



# N606: Waterflood Design, Management, and Optimization

Instructor(s): Brian Weatherill

3 Days

Competence Level:  
Foundation



Classroom Course

## Summary

This course, designed for practicing petroleum engineers, geologists, and other technical support staff, provides a basic understanding of the key technical aspects which are involved across the entire life cycle of a properly designed waterflood scheme. The sessions include an overview of data requirements, methods employed to obtain the data, and methods used to interpret the data for the design, management, and optimisation of an effective waterflood. Participants will be provided with the analytical tools that enable estimation of the primary recovery baseline production forecast and incremental waterflood recovery predictions. The sessions will also provide practical training to address waterflooding issues that are relevant in today's oil field operations. Modern methods of optimisation of existing more mature waterfloods will also be covered in detail – including the use of streamline models for waterflood surveillance and optimisation.

## Learning Outcomes

Participants will learn to:

1. Apply geological principles to assess waterflood feasibility.
2. Evaluate important water flood performance issues.
3. Construct and use a fractional flow curve for water flood design, forecasts, diagnostics, and enhancement.
4. Assess practical water flood surveillance methods and make maintenance (optimisation) decisions.
5. Judge whether your water flood is performing too slowly and propose methods of accelerating and enhancing waterflood performance.
6. Evaluate how horizontal well technologies represent a "Game Changer" for existing and future waterflood schemes.
7. Calculate vertical and horizontal well steady state water injection rates.
8. Evaluate knowledge gained from a number of classic waterfloods.
9. Judge the usefulness or applicability of detailed numerical models versus streamline models for waterflood performance predictions.

## Duration and Training Method

A three-day classroom with In-class examples and hands-on exercises. Participants are requested to bring a calculator to the course.

## Who Should Attend

Anyone who needs to become more fluent with the concepts involved in oil field waterflooding. For example anyone who is working with reservoir engineers in a multi-disciplinary team i.e. technologists, geologists, production engineers, business analysts, entry level reservoir engineers or reservoir engineers who have not previously been involved in waterflood studies or training. This course is also beneficial for anyone who has inherited a mature waterflood with the need for optimisation.

## Prerequisites and Linking Courses

Some experience in petroleum engineering is a benefit, but not a prerequisite.



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## Course Content

### Course Agenda

- Overview of Petroleum Geology and Waterflooding Implications
- Review Data Requirements for Reservoir Description
- Review Methods for Estimating Primary Recovery Forecasts
- Consideration of Various Analytical Waterflood Models
- Understanding Natural Water Drives
- Waterflood Design and Production Forecast Example
- Water Quality Issues – Review
- Regulatory Requirements for Waterflood Applications
- Waterflooding Tight Reservoirs
- Consideration of Modern Surveillance Methods for Mature Waterfloods
- Waterflood Management and Optimisation Methods
- Use of Steamline Models and Numerical Models for Waterflood Optimisation

### Day One

1. Review of Geological Aspects Important to Waterflooding
2. Implications of Pressure and Temperature
3. Understanding Reservoir Fluids
4. Reservoir Rock Properties
5. Reserve Estimating Methods
6. Drive Mechanisms
7. Primary Recovery Modelling and Production Forecasts

### Day Two

1. Waterflood Displacement Mechanisms
2. Fractional Flow Modelling
3. Segregated Flow
4. Effect of Finite Capillary Pressure Zone
5. Stratified Reservoirs
6. Areal Sweep Efficiency
7. Analytical Design Examples
8. Waterflood Candidate Screening
9. Pilot Waterflooding

### Day Three

1. Water Quality Considerations
2. Regulatory Requirements
3. Waterflood Surveillance of Mature Waterfloods
4. Modern Waterflood Improvement and Optimisation Methods
5. Pattern Design and Alteration Examples
6. Numerical Simulation Considerations



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7. Each day has a number of practical examples (exercises) to consider by the participants.