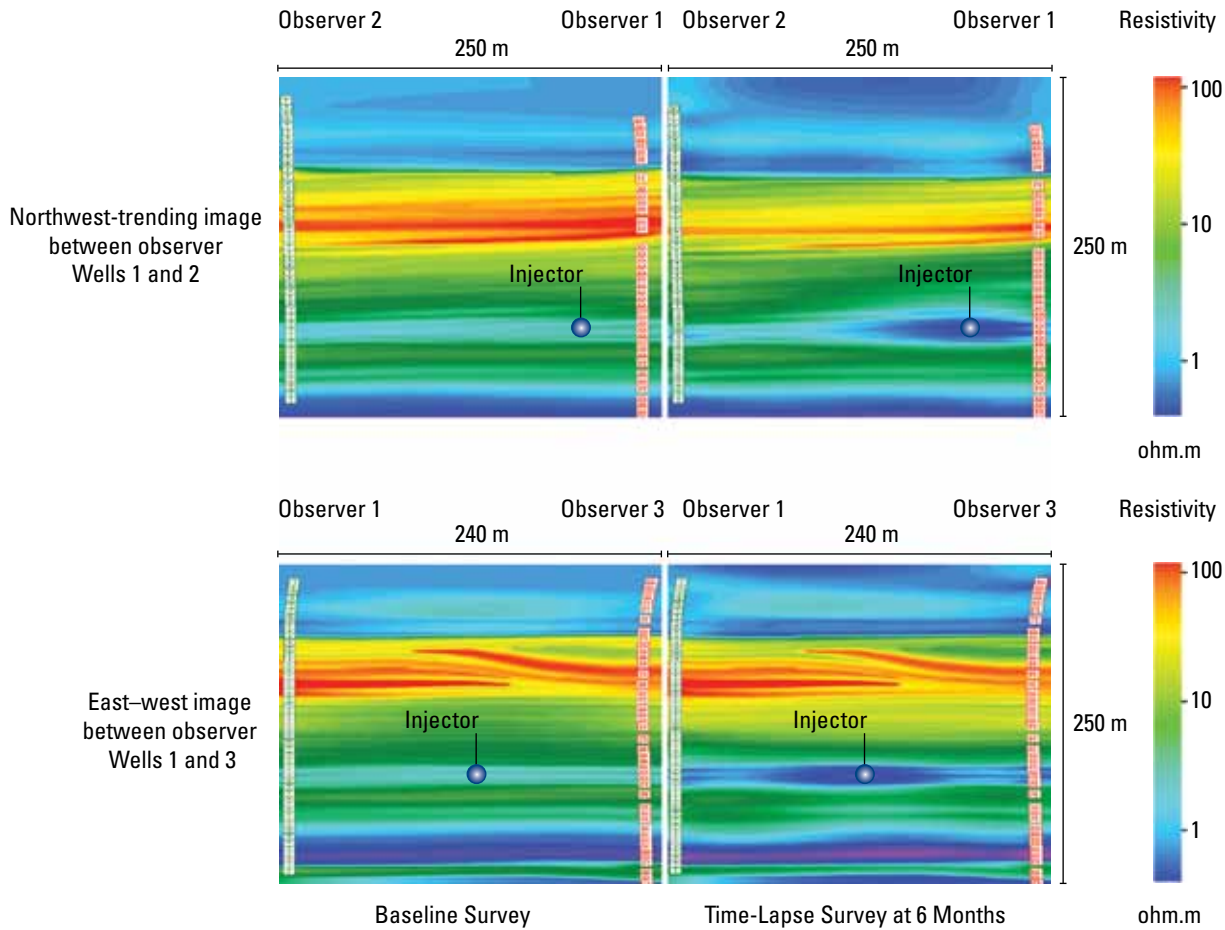
## Reservoir-scale resistivity images

Instead of logging just the near-well environment, the DeepLook-EM enhanced crosswell reservoir monitoring system provides reservoir-scale resistivity images between boreholes up to 1,000 m [3,280 ft] apart. The extent and direction of injected fluid flow is revealed by DeepLook-EM time-lapse surveys, imaging fluid displacement across the reservoir to guide injector placement and operation and infill drilling.

## Insight from accurate images of fluid flow

DeepLook-EM surveys of well pairs were acquired for a set of three observer wells, with baseline acquisition conducted preinjection. The data were fit into a model constructed from conventional wireline resistivity measurements made in the observer wells. Survey images

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*Time-lapse DeepLook-EM crosswell resistivity surveys at a 6-month interval show a large water sweep preferentially from east to west between Wells 1 and 3.*

from 6 months after the baseline indicate successful water flooding from the injector well to observer Wells 1 and 3, with a large volume of water swept through a preferential east-west flow direction. The flow preference was confirmed by RST\* reservoir saturation tool logs.

At the time of the 6-month survey, water had not migrated to the pair of observer Wells 2 and 3. Further DeepLook-EM surveys at 6-month intervals will verify the direction and coverage of water movement, enabling fine-tuning of injection management to avoid both water override and ineffective sweep for more complete recovery than usual.

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