P-07-48

Oskarshamn site investigation

Hydraulic injection tests in borehole KLX08, 2006

Subarea Laxemar

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January 2007

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Keywords: Site/project, Hydrogeology, Hydraulic tests, Injection test, Hydraulic parameters, Transmissivity, Constant head.

Abstract

Hydraulic injection tests have been performed in borehole KLX08 at the Laxemar area, Oskarshamn. The tests are part of the general program for site investigations and specifically for the Laxemar subarea. The hydraulic testing programme has the aim to characterise the rock with respect to its hydraulic properties of the fractured zones and rock mass between them. Data is subsequently delivered for the site descriptive model.

This report describes the results and primary data evaluation of the hydraulic injection tests in borehole KLX08 performed between 28th of September and 11th of October 2006.

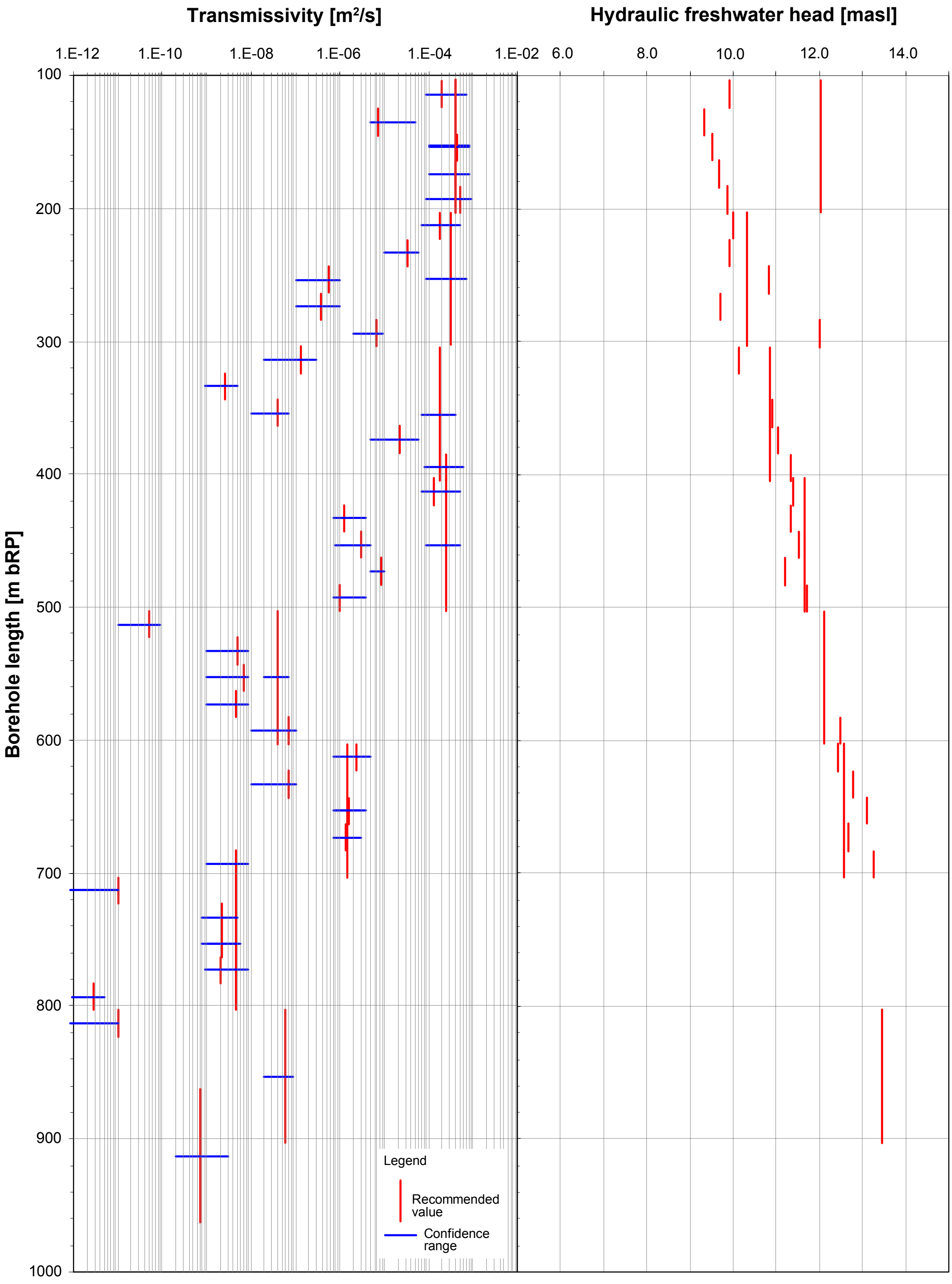
The objective of the hydrotests was to describe the rock around the borehole with respect of hydraulic parameters, mainly transmissivity (T) and hydraulic conductivity (K) at different measurement scales of 100 m and 20 m sections. Transient evaluation during flow and recovery period provided additional information such as flow regimes, hydraulic boundaries and cross-over flows. Constant pressure injection tests were conducted between 103.00–963.00 m below ToC. The results of the test interpretation are presented as transmissivity, hydraulic conductivity and hydraulic freshwater head.

Sammanfattning

Injektionstester har utförts i borrhål KLX08 i delområde Laxemar, Oskarshamn. Testerna är en del av SKB:s platsundersökningar. Hydraultestprogrammet där injektionstesterna ingår har som mål att karakterisera berget med avseende på dess hydrauliska egenskaper av sprickzoner och mellanliggande bergmassa. Data från testerna används vid den platsbeskrivande modelleringen av området.

Denna rapport redovisar resultaten och utvärderingar av primärdata de hydrauliska injektionstesterna i borrhål KLX08. Testerna utfördes mellan den 28 september till den 11 oktober 2006.

Syftet med hydraultesterna var framförallt att beskriva bergets hydrauliska egenskaper runt borrhålet med avseende på hydrauliska parametrar, i huvudsak transmissvitet (T) och hydraulisk konduktivitet (K) vid olika mätskalor av 100 m och 20 m sektioner. Transient utvärdering under injektions- och återhämntningsfasen gav ytterligare information avseende flödesgeometri, hydrauliska gränser och sprickläckage. Injektionstester utfördes mellan 103,00–963,00 m borrhålslängd. Resultaten av testutvärderingen presenteras som transmissivitet, hydraulisk konduktivitet och grundvattennivå uttryckt i ekvivalent sötvattenpelare (fresh-water head).



Borehole KLX08 – summary of results.

Contents

1 Introduction

A general program for site investigations presenting survey methods has been prepared /SKB 2001/, as well as a site-specific program for the investigations in the Simpevarp area /SKB 2006/. The hydraulic injection tests form part of the site characterization program under item 1.1.5.8 in the work breakdown structure of the execution programme, /SKB 2002/.

Measurements were carried out in borehole KLX08 during 28th of September and 11th of October 2006 following the methodology described in SKB MD 323.001 and in the activity plan AP PS 400-06-001 (SKB controlling documents). Data and results were delivered to the SKB site characterization database SICADA and are traceable by the activity plan number.

The hydraulic testing programme has the aim to characterise the rock with respect to its hydraulic properties of the fractured zones and rock mass between them. This report describes the results and primary data evaluation of the hydraulic injection tests in borehole KLX08. The commission was conducted by Golder Associates AB and Golder Associates GmbH.

Borehole KLX08 is situated in the Laxemar area approximately 2.5 km north-west of the nuclear power plant of Simpevarp, Figure 1-1. The borehole was drilled from January 2005 to June 2005 at 1,000.41 m length with an inner diameter of 76 mm and an inclination of –60.252°. The upper 12.20 m is cased with large diameter telescopic casing ranging from diameter (outer diameter) 208 mm–323 mm.

The work was carried out in accordance with activity plan AP PS 400-06-001. In Table 1-1 controlling documents for performing this activity are listed. Activity plan and method descriptions are SKB's internal controlling documents. Measurements were conducted utilising SKB's custom made testing equipment PSS2.

Table 1-1. Controlling documents for the performance of the activity.

Activity plan	**Number**	**Version**
Hydraulic pumping and injection tests in borehole KLX08	AP PS 400-06-001	1.0
Method descriptions	**Number**	**Version**
Hydraulic injection tests	SKB MD 323.001	1.0
Instruktion för rengöring av borrhålsutrustning och viss markbaserad utrustning	SKB MD 600.004	1.0
Instruktion för längdkalibrering vid undersökningar I kärnborrhål	SKB MD 620.010	1.0
Allmäna ordning-, skydds- och miljöregler för platsundersökningar Oskarshamn	SKB SDPO-003	1.0
Miljökontrollprogram Platsundersökningar	SKB SDP-301	1.0
Hantering av primärdata vid platsundersökningar	SKB SDP-508	1.0

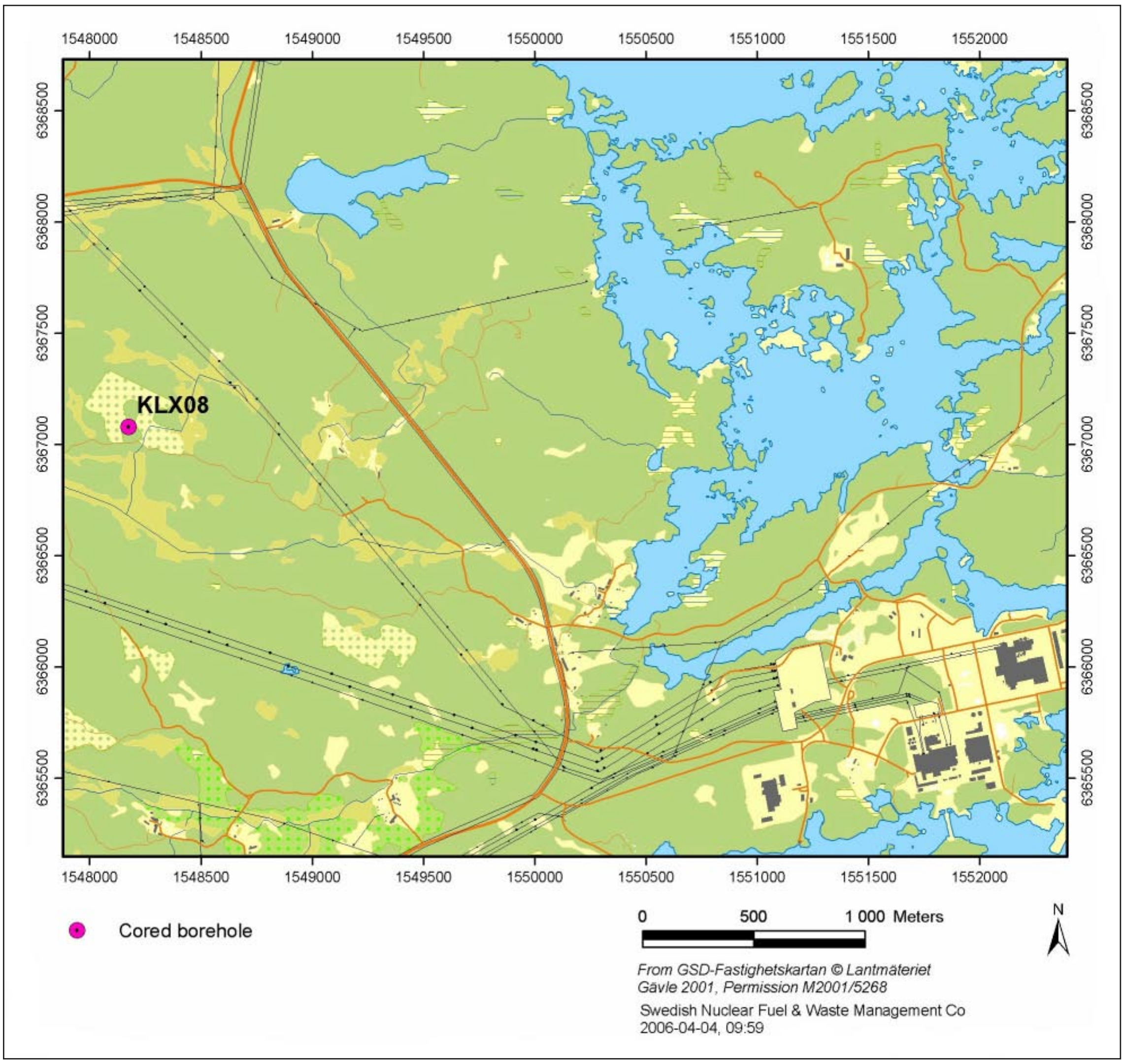


Figure 1-1. *The investigation area Laxemar, Oskarshamn with location of borehole KLX08.*

2 Objective and scope

The objective of the hydrotests in borehole KLX08 is to describe the rock around the borehole with respect to hydraulic parameters, mainly transmissivity (T) and hydraulic conductivity (K). This is done at different measurement scales of 100 m and 20 m sections. Among these parameters transient evaluation during the flow and recovery period provides additional information such as flow regimes, hydraulic boundaries and cross-over flows.

The scope of work consisted of preparation of the PSS2 tool which included cleaning of the down-hole tools, calibration and functional checks, injection tests of 100 m and 20 m test sections, analyses and reporting.

Preparation for testing was done according to the Quality plan. This step mainly consists of functions checks of the equipment to be used, the PSS2 tool. Calibration checks and function checks were documented in the daily log and/or relevant documents.

The following hydraulic injection tests were performed between 28th September and 11th October 2006.

Table 2-1. Performed injection tests at borehole KLX08.

No. of injection tests	Interval	Positions	Time/test	Total test time
9	100 m	103.00–963.00 m	125 min	18.75 hrs
36	20 m	104.00–823.00 m	90 min	54.0 hrs
Total:				72.75 hrs

* excluding repeated tests.

2.1 Borehole

The borehole is telescope drilled with specifications on its construction according to Table 2-2. The reference point of the borehole is the centre of top of casing (ToC), given as elevation in the table below. The Swedish National coordinate system (RT90) is used in the x-y direction and RHB70 in the z-direction. Northing and Easting refer to the top of the boreholes at the ground surface. The borehole diameter in Table 2-2 refers to the final diameter of the drill bit after drilling to full depth.

Table 2-2. Information about KLX08 (from SICADA 2006-07-10).

Title	Value				
Old idcode name(s):	KLX08				
Comment:	No comment exists				
Borehole length (m):	1,000.410				
Reference level:	TOC				
Drilling Period(s):	From Date	To Date	Secup (m)	Seclow (m)	Drilling Type
	2005-01-12	2005-01-24	0.000	100.330	Percussion drilling
	2005-04-04	2005-06-13	100.330	1,000.410	Core drilling
Starting point coordinate:	Length (m)	Northing (m)	Easting (m)	Elevation (m.a.s.l.)	Coord System
(centerpoint of TOC)	0.000	6367079.103	1548176.713	24.314	RT90-RHB70
Angles:	Length (m)	Bearing	Inclination (– = down)		
	0.000	199.172	–60.252		RT90-RHB70
Borehole diameter:	Secup (m)	Seclow (m)	Hole Diam (m)		
	0.300	12.200	0.343		
	12.200	100.200	0.197		
	100.200	100.330	0.165		
	100.330	101.010	0.086		
	101.010	1,000.410	0.076		
Core diameter:	Secup (m)	Seclow (m)	Core Diam (m)		
	100.330	101.010	0.072		
	101.010	1,000.410	0.050		
Casing diameter:	Secup (m)	Seclow (m)	Case In (m)	Case Out (m)	
	0.000	12.200	0.200	0.208	
	0.300	12.200	0.310	0.323	
Cone dimensions:	Secup (m)	Seclow (m)	Cone In (m)	Cone Out (m)	
	96.150	99.250	0.100	0.104	
	99.250	100.850	0.080	0.084	
Grove milling:	Length (m)	Trace detectable			
	111.000	YES			
	150.000	YES			
	200.000	YES			
	250.000	YES			
	300.000	YES			
	350.000	YES			
	400.000	YES			
	450.000	YES			
	500.000	YES			
	550.000	YES			
	600.000	YES			
	650.000	YES			
	700.000	YES			
	750.000	YES			
	800.000	YES			
	850.000	YES			
	900.000	YES			
	950.000	YES			
	980.000	YES			

2.2 Injection tests

Injection tests were conducted according to the Activity Plan AP PS 400-06-001 and the method description for hydraulic injection tests, SKB MD 323.001 (SKB internal documents). Tests were done in 100 m test sections between 103.00–963.00 m below ToC and in 20 m test sections between 104.00–823.00 m below ToC (see Table 2-3). The initial criteria for performing injection tests in 20 m sections was a measurable flow of Q > 0.001 L/min in the previous measured 100 m tests covering the smaller test sections (see Figure 2-1). The measurements were performed with SKB's custom made equipment for hydraulic testing called PSS2.

No other additional measurements except the actual hydraulic tests and related measurements of packer position and water level in annulus of borehole KLX08 were conducted.

2.3 Control of equipment

Control of equipment was mainly performed according to the Quality plan. The basis for equipment handling is described in the "Mätsystembeskrivning" SKB MD 345.101-123 which is composed of two parts 1) management description, 2) drawings and technical documents of the modified PSS2 tool.

Function checks were performed before and during the tests. Among these pressure sensors were checked at ground level and while running in the hole calculated to the static head. Temperature was checked at ground level and while running in. Leakage checks at joints in the pipe string were done at least every 100 m of running in.

Any malfunction was recorded, and measures were taken accordingly for proper operation. Approval was made according to SKB site manager, or Quality plan and the "Mätsystem-beskrivning".

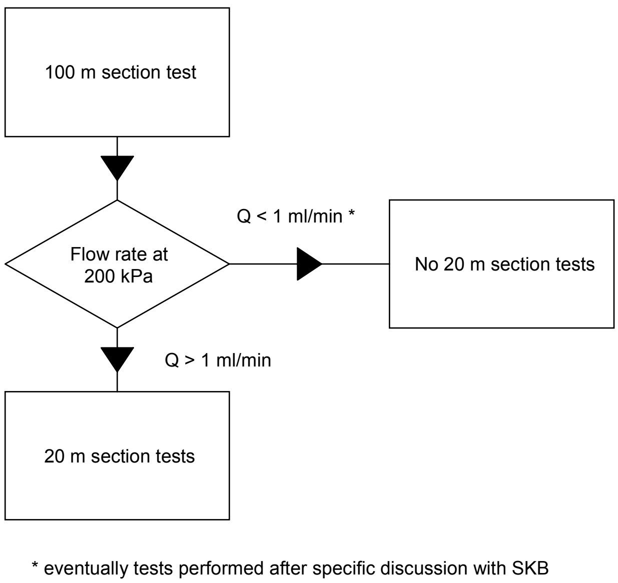


Figure 2-1. Flow chart for test sections.

Table 2-3. Tests performed.

Bh ID	Test section (m bToC)	Test type[1)]	Test no	Test start Date, Time	Test stop Date, Time
KLX08	103.00–203.00	3	1	060928 07:55	061006 12:05
KLX08	203.00–303.00	3	1	060928 11:37	061006 16:06
KLX08	305.00–405.00	3	1	060928 15:27	061006 20:40
KLX08	403.00–503.00	3	1	060928 19:13	061007 00:54
KLX08	403.00–503.00	3	2	061006 09:32	061007 09:02
KLX08	503.00–603.00	3	1	061006 14:05	061008 08:32
KLX08	603.00–703.00	3	1	061006 17:48	061008 10:41
KLX08	703.00–803.00	3	1	061006 22:17	061008 12:38
KLX08	803.00–903.00	3	1	061007 06:04	061008 14:42
KLX08	863.00–963.00	3	1	061008 07:04	061008 16:36
KLX08	104.00–124.00	3	1	061008 09:13	061008 18:30
KLX08	125.00–145.00	3	1	061008 11:12	061008 20:26
KLX08	144.00–164.00	3	1	061008 13:19	061008 22:36
KLX08	164.00–184.00	3	1	061008 15:14	061009 00:33
KLX08	183.50–203.50	3	1	061008 17:07	061009 02:31
KLX08	203.00–223.00	3	1	061008 19:00	061009 07:50
KLX08	223.50–243.50	3	1	061008 21:09	061009 10:04
KLX08	243.50–263.50	3	1	061008 23:10	061009 12:08
KLX08	264.00–284.00	3	1	061009 01:07	061009 14:27
KLX08	284.00–304.00	3	1	061009 06:17	061009 16:25
KLX08	304.00–324.00	3	1	061009 08:23	061006 12:05
KLX08	324.00–344.00	3	1	061009 10:41	061006 16:06
KLX 08	344.00–364.00	3	1	061009 12:57	061006 20:40
KLX08	364.00–384.00	3	1	061009 15:01	061007 00:54
KLX08	385.00–405.00	3	1	060928 07:55	061007 09:02
KLX08	403.00–423.00	3	1	061009 16:55	061009 18:19
KLX08	423.00–443.00	3	1	061009 18:50	000100 20:17
KLX08	443.00–463.00	3	1	061009 21:00	061009 22:23
KLX08	463.00–483.00	3	1	061009 23:36	061010 00:35
KLX08	463.00–483.00	3	2	061010 01:14	061010 02:38
KLX08	483.00–503.00	3	1	061010 06:13	061010 08:07
KLX08	503.00–523.00	4B	1	061010 08:37	061010 10:22
KLX08	523.00–543.00	3	1	061010 10:59	061010 12:41
KLX08	543.00–563.00	3	1	061010 13:25	061010 15:01
KLX08	563.00–583.00	3	1	061010 15:33	061010 16:58
KLX08	583.00–603.00	3	1	061010 17:32	061010 18:55
KLX08	603.00–623.00	3	1	061010 19:25	061010 20:50
KLX08	623.00–643.00	3	1	061010 21:30	061010 22:54
KLX08	643.00–663.00	3	1	061010 23:25	061011 00:49
KLX08	663.00–683.00	3	1	061011 01:25	061011 03:01
KLX08	683.00–703.00	3	1	061011 05:22	061011 06:11
KLX08	703.00–723.00	3	1	061011 06:43	061011 08:51
KLX08	723.00–743.00	3	1	061011 09:27	061011 11:47
KLX08	743.00–763.00	3	1	061011 12:33	061011 14:52
KLX08	763.00–783.00	3	1	061011 15:28	061011 17:14
KLX08	783.00–803.00	4B	1	061011 17:47	061011 18:34
KLX08	803.00–823.00	3	1	061009 16:55	061009 18:19

[1)] 3: Injection test; 4B: Pulse injection test.

3 Equipment

3.1 Description of equipment

The equipment called PSS2 (Pipe String System 2) is a highly integrated tool for testing boreholes at great depth (see conceptual drawing in the next figure). The system is built inside a container suitable for testing at any weather. Briefly, the components consists of a hydraulic rig, down-hole equipment including packers, pressure gauges, shut-in tool and level indicator, racks for pump, gauge carriers, breakpins, etc. shelfs and drawers for tools and spare parts.

There are three spools for a multi-signal cable, a test valve hose and a packer inflation hose. There is a water tank for injection purposes, pressure vessels for injection of packers, to open test valve and for low flow injection. The PSS2 has been upgraded with a computerized flow regulation system. The office part of the container consists of a computer, regulation valves for the nitrogen system, a 24 V back-up system in case of power shut-offs and a flow regulation board.

PSS2 is documented in photographs 1–6.

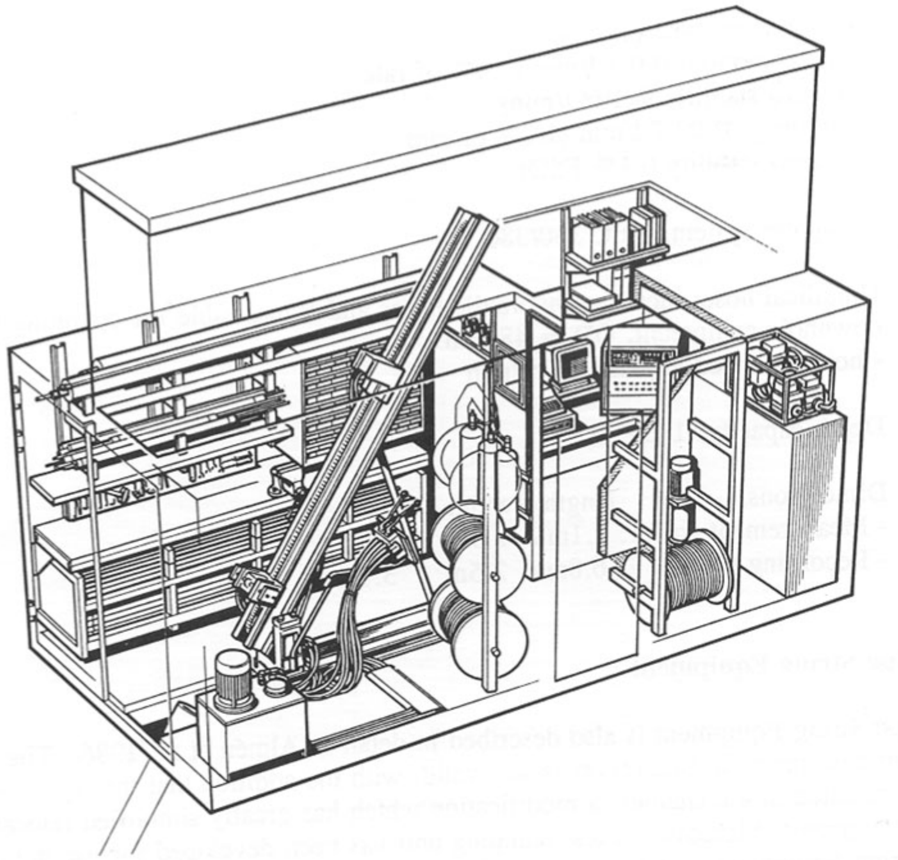


Figure 3-1. *A view of the layout and equipment of PSS2.*

Photo 1. *Hydraulic rig.*

Photo 2. *Rack for pump, down-hole equipment, workbench and drawers for tools.*

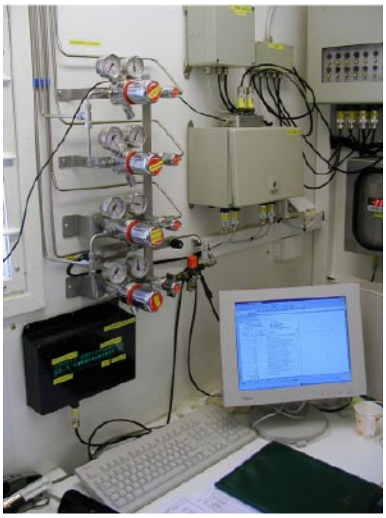


Photo 3. *Computer room, displays and gas regulators.*

Photo 4. *Pressure vessels for test valve, packers and injection.*

Photo 5. *Positioner, bottom end of down-in-hole string.*

Photo 6. *Packer and gauge carrier.*

The down-hole equipment consists from bottom to top of the following equipment:

- Level indicator – SS 630 mm pipe with OD 73 mm with 3 plastic wheels connected to a Hallswitch.
- Gauge carrier – SS 1.5 m carrying bottom section pressure transducer and connections from positioner.
- Lower packer – SS and PUR 1,5 m with OD 72 mm, stiff ends, tightening length 1.0 m, maximum pressure 6.5 MPa, working pressure 1.6 MPa
- Gauge carrier with breakpin – SS 1.75 m carrying test section pressure transducer, temperature sensor and connections for sensors below. Breakpin with maximum load of 47.3 (± 1.0) kN. The gauge carrier is covered by split pipes and connected to a stone catcher on the top.
- Pop joint – SS 1.0 or 0.5 m with OD 33 mm and ID 21 mm, double O-ring fittings, trapezoid thread, friction loss of 3 kPa/m at 50 L/min.
- Pipe string – SS 3.0 m with OD 33 mm and ID 21 mm, double O-ring fittings, trapezoid thread, friction loss of 3 kPa/m at 50 L/min.
- Contact carrier – SS 1.0 m carrying connections for sensors below and
- Upper packer – SS and PUR 1.5 m with OD 72 mm, fixed ends, seal length 1.0 m, maximum pressure 6.5 MPa, working pressure 1.6 MPa.
- Breakpin – SS 250 mm with OD 33.7 mm. Maximum load of 47.3 (± 1.0) kN.
- Gauge carrier – SS 1.5 m carrying top section pressure transducer, connections from sensors below. Flow pipe is double bent at both ends to give room for sensor equipment. The pipe gauge carrier is covered by split pipes.
- Shut-in tool (test valve) – SS 1.0 m with a OD of 48 mm, Teflon coated valve piston, friction loss of 11 kPa at 10 L/min (260 kPa–50 L/min). Working pressure 2.8–4.0 MPa. Breakpipe with maximum load of 47.3 (± 1.0) kN. The shut-in tool is covered by split pipes and connected to a stone catcher on the top.

The tool scheme is presented in Figure 3-2.

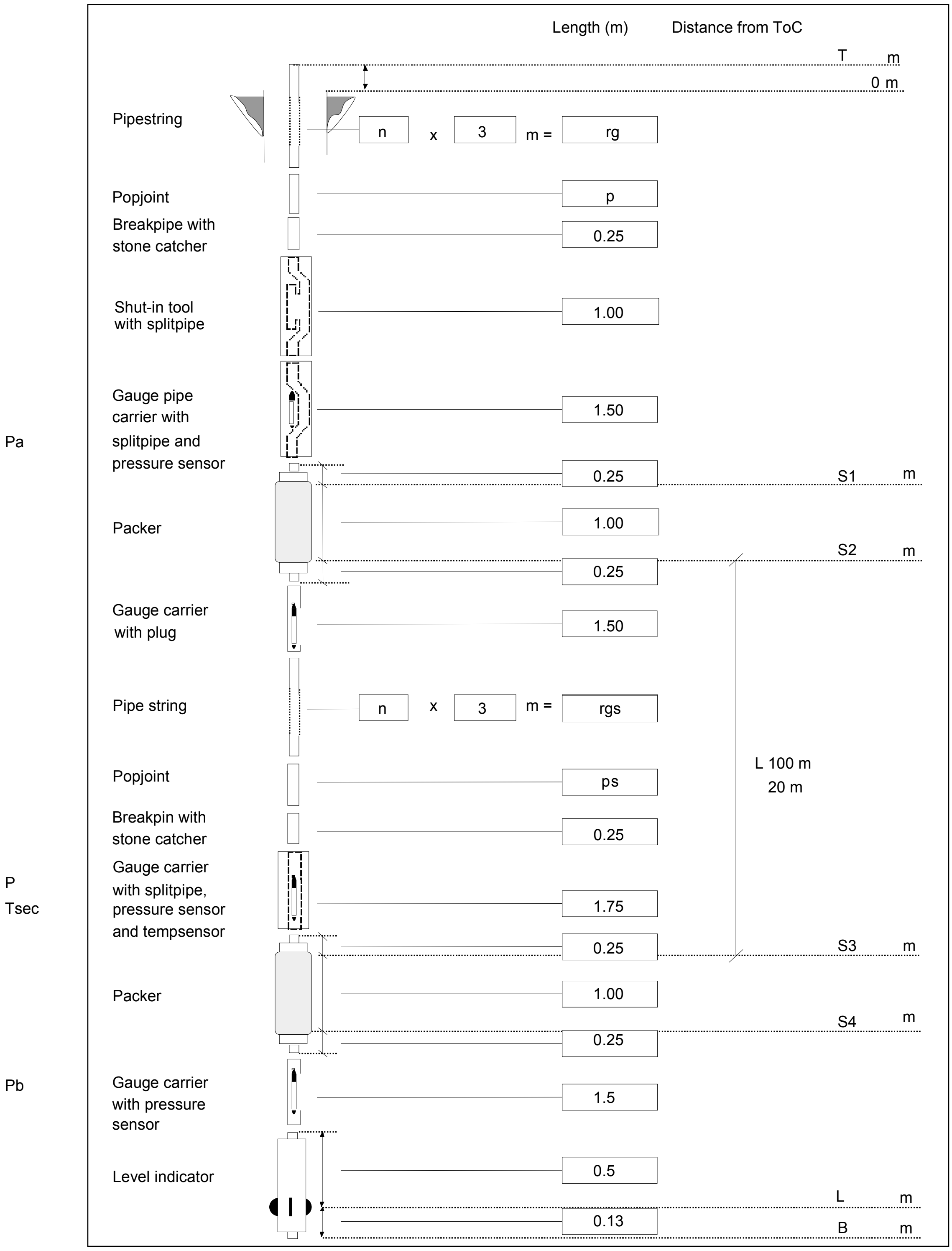


Figure 3-2. *Schematic drawing of the down-hole equipment in the PSS2 system.*

3.2 Sensors

Table 3-1. Technical specifications of sensors.

Keyword	Sensor	Name	Value/range	Unit	Comments
$P_{sec,a,b}$	Pressure	Druck PTX 162-1464abs	9–30 4–20 0–13,5 +0,1	VDC mA MPa % of FS	
$T_{sec,surf,air}$	Temperature	BGI	18–24 4–20 0–32 +0,1	VDC mA °C °C	
Q_{big}	Flow	Micro motion Elite sensor	0–100 +0,1	kg/min %	Massflow
Q_{small}	Flow	Micro motion Elite sensor	0–1,8 +0,1	kg/min %	Massflow
p_{air}	Pressure	Druck PTX 630	9–30 4–20 0–120 +0,1	VDC mA KPa % of FS	
p_{pack}	Pressure	Druck PTX 630	9–30 4–20 0–4 +0,1	VDC mA MPa % of FS	
$p_{in,out}$	Pressure	Druck PTX 1400	9–28 4–20 0–2,5 +0,15	VDC mA MPa % of FS	
L	Level Indicator				Length correction

Table 3-2. Sensor positions and wellbore storage (WBS) controlling factors.

Borehole information		Sensors		Equipment affecting WBS coefficient			
ID	Test section (m)	Type	Position (m fr ToC)	Position	Function	Outer diameter (mm)	Volume in test section (m³)
KLX08	104.00–204.00	p_a p T p_b L	102.11 203.37 203.20 206.01 206.25	Test section	Signal cable Pump string Packer line	9.1 33 6	0.454
KLX08	104.00–124.00	p_a p T p_b L	102.11 123.37 123.20 126.01 126.25	Test section	Signal cable Pump string Packer line	9.1 33 6	0.091

3.3 Data acquisition system

The data acquisition system in the PSS2 container contains a stationary PC with the software Orchestrator, pump- and injection test parameters such as pressure, temperature and flow are monitored and sensor data collected. A second laptop PC is connected to the stationary PC through a network containing evaluation software, Flowdim. While testing, data from previously tested section is converted with IPPlot and entered in Flowdim for evaluation.

The data acquisition system starts and stops the test automatically or can be disengaged for manual operation of magnetic and regulation valves within the injection/pumping system. The flow regulation board is used for differential pressure and valve settings prior testing and for monitoring valves during actual test. An outline of the data acquisition system is outlined in Figure 3-3.

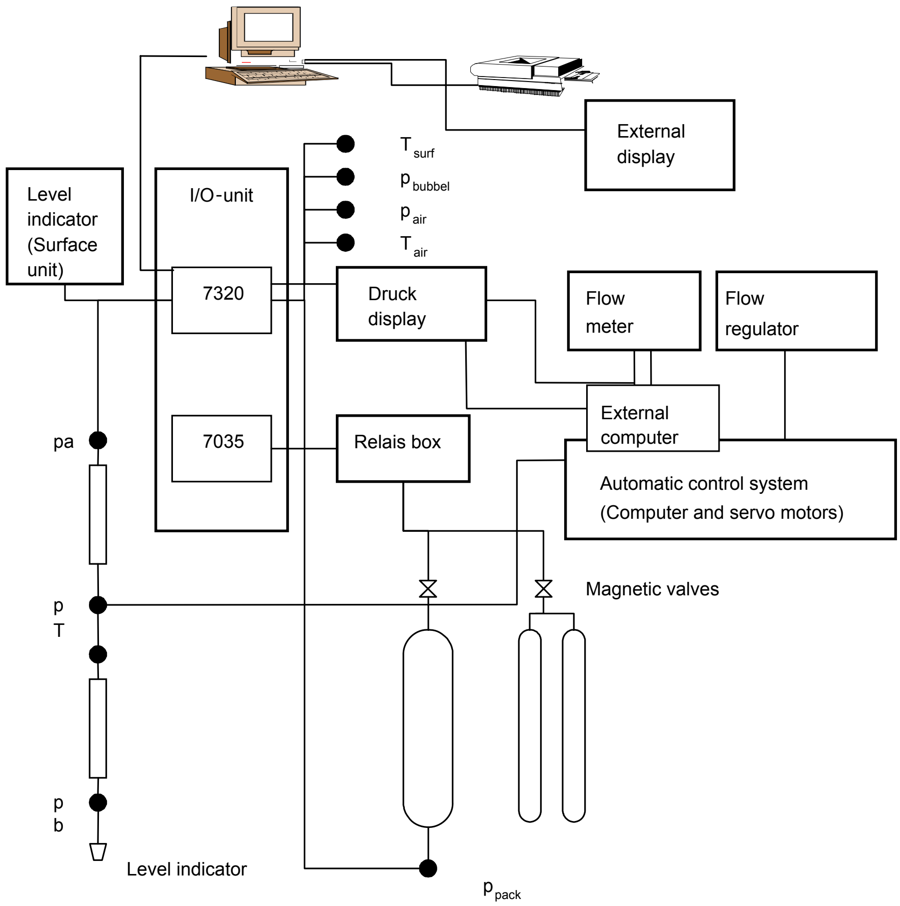


Figure 3-3. *Schematic drawing of the data acquisition system and the flow regulation control system in PSS2.*

4 Execution

4.1 Preparations

Following preparation work and functional checks were conducted prior to starting test activities:

- Place pallets and container, lifting rig up, installing fence on top of container, lifting tent on container.
- Clean and disinfect of Multikabel and hoses for packer and test valve. Clean the tubings with hot steam.
- Filling injection tank with water out of the borehole HLX14.
- Filling buffer tank with water and tracer it with Uranin; take water sample.
- Filling vessels.
- Filling the hoses for test valve and packer.
- Entering calibration constants to system and regulation unit.
- Synchronize clocks on all computers.
- Function check of shut-in tool both ends, overpressure by 900 kPa for 5 min (OK).
- Check pressure gauges against atmospheric pressure and than on test depth against column of water.
- Translate all protocols into English (where necessary).
- Filling packers with water and de-air.
- Measure and assemble test tool.

4.2 Length correction

By running in with the test tool, a level indicator is incorporated at the bottom of the tool. The level indicator is able to record groves milled into the borehole wall. The depths of these groves are given by SKB in the activity plan (see Table 2-2) and the measured depth is counter checked against the number/length of the tubes build in. The achieved correction value, based on linear interpolation between the reference marks, is used to adjust the location of the packers for the test sections to avoid wrong placements and minimize elongation effects of the test string.

4.3 Execution of field work

4.3.1 Test principle

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a shut-in pressure recovery (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

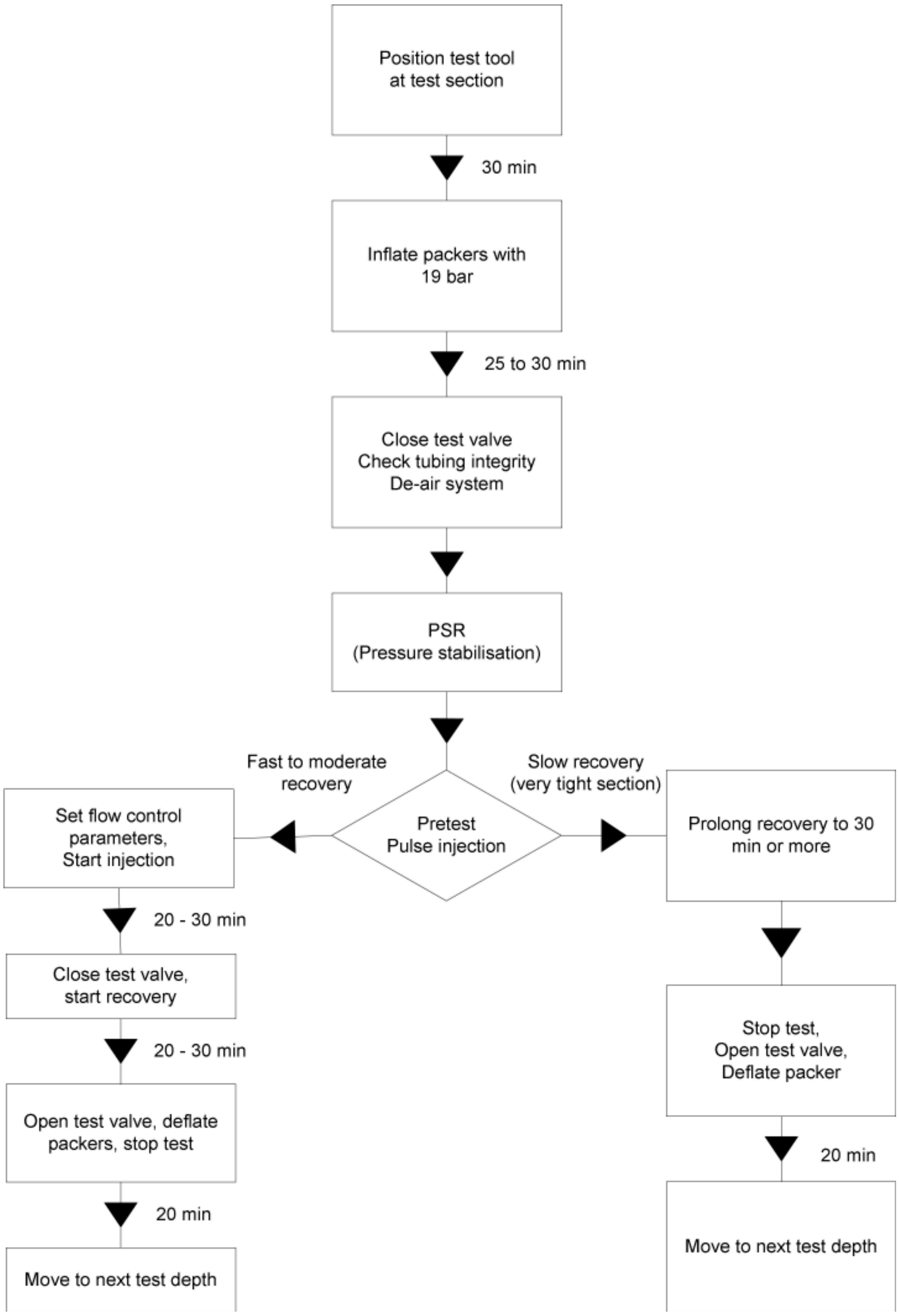


Figure 4-1. *Flow chart for test performance.*

4.3.2 Test procedure

A typical test cycle includes the following phases: 1) Transfer of down-hole equipment to the next section. 2) Packer inflation. 3) Pressure stabilisation. 4) Preliminary Pulse injection. 5) Constant head injection. 6) Pressure recovery. 7) Packer deflation.

The preliminary pulse injection (Step 4) derives the first estimations of the formation transmissivity. It is conducted by applying a pressure difference of approx. 200 kPa to the static formation pressure. If the pulse recovery indicates a very low transmissivity (flow probably below 1 mL/min) the pulse recovery is prolonged and no constant head injection test is performed. The decision to continue the pulse or to conduct an injection tests is based on the pressure response of the pulse recovery. A pressure recovery less than 50 % during the first ten minutes of the pulse indicates a low transmissivity. In such a case no injection test will be conducted.

The pressure static recovery (PSR) after packer inflation and before the pulse gives a direct measure of the magnitude of the packer compliance. A steep PSR indicates extremely low test section transmissivity. In such a case the packer compliance would influence the subsequent pulse test too much and introduce very large uncertainties. Therfore tests with this behaviour would be stopped after PSR phase.

If the preliminary pulse injection test indicates a formation transmissivity with a flow above 1 mL/min a constant head injection test (Step 5 and 6) is carried out. It is applied with a constant injection pressure of approx. 200 kPa (20 m water column) above the static formation pressure in the test section. Before start of the injection tests, approximately stable pressure conditions prevailed in the test section. After the injection period, the pressure recovery in the section is measured. In cases, where small flow rates were expected, the automatic regulation unit was switched off and the test was performed manually (determined by the preliminary pulse injection). In those cases, the constant difference pressure was usually unequal to 200 kPa.

In cases when the derived transmissivity of a test section influences the subsequent test program the constant head injection was conducted even if the preliminary pulse indicates a very tight section (e.g. flow below 1 mL/min). The injection phase is then performed to verify the results of the pulse.

The duration for each phase is presented in Table 4-1.

Table 4-1. Durations for packer inflation, pressure stabilisation, injection and recovery phase and packer deflation.

Step	Phase	Time
1	• Position test tool to new test section (correct position using the borehole markers)	Approx. 30 min.
2	• Inflate packers with appr. 1,900 kPa	25 min.
3	• Close test valve	10 min.
	• Check tubing integrity with appr. 800 kPa	5 min.
	• De-air system	2 min.
4	• Pretest, pulse injection (duration depends on the formation transmissivity)	–
5*	• Set automatic flow control parameters or setting for manual test	5 min.
	• Start injection	20 to 45 min.
6*	• Close test valve, start recovery	20 min. or more
	• Open test valve	10 min.
7	• Deflate packers	25 min.
	• Move to next test depth	–

* Step 5 and 6 conducted if the preliminary pulse indicates a formation transmissivity with a sufficient flow.

4.4 Data handling/post processing

The data handling followed several stages. The data acquisition software (Orchestrator) produced an ASCII raw data file (*.ht2) which contains the data in voltage and milliampere format plus calibration coefficients. The *.ht2 files were processed to *.dat files using the SKB program called IPPlot. These files contain the time, pressure, flow rate and temperature data. The *.dat files were synthesised in Excel to a *.xls file for plotting purposes. Finally, the test data to be delivered to SKB were exported from Excel in *.csv format. These files were also used for the subsequent analysis (field and final) of the injection phase (CHi). The synthesised data of the recovery phase (CHir) was used for the field analysis and to receive preliminary results for concistency reviews.

4.5 Analyses and interpretations

4.5.1 Analysis software

The tests were analysed using a type curve matching method. The analysis was performed using Golder's test analysis program FlowDim. FlowDim is an interactive analysis environment allowing the user to interpret constant pressure, constant rate and slug/pulse tests in source as well as observation boreholes. The program allows the calculation of type-curves for homogeneous, dual porosity and composite flow models in variable flow geometries from linear to spherical.

4.5.2 Analysis approach

Constant pressure tests are analysed using a rate inverse approach. The method initially known as the Jacob-Lohman method /Jacob and Lohman 1952/ was further improved for the use of type curve derivatives and for different flow models.

Constant pressure recovery tests are analysed using the method described by /Gringarten 1986/ and /Bourdet et al. 1989/ by using type curve derivatives calculated for different flow models.

Pulse tests are analysed by using the pressure deconvolution method described by /Peres et al. 1989/ with improvements introduced by /Chakrabarty and Enachescu 1997/.

4.5.3 Analysis methodology

Each of the relevant test phases is subsequently analyzed using the following steps:

- **Injection Tests**
- Identification of the flow model by evaluation of the derivative on the log-log diagnostic plot. Initial estimates of the model parameters are obtained by conventional straight-line analysis.
- Superposition type curve matching in log-log coordinates. A non-linear regression algorithm is used to provide optimized model parameters in the latter stages.
- Non-linear regression in semi-log coordinates (superposition HORNER plot; /Horner 1951/). In this stage of the analysis, the static formation pressure is selected for regression.

The test analysis methodology is best explained in /Horne 1990/.

- **Pre-test for the Injection Tests**

The test cycle always starts with a pulse injection phase with the aim of deriving a first estimation of the formation transmissivity. In cases when the pulse recovery is low (indicating low transmissivity) the pulse phase is extended and analysed as the main phase of the test.

The transmissivity derived from a pulse test is strongly influenced by the wellbore storage coefficient used as an input in the analysis. The wellbore storage coefficient is calculated as C = dV/dP where dV is the volume difference injected during the brief flow period of the pulse and dP is the initial pressure difference of the pulse. dV is directly measured either by using the flowmeter readings or water level measurements in the injection vessel.

It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity. Figure 4-2 below show an example of a typical pressure versus time evolution for such a tight section.

- Flow model identification and type curve analysis in the deconvolution Peres Plot /Peres et al. 1989, Chakrabarty and Enachescu 1997/. A non-linear regression algorithm is used to provide optimized model parameters in the later stages. An example of type curves is presented in Figure 4-3.

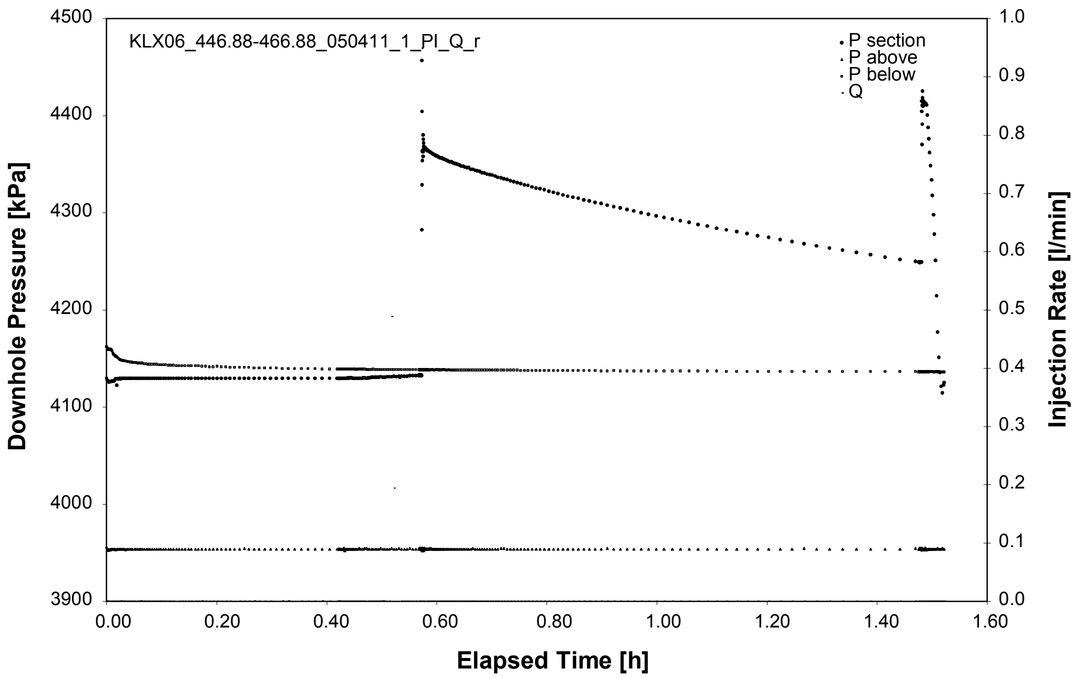


Figure 4-2. *Typical pressure versus time plot of a Pulse injection test.*

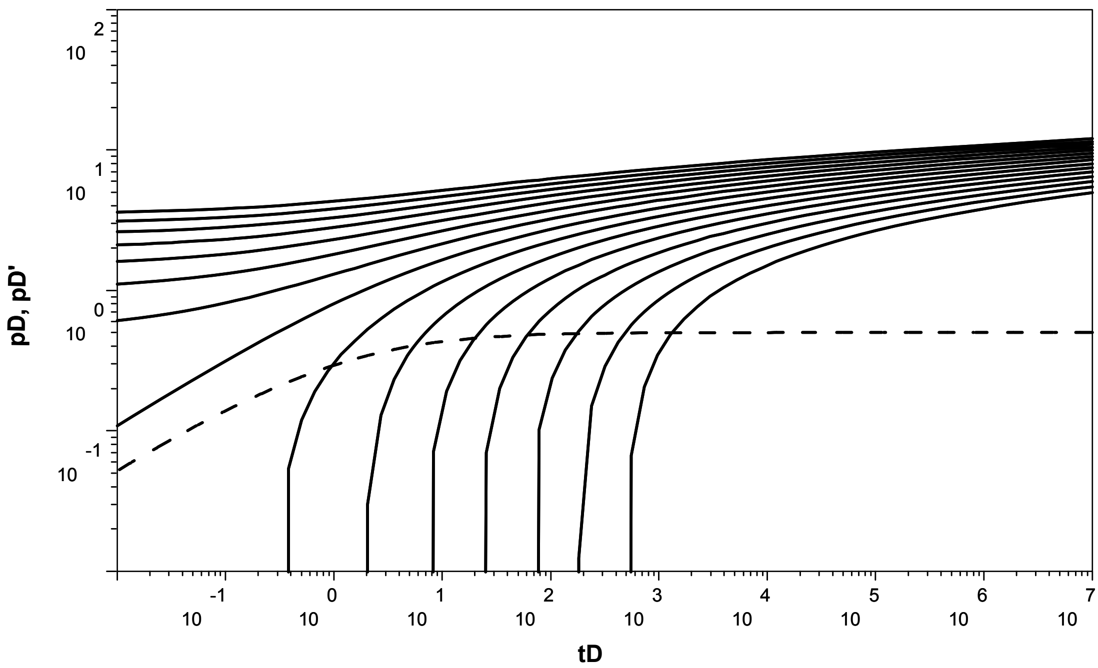


Figure 4-3. *Deconvolution type curve set for pulse test analysis.*

4.5.4 Correlation between Storativity and Skin factor

For the analysis of the conducted hydraulic tests below 100 m depth a storativity of $1 \cdot 10^{-6}$ is assumed (SKB MD 320.004e). Based on this assumption the skin will be calculated. In the following the correlation between storativity and skin for the relevant test phases will be explained in greater detail.

- **Injection phase (CHi) / Pulse tests (Pi)**

Due to the fact that the early time data of the CHi and Pi phases, respectively, is not available or too noisy (attributed to the automatic regulation system) the storativity and the skin factor become correlated. Consequently they cannot be solved independently any more. In this case as a result of the analysis one determines the correlation group e^{2s} / S. This means that in such cases the skin factor can only be calculated when assuming the storativity as known.

- **Recovery phase (CHir)**

The wellbore storage coefficient (C) is determined by matching the early time data with the corresponding type curve. The derived C-value is introduced in the equation of the type curve parameter:

$$(C_D e^{2s})_M = \frac{C \rho g}{2\pi r_w^2 S} e^{2s}$$

The equation above has two unknowns, the storativity (S) and the skin factor (s) which expresses the fact that for the case of constant rate and pressure recovery tests the storativity and the skin factor are 100% correlated. Therefore, the equation can only be either solved for skin by assuming that the storativity is known or solved for storativity by assuming the skin as known.

4.5.5 Determination of the ri-index and calculation of the radius of influence (ri)

The analysis provides also the radius of influence and the ri-index, which describes the late time behaviour of the derivative.

Ri-index

The determination of the ri-index is based on the shape of the derivative plotted in log-log coordinates and describes the behaviour of the derivative after the time t_2, representing the end of the near wellbore response. The ri-index also describes the flow regime at the end of the test. Following ri-indices can be assigned:

- ri-index = 0: The middle and late time derivative shows a horizontal stabilization. This pressure response indicates that the size of the hydraulic feature is greater than the radius of influence. The calculated radius of influence is based on the entire test time t_P.
- ri-index = 1: The derivative shows an upward trend at late times, indicating a decrease of transmissivity or a barrier boundary at some distance from the borehole. The size of the hydraulic feature near the borehole is estimated as the radius of influence based on t_2.
- ri-index = –1: The derivative shows a downward trend at late times, indicating an increase of transmissivity or a constant head boundary at some distance from the borehole. The size of the hydraulic feature near the borehole is estimated as the radius of influence based on t_2.

Figure 4-4 presents the relationship between the shape of derivative and the ri-index.

If no radial flow stabilization can be observed the ri-index is based on the flow regime at the end of the test: i.e. ri-index = 1 for tests with a derivative showing an upward trend at the end and a ri-index = –1 for tests with a derivative showing a downward trend. In such cases the calculated radius of influence is based on the entire test time t_P.

The assignment of the ri-index is based on /Rhen et al. 2006/.

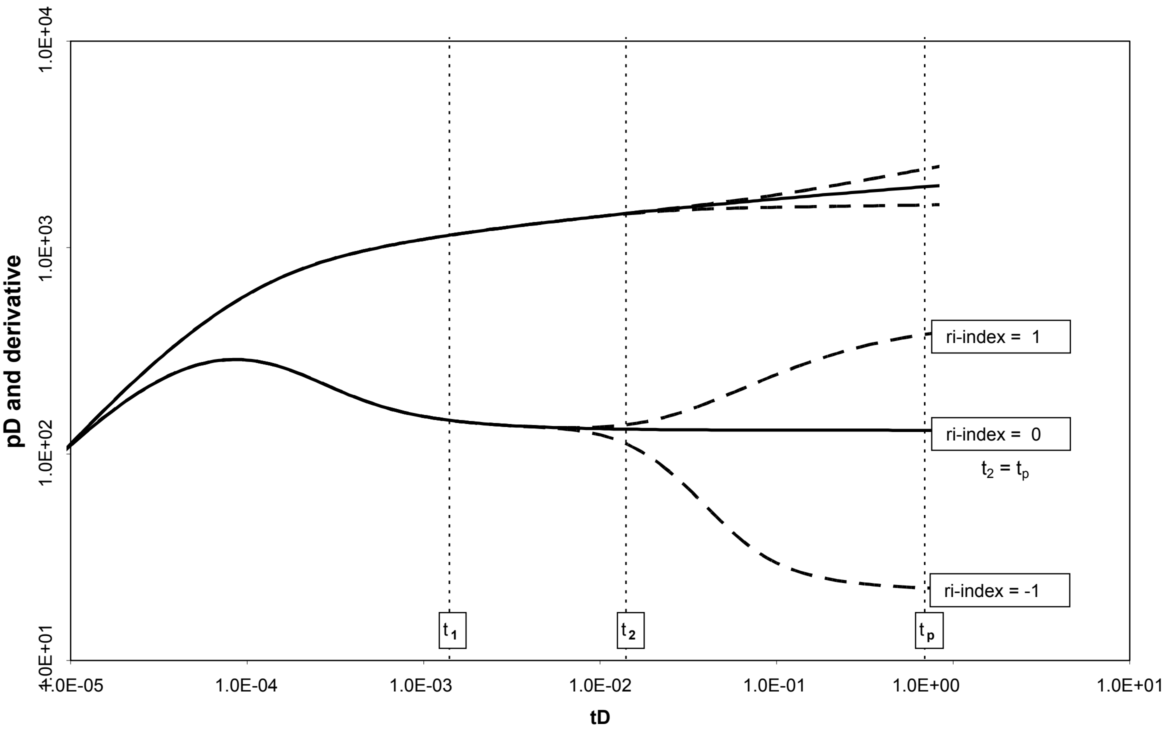


Figure 4-4. Schematic plot of the assignments for the ri-indices.

Calculation of the radius of influence

The radius of influence (ri) is calculated as follows:

$$ri = 1.89 * \sqrt{\frac{T_T}{S_T} * t_2} \quad \text{(m)}$$

T_T recommended inner zone transmissivity (m²/s)

t_2 time when hydraulic formation properties changes (see previous chapter) (s)

S_T for the calculation of the ri the storage coefficient (S) is estimated from the transmissivity /SKB 2006/:

$S_T = 0.0007 * T_T^{0.5}$ (–)

4.5.6 Steady state analysis

In addition to the type curve analysis, an interpretation based on the assumption of stationary conditions was performed as described by /Moye 1967/.

4.5.7 Flow models used for analysis

The flow models used in analysis were derived from the shape of the pressure derivative calculated with respect to log time and plotted in log-log coordinates.

In several cases the pressure derivative suggests a change of transmissivity with the distance from the borehole. In such cases a composite flow model was used in the analysis.

If there were different flow models matching the data in comparable quality, the simplest model was preferred.

The flow dimension displayed by the test can be diagnosed from the slope of the pressure derivative. A slope of 0.5 indicates linear flow, a slope of 0 (horizontal derivative) indicates radial flow and a slope of –0.5 indicates spherical flow. The flow dimension diagnosis was commented for each of the tests. At tests where a flow regime could not clearly identified from the test data, we assume in general a radial flow regime as the most simple flow model available. The value of p* was then calculated according to this assumption.

In cases when the infinite acting radial flow (IARF) phase was not supported by the data the derivative was extrapolated using the most conservative assumption, which is that the derivative would stabilise short time after test end. In such cases the additional uncertainty was accounted for in the estimation of the transmissivity confidence ranges.

4.5.8 Calculation of the static formation pressure and equivalent freshwater head

The static formation pressure (p*) measured at transducer depth, was derived from the pressure recovery (CHir) following the constant pressure injection phase by using:

(1) straight line extrapolation in cases infinite acting radial flow (IARF) occurred,

(2) type curve extrapolation in cases infinite acting radial flow (IARF) is unclear or was not reached.

The equivalent freshwater head (expressed in meters above sea level) was calculated from the extrapolated static formation pressure (p*), corrected for athmospheric pressure measured by the surface gauge and corrected for the vertical depth considering the inclination of the drill hole, by assuming a water density of 1,000 kg/m³ (freshwater). The equivalent freshwater head is the static water level an individual test interval would show if isolated and connected to the surface by tubing full of freshwater. Figure 4-5 shows the methodology schematically.

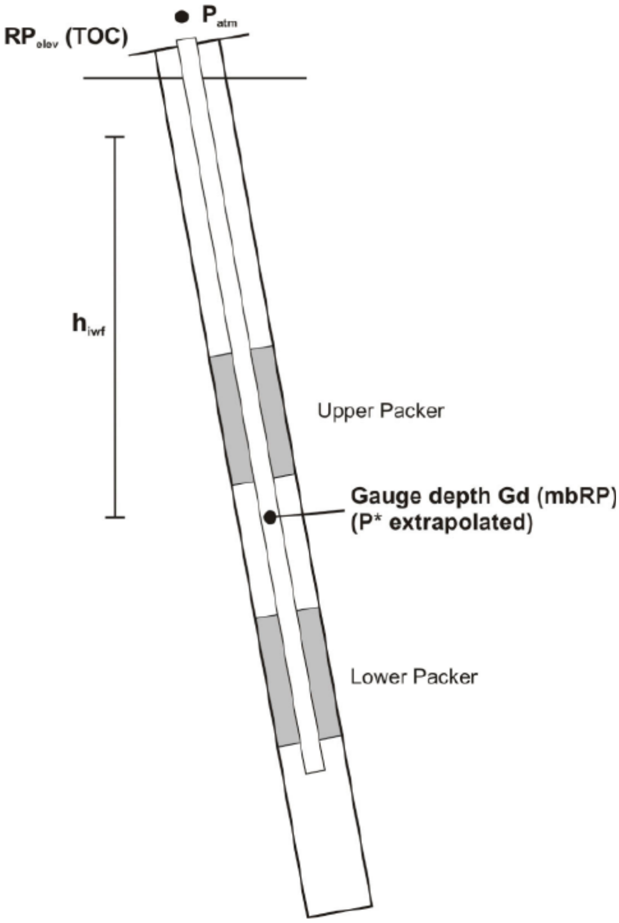


Figure 4-5. *Schematic methodologies for calculation of the freshwater head.*

The freshwater head in meters above sea level is calculated as following:

$$head = \frac{(p^* - p_{atm})}{\rho \cdot g}$$

which is the p* value expressed in a water column of freshwater.

With consideration of the elevation of the reference point (RP) and the gauge depth (Gd), the freshwater head h_{iwf} is:

$$h_{iwf} = RP_{elev} - Gd + \frac{(p^* - p_{atm})}{\rho \cdot g}$$

4.5.9 Derivation of the recommended transmissivity and the confidence range

In most of the cases more than one analysis was conducted on a specific test. Typically both test phases were analysed (CHi and CHir) and in some cases the CHi or the CHir phase was analysed using two different flow models. The parameter sets (i.e. transmissivities) derived from the individual analyses of a specific test usually differ. In the case when the differences are small (which is typically the case) the recommended transmissivity value is chosen from the test phase that shows the best data and derivative quality.

In cases when the difference in results of the individual analyses was large (more than half order of magnitude) the test phases were compared and the phase showing the best derivative quality was selected.

The confidence range of the transmissivity was derived using expert judgement. Factors considered were the range of transmissivities derived from the individual analyses of the test as well as additional sources of uncertainty such as noise in the flow rate measurement, numeric effects in the calculation of the derivative or possible errors in the measurement of the wellbore storage coefficient. No statistical calculations were performed to derive the confidence range of transmissivity.

In cases when changing transmissivity with distance from the borehole (composite model) was diagnosted, the transmissivity of the zone, which was showing the better derivative quality, was recommended.

In cases when the infinite acting radial flow (IARF) phase was not supported by the data the additional uncertainty was accounted for in the estimation of the transmissivity confidence ranges.

4.6 Nonconformities

Difference flow logging was carried out in KLX08 from July to October 2005, including measurements of electric conductivity and temperature. After getting stuck in the borehole, parts of the flow logging device still remain in the borehole. Therefore the borehole was accessible only until a final depth of 970 m below TOC.

At a test depth of 823 m a malfunction at the shut in tool was observed. It was decided to abort the injection tests because no unknown major inflows and anomalies were expected in the remaining depth of 823.00 m–963.00 m. This decision was made by SKB.

5 Results

In the following, results of all tests are presented and analysed. Section 5.1 presents the 100 m tests, 5.2 the 20 m tests. The results are given as general comments to test performance, the identified flow regimes and calculated parameters and finally the parameters which are considered as most representative are chosen and justification is given. All results are also summarised in Table 6-1 and 6-2 of the Summary chapter. In addition, the results are presented in Appendices 3 and 5.

The results are stored in the primary data base (SICADA). The SICADA data base contains data that will be used for further interpretation (modelling). The data are traceable in SICADA by the Activity plan number (AP PS 400-06-001; SKB controlling document).

5.1 100 m single-hole injection tests

In the following, the 100 m section tests conducted in borehole KLX08 are presented and analysed.

5.1.1 Section 103.00–203.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the fast recovery of the pulse test indicated a very high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 11 kPa. Due to the high formation transmissivity and the slight pressure difference the pressure control of the automatic regulation system worked very poor. However, the CHi phase is amenable for qualitative analysis. No hydraulic connection to the adjacent zones was observed. The injection rate decreased from 55 L/min at start of the CHi phase to 54 L/min at the end, indicating a very high interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a flat derivative at late times, indicating radial flow. A two shell composite flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows stabilization at middle times and a homogeneous radial flow model with wellbore storage and skin was chosen for the analysis. The analysis is presented in Appendix 2-1.

Selected representative parameters

The recommended transmissivity of $4.2 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHir phase, which shows the better derivative quality. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-4}$ m^2/s to $8.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,696.5 kPa.

The analyses of the CHi and CHir phases show some inconsistency as far as the flow models concerned. This can be attributed to the poor pressure control during the CHi phase. No further analysis is recommended.

5.1.2 Section 203.00–303.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the fast recovery of the pulse test indicated a very high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 42 kPa. No hydraulic connection to the adjacent zones was observed. The injection rate decreased from 45 L/min at start of the CHi phase to 41 L/min at the end, indicating a very high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows an upward trend at early and late times, indicating a change of transmissivity at some distance from the borehole. A two shell composite flow model with decreasing transmissivity was used for the analysis of the CHi phase. The derivative of the CHir phase shows slight stabilization at middle times followed by an upward trend at late times. A two shell composite radial flow model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-2.

Selected representative parameters

The recommended transmissivity of $3.2·10^{-4}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $9.0·10^{-5}$ m^2/s to $7.0·10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,528.2 kPa.

The analyses of the CHi and CHir phases show good consistency. No further analysis is recommended.

5.1.3 Section 305.00–405.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the fast recovery of the pulse test indicated a very high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 46 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system worked well. However, the recorded data is noisy. The injection rate decreased from 31 L/min at start of the CHi phase to 28 L/min at the end, indicating a very high interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a noisy but relative flat derivative. A homogeneous flow model was chosen for the analysis of the CHi phase. The early time derivative of the CHir phase is not very conclusive. However, the derivative shows a horizontal stabilization at middle times and was matched using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-3.

Selected representative parameters

The recommended transmissivity of $1.7 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHir phase, which shows the better derivative stabilization. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-5}$ m^2/s to $4.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,394.0 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.1.4 Section 403.00–503.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the fast recovery of the pulse test indicated a very high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 25 kPa. No hydraulic connection to the adjacent zones was observed. The injection rate decreased from 40 L/min at start of the CHi phase to 34 L/min at the end, indicating a very high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows an upward trend at middle and late times, indicating a decrease of transmissivity at some distance from the borehole. A two shell composite flow model was chosen for the analysis of the CHi phase. The early time derivative of the CHir phase is not very conclusive. However, the derivative shows a horizontal stabilization at middle times and was matched using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-4.

Selected representative parameters

The recommended transmissivity of $2.5 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $9.0 \cdot 10^{-5}$ m^2/s to $5.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,226.5 kPa.

The analyses of the CHi and CHir phases show inconsistency regarding the chosen flow models. The negative skin derived from the CHir phase is consistent with the behaviour of the CHi derivative (decreasing transmissivity at some distance from the borehole). However, regarding the derived transmissivities the analyses show consistency. No further analysis is recommended.

5.1.5 Section 503.00–603.00 m, test no. 1 and 2, injection

Comments to test

The first test was aborted due to a technical problem with the flowmeter. After replacing the flowmeter and new calibration a second test was conducted in this section.

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system worked well. However, the recorded early time data is noisy. The injection rate decreased from 50 mL/min at start of the CHi phase to 40 mL/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase and the late time data of the CHi phase show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a relative flat derivative at middle and late times, indicating radial flow. The CHi phase was analysed using an infinite acting homogeneous radial flow model. The derivative of the CHir phase shows a downward trend at middle and late times. A two shell composite model with increasing transmissivity was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-5.

Selected representative parameters

The recommended transmissivity of $4.1 \cdot 10^{-8}$ m^2/s was derived from the analysis of the CHi phase, which shows a horizontal stabilization. The confidence range for the interval transmissivity is estimated to be $2.0 \cdot 10^{-8}$ m^2/s to $7.0 \cdot 10^{-8}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,070.9 kPa.

The analyses of the CHi and CHir phases show inconsistency regarding the chosen flow models. However, regarding the derived transmissivities the analyses show consistency. No further analysis is recommended.

5.1.6 Section 603.00–703.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system worked well. However, the recorded early time data is noisy. The injection rate decreased from 8 L/min at start of the CHi phase to 4 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). The CHir phase and the middle to late time data of the CHi phase show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a horizontal stabilization at middle times followed by a downward trend at late times. This behaviour indicates an increase of transmissivity at some distance from the borehole. The CHi phase was analysed using a two shell composite radial flow model. The response of the CHir derivative is consistent to the CHi phase. A two shell composite model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-6.

Selected representative parameters

The recommended transmissivity of $1.5 \cdot 10^{-6}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $8.0 \cdot 10^{-7}$ m^2/s to $4.0 \cdot 10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,914.3 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.1.7 Section 703.00–803.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 195 kPa. No hydraulic connection to the adjacent zones was observed. The injection rate decreased from 65 mL/min at start of the CHi phase to 14 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows an upward trend at middle times followed by a horizontal stabilization at late times, indicating a change of transmissivity at some distance from the section and radial flow. A two shell composite flow model with decreasing transmissivity was chosen for the analysis of the CHi phase. The derivative of the CHir phase shows an upward trend at middle and late times. The CHir phase was matched using a two shell composite flow model with wellbore storage and skin. The analysis is presented in Appendix 2-7.

Selected representative parameters

The recommended transmissivity of $4.5 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHi phase (outer zone), which shows a clear horizontal stabilization. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-9}$ m^2/s to $6.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

The analyses of the CHi and CHir phases show some inconsistency as far as the inner zone transmissivities concerned. However, regarding the flow models and outer zone transmissivities the analyses show consistency. No further analysis is recommended.

5.1.8 Section 803.00–903.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 197 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system functioned well, with the exception of some oscillations at the start of the CHi phase. The injection rate decreased from 110 mL/min at start of the CHi phase to 90 mL/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a horizontal stabilization, which is indicative for radial flow. A homogeneous radial flow model was chosen for the analysis of the CHi phase. The CHir derivative shows an upward trend at middle and late times, indicating a transition from wellbore storage and skin dominated flow to pure formation flow. The CHir phase was matched using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-8.

Selected representative parameters

The recommended transmissivity of $6.0 \cdot 10^{-8}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $2.0 \cdot 10^{-8}$ m^2/s to $9.0 \cdot 10^{-8}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,591.3 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.1.9 Section 863.00–963.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 206 kPa. No hydraulic connection to the adjacent zones was observed. Due to the expected small injection rate, the CHi phase was conducted without the automatic regulation, directly from the injection vessel with N_2 backpressure. Because of this, the pressure decreased during the injection by approx. 2 kPa. The injection rate decreased from 6 mL/min at start of the CHi phase to 2 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). Due to the low flow rate the recorded data of the flow rate is a little bit noisy. The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a relative flat derivative and a homogeneous flow model was chosen for the analysis. No clear flow stabilization was reached during the CHir phase and the data is still influenced by near wellbore effects like wellbore storage and skin. The CHir phase was matched using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-9.

Selected representative parameters

The recommended transmissivity of $7.3 \cdot 10^{-10}$ m^2/s was derived from the analysis of the CHi phase. The confidence range for the interval transmissivity is estimated to be $2.0 \cdot 10^{-10}$ m^2/s to $3.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

The analyses of the CHi and CHir phases show relative good consistency. No further analysis is recommended.

5.2 20 m single-hole injection tests

In the following, the 20 m section tests conducted in borehole KLX08 are presented and analysed.

5.2.1 Section 104.00–124.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the fast recovery of the pulse test indicated a very high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 88 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system worked well, with the exception of some oscillations at early times. The injection rate decreased from 33 L/min at start of the CHi phase to 28 L/min at the end, indicating a very high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a horizontal stabilization at middle times and a downward trend at late times. A two shell composite flow model with decreasing transmissivity away from the borehole was used for the analysis of the CHi phase. The derivative of the CHir phase shows a downward trend at middle and late times. A two shell composite radial flow model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-10.

Selected representative parameters

The recommended transmissivity of $2.0 \cdot 10^{-4}$ m²/s was derived from the analysis of the CHir phase (outer zone), which shows the better derivative quality. The confidence range for the interval transmissivity is estimated to be $9.0 \cdot 10^{-5}$ m²/s to $7.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,003.6 kPa.

The analyses of the CHi and CHir phases show some inconsistency as far as the derived inner zone transmissivities concerned. However, regarding the outer zone transmissivities the analyses show consistency. No further analysis is recommended.

5.2.2 Section 125.00–145.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system worked well. However, the recorded data is a little bit noisy. The injection rate decreased from 1.9 L/min at start of the CHi phase to 1.8 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows (although noisy) a relative flat derivative and a homogeneous flow model was used for the analysis. The derivative of the CHir phase shows a downward trend at middle times followed by a kind of horizontal stabilization at late times. This is indicative for an increase of transmissivity at some distance from the borehole. A two shell composite radial flow model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-11.

Selected representative parameters

The recommended transmissivity of $7.3 \cdot 10^{-6}$ m²/s was derived from the analysis of the CHir phase (outer zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $5.0 \cdot 10^{-6}$ m²/s to $5.0 \cdot 10^{-5}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,176.3 kPa.

The analyses of the CHi and CHir phases show some inconsistencies regarding the chosen flow models. This can be attributed to the noise in the recorded data of the CHi phase. No further analysis is recommended.

5.2.3 Section 144.00–164.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 34 kPa. A slight reaction in the bottom zone was observed, indicating a connection to the test interval. The injection rate decreased from 37 L/min at start of the CHi phase to 29 L/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows horizontal stabilization at middle times followed by an upward trend at late times, indicating a decrease of transmissivity at some distance from the borehole. The response of the CHir phase is similar to the response of the CHi phase. A two shell composite flow model was used for the analysis of both phases. The analysis is presented in Appendix 2-12.

Selected representative parameters

The recommended transmissivity of $4.3 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHi phase (inner zone), which shows the clearest horizontal stabilization. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-4}$ m^2/s to $8.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,339.6 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.4 Section 164.00–184.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 17 kPa. A slight reaction in the annulus was observed, indicating a connection to the test interval. The recorded data of the CHi phase shows some oscillations at early times. The injection rate decreased from 33 L/min at start of the CHi phase to 29 L/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a slight horizontal stabilization at middle times followed by an upward trend at late times, indicating a decrease of transmissivity at some distance from the borehole. A two shell composite flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a horizontal stabilization at middle times and an upward trend at late times. The CHir phase was matched using a two shell composite flow model with wellbore storage and skin. The analysis is presented in Appendix 2-13.

Selected representative parameters

The recommended transmissivity of $4.2 \cdot 10^{-4}$ m²/s was derived from the analysis of the CHir phase (inner zone), which shows a horizontal stabilization. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-4}$ m²/s to $8.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,511.6 kPa.

The analyses of the CHi and CHir phases show good consistency. No further analysis is recommended.

5.2.5 Section 183.50–203.50 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 11 kPa. A slight hydraulic connection to the annulus and bottom zone was observed. The automatic regulation system worked well. However, the recorded data is a little bit noisy. The injection rate decreased from 33 L/min at start of the CHi phase to 28 L/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). The small pressure difference during the CHi phase and the following fast recovery adds some ambiguity to the analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both phases were matched using an infinite acting homogeneous flow model. The analysis is presented in Appendix 2-14.

Selected representative parameters

The recommended transmissivity of $5.0 \cdot 10^{-4}$ m²/s was derived from the analysis of the CHi phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $9.0 \cdot 10^{-5}$ m²/s to $9.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,679.3 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.6 Section 203.00–223.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 32 kPa. A slight hydraulic connection to the annulus was observed. The automatic regulation system worked well. However, the recorded data is noisy. The injection rate decreased from 35 L/min at start of the CHi phase to 32 L/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a noisy derivative. However, a homogeneous radial flow model was used for the analysis of the CHi phase. The derivative of the CHir phase is not very conclusive at early times. At middle times the CHir derivative shows a horizontal stabilization. The analysis is presented in Appendix 2-15.

Selected representative parameters

The recommended transmissivity of $1.8 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-5}$ m^2/s to $5.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,846.7 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.7 Section 223.50–243.50 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 199 kPa. No hydraulic connection to the adjacent zones was observed. The injection rate decreased from 11 L/min at start of the CHi phase to 9 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery. Both phases are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a horizontal stabilization at middle and late times. A composite radial flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a steep downward trend at middle times, which is consistent with a high positive skin. At late times the CHir derivative shows a horizontal stabilization. The CHir phase was analysed using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-16.

Selected representative parameters

The recommended transmissivity of $3.4 \cdot 10^{-5}$ m^2/s was derived from the analysis of the CHi phase (outer zone), which shows the clearest derivative stabilization. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-5}$ m^2/s to $6.0 \cdot 10^{-5}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,020.3 kPa.

The analyses of the CHi and CHir phases show some discrepancy regarding the chosen flow models. However, regarding the derived transmissivities the analyses show consistency. No further analysis is recommended.

5.2.8 Section 243.50–263.50 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system functioned well, but the recorded data is however noisy. The injection rate decreased from 25 mL/min at start of the CHi phase to 21 mL/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a noisy derivative. However, a composite radial flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a steep downward trend at middle times, which is consistent with a high positive skin. At late times the CHir derivative shows a horizontal stabilization. The CHir phase was analysed using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-17.

Selected representative parameters

The recommended transmissivity of $5.8\cdot10^{-7}$ m^2/s was derived from the analysis of the CHir phase, which shows a derivative stabilization at late times. The confidence range for the interval transmissivity is estimated to be $1.0\cdot10^{-7}$ m^2/s to $1.0\cdot10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,189.7 kPa.

The analyses of the CHi and CHir phases show some discrepancy regarding the chosen flow models. This can be attributed to the noise in the recorded data of the CHi phase. However, regarding the derived transmissivities the analyses show consistency. No further analysis is recommended.

5.2.9 Section 264.00–284.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system functioned well, but the recorded data is however very noisy. The injection rate decreased from 1.3 L/min at start of the CHi phase to 0.6 L/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a noisy derivative, which is not very conclusive and does not allow flow model identification. However, an infinite acting homogeneous radial flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a horizontal stabilization at middle times followed by a downward trend at late times, indicating an increase of transmissivity at some distance of the borehole. The CHir phase was analysed using a two shell composite radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-18.

Selected representative parameters

The recommended transmissivity of $3.8·10^{-7}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows a derivative stabilization. The confidence range for the interval transmissivity is estimated to be $1.0·10^{-7}$ m^2/s to $1.0·10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,361.3 kPa.

The analyses of the CHi and CHir phases show some discrepancy regarding the chosen flow models. This can be attributed to the noise in the recorded data of the CHi phase. However, regarding the derived transmissivities the analyses show consistency. No further analysis is recommended.

5.2.10 Section 284.00–304.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data is a little bit noisy. The injection rate decreased from 6 L/min at start of the CHi phase to 2 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both phases were matched using a two shell composite flow model with increasing transmissivity away from the borehole. The analysis is presented in Appendix 2-19.

Selected representative parameters

The recommended transmissivity of $6.6·10^{-6}$ m^2/s was derived from the analysis of the CHi phase (outer zone), which shows a better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $2.0·10^{-6}$ m^2/s to $9.0·10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,533.2 kPa.

The analyses of the CHi and CHir phases show good consistency. No further analysis is recommended.

5.2.11 Section 304.00–324.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data is a little bit noisy. The injection rate decreased from 40 mL/min at start of the CHi phase to 37 mL/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the the CHi phase shows (although noisy) a relative flat derivative at late times. A two shell composite flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a steep downward trend at middle times and a slight stabilization at late times. A composite radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-20.

Selected representative parameters

The recommended transmissivity of $1.3 \cdot 10^{-7}$ m^2/s was derived from the analysis of the CHi phase (outer zone), which shows a better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $2.0 \cdot 10^{-8}$ m^2/s to $3.0 \cdot 10^{-7}$ m^2/s (this range includes the inner zone transmissivity). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,703.6 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.12 Section 324.00–344.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The automatic regulation system was not able to maintain stable pressure conditions in the formation. The recorded data of the CHi phase is very noise and not analysable. The average injection rate was approx. 3 mL/min, indicating a low interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase is not analysable. The derivative of the CHir phase shows a downward trend at middle times and late times, indicating a transition from wellbore storage and skin dominated flow to pure formation flow. A composite radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-21.

Selected representative parameters

The recommended transmissivity of $2.7·10^{-9}$ m^2/s was derived from the analysis of the CHir phase (inner zone). The confidence range for the interval transmissivity is estimated to be $9.0·10^{-10}$ m^2/s to $5.0·10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

No further analysis is recommended.

5.2.13 Section 344.00–364.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No hydraulic connection to the adjacent zones was observed. The CHir phase shows no problems and is adequate for quantitative analysis. The injection rate decreased from 56 mL/min at start of the CHi phase to 44 mL/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a flat derivative at early and late times, indicating radial flow. The middle time data show some disturbances, but does not influence the analysis. A homogeneous flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a steep downward trend at middle times and a kind of stabilization at late times. A composite radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-22.

Selected representative parameters

The recommended transmissivity of $4.0·10^{-8}$ m^2/s was derived from the analysis of the CHi phase, which shows a horizontal stabilization of the derivative. The confidence range for the interval transmissivity is estimated to be $1.0·10^{-8}$ m^2/s to $7.0·10^{-8}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,048.7 kPa.

The analyses of the CHi and CHir phases show some inconsistency regarding the chosen flow models. This may attributed to the relative fast recovery of the CHir phase. No further analysis is recommended.

5.2.14 Section 364.00–384.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No hydraulic connection to the adjacent zones was observed. The CHir phase shows no problems and is adequate for quantitative analysis. The injection rate decreased from 5.0 L/min at start of the CHi phase to 4.7 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). The CHir phase shows a fast recovery.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a kind of a downward trend at early times, followed by a horizontal stabilization at middle and late times. This behaviour is consistent with an increase of transmissivity at some distance from the borehole. A two shell composite flow model was used for the analysis of the CHi phase. Due to fast recovery the early time data of the CHir phase is not very conclusive. However, a composite radial flow model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-23.

Selected representative parameters

The recommended transmissivity of $2.3 \cdot 10^{-5}$ m²/s was derived from the analysis of the CHi phase (outer zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $5.0 \cdot 10^{-6}$ m²/s to $6.0 \cdot 10^{-5}$ m²/s (this range includes the inner zone transmissivity). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,218.8 kPa.

The analyses of the CHi and CHir phases show relative good consistency. No further analysis is recommended.

5.2.15 Section 385.00–405.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The recovery of the pulse test indicated a high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 52 kPa. During the injection the pressure rose by 8 kPa in the bottom zone, indicating a connection to the test section. The injection rate decreased from 32 L/min at start of the CHi phase to 29 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a horizontal stabilization at middle and late times, which is indicative for radial flow. A homogeneous flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows stabilization at middle times and an upward trend at late times. A two shell composite flow model with decreasing transmissivity was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-24.

Selected representative parameters

The recommended transmissivity of $2.4 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $8.0 \cdot 10^{-5}$ m^2/s to $6.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,398.8 kPa.

The analyses of the CHi and CHir phases show a discrepancy as far as the late time responses of the two phases are concerned. In case further analysis is planned, a total test simulation should help resolving this inconsistency. No further analysis is recommended.

5.2.16 Section 403.00–423.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the fast recovery of the pulse test indicated a high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 11 kPa. A slight hydraulic connection to the adjacent zones was observed. The injection rate decreased from 30 L/min at start of the CHi phase to 24 L/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). The small pressure difference during the CHi phase and the following fast recovery adds some ambiguity to the analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows an upward trend at middle and late times, indicating a decrease of transmissivity at some distance from the borehole. A two shell composite flow model was chosen for the analysis of the CHi phase. Due to the fast recovery and small pressure response in the test section the early time data of the CHir phase is not very conclusive, but a horizontal stabilization of the derivative can be observed at middle times. The CHir phase was matched using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-25.

Selected representative parameters

The recommended transmissivity of $1.3 \cdot 10^{-4}$ m^2/s was derived from the analysis of the CHir phase. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-5}$ m^2/s to $5.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,550.9 kPa.

The analyses of the CHi and CHir phases show inconsistency regarding the chosen flow models. The negative skin derived from the CHir phase is consistent with the behaviour of the CHi derivative (decreasing transmissivity at some distance from the borehole). However, regarding the derived transmissivities the analyses show consistency. No further analysis is recommended.

5.2.17 Section 423.00–443.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data of the CHi phase is noisy. The injection rate decreased from 390 mL/min at start of the CHi phase to 370 mL/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase was analysed using an infinite acting homogeneous flow model. The derivative of the CHir phase shows a steep downward trend at early times, indicating a relative high positive skin. The behaviour of the late time derivative (horizontal stabilization) is consistent with radial flow. A homogeneous radial flow model was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-26.

Selected representative parameters

The recommended transmissivity of $1.3 \cdot 10^{-6}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-7}$ m^2/s to $4.0 \cdot 10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,718.9 kPa.

Apart from the relative high skin derived from the CHir phase, the analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.18 Section 443.00–463.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data of the CHi phase is very noisy. The injection rate decreased from 1 L/min at start of the CHi phase to 0.9 L/min at the end, indicating a medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase is very noisy and does not allow flow model identification. However, an infinite acting homogeneous flow model was used for the analysis of the CHi phase. The response of the CHir derivative is consistent with a high positive skin. A homogeneous radial flow model was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-27.

Selected representative parameters

The recommended transmissivity of $3.1 \cdot 10^{-6}$ m²/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $8.0 \cdot 10^{-7}$ m²/s to $5.0 \cdot 10^{-6}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,888.9 kPa.

Apart from the relative high skin derived from the CHir phase, the analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.19 Section 463.00–483.00 m, test no. 1 and 2, injection

Comments to test

After the conduction of the preliminary pulse the test was stopped and repeated. Only the second test includes all test phases and was evaluated and analysed.

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The injection rate decreased from 5.4 L/min at start of the CHi phase to 4.1 L/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a flat derivative, indicating radial flow. An infinite acting homogeneous radial flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows a horizontal stabilization at late times, also indicating radial flow. A homogeneous radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-28.

Selected representative parameters

The recommended transmissivity of $8.7 \cdot 10^{-6}$ m²/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $5.0 \cdot 10^{-6}$ m²/s to $1.0 \cdot 10^{-5}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,054.0 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.20 Section 483.00–503.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The CHi phase shows some oscillations at the beginning due to the adjustments of the regulation unit, but is still adequate for quantitative analysis. The injection rate decreased from 410 mL/min at start of the CHi phase to 390 mL/min at the end, indicating a high interval transmissivity (consistent with the pulse recovery). The CHir phase recovers relatively fast.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase is not very conclusive at early times, but it shows a horizontal stabilization at late times. A two shell composite flow model with increasing transmissivity at some distance from the borehole was used for the analysis of the CHi phase. Mainly caused by the fast recovery and the resulting data quality the derivative of the CHir phase is not very conclusive. However, the CHir phase was matched using a two shell composite flow model with wellbore storage and skin. The analysis is presented in Appendix 2-29.

Selected representative parameters

The recommended transmissivity of $1.0 \cdot 10^{-6}$ m²/s was derived from the analysis of the CHi phase (outer zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-7}$ m²/s to $4.0 \cdot 10^{-6}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,226.9 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.21 Section 503.00–523.00 m, test no. 1, pulse injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The very slow recovery of the pulse test indicated a very low formation transmissivity. Based on this result no constant pressure injection test was performed. Instead, the recovery of the pulse injection test was analysed.

During the brief injection phase of the pulse injection a total volume of about 13 mL was injected (derived from the flow meter readings). This injected volume produced a pressure increase of 217 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to $4.9 \cdot 10^{-11}$ m³/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

For the interpretation a flow dimension of 2 (radial flow) was assumed. In case of the present test the deconvolved PI pressure derivative shows a continuing upward trend which can be interpreted to the fact that the dimensionless test time is to small and semi-logarithmic asymptotic solution was not achieved (due to the relative small transmissivity). The PI phase was analysed using a radial homogeneous flow model. The analysis is presented in Appendix 2-30.

Selected representative parameters

The recommended transmissivity of $4.9 \cdot 10^{-11}$ m^2/s was derived from the analysis of the Pi phase. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-11}$ to $9.0 \cdot 10^{-11}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

No further analysis is recommended.

5.2.22 Section 523.00–543.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No connection to the adjacent zones was observed. The CHi phase shows some oscillations at the beginning due to the adjustments of the regulation unit, but is still adequate for quantitative analysis. The injection rate decreased from 17 mL/min at start of the CHi phase to 10 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows flat derivative at late times, which is indicative for radial flow. An infinite acting radial flow model was chosen for the analysis of the CHi phase. No clear flow stabilization was reached during the CHir phase and the data is still influenced by near wellbore effects like wellbore storage and skin. However, a homogeneous radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-31.

Selected representative parameters

The recommended transmissivity of $5.1 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHi phase, which shows a horizontal stabilisation. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-9}$ m^2/s to $9.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

The analyses of the CHi and CHir phases show little inconsistency in the derived transmissivity, which can be attributed to fact that no flow stabilization was reached during the CHir phase. No further analysis is recommended.

5.2.23 Section 543.00–563.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 206 kPa. No connection to the adjacent zones was observed. The automatic regulation system worked well with the exception of some oscillations at the beginning. However, the recorded flow rate is very noisy. The CHi phase is amenable for qualitative analysis. The injection rate decreased from approx. 10 mL/min at start of the CHi phase to 5 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase does not allow flow model identification. The analysis of the CHi phase was conducted using an infinite acting homogeneous flow model. The CHir phase shows a horizontal stabilization at middle times, followed by an upward trend at late times, which is indicative for a decrease of transmissivity at some distance from the borehole. The CHir phase was matched using a two shell composite flow model with wellbore storage and skin. The analysis is presented in Appendix 2-32.

Selected representative parameters

The recommended transmissivity of $6.6 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-9}$ m^2/s to $9.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

The analyses of the CHi and CHir phases show inconsistency as far as the flow models concerned. This inconsistency can be attributed to poor data quality of the CHi phase. No further analysis is recommended.

5.2.24 Section 563.00–583.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No connection to the adjacent zones was observed. The automatic regulation system worked well. However, the recorded flow rate is noisy. The CHi phase is amenable for qualitative analysis. The injection rate decreased from approx. 7 mL/min at start of the CHi phase to 5 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows a relative flat derivative. The CHi phase was matched using an infinite acting homogeneous flow model. The CHir phase shows a downward trend at late times. The behaviour of the CHir phase is typical for transition from wellbore storage and skin dominated flow to pure formation flow. A homogeneous radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-33.

Selected representative parameters

The recommended transmissivity of $4.7 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-9}$ m^2/s to $9.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.25 Section 583.00–603.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data of the CHi phase is very noisy. The injection rate decreased from 30 mL/min at start of the CHi phase to 25 mL/min at the end, indicating a relative low interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery, but is still adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase is very noisy and does not allow flow model identification. However, an infinite acting homogeneous flow model was used for the analysis of the CHi phase. The response of the CHir derivative (unit sloop downward trend at middle times) is consistent with a high positive skin. The late time derivative shows a horizontal stabilization, which is indicative for radial flow. A homogeneous radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-34.

Selected representative parameters

The recommended transmissivity of $6.9 \cdot 10^{-8}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-8}$ m^2/s to $1.0 \cdot 10^{-7}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,074.5 kPa.

Apart from the relative high skin derived from the CHir phase, the analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.26 Section 603.00–623.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a medium formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data of the CHi phase is a little bit noisy. The injection rate decreased from 1.3 L/min at start of the CHi phase to 1.2 L/min at the end, indicating medium interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the CHi phase shows (although noisy) a relative flat derivative. An infinite acting homogeneous flow model was used for the analysis of the CHi phase. The CHir phase shows horizontal flow stabilization at late times and was matched using a homogeneous radial flow model with wellbore storage and skin. The analysis is presented in Appendix 2-35.

Selected representative parameters

The recommended transmissivity of $2.4 \cdot 10^{-6}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-7}$ m^2/s to $5.0 \cdot 10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,241.9 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.27 Section 623.00–643.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The automatic regulation system functioned well. However, the recorded data of the CHi phase is very noisy. The injection rate decreased from 22 mL/min at start of the CHi phase to 20 mL/min at the end, indicating a relative low interval transmissivity (consistent with the pulse recovery). The CHir phase shows a relative fast recovery, but is still adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase is very noisy and does not allow flow model identification. However, the analysis of the CHi phase was conducted using a homogeneous radial flow model. The response of the CHir derivative (unit sloop downward trend at middle times) is consistent with a high positive skin. A homogeneous radial flow model with wellbore storage and skin was used for the analysis of the CHir phase. The analysis is presented in Appendix 2-36.

Selected representative parameters

The recommended transmissivity of $7.1 \cdot 10^{-8}$ m^2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-8}$ m^2/s to $1.0 \cdot 10^{-7}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,413.0 kPa.

Apart from the relative high skin derived from the CHir phase, the analyses of the CHi and CHir phases show relative good consistency. No further analysis is recommended.

5.2.28 Section 643.00–663.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 202 kPa. The pressure in the bottom zone rose by approx. 160 kPa, indicating a connection to the test zone. The injection rate decreased from 6.9 L/min at start of the CHi phase to 2.6 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test both phases were matched using a homogeneous radial flow model. The analysis is presented in Appendix 2-37.

Selected representative parameters

The recommended transmissivity of $1.5 \cdot 10^{-6}$ m^2/s was derived from the analysis of the CHi phase, which shows the slight better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-7}$ m^2/s to $3.0 \cdot 10^{-6}$ m^2/s (This range includes the derived transmissivity from the CHir phase). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,583.9 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.29 Section 663.00–683.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative high formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 200 kPa. No connection to the adjacent zones was observed. The injection rate decreased from 7.8 L/min at start of the CHi phase to 2.8 L/min at the end, indicating a relative high interval transmissivity (consistent with the pulse recovery). Both phases show no problems and are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows a horizontal stabilization at early times, followed by a downward trend at middle times and a new stabilization at late times. This behaviour is typical for an increase of transmissivity at some distance from the borehole. The CHir response is similar to the response of the CHi phase, whereas the late time stabilization was not observed. Both phases were matched using a two shell composite radial flow model. The analysis is presented in Appendix 2-38.

Selected representative parameters

The recommended transmissivity of $1.3 \cdot 10^{-6}$ m^2/s was derived from the analysis of the CHi phase (inner zone), which shows the clearest horizontal stabilization. The confidence range for the interval transmissivity is estimated to be $7.0 \cdot 10^{-7}$ m^2/s to $3.0 \cdot 10^{-6}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,747.7 kPa.

The analyses of the CHi and CHir phases show consistency. No further analysis is recommended.

5.2.30 Section 683.00–703.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The pressure response and the recovery of the pulse test indicated a relative low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 183 kPa. No connection to the adjacent zones was observed. The pressure control during the CHi phase was very poor. The injection rate decreased from 5 mL/min at start of the CHi phase to 3 mL/min at the end, indicating a relative low interval transmissivity (consistent with the pulse recovery). The CHir phase shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase is very noisy and does not allow flow model identification. However, the analysis of the CHi phase was conducted using a homogeneous radial flow model. The derivative of the CHir phase shows a unit slope downward trend, indicating a transition from wellbore storage and skin dominated flow to pure formation flow. A composite flow model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-39.

Selected representative parameters

The recommended transmissivity of $4.6 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $1.0 \cdot 10^{-9}$ m^2/s to $9.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,921.1 kPa.

The analyses of the CHi and CHir phases show some inconsistency regarding the chosen flow models. This inconsistency is caused to the poor data quality of the CHi phase. No further analysis is recommended.

5.2.31 Section 703.00–723.00 m, test no. 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising by approx. 70 kPa in 20 minutes. This phenomenon is caused by prolonged packer expansion in a very tight section (T probably smaller than 1E–11 m^2/s). None of the test phases is analysable.

The measured data is presented in Appendix 2-40.

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than $1.0 \cdot 10^{-11}$ m^2/s.

No further analysis recommended.

5.2.32 Section 723.00–743.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The slow recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 205 kPa. No hydraulic connection to the adjacent zones was observed. Due to the expected small injection rate, the CHi phase was conducted without the automatic regulation, directly from the injection vessel with N_2 backpressure. However, no pressure loss occurred during the injection phase. The injection rate decreased from 8 mL/min at start of the CHi phase to 3 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). Due to the low flow rate the recorded data of the flow rate is noisy and the results of the CHi phase should be regarded carefully. The CHir shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. Due to the poor data quality the CHi phase is not very conclusive. However, in case of the present test an infinite acting homogenous radial flow model was used for the analysis of the CHi phase. The response of the CHir phase indicates a transition from wellbore storage and skin dominated flow to pure formation flow. A composite radial flow model with wellbore storage and skin was chosen for the analysis of the CHir phase. The analysis is presented in Appendix 2-41.

Selected representative parameters

The recommended transmissivity of $2.2 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $8.0 \cdot 10^{-10}$ m^2/s to $5.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

The analyses of the CHi and CHir phases show some inconsistency regarding the chosen flow models. This inconsistency is caused to the poor data quality of the CHi phase. No further analysis recommended.

5.2.33 Section 743.00–763.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The slow recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 207 kPa. No hydraulic connection to the adjacent zones was observed. Due to the expected small injection rate, the CHi phase was conducted without the automatic regulation, directly from the injection vessel with N_2 backpressure. However, a pressure loss of approx. 4 kPa occurred during the injection phase. The injection rate decreased from 4 mL/min at start of the CHi phase to 1 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). Due to the low flow rate the recorded data of the flow rate is noisy and the results of the CHi phase should be regarded carefully. The CHir shows no problems and is adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. Due to the poor data quality the CHi phase is not very conclusive, but the derivative shows an upward trend at middle times. An infinite acting homogenous radial flow model was used for the analysis of the CHi phase. The derivative of the CHir phase shows an upward trend and a two shell composite flow model with wellbore storage and skin was chosen for the analysis. The analysis is presented in Appendix 2-42.

Selected representative parameters

The recommended transmissivity of $2.2 \cdot 10^{-9}$ m^2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be $8.0 \cdot 10^{-10}$ m^2/s to $5.0 \cdot 10^{-9}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

No further analysis recommended.

5.2.34 Section 763.00–783.00 m, test no. 1, injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The slow recovery of the pulse test indicated a low formation transmissivity. Based on this result a sequence consisting of a constant pressure injection phase (CHi) and a recovery phase (CHir) was conducted. Only the CHi and CHir phases were analysed quantitatively.

The CHi phase was conducted using a pressure difference of 201 kPa. No hydraulic connection to the adjacent zones was observed. Due to the expected small injection rate, the CHi phase was conducted without the automatic regulation, directly from the injection vessel with N_2 backpressure. However, a pressure loss of approx. 6 kPa occurred during the injection phase. The injection rate decreased from 100 mL/min at start of the CHi phase to 13 mL/min at the end, indicating a low interval transmissivity (consistent with the pulse recovery). Both phases are adequate for quantitative analysis.

Flow regime and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test the derivative of the CHi phase shows an upward trend at middle times followed by a horizontal stabilization at late times. This is indicative for a decrease of transmissivity at some distance from the borehole and radial flow. A two shell composite flow model was chosen for the analysis of the CHi phase. The derivative of the CHir phase shows an upward trend and a two shell composite flow model with wellbore storage and skin was chosen for the analysis. The analysis is presented in Appendix 2-43.

Selected representative parameters

The recommended transmissivity of $2.1 \cdot 10^{-9}$ m²/s was derived from the analysis of the CHi phase (outer zone), which shows the clearest horizontal stabilization. The confidence range for the interval transmissivity is estimated to be $9.0 \cdot 10^{-10}$ m²/s to $9.0 \cdot 10^{-9}$ m²/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

No further analysis recommended.

5.2.35 Section 783.00–803.00 m, test no. 1, pulse injection

Comments to test

The test design consisted of a preliminary pulse injection test conducted with the goal of deriving a first estimate of the formation transmissivity. The very slow recovery of the pulse test indicated a very low formation transmissivity. Based on this result no constant pressure injection test was performed. Instead, the recovery of the pulse injection test was analysed.

During the brief injection phase of the pulse injection a total volume of about 8 mL was injected (derived from the flow meter readings). This injected volume produced a pressure increase of 173 kPa. Using a dV/dP approach, the wellbore storage coefficient relevant for the subsequent pressure recovery can be calculated to $2.8 \cdot 10^{-12}$ m³/Pa. It should be noted though that there is large uncertainty connected with the determination of the wellbore storage coefficient (probably one order of magnitude), which will implicitly translate into uncertainty in the derived transmissivity.

Flow regime and calculated parameters

For the interpretation a flow dimension of 2 (radial flow) was assumed. In case of the present test the deconvolved PI pressure derivative shows a continuing upward trend which can be interpreted to the fact that the dimensionless test time is to small and semi-logarithmic asymptotic solution was not achieved (due to the relative small transmissivity). The PI phase was analysed using a radial homogeneous flow model. The analysis is presented in Appendix 2-44.

Selected representative parameters

The recommended transmissivity of $2.8 \cdot 10^{-12}$ m^2/s was derived from the analysis of the Pi phase. The confidence range for the interval transmissivity is estimated to be $9.0 \cdot 10^{-13}$ to $5.0 \cdot 10^{-12}$ m^2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

No further analysis is recommended.

5.2.36 Section 803.00–823.00 m, test no. 1, injection

Comments to test

The intention was to conduct the test as a constant pressure injection test phase (CHi), followed by a pressure recovery phase (CHir). However, after inflating the packers and closing the test valve, the pressure kept rising by approx. 72 kPa in 20 minutes. This phenomenon is caused by prolonged packer expansion in a very tight section (T probably smaller than 1E–11 m^2/s). None of the test phases is analysable.

The measured data is presented in Appendix 2-45.

Selected representative parameters

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than $1.0 \cdot 10^{-11}$ m^2/s.

No further analysis recommended.

6 Summary of results

This chapter summarizes the basic test parameters and analysis results. In addition, the correlation between steady state and transient transmissivities as well as between the matched and the theoretical wellbore storage (WBS) coefficient are presented and discussed.

6.1 General test data and results

Table 6-1. General test data from hydraulic tests in KLX08 (for nomenclature see Appendix 4).

Borehole secup (m)	Borehole seclow (m)	Date and time for test, start YYYYMMDD hh:mm	Date and time for test, stop YYYYMMDD hh:mm	Q_p (m**3/s)	Q_m (m**3/s)	tp (s)	t_F (s)	p_0 (kPa)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (oC)	Test phases measured Analysed test phases marked bold
103.00	203.00	060928 07:55	060928 10:12	8.92E–04	9.05E–04	1800	1800	1695	1696	1707	1697	9.2	**CHi / CHir**
203.00	303.00	060928 11:37	060928 14:04	6.86E–04	7.19E–04	1800	1800	2526	2526	2568	2529	10.6	**CHi / CHir**
305.00	405.00	060928 15:27	060928 17:28	4.70E–04	4.89E–04	1800	1800	3393	3393	3439	3394	11.3	**CHi / CHir**
403.00	503.00	060928 19:13	060928 21:27	5.69E–04	6.13E–04	1800	1800	4225	4226	4251	4227	13.5	**CHi / CHir**
503.00	603.00	061006 09:32	061006 12:05	6.53E–07	7.32E–07	1800	1800	5074	5077	5278	5082	14.8	**CHi / CHir**
603.00	703.00	061006 14:05	061006 16:06	6.08E–05	6.98E–05	1800	1800	5923	5923	6123	5938	16.1	**CHi / CHir**
703.00	803.00	061006 17:48	061006 20:40	2.33E–07	3.28E–07	1800	1800	6766	6775	6970	6864	17.5	**CHi / CHir**
803.00	903.00	061006 22:17	061007 00:54	1.48E–06	1.72E–06	1800	1800	7605	7607	7804	7616	18.9	**CHi / CHir**
863.00	963.00	061007 06:04	061007 09:02	3.17E–08	4.11E–08	1800	1800	8110	8116	8322	8221	19.7	**CHi / CHir**
104.00	124.00	061008 07:04	061008 08:32	4.73E–04	4.94E–04	1200	1200	999	1003	1091	1005	8.4	**CHi / CHir**
125.00	145.00	061008 09:13	061008 10:41	2.96E–05	3.08E–05	1200	1200	1179	1176	1377	1176	8.9	**CHi / CHir**
144.00	164.00	061008 11:12	061008 12:38	4.86E–04	5.03E–04	1200	1200	1341	1339	1373	1340	8.8	**CHi / CHir**
164.00	184.00	061008 13:19	061008 14:42	4.79E–04	5.05E–04	1200	1200	1511	1511	1528	1512	9.1	**CHi / CHir**
183.50	203.50	061008 15:14	061008 16:36	4.61E–04	5.06E–04	1200	1200	1679	1679	1690	1679	9.2	**CHi / CHir**
203.00	223.00	061008 17:07	061008 18:30	5.30E–04	5.51E–04	1200	1200	1846	1847	1879	1847	9.5	**CHi / CHir**
223.50	243.50	061008 19:00	061008 20:26	1.55E–04	1.60E–04	1200	1200	2021	2021	2220	2021	9.9	**CHi / CHir**
243.50	263.50	061008 21:09	061008 22:36	3.43E–06	3.62E–06	1200	1200	2191	2191	2391	2190	10.2	**CHi / CHir**
264.00	284.00	061008 23:10	061009 00:33	9.65E–06	1.07E–05	1200	1200	2365	2364	2564	2364	10.5	**CHi / CHir**
284.00	304.00	061009 01:07	061009 02:31	4.16E–05	4.26E–05	1200	1200	2536	2534	2734	2534	10.7	**CHi / CHir**
304.00	324.00	061009 06:17	061009 07:50	6.17E–07	6.25E–07	1200	1200	2706	2705	2905	2704	11.0	**CHi / CHir**
324.00	344.00	061009 08:23	061009 10:04	5.17E–08	6.06E–08	1200	1200	2877	2887	3087	2893	11.2	**CHi / CHir**
344.00	364.00	061009 10:41	061009 12:08	7.27E–07	7.94E–07	1200	1200	3048	3048	3248	3048	11.5	**CHi / CHir**
364.00	384.00	061009 12:57	061009 14:27	7.96E–05	8.13E–05	1200	1200	3218	3218	3419	3219	11.6	**CHi / CHir**
385.00	405.00	061009 15:01	061009 16:25	4.97E–04	5.10E–04	1200	1200	3397	3398	3450	3399	11.4	**CHi / CHir**
403.00	423.00	061009 16:55	061009 18:19	4.01E–04	4.47E–04	1200	1200	3550	3550	3561	3551	12.3	**CHi / CHir**
423.00	443.00	061009 18:50	060109 20:17	6.08E–06	6.25E–06	1200	1200	3719	3719	3919	3719	12.6	**CHi / CHir**

443.00	463.00	061009 21:00	061009 22:23	1.48E–05	1.51E–05	1200	1200	3889	3889	4089	3888	12.9	**CHi / CHir**
463.00	483.00	061009 23:36	061010 00:35	6.82E–05	7.17E–05	1200	1200	4060	4060	4260	4059	13.2	**CHi / CHir**
483.00	503.00	061010 01:14	061010 02:38	6.45E–06	6.66E–06	1200	1200	4227	4227	4427	4227	13.4	**CHi / CHir**
503.00	523.00	061010 06:13	061010 08:07	#NV	#NV	10	3659	4396	4410	4627	4479	13.7	**Pi**
523.00	543.00	061010 08:37	061010 10:22	1.70E–07	2.04E–07	1200	1200	4567	4574	4775	4604	14.0	**CHi / CHir**
543.00	563.00	061010 10:59	061010 12:41	8.33E–08	1.14E–07	1200	1200	4737	4746	4952	4788	14.2	**CHi / CHir**
563.00	583.00	061010 13:25	061010 15:01	9.00E–08	1.13E–07	1200	1200	4906	4912	5113	4920	14.5	**CHi / CHir**
583.00	603.00	061010 15:33	061010 16:58	4.17E–07	4.33E–07	1200	1200	5076	5077	5278	5077	14.7	**CHi / CHir**
603.00	623.00	061010 17:32	061010 18:55	1.93E–05	1.98E–05	1200	1200	5245	5246	5446	5247	15.0	**CHi / CHir**
623.00	643.00	061010 19:25	061010 20:50	3.33E–07	3.50E–07	1200	1200	5415	5418	5618	5418	15.3	**CHi / CHir**
643.00	663.00	061010 21:30	061010 22:54	4.37E–05	4.98E–05	1200	1200	5585	5587	5789	5600	15.5	**CHi / CHir**
663.00	683.00	061010 23:25	061011 00:49	4.68E–05	5.28E–05	1200	1200	5755	5764	5964	5774	15.8	**CHi / CHir**
683.00	703.00	061011 01:25	061011 03:01	5.50E–08	6.48E–08	1200	3600	5925	5931	6114	5925	16.0	**CHi / CHir**
703.00	723.00	061011 05:22	061011 06:11	#NV	#NV	#NV	#NV	6091	#NV	#NV	#NV	16.4	#NV
723.00	743.00	061011 06:43	061011 08:51	4.50E–08	5.07E–08	1200	1200	6261	6272	6477	6317	16.6	**CHi / CHir**
743.00	763.00	061011 09:27	061011 11:47	2.33E–08	2.92E–08	1200	1200	6432	6439	6646	6575	16.9	**CHi / CHir**
763.00	783.00	061011 12:33	061011 14:52	2.17E–07	5.28E–07	1200	1200	6603	6604	6805	6713	17.2	**CHi / CHir**
783.00	803.00	061011 15:28	061011 17:14	#NV	#NV	10	3630	6770	6786	6959	6927	17.5	**Pi**
803.00	823.00	061011 17:47	061011 18:34	#NV	#NV	#NV	#NV	6938	#NV	#NV	#NV	17.7	#NV

Nomenclature

Q_p Flow in test section immediately before stop of flow (m^3/s).

Q_m Arithmetical mean flow during perturbation phase (m^3/s).

t_p Duration of perturbation phase (s).

t_f Duration of recovery phase (s).

p_0 Pressure in borehole before packer inflation (kPa).

p_i Pressure in test section before start of flowing (kPa).

p_p Pressure in test section before stop of flowing (kPa).

p_F Pressure in test section at the end of the recovery (kPa).

Te_w Temperature in test section.

Test phases CHi Constant Head injection phase.
CHir: Recovery phase following the constant head injection phase.
Pi: Pulse injection phase.

#NV Not analysed/no values.

Table 6-2. Results from analysis of hydraulic tests in KLX08 (for nomenclature see Appendix 4).

Interval position up m btoc	 low m btoc	Stationary flow parameters Q/s m²/s	 T_M m²/s	Transient analysis Flow regime Per-turb. phase	 Recov-ery phase	 Formation parameters T_{f1} m²/s	 T_{f2} m²/s	 T_{s1} m²/s	 T_{s2} m²/s	 T_T m²/s	 T_{TMIN} m²/s	 T_{TMAX} m²/s	 C m³/Pa	 ξ –	 dt_1 min	 dt_2 min	 Static conditions p* kPa	 h_{wif} m.a.s.l.
103.00	203.00	7.96E–04	1.04E–03	22	WBS2	6.1E–04	8.7E–03	4.2E–04	#NV	4.2E–04	1.0E–04	8.0E–04	4.6E–07	–6.0	0.43	0.53	1696.5	12.04
203.00	303.00	1.60E–04	2.09E–04	2	WBS22	3.9E–04	1.4E–04	3.2E–04	1.5E–04	3.2E–04	9.0E–05	7.0E–04	1.7E–07	0.8	0.83	2.32	2528.2	10.31
305.00	405.00	1.00E–04	1.31E–04	2	WBS2	3.2E–04	#NV	1.7E–04	#NV	1.7E–04	7.0E–05	4.0E–04	4.0E–08	1.6	0.76	4.64	3394.0	10.86
403.00	503.00	2.23E–04	2.91E–04	22	WBS2	6.9E–04	2.3E–04	2.5E–04	#NV	2.5E–04	9.0E–05	5.0E–04	7.7E–08	–5.1	0.35	4.34	4226.5	11.66
503.00	603.00	3.19E–08	4.15E–08	2	WBS22	4.1E–08	#NV	3.3E–08	6.6E–08	4.1E–08	2.0E–08	7.0E–08	4.0E–10	2.2	4.15	24.11	5070.9	12.12
603.00	703.00	2.98E–06	3.89E–06	2	WBS22	2.4E–06	4.05E–06	1.5E–06	2.5E–06	1.5E–06	8.0E–07	4.0E–06	7.6E–09	–4.5	0.62	2.84	5914.3	12.58
703.00	803.00	1.17E–08	1.53E–08	22	WBS22	9.9E–09	4.5E–09	1.8E–08	2.5E–09	4.5E–09	1.0E–09	6.0E–09	3.9E–10	–1.8	4.53	25.22	#NV	#NV
803.00	903.00	7.39E–08	9.62E–08	2	WBS2	6.3E–08	#NV	6.0E–08	#NV	6.0E–08	2.0E–08	9.0E–08	2.1E–09	–1.6	#NV	#NV	7591.3	13.44
863.00	963.00	1.51E–09	1.96E–09	2	WBS22	7.3E–10	#NV	2.5E–10	#NV	7.3E–10	2.0E–10	3.0E–09	1.9E–10	–1.0	0.78	13.12	#NV	#NV
104.00	124.00	5.27E–05	5.52E–05	22	WBS22	1.4E–04	2.0E–04	5.8E–05	1.9E–04	2.0E–04	9.0E–05	7.0E–04	6.6E–08	7.0	#NV	#NV	1003.6	9.92
125.00	145.00	1.45E–06	1.51E–06	2	WBS22	2.9E–06	#NV	1.5E–06	7.3E–06	7.3E–06	5.0E–06	5.0E–05	8.3E–10	0.0	2.34	6.47	1176.3	9.32
144.00	164.00	1.40E–04	1.47E–04	22	WBS22	4.3E–04	2.9E–04	3.4E–04	1.4E–04	4.3E–04	1.0E–04	8.0E–04	1.6E–07	8.7	2.18	6.07	1339.6	9.51
164.00	184.00	2.76E–04	2.89E–04	2	WBS22	5.5E–04	3.4E–04	4.2E–04	2.1E–04	4.2E–04	1.0E–04	8.0E–04	9.7E–08	1.1	0.43	3.20	1511.6	9.69
183.50	203.50	4.11E–04	4.30E–04	2	WBS2	5.0E–04	#NV	1.1E–04	#NV	5.0E–04	9.0E–05	9.0E–04	1.1E–08	–3.1	2.65	19.97	1679.3	9.86
203.00	223.00	1.62E–04	1.70E–04	2	WBS2	3.6E–04	#NV	1.8E–04	#NV	1.8E–04	7.0E–05	5.0E–04	1.1E–07	–2.4	0.82	3.73	1846.7	10.00
223.50	243.50	7.63E–06	7.98E–06	22	WBS2	1.7E–05	3.4E–05	3.4E–05	#NV	3.4E–05	1.0E–05	6.0E–05	4.1E–09	5.9	1.54	16.37	2020.3	9.93
243.50	263.50	1.68E–07	1.76E–07	22	WBS2	5.6E–07	3.3E–07	5.8E–07	#NV	5.8E–07	1.0E–07	1.0E–06	8.3E–11	15.0	1.17	16.40	2198.7	10.84
264.00	284.00	4.73E–07	4.95E–07	2	WBS22	4.6E–07	#NV	3.8E–07	1.3E–06	3.8E–07	1.0E–07	1.0E–06	8.1E–11	–1.1	0.14	0.62	2361.3	9.70
284.00	304.00	2.04E–06	2.13E–06	22	WBS22	1.3E–06	6.6E–06	2.2E–06	9.0E–06	6.6E–06	2.0E–06	9.0E–06	1.2E–09	1.0	0.94	11.20	2553.2	12.00
304.00	324.00	3.02E–08	3.16E–08	22	WBS22	2.0E–08	1.3E–07	1.8E–08	1.8E–07	1.3E–07	2.0E–08	3.0E–07	4.6E–11	–0.1	4.80	17.92	2703.6	10.13
324.00	344.00	2.53E–09	2.65E–09	#NV	WBS22	#NV	#NV	2.7E–09	3.8E–09	2.7E–09	9.0E–10	5.0E–09	7.1E–11	2.4	#NV	#NV	#NV	#NV
344.00	364.00	3.56E–08	3.73E–08	2	WBS22	4.0E–08	#NV	6.2E–08	2.1E–07	4.0E–08	1.0E–08	7.0E–08	5.7E–11	–1.0	0.82	19.54	3048.7	10.90
364.00	384.00	3.88E–06	4.06E–06	22	WBS22	5.7E–06	2.3E–05	3.9E–06	3.9E–05	2.3E–05	5.0E–06	6.0E–05	4.0E–10	2.3	0.79	11.86	3218.8	11.05
385.00	405.00	9.38E–05	9.81E–05	2	WBS22	3.0E–04	#NV	2.4E–04	1.4E–04	2.4E–04	8.0E–05	6.0E–04	3.2E–08	6.3	0.38	2.27	3398.8	11.35
403.00	423.00	3.57E–04	3.74E–04	22	WBS2	1.3E–03	2.3E–04	1.3E–04	#NV	1.3E–04	7.0E–05	5.0E–04	5.5E–09	–6.1	0.69	6.59	3550.9	11.38
423.00	443.00	2.98E–07	3.12E–07	2	WBS2	9.7E–07	#NV	1.3E–06	#NV	1.3E–06	7.0E–07	4.0E–06	7.7E–11	20.8	0.33	12.94	3718.9	11.34
443.00	463.00	7.23E–07	7.57E–07	2	WBS2	9.0E–07	#NV	3.1E–06	#NV	3.1E–06	8.0E–07	5.0E–06	2.0E–10	20.3	0.58	3.71	3888.9	11.52
463.00	483.00	3.34E–06	3.50E–06	2	WBS2	5.8E–06	#NV	8.7E–06	#NV	8.7E–06	5.0E–06	1.0E–05	1.3E–09	7.9	0.71	18.67	4054.0	11.21
483.00	503.00	3.16E–07	3.31E–07	22	WBS22	4.1E–07	1.0E–06	4.6E–07	1.3E–06	1.0E–06	7.0E–07	4.0E–06	1.0E–10	2.2	5.78	16.13	4226.9	11.70

503.00	523.00	#NV	#NV	#NV	WBS2	#NV	#NV	4.9E–11	#NV	4.9E–11	1.0E–11	9.0E–11	5.9E–11	–0.5	#NV	#NV	#NV	#NV
523.00	543.00	8.30E–09	8.68E–09	2	WBS2	5.1E–09	#NV	9.0E–10	#NV	5.1E–09	1.0E–09	9.0E–09	1.4E–10	–0.9	3.52	17.54	#NV	#NV
543.00	563.00	3.97E–09	4.15E–09	2	WBS22	2.24E–09	#NV	6.6E–09	2.0E–09	6.6E–09	1.0E–09	9.0E–09	8.6E–11	1.2	1.57	6.34	#NV	#NV
563.00	583.00	4.39E–09	4.59E–09	2	WBS2	3.3E–09	#NV	4.7E–09	#NV	4.7E–09	1.0E–09	9.0E–09	9.3E–11	1.2	#NV	#NV	#NV	#NV
583.00	603.00	2.03E–08	2.13E–08	2	WBS2	4.3E–08	#NV	6.9E–08	#NV	6.9E–08	1.0E–08	1.0E–07	5.1E–11	15.3	3.32	13.85	5074.5	12.49
603.00	623.00	9.48E–07	9.92E–07	2	WBS2	2.2E–06	#NV	2.4E–06	#NV	2.4E–06	7.0E–07	5.0E–06	3.5E–10	8.5	0.62	17.95	5241.9	12.44
623.00	643.00	1.64E–08	1.71E–08	2	WBS2	2.6E–08	#NV	7.1E–08	#NV	7.1E–08	1.0E–08	1.0E–07	7.4E–11	20.8	6.39	16.69	5413.0	12.78
643.00	663.00	2.12E–06	2.22E–06	2	WBS2	1.5E–06	#NV	7.4E–07	#NV	1.5E–06	7.0E–07	3.0E–06	4.4E–10	–3.1	0.83	17.71	5583.9	13.10
663.00	683.00	2.30E–06	2.40E–06	22	WBS22	1.3E–06	2.0E–06	7.3E–07	1.5E–06	1.3E–06	7.0E–07	3.0E–06	5.5E–09	–3.7	0.31	2.80	5747.7	12.68
683.00	703.00	2.95E–09	3.08E–09	2	WBS22	2.3E–09	#NV	4.6E–09	9.2E–09	4.6E–09	1.0E–09	9.0E–09	7.2E–11	4.7	3.07	6.86	5921.1	13.27
703.00	723.00	#NV	#NV	#NV	#NV	#NV	#NV	#NV	#NV	1.0E–11	1.0E–13	1.0E–11	#NV	#NV	#NV	#NV	#NV	#NV
723.00	743.00	2.2E–09	2.3E–09	2	WBS22	1.6E–09	#NV	2.2E–09	1.3E–09	2.2E–09	8.0E–10	5.0E–09	8.4E–11	1.2	6.32	16.62	#NV	#NV
743.00	763.00	1.1E–09	1.2E–09	22	WBS22	9.6E–10	4.8E–10	2.2E–09	1.1E–09	2.2E–09	8.0E–10	5.0E–09	1.5E–10	0.9	#NV	#NV	#NV	#NV
763.00	783.00	1.1E–08	1.1E–08	22	WBS22	1.0E–08	2.1E–09	1.8E–08	3.5E–09	2.1E–09	9.0E–10	9.0E–09	6.8E–10	–3.9	2.82	17.44	#NV	#NV
783.00	803.00	#NV	#NV	#NV	WBS2	#NV	#NV	2.8E–12	#NV	2.8E–12	9.0E–13	5.0E–12	4.8E–11	–1.4	#NV	#NV	#NV	#NV
803.00	823.00	#NV	#NV	#NV	#NV	#NV	#NV	#NV	#NV	1.0E–11	1.0E–13	1.0E–11	#NV	#NV	#NV	#NV	#NV	#NV

Nomenclature

Q/s	Specific capacity.
T_M	Transmissivity according to /Moye 1967/.
Flow regime	The flow regime description refers to the recommended model used in the transient analysis. WBS denotes wellbore storage and skin and is followed by a set of numbers describing the flow dimension used in the analysis (1 = linear flow, 2 = radial flow, 3 = spherical flow). If only one number is used (e.g. WBS2 or 2) a homogeneous flow model (1 composite zone) was used in the analysis, if two numbers are given (WBS22 or 22) a 2 zones composite model was used.
T_f	Transmissivity derived from the analysis of the perturbation phase (CHi). In case a homogeneous flow model was used only one T_f value is reported, in case a two zone composite flow model was used both T_{f1} (inner zone) and T_{f2} (outer zone) are given.
T_s	Transmissivity derived from the analysis of the recovery phase (CHir or Pi). In case a homogeneous flow model was used only one T_s value is reported, in case a two zone composite flow model was used both T_{s1} (inner zone) and T_{s2} (outer zone) are given.
T_T	Recommended transmissivity.
T_{TMIN}	Confidence range lower limit.
T_{TMAX}	Confidence range upper limit.
C	Wellbore storage coefficient.
ξ	Skin factor (calculated based on a Storativity of $1 \cdot 10^{-6}$).
dt_1	Estimated start time of evaluation.
dt_2	Estimated stop time of evaluation.
p*	The parameter p* denoted the static formation pressure (measured at transducer depth) and was derived from the HORNER plot of the CHir phase using straight line or type-curve extrapolation.
h_{wif}	Fresh-water head (based on transducer depth and p*).
#NV	Not analysed/no values.

Table 6-3. Results from the ri-index calculation of hydraulic tests in KLX08 (see Section 4.5.5 for details and nomenclature).

Borehole secup (m)	Borehole seclow (m)	Recommended transmissivity T_T (m²/s)	Time t_2 for radius of influence calculation (s)	ri-index (–)	Radius of Influence (m)
103.00	203.00	4.2E–04	1800	0	432.57
203.00	303.00	3.2E–04	139	1	112.37
305.00	405.00	1.7E–04	1800	0	348.09
403.00	503.00	2.5E–04	1800	0	382.61
503.00	603.00	4.1E–08	1800	0	43.13
603.00	703.00	1.5E–06	170	–1	32.52
703.00	803.00	4.5E–09	272	1	9.65
803.00	903.00	6.0E–08	1800	0	47.33
863.00	963.00	7.3E–10	1800	0	15.75
104.00	124.00	2.0E–04	1200	–1	294.28
125.00	145.00	7.3E–06	1200	–1	128.63
144.00	164.00	4.3E–04	364.2	1	196.08
164.00	184.00	4.2E–04	192	1	141.70
183.50	203.50	5.0E–04	1200	0	369.67
203.00	223.00	1.8E–04	1200	0	287.82
223.50	243.50	3.4E–05	1200	–1	188.40
243.50	263.50	5.8E–07	1200	0	68.38
264.00	284.00	3.8E–07	37.2	–1	10.79
284.00	304.00	6.6E–06	1200	–1	125.43
304.00	324.00	1.3E–07	1200	–1	28.46
324.00	344.00	2.7E–09	1200	–1	17.84
344.00	364.00	4.0E–08	1200	0	34.95
364.00	384.00	2.3E–05	1200	–1	171.37
385.00	405.00	2.4E–04	136.2	1	103.87
403.00	423.00	1.3E–04	1200	0	262.70
423.00	443.00	1.3E–06	1200	0	83.56
443.00	463.00	3.1E–06	1200	0	104.09
463.00	483.00	8.7E–06	1200	0	134.28
483.00	503.00	1.0E–06	1200	–1	78.25
503.00	523.00	4.9E–11	3659	0	11.43
523.00	543.00	5.1E–09	1200	0	20.93
543.00	563.00	6.6E–09	380.4	1	12.56
563.00	583.00	4.7E–09	1200	–1	20.49
583.00	603.00	6.9E–08	1200	0	40.03
603.00	623.00	2.4E–06	1200	0	97.50
623.00	643.00	7.1E–08	1200	0	40.41
643.00	663.00	1.5E–06	1200	0	87.03
663.00	683.00	1.3E–06	168	–1	31.32
683.00	703.00	4.6E–09	411.6	–1	11.94
703.00	723.00	1.0E–11	#NV	#NV	#NV
723.00	743.00	2.2E–09	997.2	1	15.45
743.00	763.00	2.2E–09	#NV	1	#NV
763.00	783.00	2.1E–09	1200	1	16.71
783.00	803.00	2.8E–12	3630	1	5.54
803.00	823.00	1.0E–11	#NV	#NV	#NV

The Figures 6-1 to 6-3 present the transmissivity, conductivity and hydraulic freshwater head profiles.

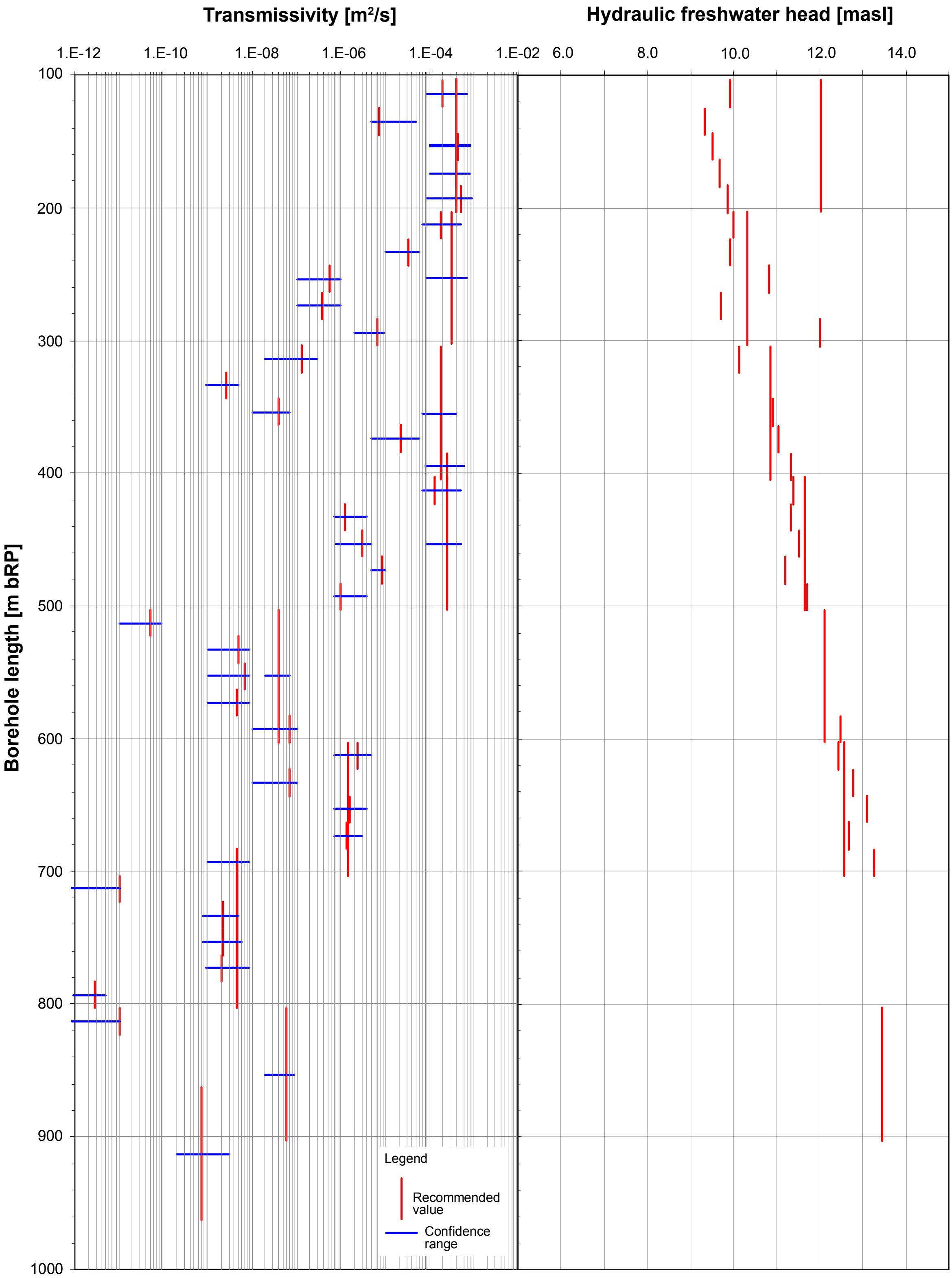


Figure 6-1. *Results summary – profiles of transmissivity and equivalent freshwater head, transmissivities derived from injection tests, freshwater head extrapolated.*

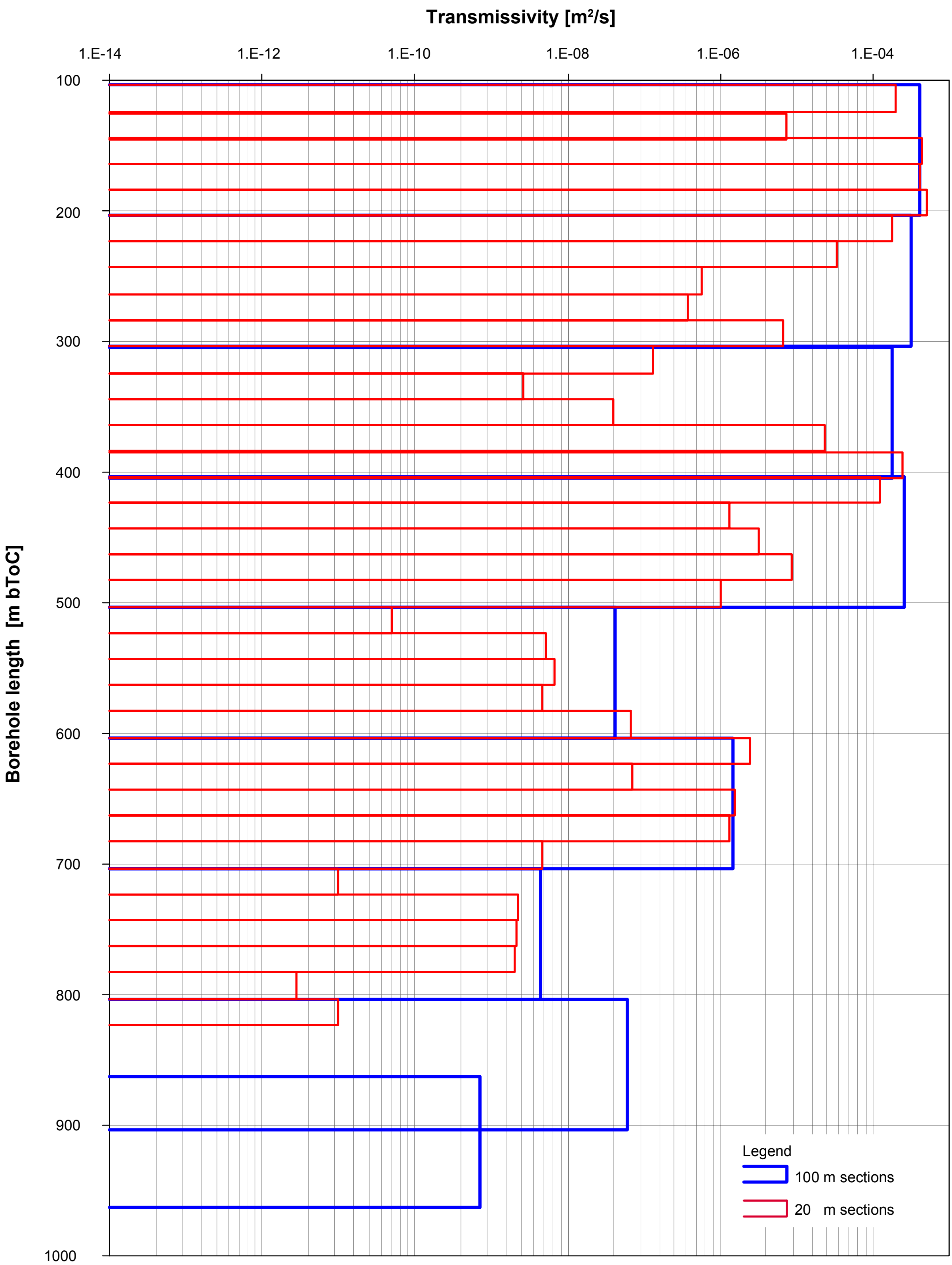


Figure 6-2. Results summary – profile of transmissivity.

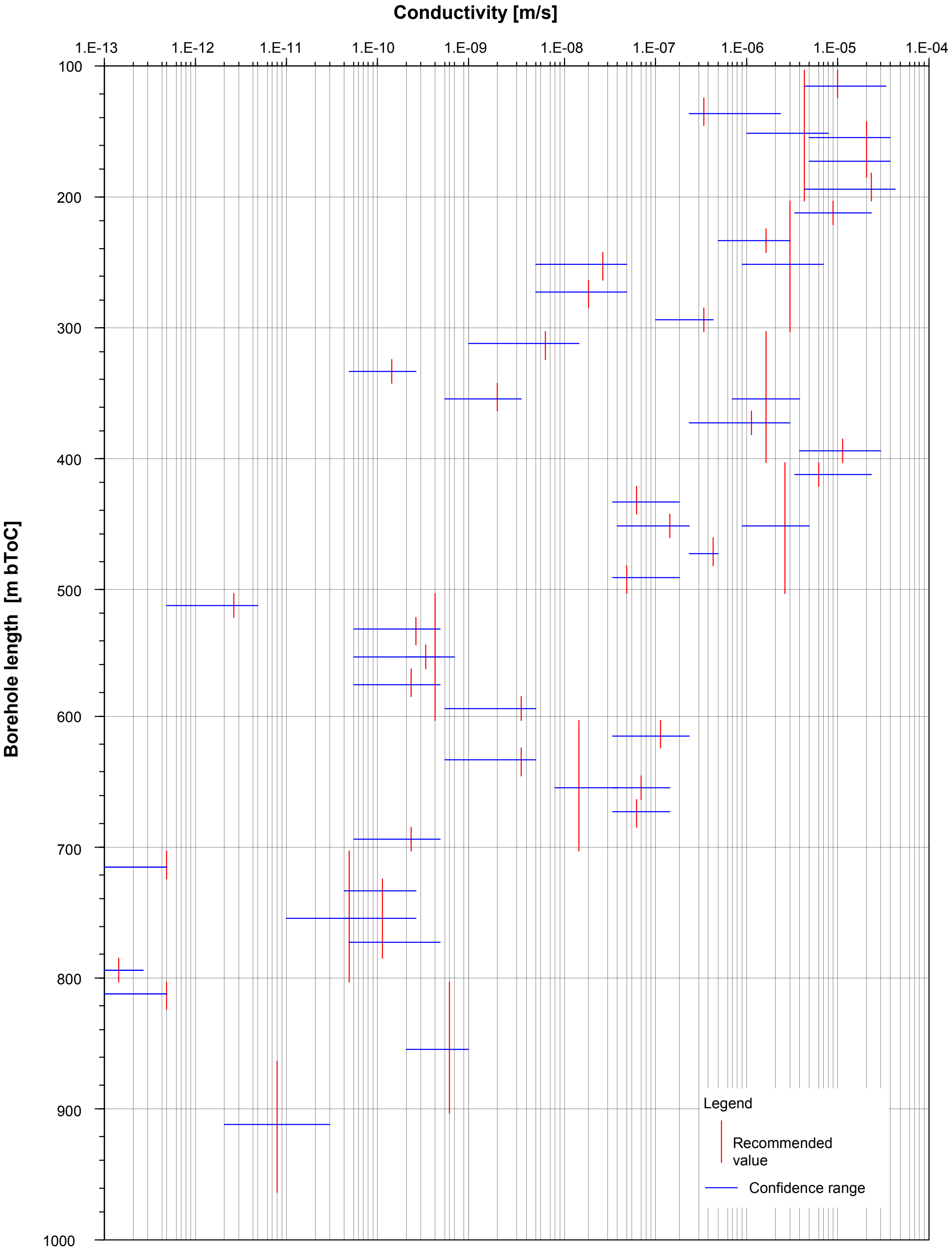


Figure 6-3. *Results summary – profile of hydraulic conductivity.*

6.2 Correlation analysis

A correlation analysis was used with the aim of examining the consistency of results and deriving general conclusion regarding the testing and analysis methods used.

6.2.1 Comparison of steady state and transient analysis results

The steady state derived transmissivities (T_M) and specific capacities (Q/s) were compared in a cross-plot with the recommended transmissivity values derived from the transient analysis (see Figure 6-4).

The correlation analysis shows that the transmissivities derived from the steady state analysis differ by less than one order of magnitude from the transmissivities derived from the transient analysis.

6.2.2 Comparison between the matched and theoretical wellbore storage coefficient

The wellbore storage coefficient describes the capacity of the test interval to store fluid as result to an unit pressure change in the interval. For a closed system (i.e. closed downhole valve) the theoretical value of the wellbore storage coefficient is given by the product between the interval volume and the test zone compressibility. The interval volume is calculated from the borehole radius and interval length. There are uncertainties concerning the interval volume calculation. Cavities or high transmissivity fractures intersecting the interval may enlarge the effective volume of the interval.

The test zone compressibility is given by the sum of compressibilities of the individual components present in the interval (water, packer elements, other test tool components, and the borehole wall). The water compressibility depends on the temperature and salinity. However, for temperature and salinity values as encountered at the Oskarshamn site the water compressibility varies only slightly between $4.5 \cdot 10^{-10}$ and $5.0 \cdot 10^{-10}$ 1/Pa.

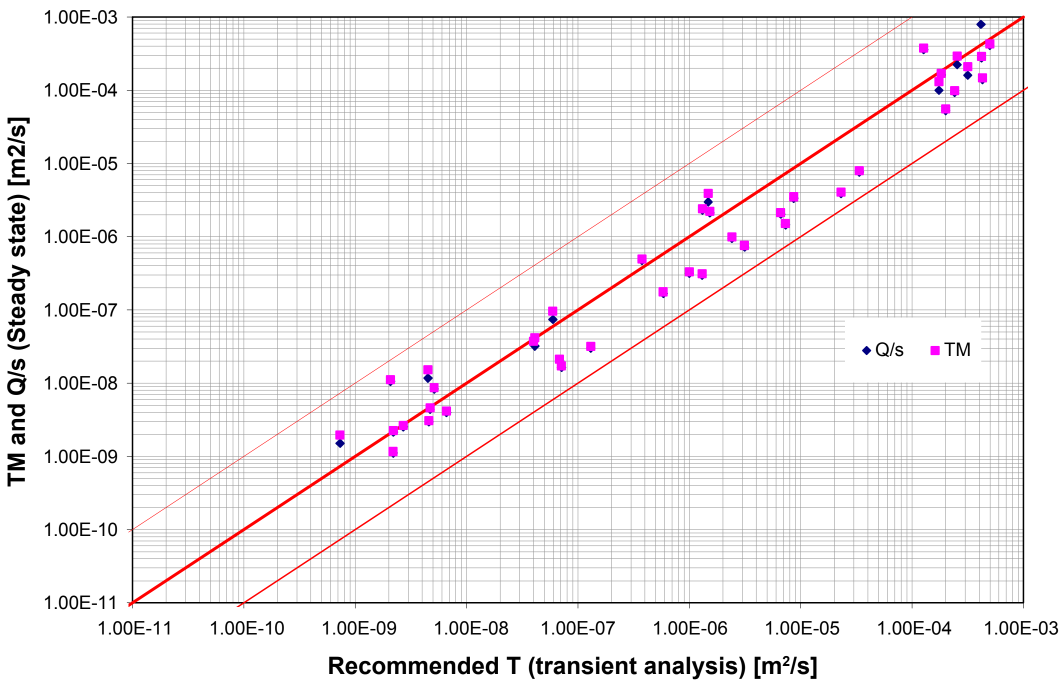


Figure 6-4. Correlation analysis of transmissivities derived by steady state and transient methods.

A water compressibility of $5 \cdot 10^{-10}$ 1/Pa and a rock compressibility of $1 \cdot 10^{-10}$ 1/Pa was assumed for the analysis. In addition, the test zone compressibility is influenced by the test tool (packer compliance). The test tool compressibility was calculated as follow:

$$c = \frac{\Delta V}{\Delta p} * \frac{1}{V} \quad \text{(1/Pa)}$$

ΔV Volume change of 2 Packers (The volume change was estimated at $7 \cdot 10^{-7}$ m³/100 kPa based on the results of laboratory tests conducted by GEOSIGMA) (m³).

Δp Pressure change in test section (usually $2 \cdot 10^{5}$ Pa) (Pa).

V Volume in test section (m³).

The following table presents the calculated compressibilities for each relevant section length. The average value for the test tool compressibility based on different section length is $5 \cdot 10^{-11}$ 1/Pa.

Table 6-4. Test tool compressibility values based on packer displacement.

Length of test section (m)	Volume in test section (m³)	Compressibility (1/Pa)
20	0.091	$8 \cdot 10^{-11}$
100	0.454	$2 \cdot 10^{-11}$
Average compressibility:		$5 \cdot 10^{-11}$

The sum of the compressibilities (water, rock, test tool) leads to a test zone compressibility with a value of $7 \cdot 10^{-10}$ 1/Pa. This value is used for the calculation of the theoretical wellbore storage coefficient.

The matched wellbore storage coefficient is derived from the transient type curve analysis by matching the unit slope early times derivative plotted in log-log coordinates.

The following figure presents a cross-plot of the matched and theoretical wellbore storage coefficients.

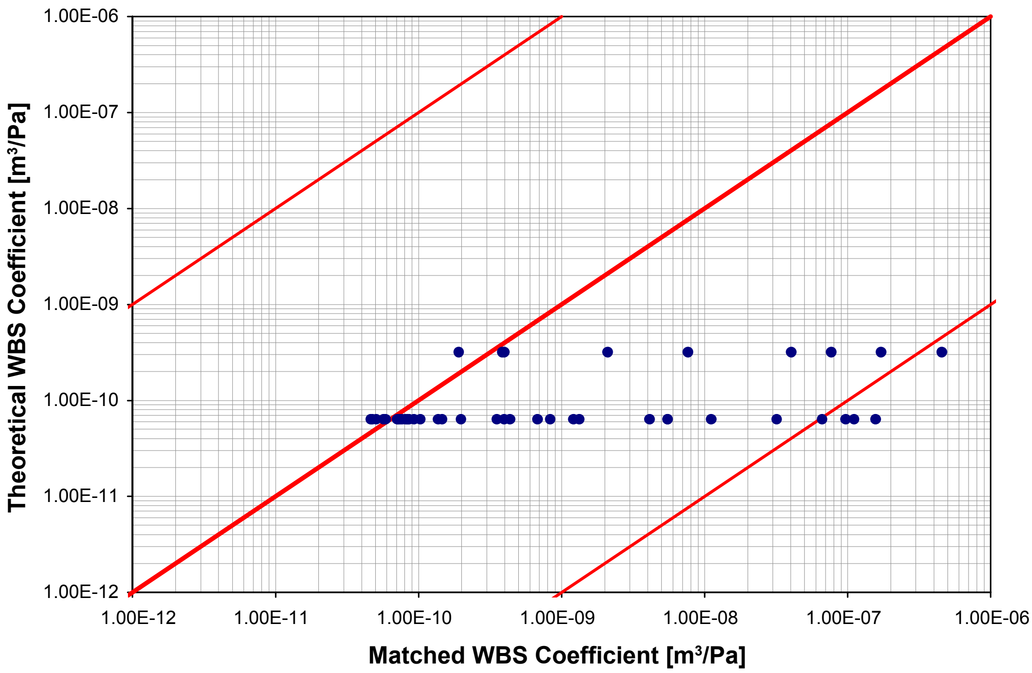


Figure 6-5. Correlation analysis of theoretical and matched wellbore storage coefficients.

It can be seen that the matched wellbore storage coefficients differ up to three orders of magnitude from the theoretical. This phenomenon was already observed at the previous boreholes. A two or three orders of magnitude increase is difficult to explain by volume uncertainty. Even if large fractures are connected to the interval, a volume increase by two orders of magnitude does not seem probable. This discrepancy is not fully understood, but following hypotheses may be formulated:

- increased compressibility of the packer system,
- as shown by previous work conducted at site, the phenomenon of increased wellbore storage coefficients can be explained by turbulent flow induced by the test in the vicinity of the borehole. Considering the fact that deviations concerning the wellbore storage rather occur in test sections with a higher transmissivity (which can lead to turbulent flow) seems to rest upon this hypothesis.

7 Conclusions

7.1 Transmissivity

Figure 6-1 presents a profile of transmissivity, including the confidence ranges derived from the transient analysis. The method used for deriving the recommended transmissivity and its confidence range is described in Section 4.5.9.

Whenever possible, the transmissivities derived are representative for the "undisturbed formation" further away from the borehole. The borehole vicinity was typically described by using a skin effect.

In few cases the tests were not analysable because the compliance phase following the packer inflation was to long or because the conducted preliminary pulse did not recover. Both responses are indicative for a very low interval transmissivity and a transmissivity value of $1\cdot10^{-11}$ m^2/s was recommended (regarded as the upper limit of the confidence range).

If the conducted preliminary pulse injection (PI) showed a slow recovery the pulse test was prolonged and no further injection test was performed. The pulse test was used for a quantitative analysis. In two cases the preliminary pulse was prolonged and the recommended transmissivities is $4.9\cdot10^{-11}$ m^2/s and $2.8\cdot10^{-12}$ m^2/s, respectively.

The recommended transmissivities derived from the conducted injection tests (CHi and CHir) range between $2.1\cdot10^{-09}$ m^2/s and $5.0\cdot10^{-04}$ m^2/s.

A few 20 m sections show larger transmissivities than the appropriate longer interval. The most of the differences are relatively small and are covered by the confidence range. Additionally, this can be explained by crossflow and connections to the adjacent zones.

7.2 Equivalent freshwater head

Figure 6-1 presents a profile of the derived equivalent freshwater head expressed in meters above sea level. The method used for deriving the equivalent freshwater head is described in Section 4.5.8.

The head profile shows that the freshwater head ranges from 9.3 m to 13.4 m and an increase with increasing depth. This can be explained by higher salinity of the water.

The uncertainty related to the derived freshwater heads is dependent on the test section transmissivity. Due to the relatively short pressure recovery phase, the static pressure extrapolation becomes increasingly uncertain at lower transmissivities.

7.3 Flow regimes encountered

The flow models used in analysis were derived from the shape of the pressure derivative calculated with respect to log time and plotted in log-log coordinates.

In several cases the pressure derivative suggests a change of transmissivity with the distance from the borehole. In such cases a composite flow model was used in the analysis.

If there were different flow models matching the data in comparable quality, the simplest model was preferred.

In some cases very large skins has been observed. This is unusual and should be further examined. There are several possible explanations to this behaviour:

- If the behaviour is to be completely attributed to changes of transmissivity in the formation, this indicates the presence of larger transmissivity zones in the borehole vicinity, which could be caused by steep fractures that do not intersect the test interval, but are connected to the interval by lower transmissivity fractures. The fact that in many cases the test derivatives of adjacent test sections converge at late times seems to support this hypothesis.
- A further possibility is that the large skins are caused by turbulent flow taking place in the tool or in fractures connected to the test interval. This hypothesis is more difficult to examine. However, considering the fact that some high skins were observed in sections with transmissivities as low as $1 \cdot 10^{-8}$ m^2/s (which imply low flow rates) seems to speak against this hypothesis.

The flow dimension displayed by the test can be diagnosed from the slope of the pressure derivative. A slope of 0.5 indicates linear flow, a slope of 0 (horizontal derivative) indicates radial flow and a slope of –0.5 indicates spherical flow. The flow dimension diagnosis was commented for each of the tests. In all of the cases it was possible to get a good match quality by using radial flow geometry. In no cases an alternative analysis with a flow dimension unequal to two was performed. Those analyses are presented in Appendix 2.

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APPENDIX 1

File Description Table

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX08				
TEST- AND FILEPROTOCOL					**Testorder dated : 2006-09-27**				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
2006-09-28	07:55	103.00	203.00	___KLX08_0103.00_200609280755.ht2	KLX08_103.00-203.00_060928_1_CHir_Q_r.csv	Chir	2006-10-12	2006-09-28	
2006-09-28	11:37	203.00	303.00	___KLX08_0203.00_200609281137.ht2	KLX08_203.00-303.00_060928_1_CHir_Q_r.csv	Chir	2006-10-12	2006-09-28	
2006-09-28	15:27	305.00	405.00	___KLX08_0305.00_200609281527.ht2	KLX08_305.00-405.00_060928_1_CHir_Q_r.csv	Chir	2006-10-12	2006-09-28	
2006-09-28	19:13	403.00	503.00	___KLX08_0403.00_200609281913.ht2	KLX08_403.00-503.00_060928_1_CHir_Q_r.csv	Chir	2006-10-12	2006-09-28	
2006-09-28	23:13	503.00	603.00	___KLX08_0503.00_200609282313.ht2	KLX08_503.00-603.00_060928_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-06	
2006-10-06	09:32	503.00	603.00	___KLX08_0503.00_200610060932.ht2	KLX08_503.00-603.00_061006_2_CHir_Q_r.csv	Chir	2006-10-12	2006-10-06	
2006-10-06	14:05	603.00	703.00	___KLX08_0603.00_200610061405.ht2	KLX08_603.00-703.00_061006_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-06	
2006-10-06	17:48	703.00	803.00	___KLX08_0703.00_200610061748.ht2	KLX08_703.00-803.00_061006_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-06	
2006-10-06	22:17	803.00	903.00	___KLX08_0803.00_200610062217.ht2	KLX08_803.00-903.00_061006_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-07	
2006-10-07	06:04	863.00	963.00	___KLX08_0863.00_200610070604.ht2	KLX08_863.00-963.00_061007_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-07	
2006-10-08	07:04	104.00	124.00	___KLX08_0104.00_200610080704.ht2	KLX08_104.00-124.00_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	09:13	125.00	145.00	___KLX08_0125.00_200610080913.ht2	KLX08_125.00-145.00_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	11:12	144.00	164.00	___KLX08_0144.00_200610081112.ht2	KLX08_144.00-164.00_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	13:19	164.00	184.00	___KLX08_0164.00_200610081319.ht2	KLX08_164.00-184.00_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	15:14	183.50	203.50	___KLX08_0183.50_200610081514.ht2	KLX08_183.50-203.50_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX08				
TEST- AND FILEPROTOCOL					**Testorder dated : 2006-09-27**				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
2006-10-08	17:07	203.00	223.00	___KLX08_0203.00_200610081707.ht2	KLX08_203.00-223.00_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	19:00	223.50	243.50	___KLX08_0223.50_200610081900.ht2	KLX08_223.50-243.50_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	21:09	243.50	263.50	___KLX08_0243.50_200610082109.ht2	KLX08_243.50-263.50_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-08	
2006-10-08	23:10	264.00	284.00	___KLX08_0264.00_200610082310.ht2	KLX08_264.00-284.00_061008_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	01:07	284.00	304.00	___KLX08_0284.00_200610090107.ht2	KLX08_284.00-304.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	06:17	304.00	324.00	___KLX08_0304.00_200610090617.ht2	KLX08_304.00-324.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	08:23	324.00	344.00	___KLX08_0324.00_200610090823.ht2	KLX08_324.00-344.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	10:41	344.00	364.00	___KLX08_0344.00_200610091041.ht2	KLX08_344.00-364.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	12:57	364.00	384.00	___KLX08_0364.00_200610091257.ht2	KLX08_364.00-384.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	15:01	385.00	405.00	___KLX08_0385.00_200610091501.ht2	KLX08_385.00-405.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	16:55	403.00	423.00	___KLX08_0403.00_200610091655.ht2	KLX08_403.00-423.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	18:50	423.00	443.00	___KLX08_0423.00_200610091850.ht2	KLX08_423.00-443.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	21:00	443.00	463.00	___KLX08_0443.00_200610092100.ht2	KLX08_443.00-463.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-09	
2006-10-09	22:55	463.00	483.00	___KLX08_0463.00_200610092255.ht2	KLX08_463.00-483.00_061009_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-09	23:36	463.00	483.00	___KLX08_0463.00_200610092336.ht2	KLX08_463.00-483.00_061009_2_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	01:14	483.00	503.00	___KLX08_0483.00_200610100114.ht2	KLX08_483.00-503.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX08				
TEST- AND FILEPROTOCOL					**Testorder dated : 2006-09-27**				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
2006-10-10	06:13	503.00	523.00	___KLX08_0503.00_200610100613.ht2	KLX08_503.00-523.00_061010_1_Pi_Q_r.csv	Pi	2006-10-12	2006-10-10	
2006-10-10	08:37	523.00	543.00	___KLX08_0523.00_200610100837.ht2	KLX08_523.00-543.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	10:59	543.00	563.00	___KLX08_0543.00_200610101059.ht2	KLX08_543.00-563.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	13:25	563.00	583.00	___KLX08_0563.00_200610101325.ht2	KLX08_563.00-583.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	15:33	583.00	603.00	___KLX08_0583.00_200610101533.ht2	KLX08_583.00-603.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	17:32	603.00	623.00	___KLX08_0603.00_200610101732.ht2	KLX08_603.00-623.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	19:25	623.00	643.00	___KLX08_0623.00_200610101925.ht2	KLX08_623.00-643.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	21:30	643.00	663.00	___KLX08_0643.00_200610102130.ht2	KLX08_643.00-663.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-10	
2006-10-10	23:25	663.00	683.00	___KLX08_0663.00_200610102325.ht2	KLX08_663.00-683.00_061010_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	
2006-10-11	01:25	683.00	703.00	___KLX08_0683.00_200610110125.ht2	KLX08_683.00-703.00_061011_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	
2006-10-11	05:22	703.00	723.00	___KLX08_0703.00_200610110522.ht2	KLX08_703.00-723.00_061011_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	
2006-10-11	06:43	723.00	743.00	___KLX08_0723.00_200610110643.ht2	KLX08_723.00-743.00_061011_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	
2006-10-11	09:27	743.00	763.00	___KLX08_0743.00_200610110927.ht2	KLX08_743.00-763.00_061011_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	
2006-10-11	12:33	763.00	783.00	___KLX08_0763.00_200610111233.ht2	KLX08_763.00-783.00_061011_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	
2006-10-11	15:28	783.00	803.00	___KLX08_0783.00_200610111528.ht2	KLX08_783.00-803.00_061011_1_Pi_Q_r.csv	Pi	2006-10-12	2006-10-11	

HYDROTESTING WITH PSS					DRILLHOLE IDENTIFICATION NO.: KLX08				
TEST- AND FILEPROTOCOL					**Testorder dated : 2006-09-27**				
Teststart		Interval boundaries		Name of Datafiles		Testtype	Copied to	Plotted	Sign.
Date	Time	Upper	Lower	(*.HT2-file)	(*.CSV-file)		disk/CD	(date)	
2006-10-11	17:57	803.00	823.00	___KLX08_0803.00_200610111747.ht2	KLX08_803.00-823.00_061011_1_CHir_Q_r.csv	Chir	2006-10-12	2006-10-11	

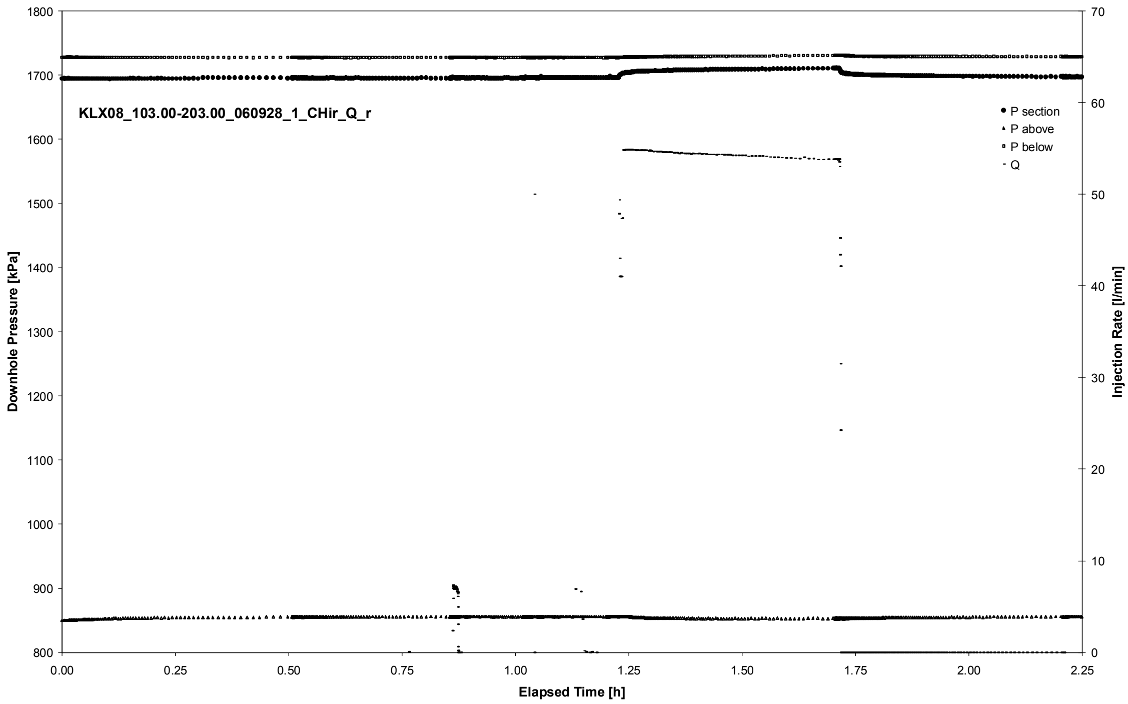
APPENDIX 2

Analysis diagrams

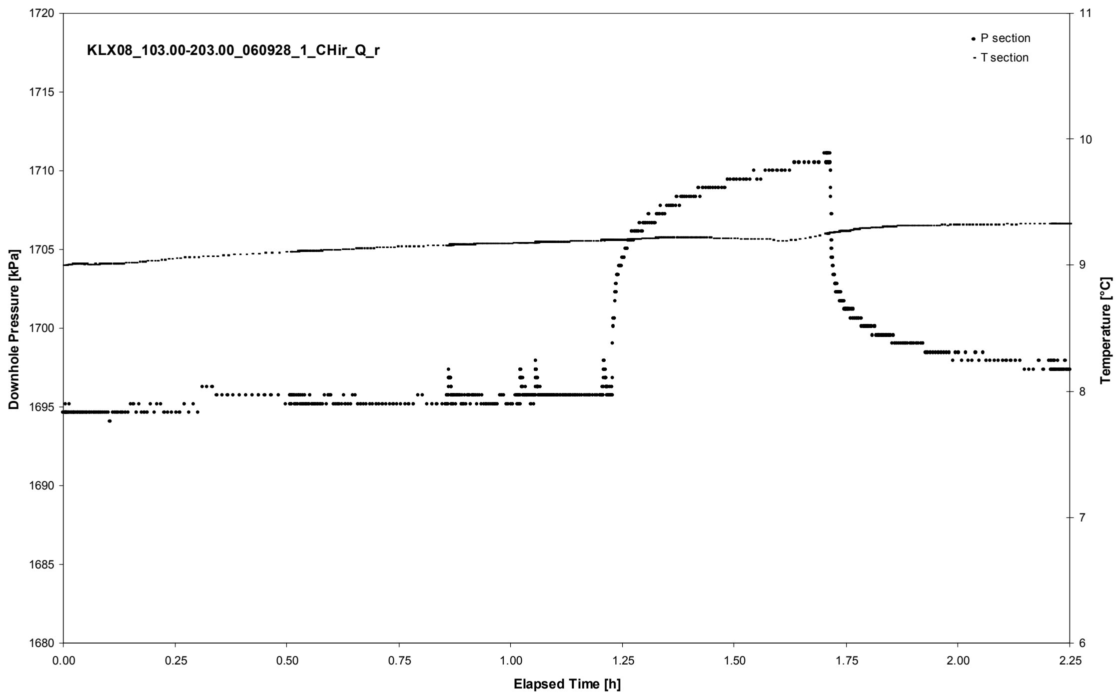
APPENDIX 2-1

Test 103.00 – 203.00 m

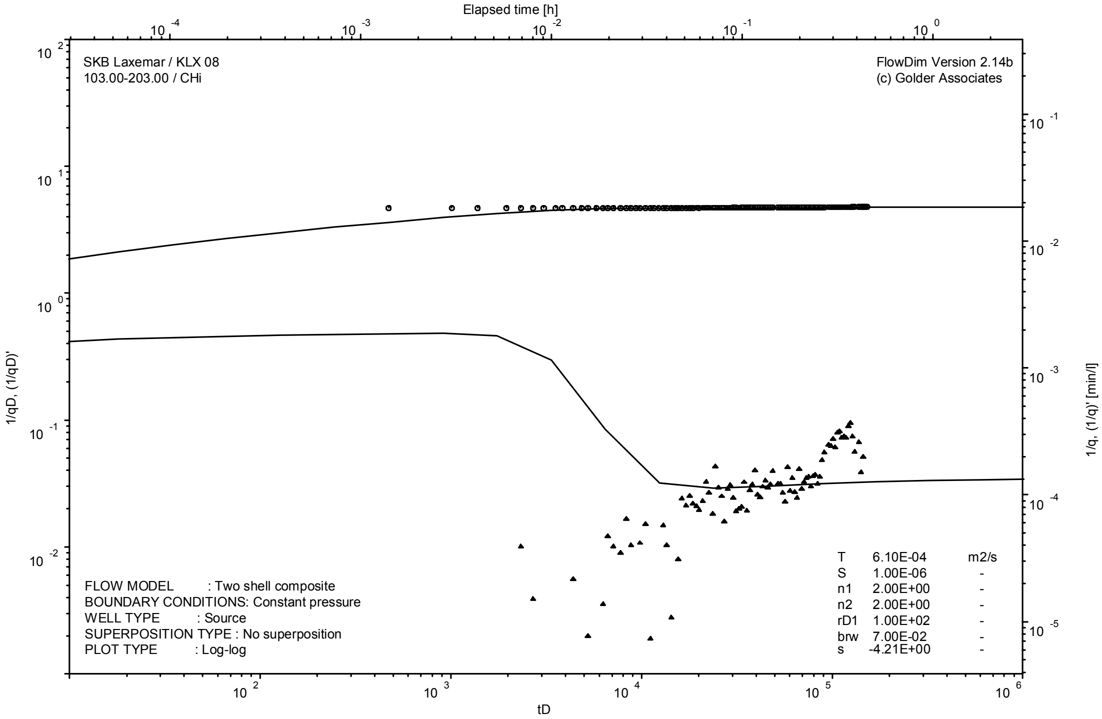
Analysis diagrams



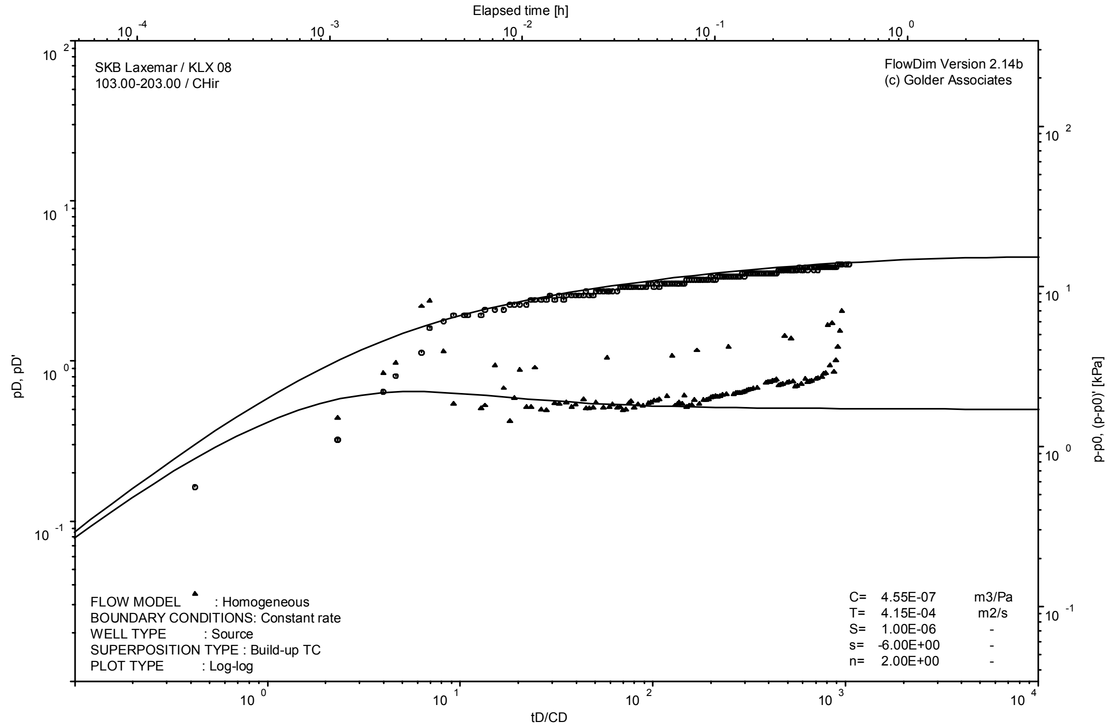
Pressure and flow rate vs. time; cartesian plot



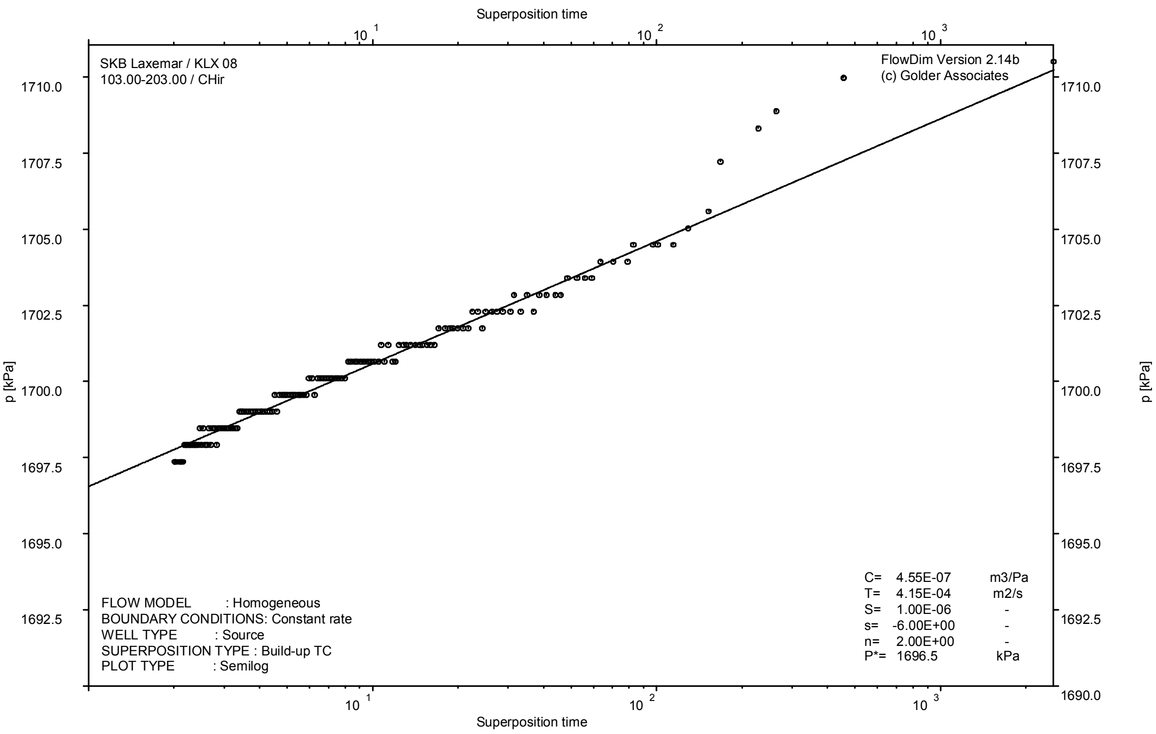
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

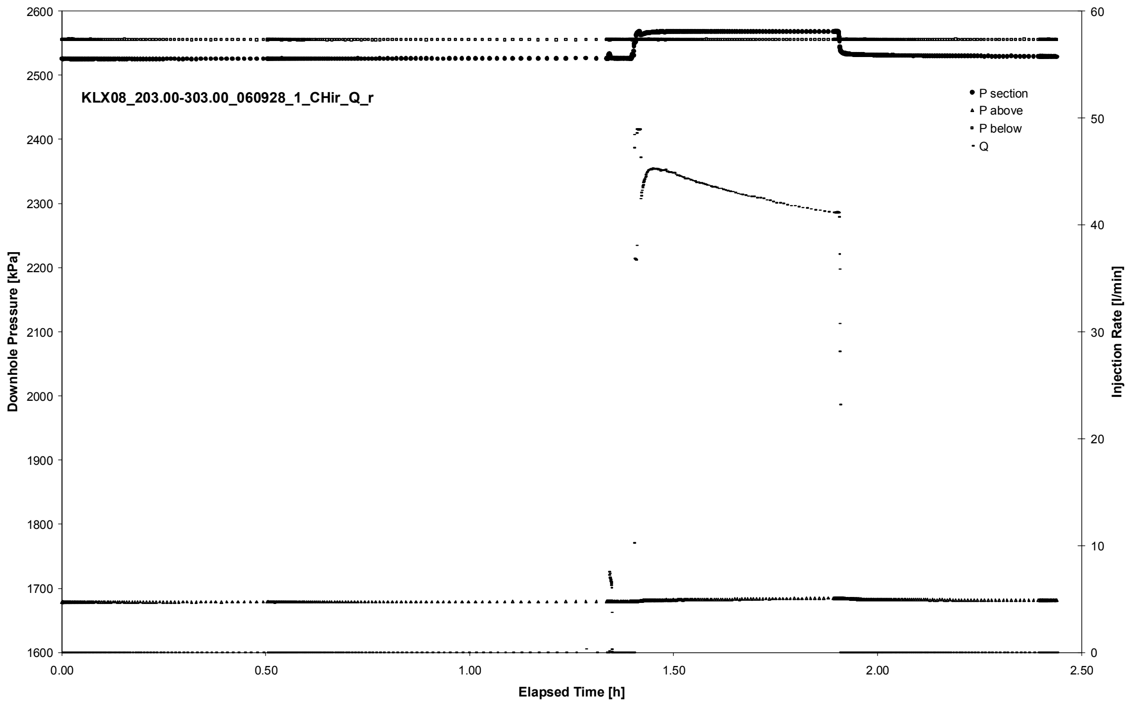


CHIR phase; HORNER match

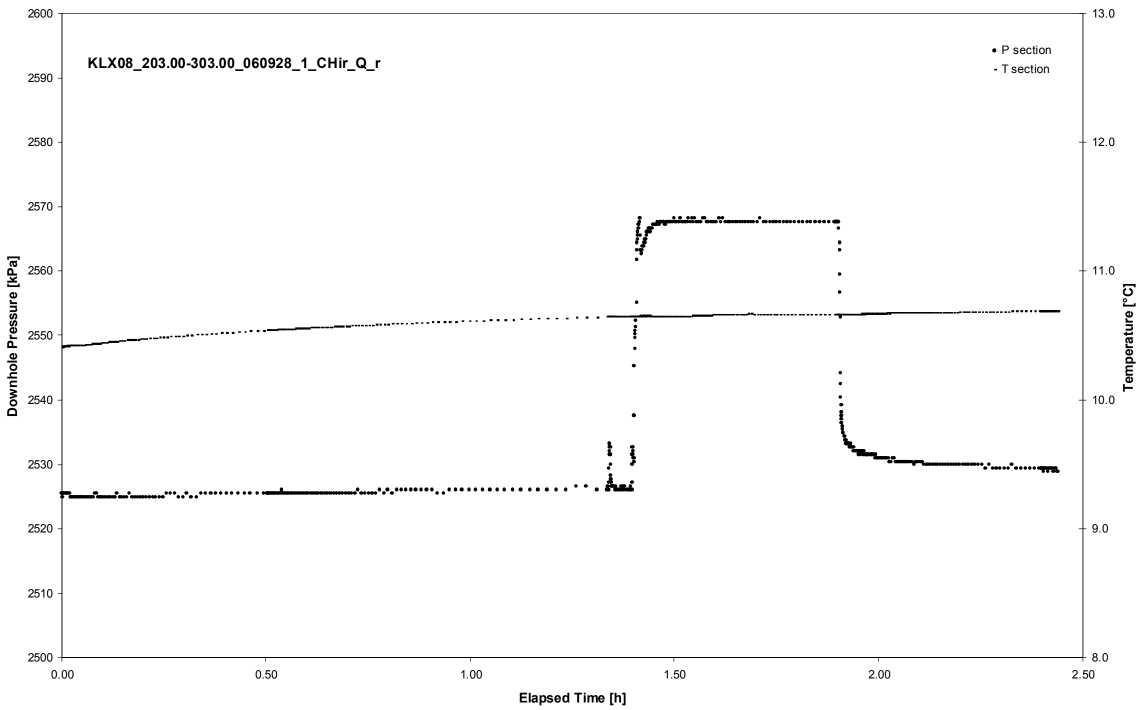
APPENDIX 2-2

Test 203.00 – 303.00 m

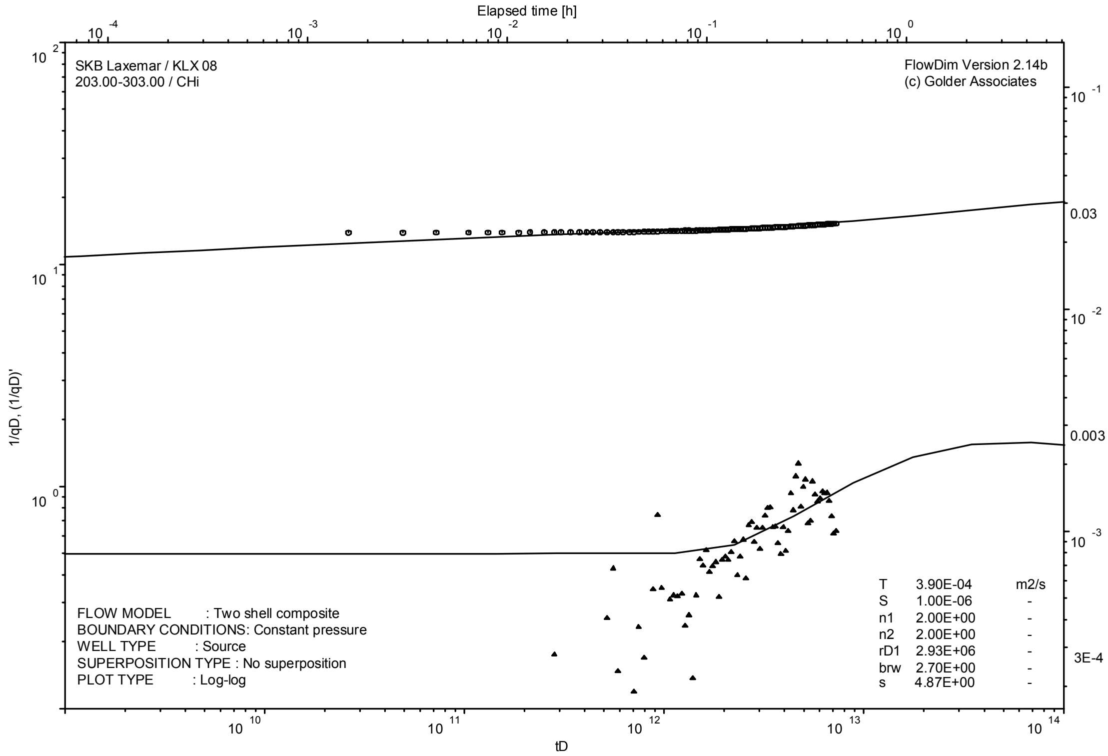
Analysis diagrams



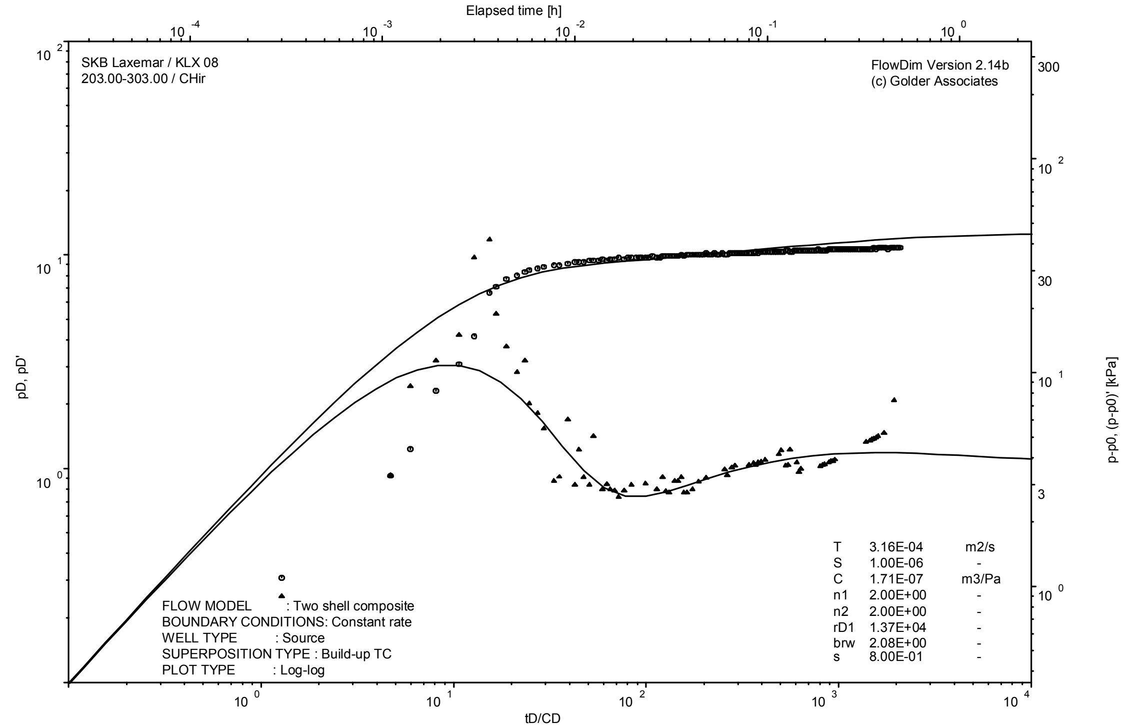
Pressure and flow rate vs. time; cartesian plot



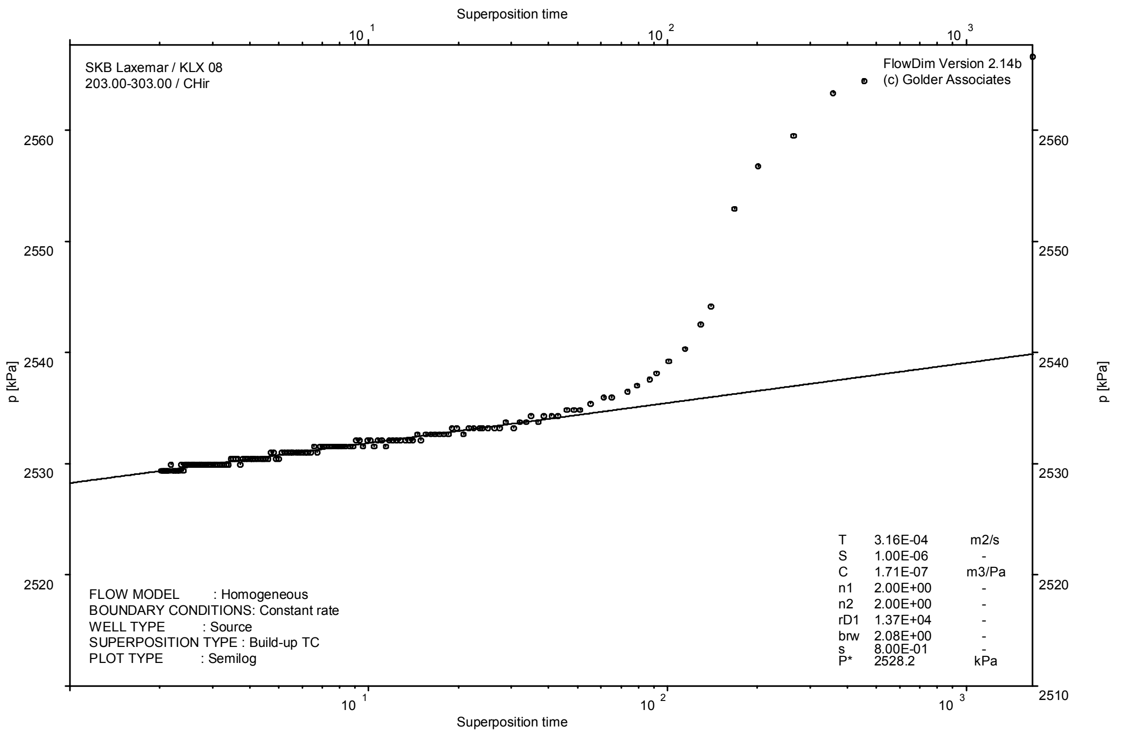
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

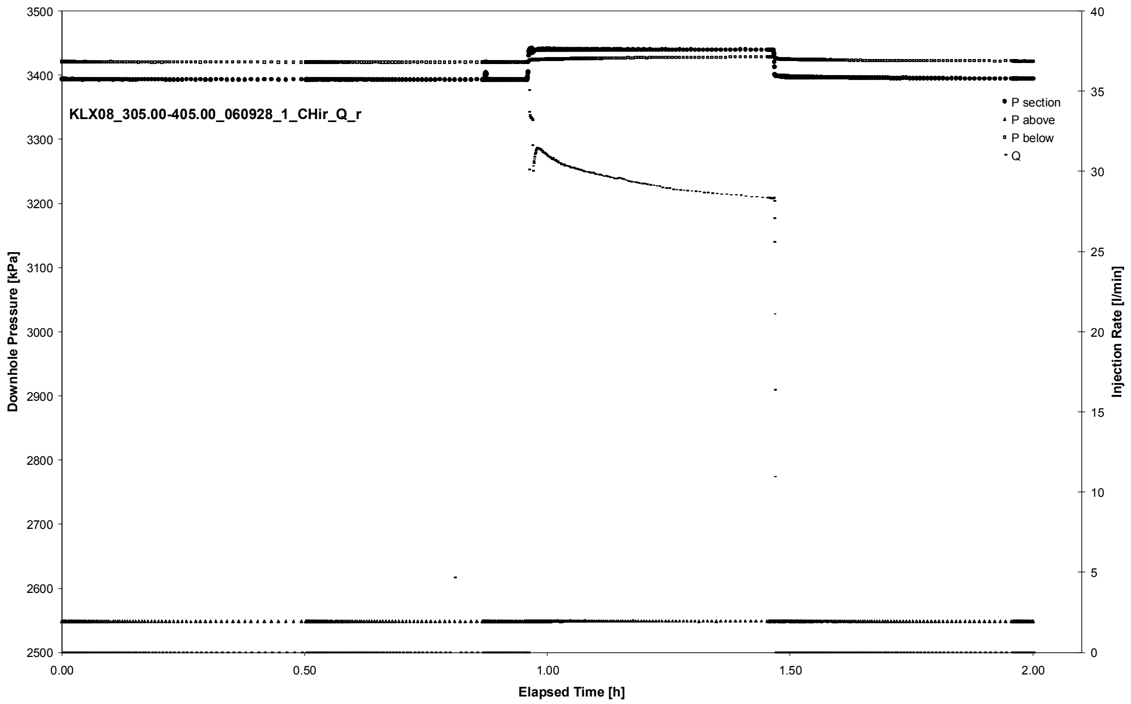


CHIR phase; HORNER match

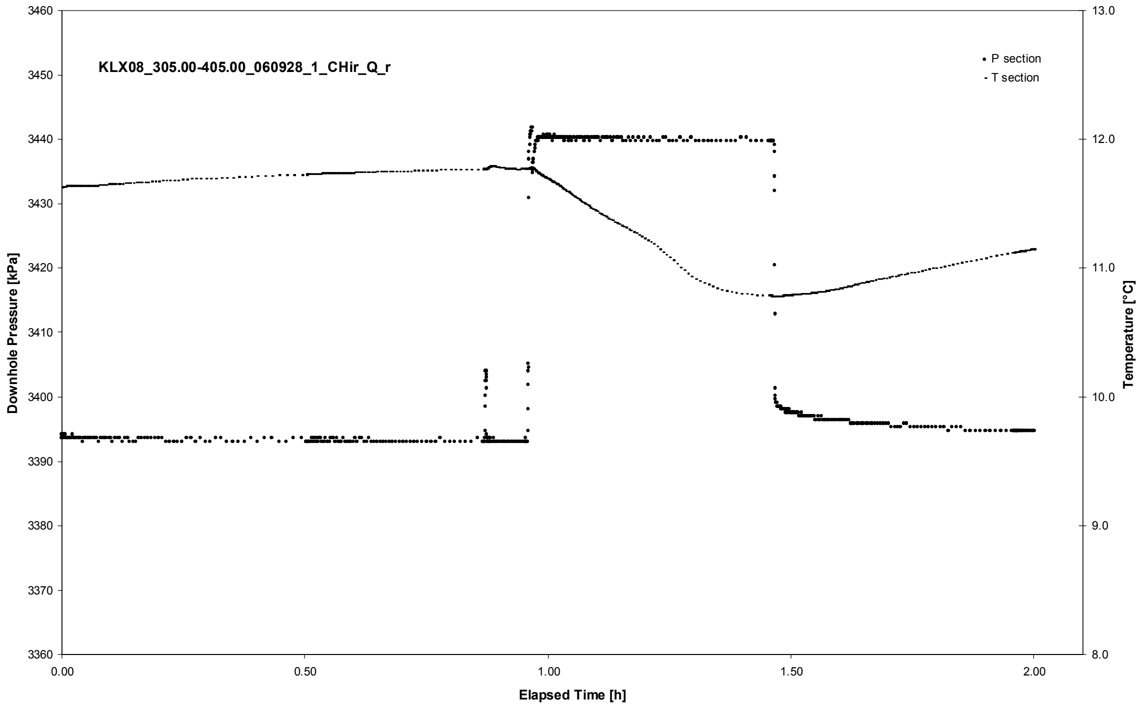
APPENDIX 2-3

Test 305.00 – 405.00 m

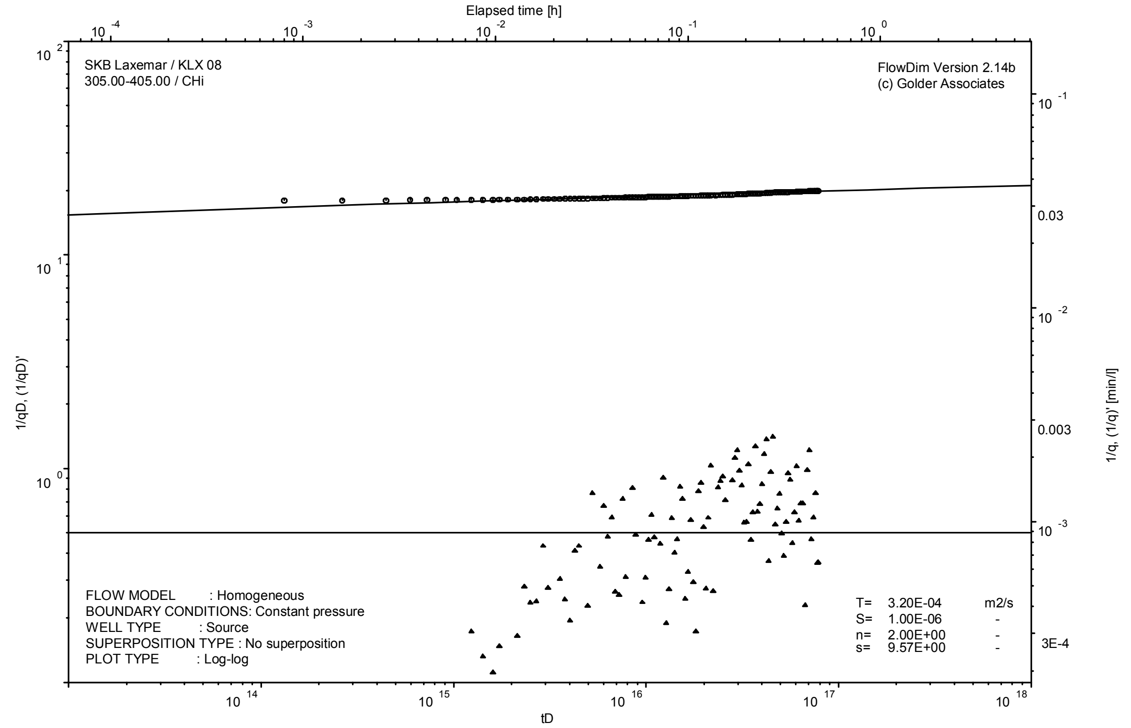
Analysis diagrams



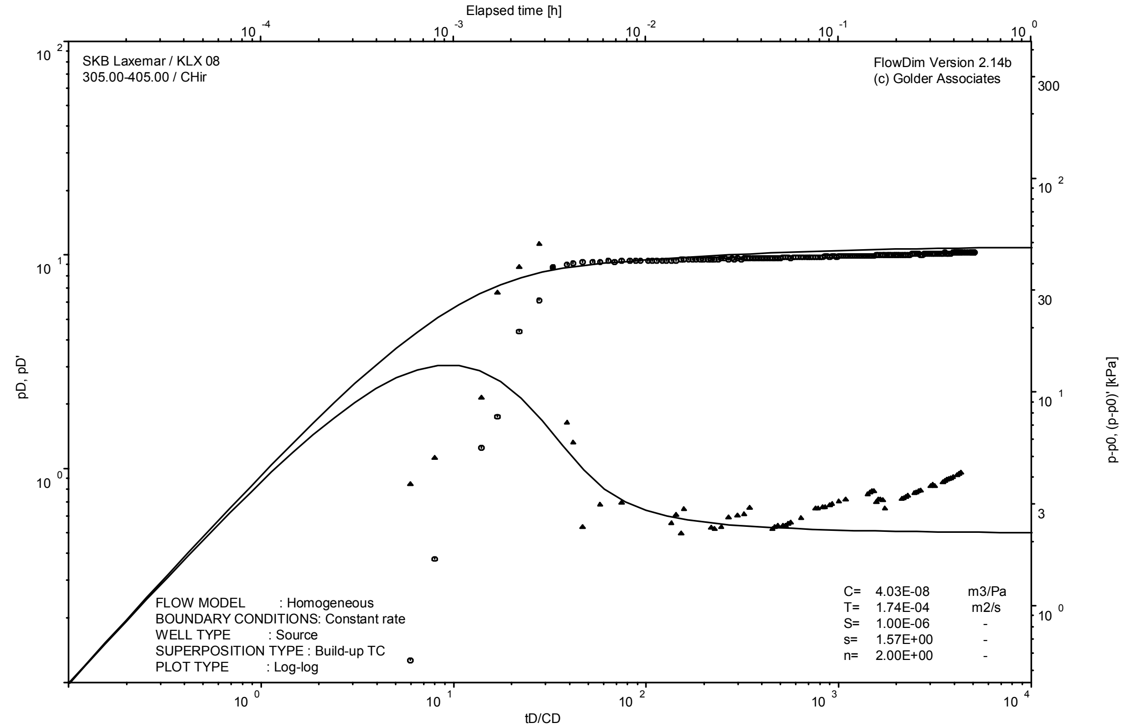
Pressure and flow rate vs. time; cartesian plot



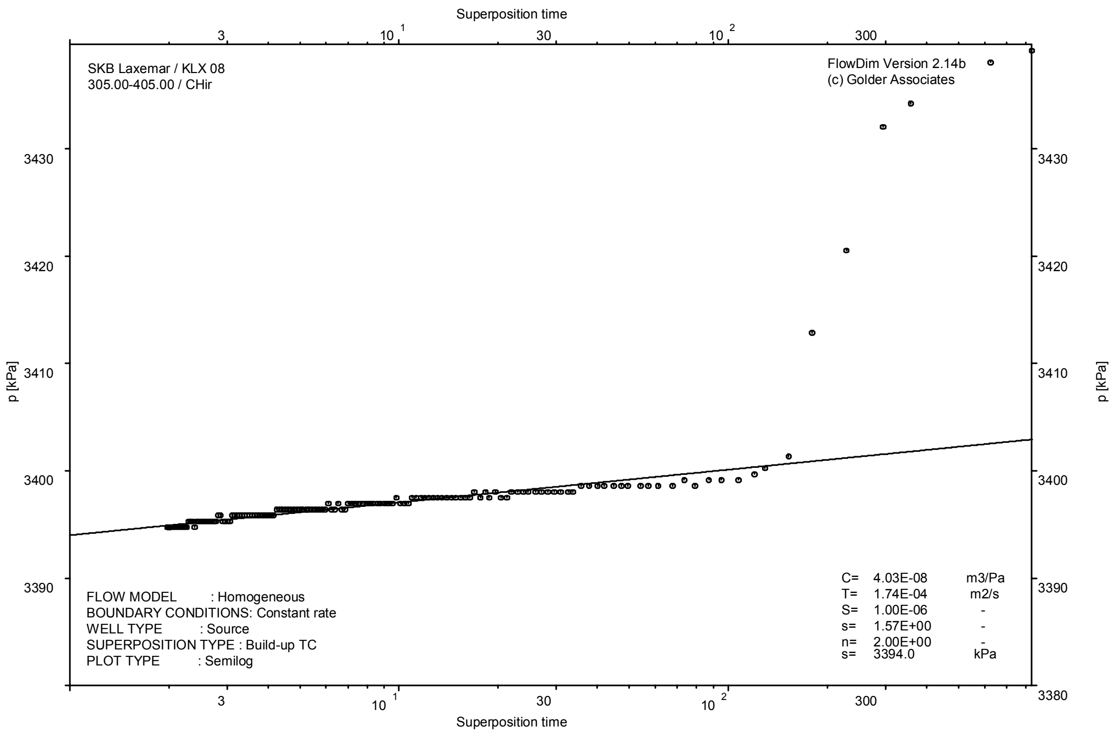
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

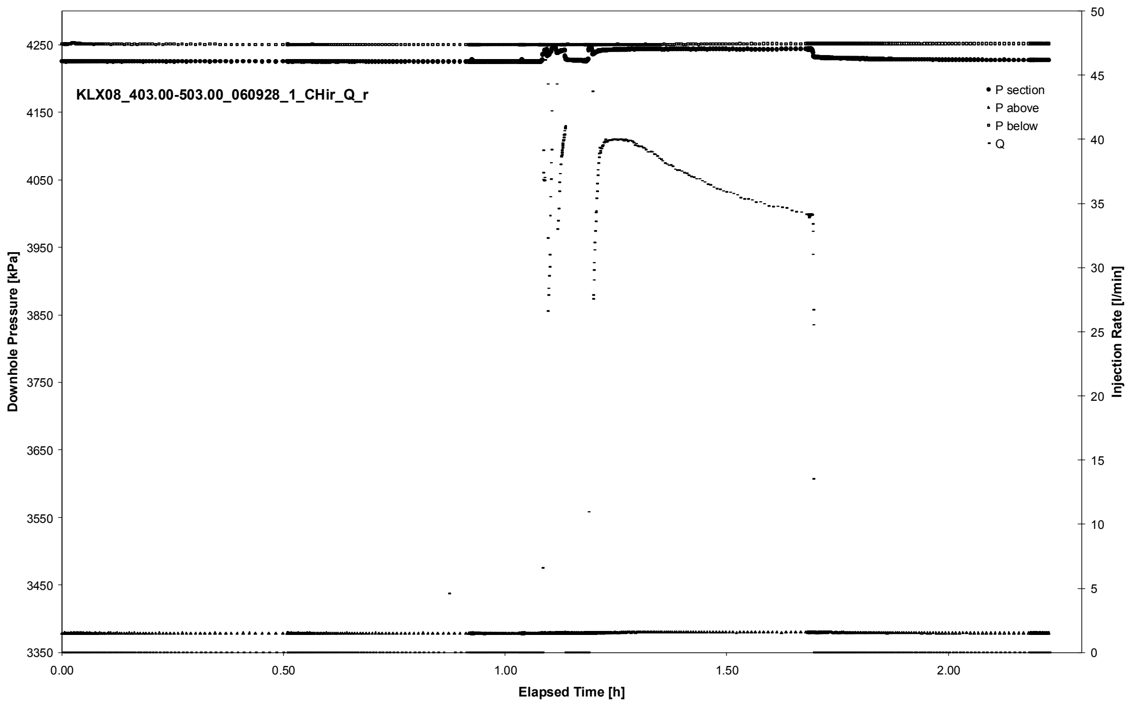


CHIR phase; HORNER match

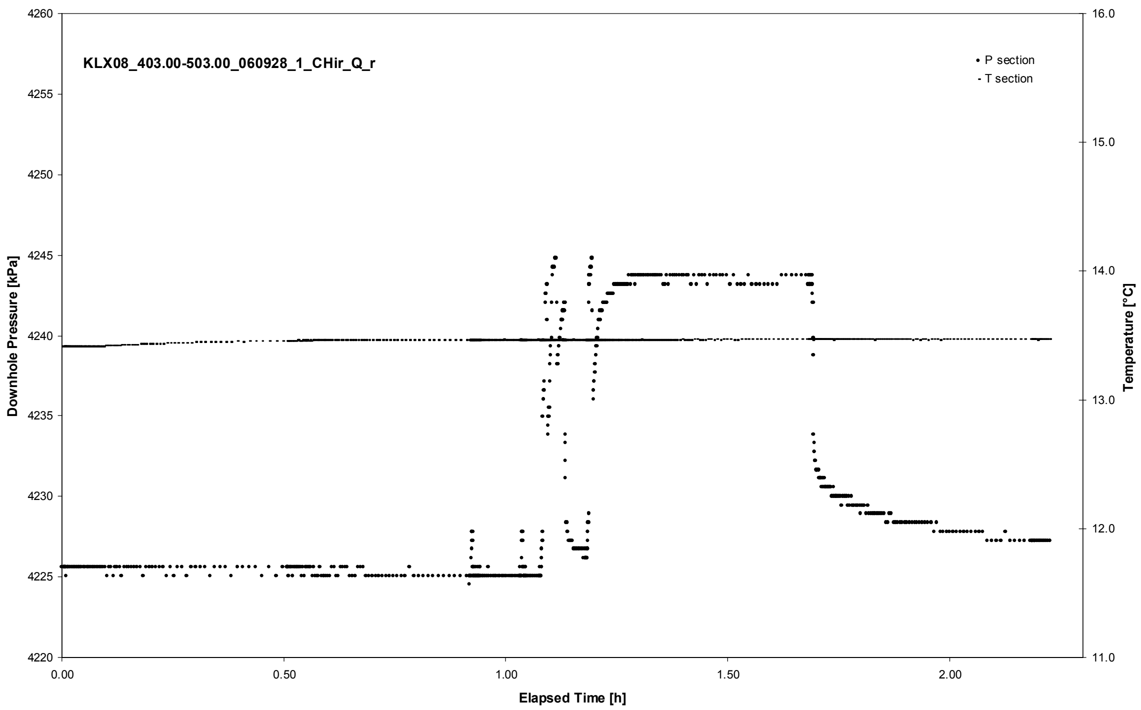
APPENDIX 2-4

Test 403.00 – 503.00 m

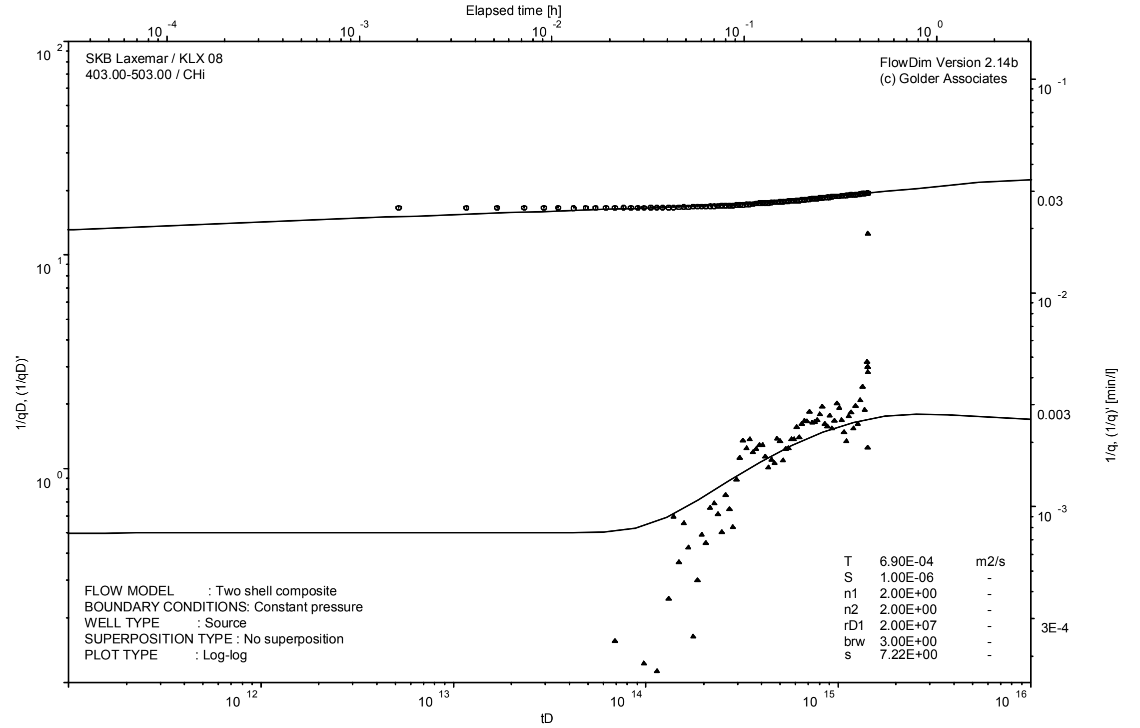
Analysis diagrams



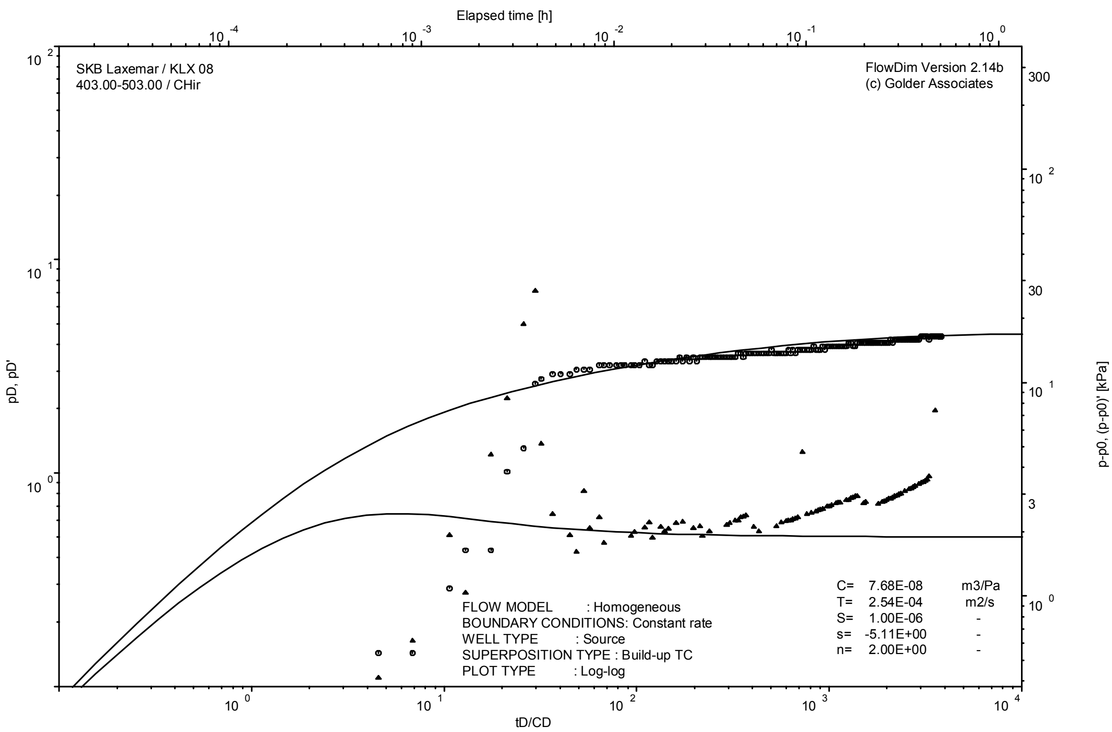
Pressure and flow rate vs. time; cartesian plot



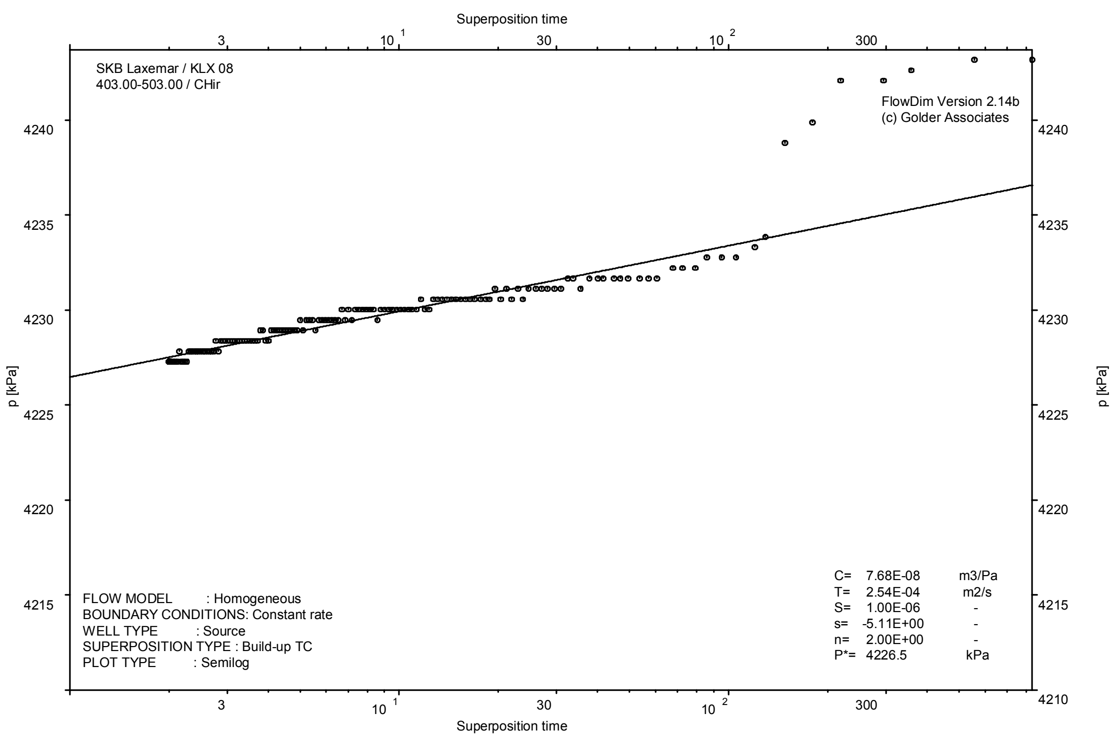
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

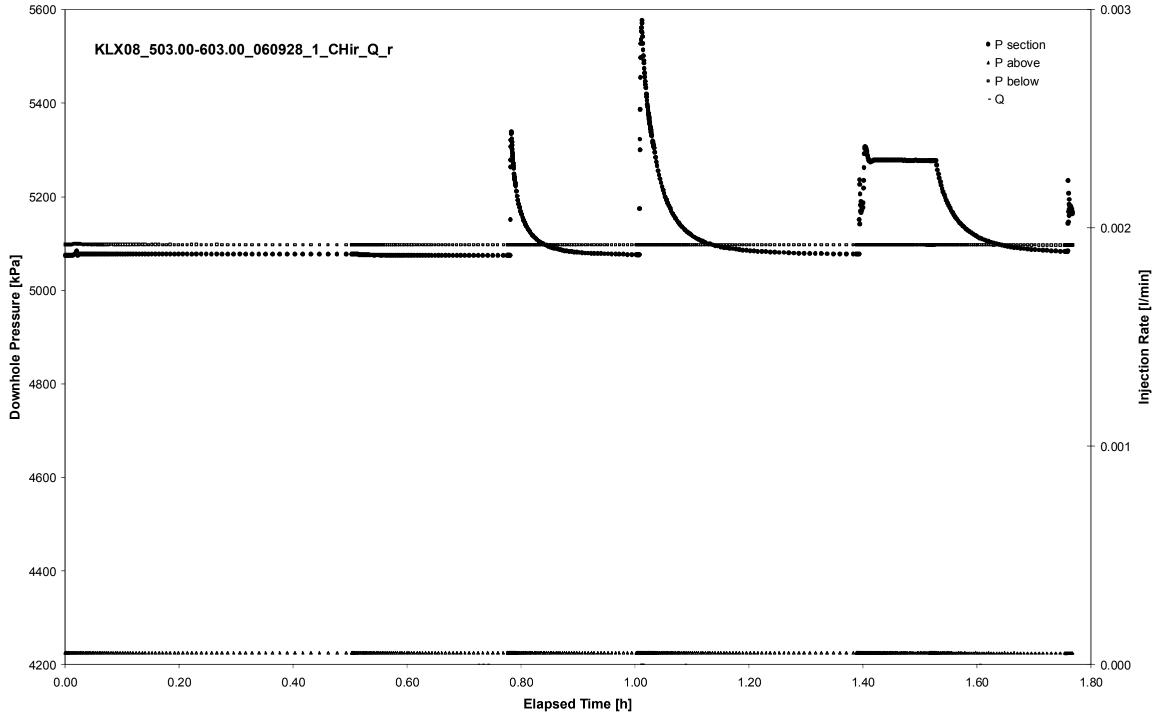


CHIR phase; HORNER match

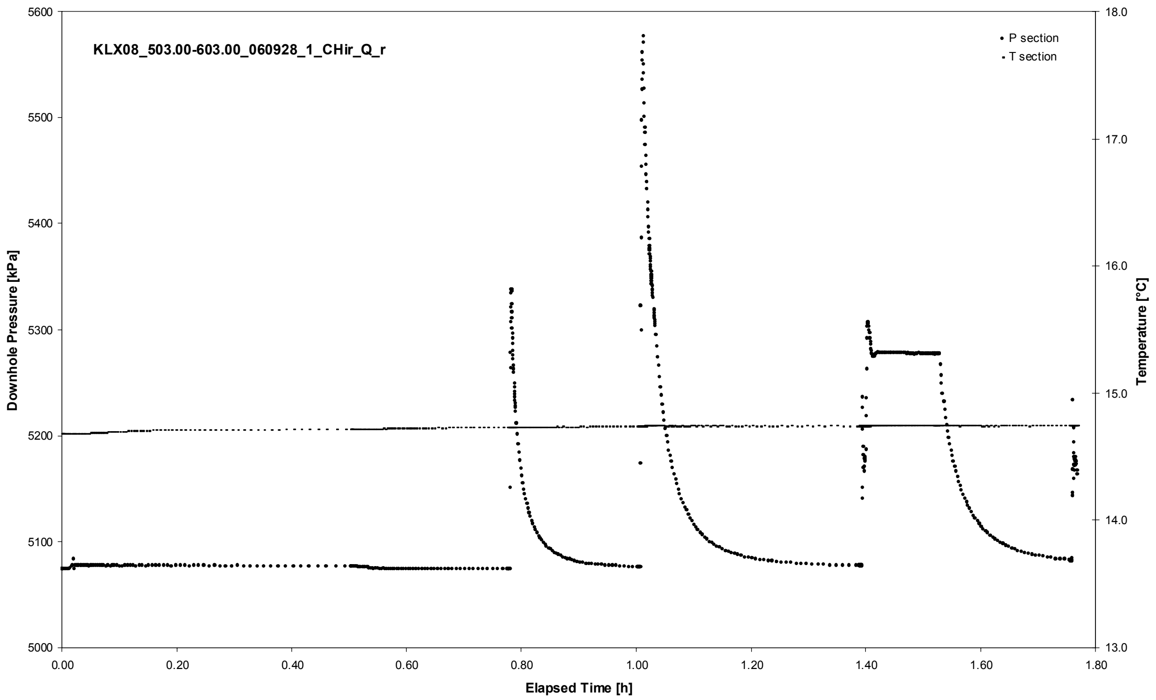
APPENDIX 2-5

Test 503.00 – 603.00 m

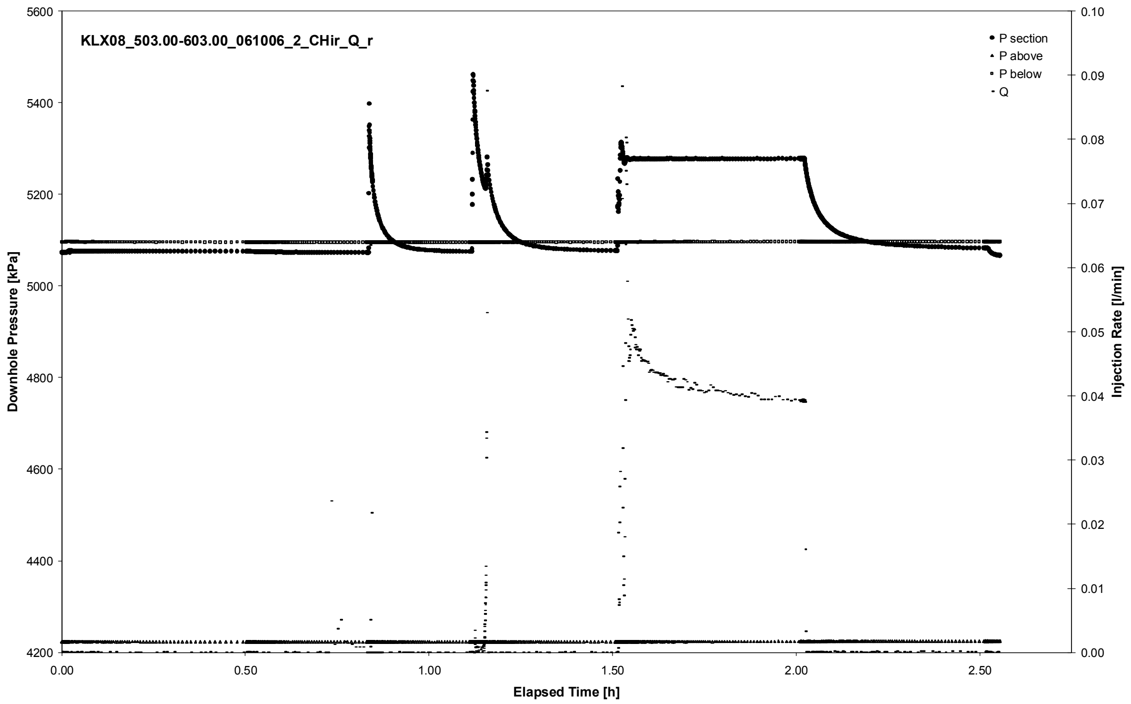
Analysis diagrams



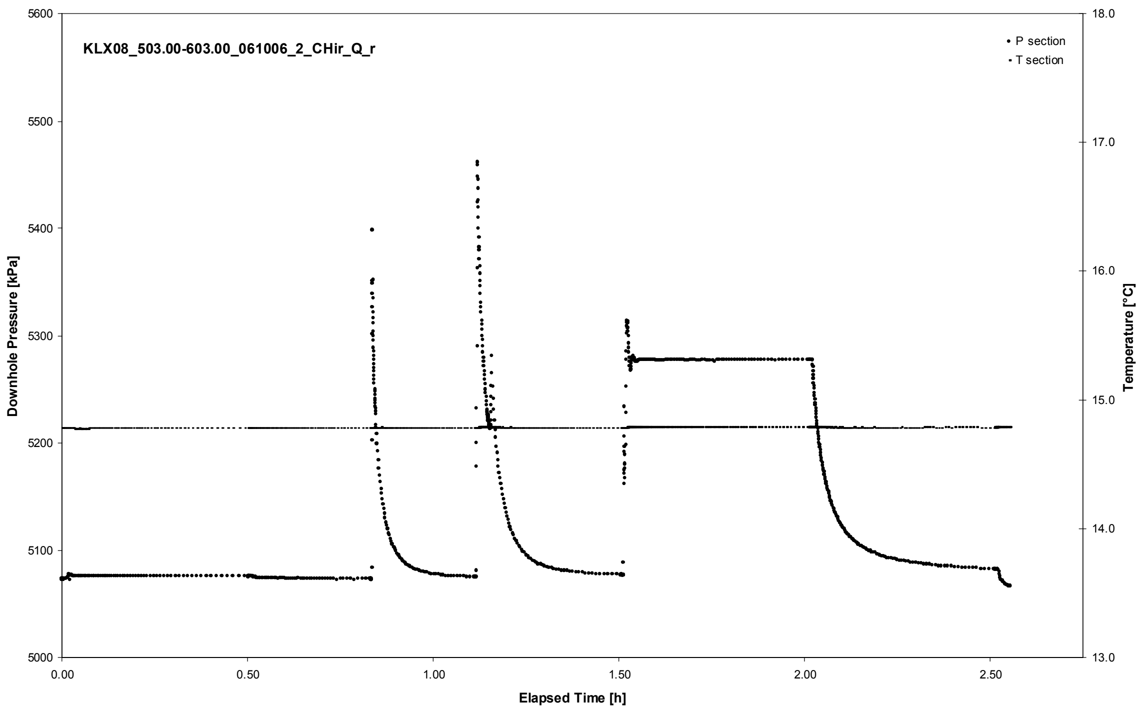
Pressure and flow rate vs. time; cartesian plot (test repeated)



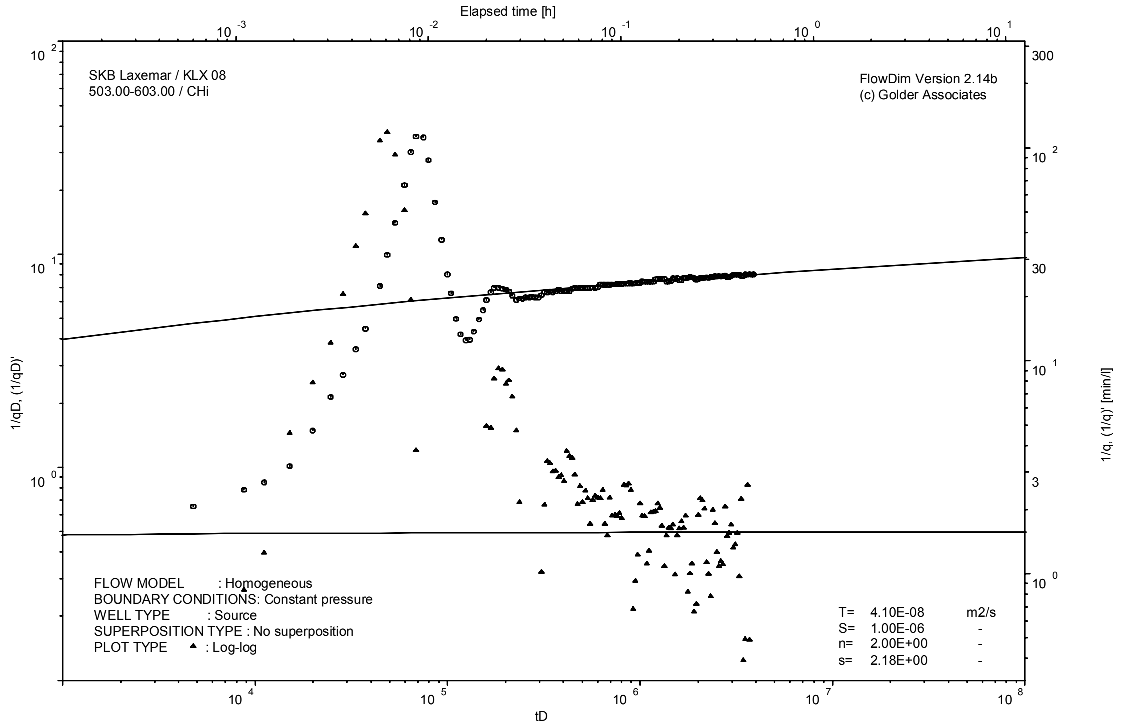
Interval pressure and temperature vs. time; cartesian plot (test repeated)



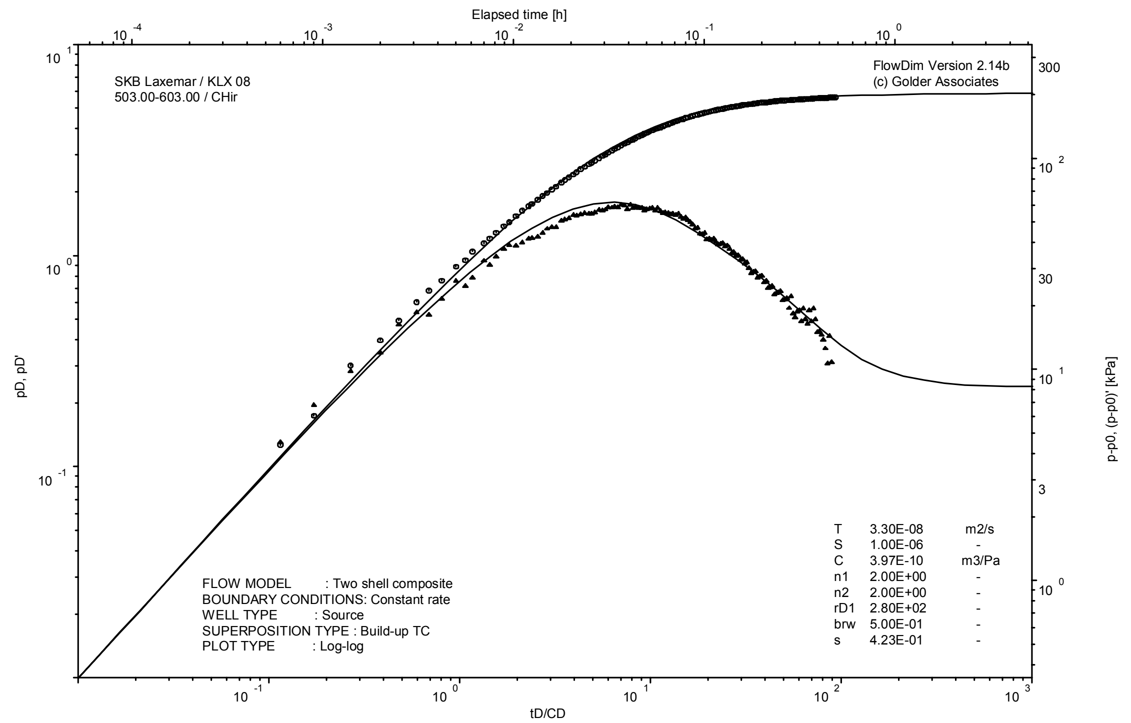
Pressure and flow rate vs. time; cartesian plot (analysed)



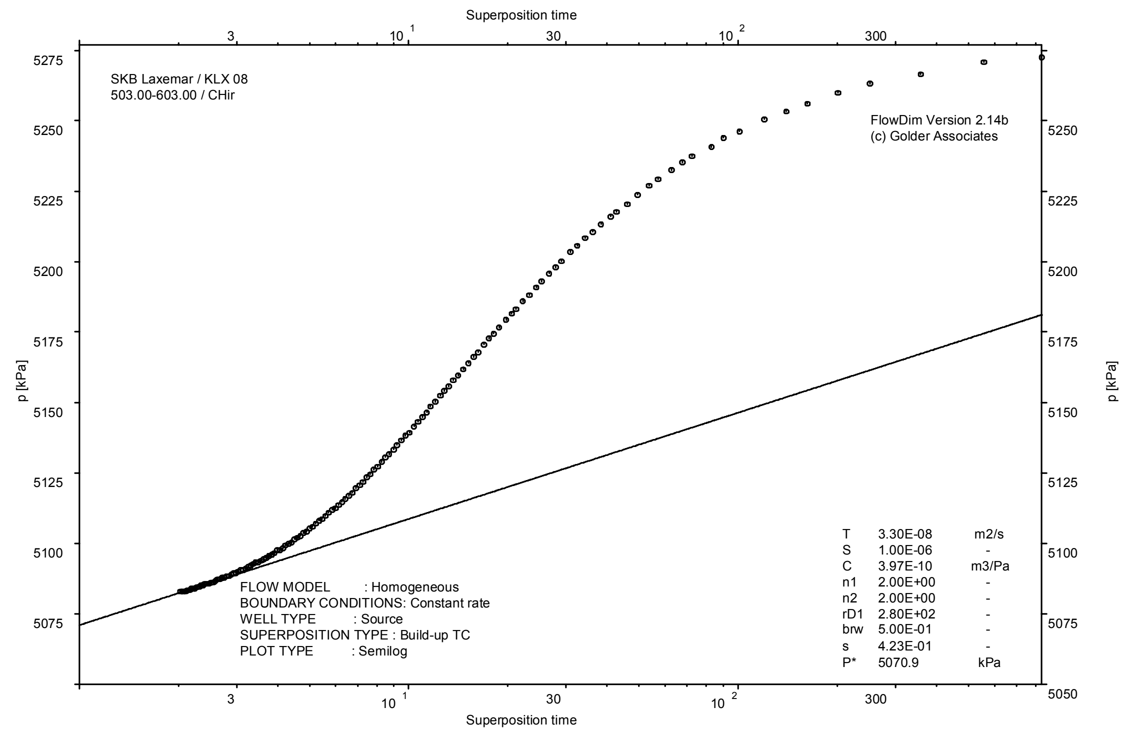
Interval pressure and temperature vs. time; cartesian plot (analysed)



CHI phase; log-log match



CHIR phase; log-log match

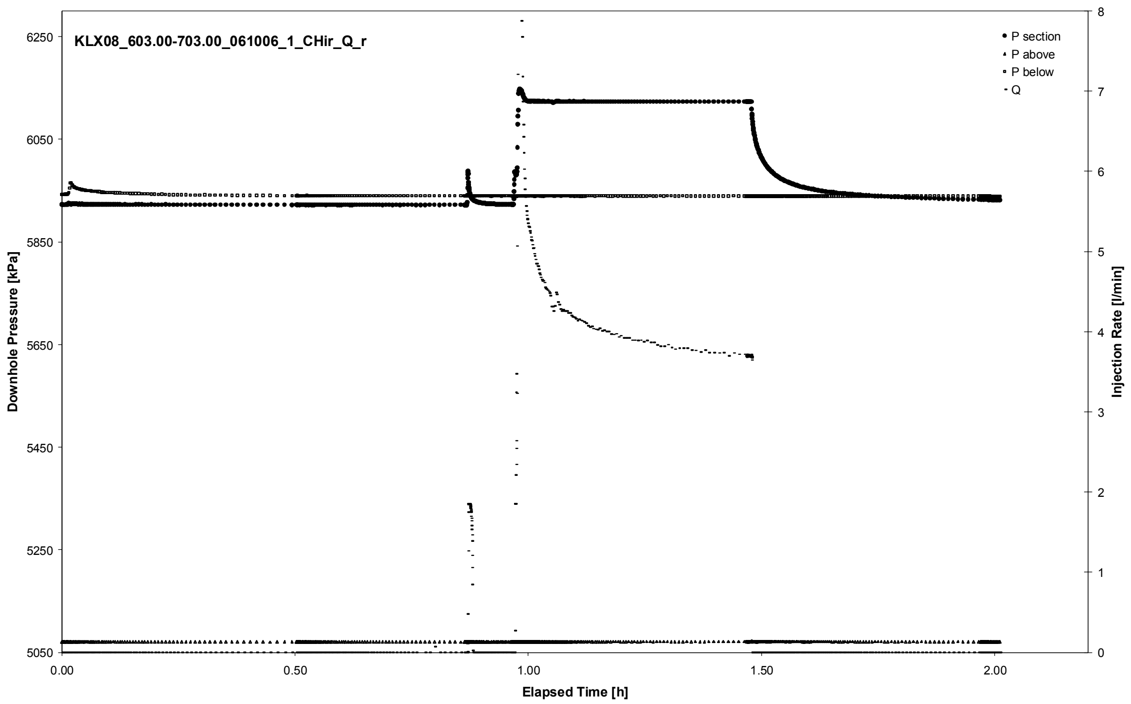


CHIR phase; HORNER match

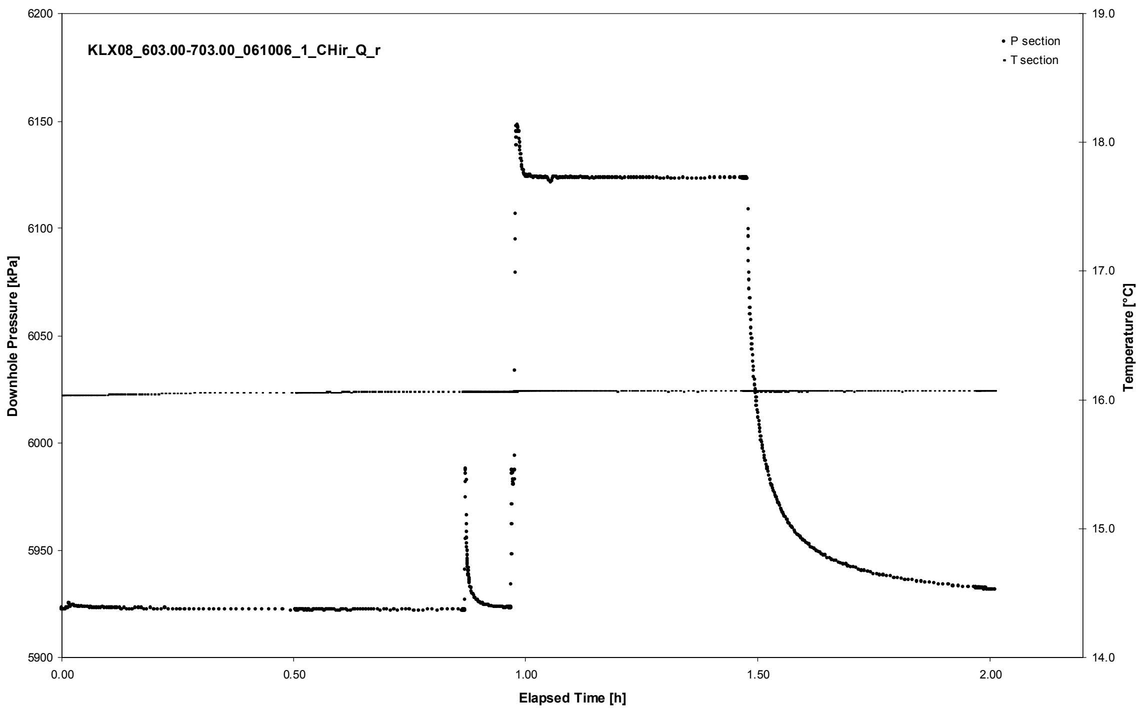
APPENDIX 2-6

Test 603.00 – 703.00 m

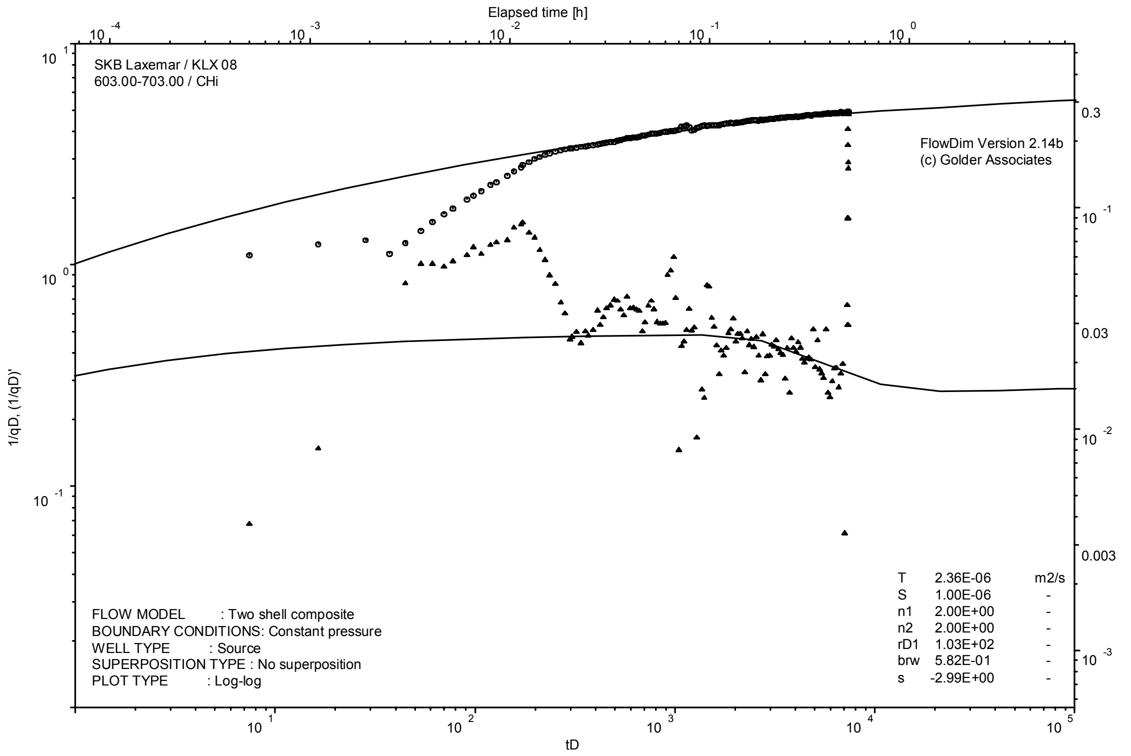
Analysis diagrams



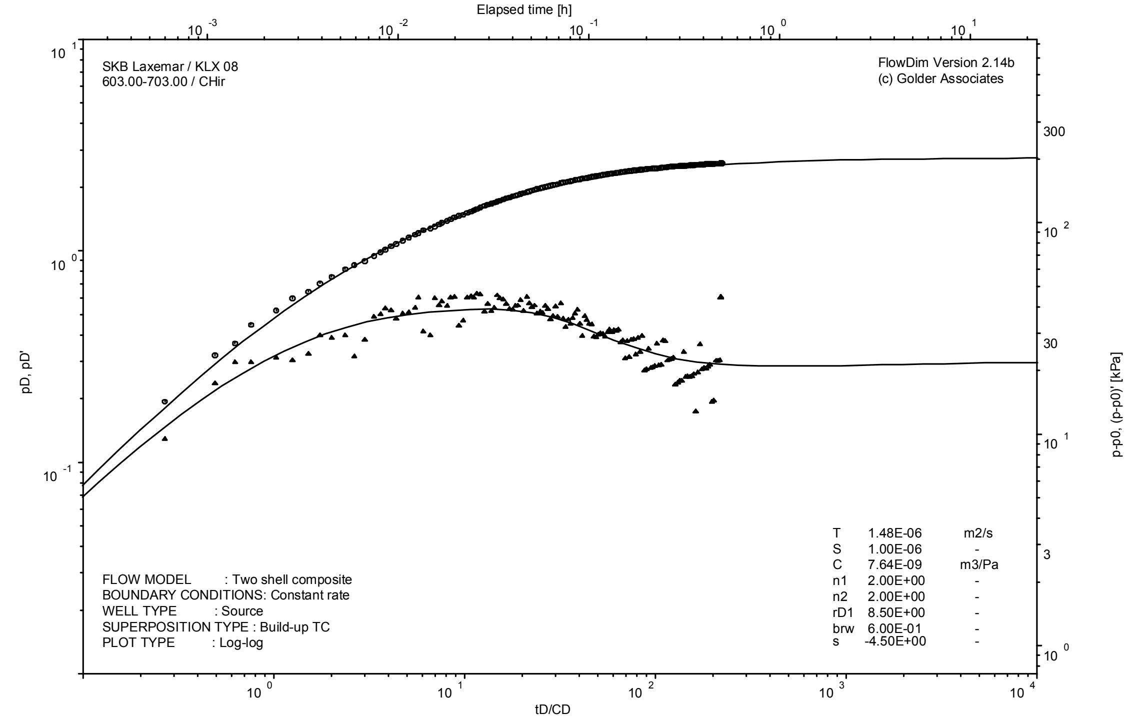
Pressure and flow rate vs. time; cartesian plot



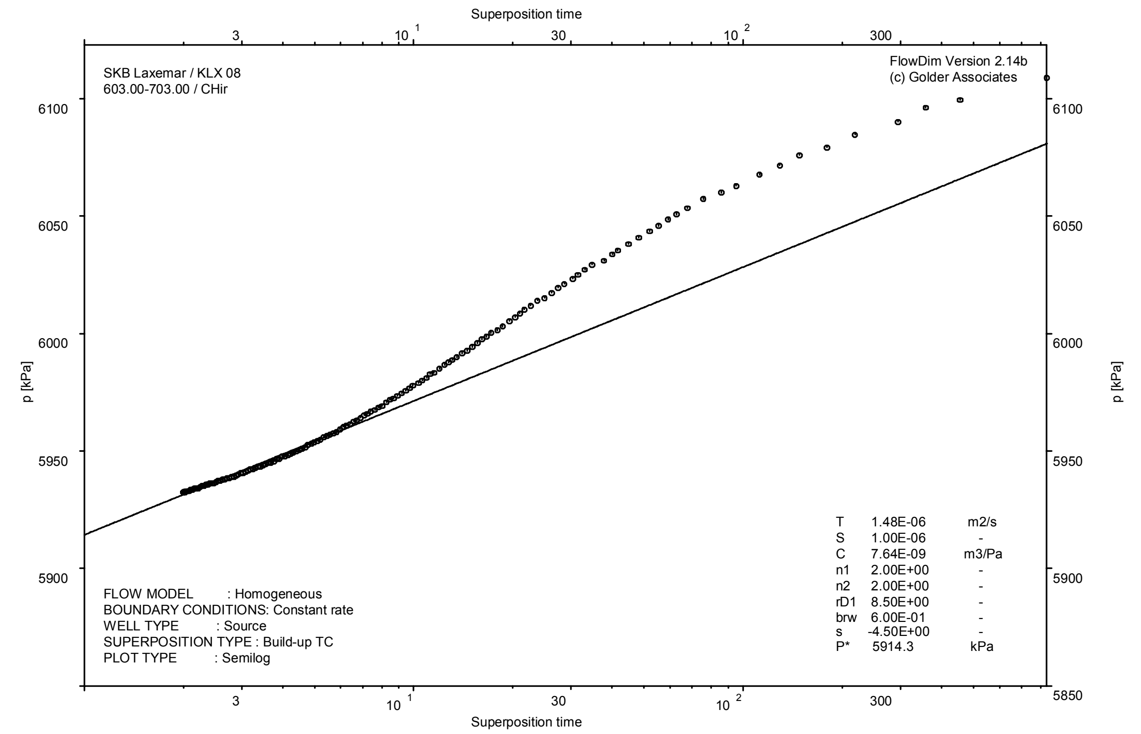
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

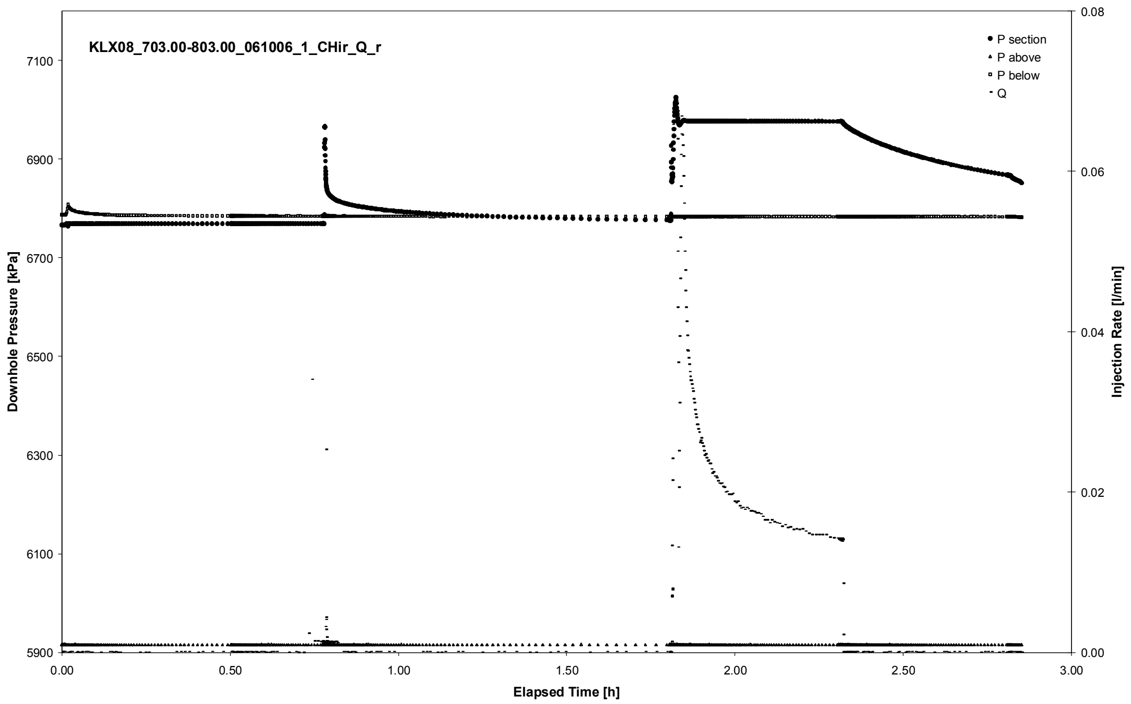


CHIR phase; HORNER match

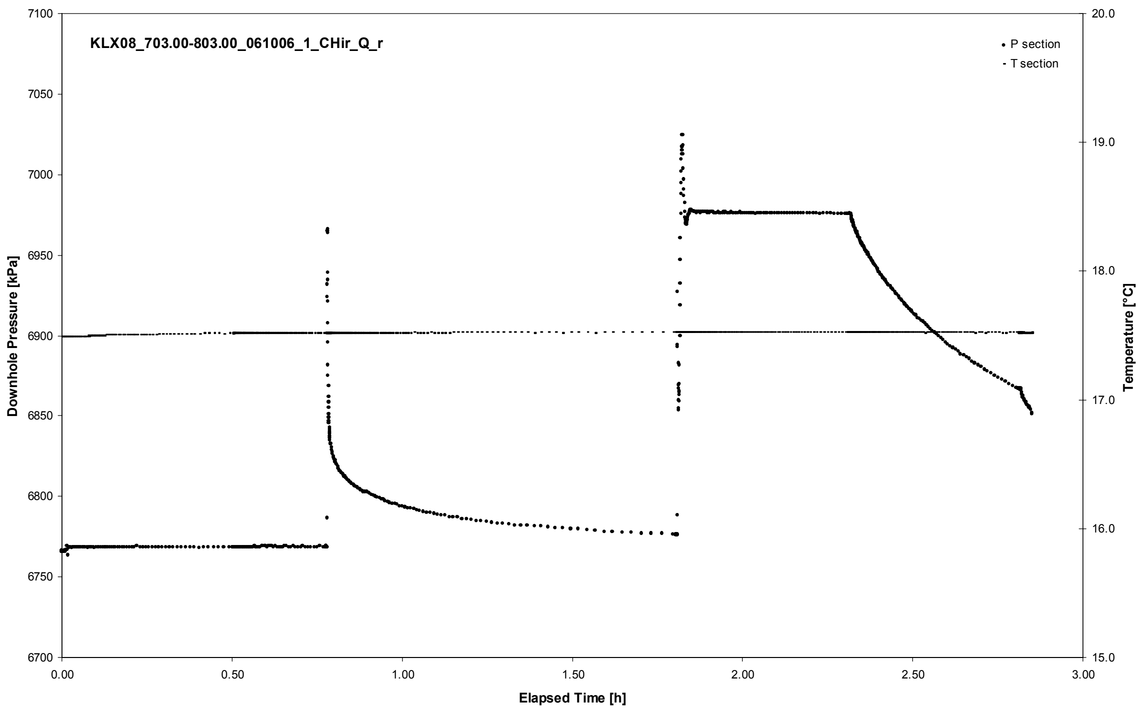
APPENDIX 2-7

Test 703.00 – 803.00 m

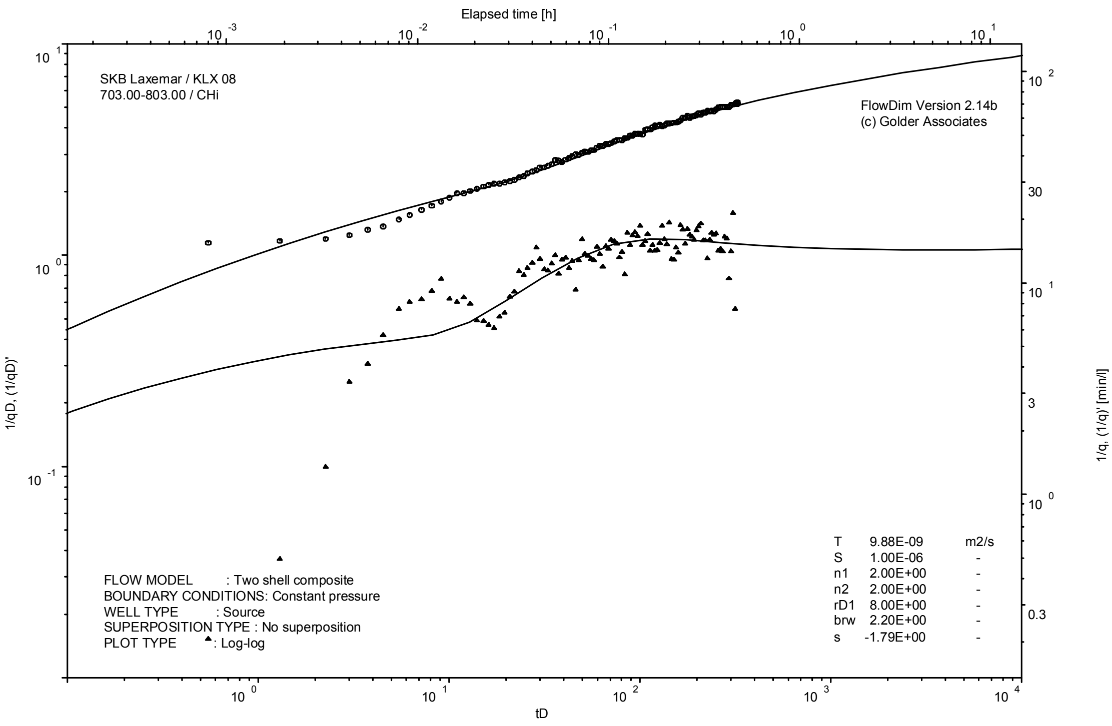
Analysis diagrams



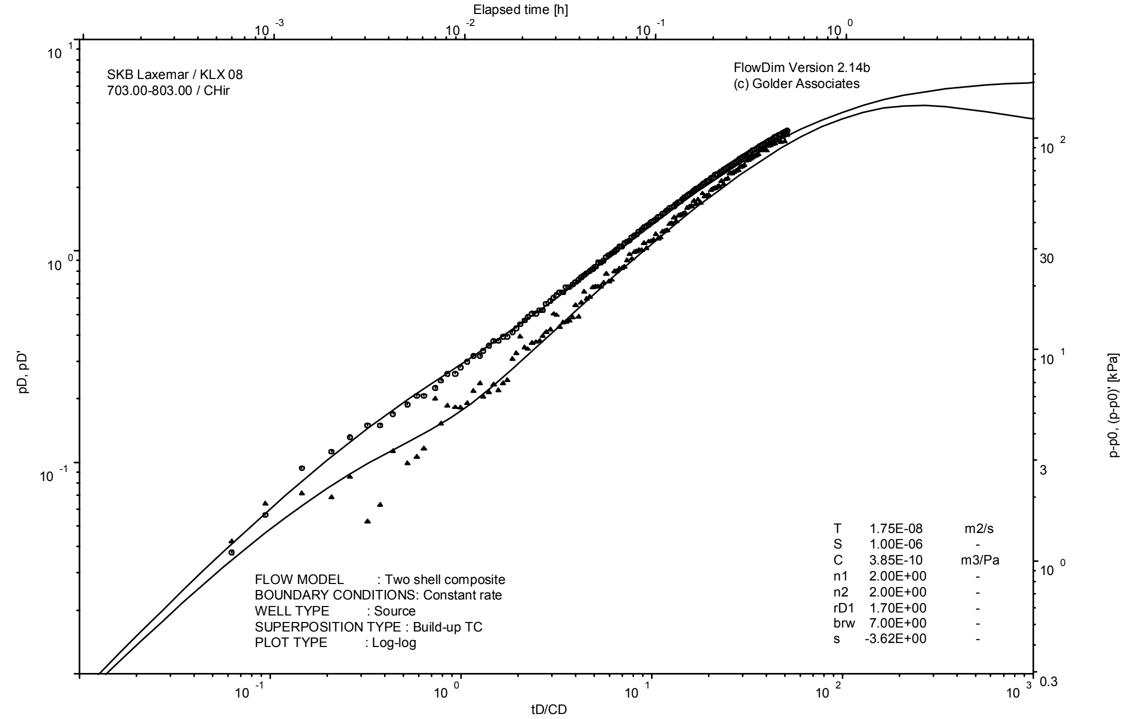
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

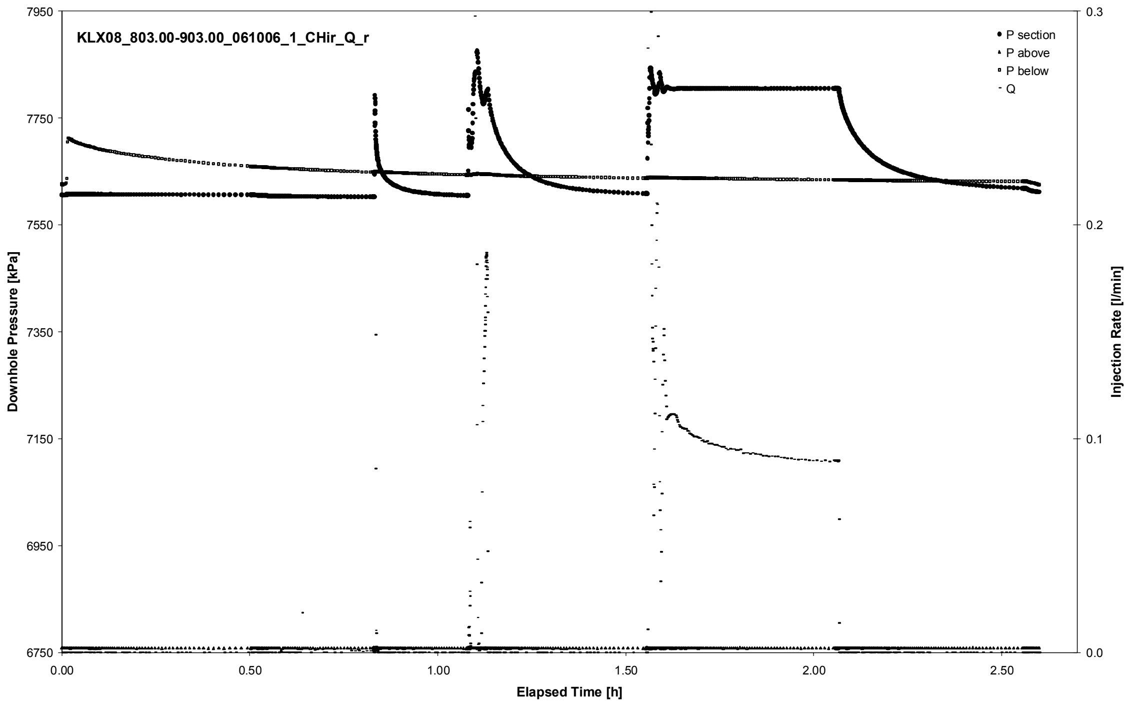
Not analysable

CHIR phase; HORNER match

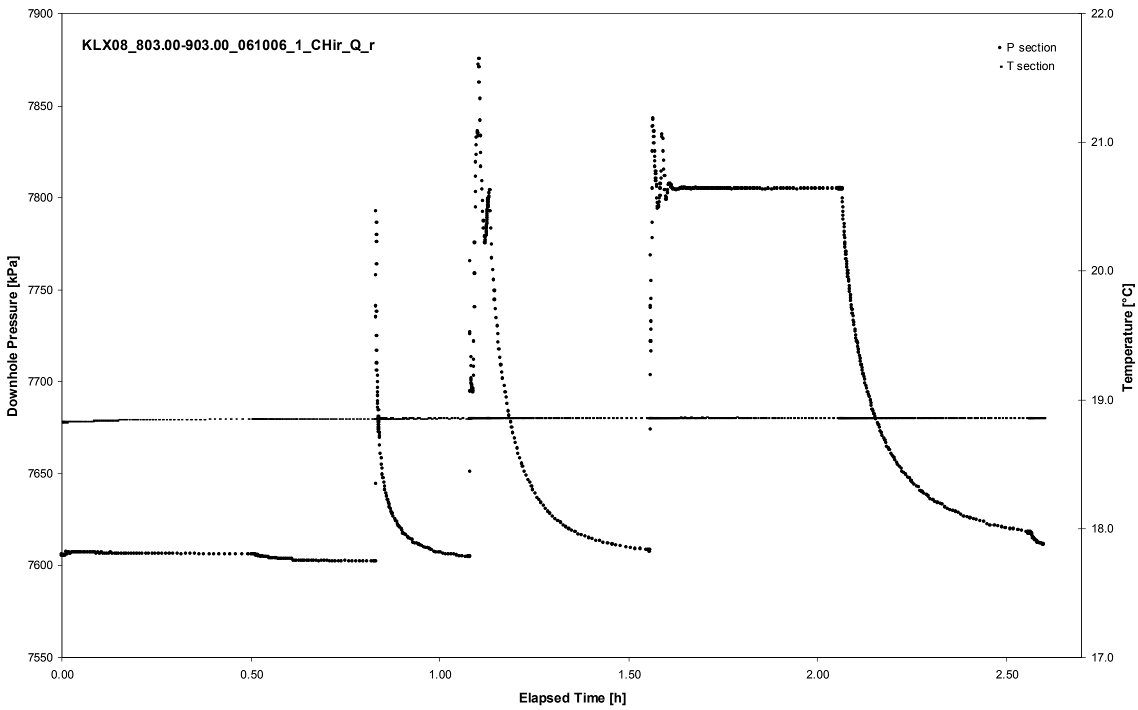
APPENDIX 2-8

Test 803.00 – 903.00 m

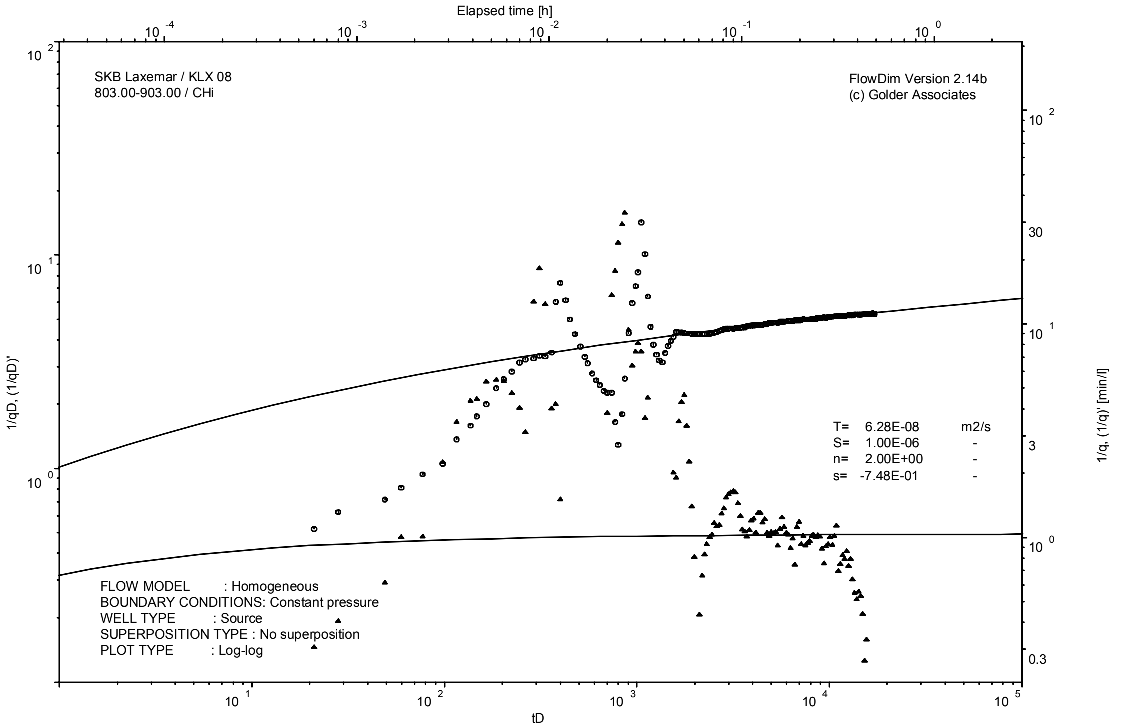
Analysis diagrams



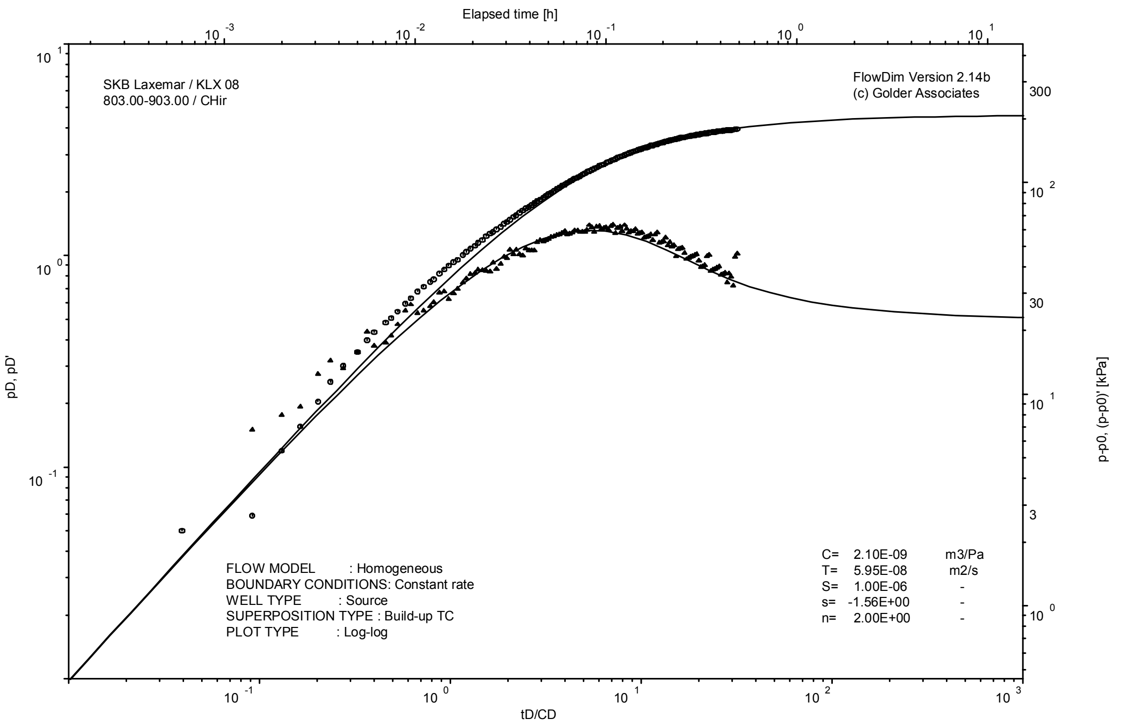
Pressure and flow rate vs. time; cartesian plot



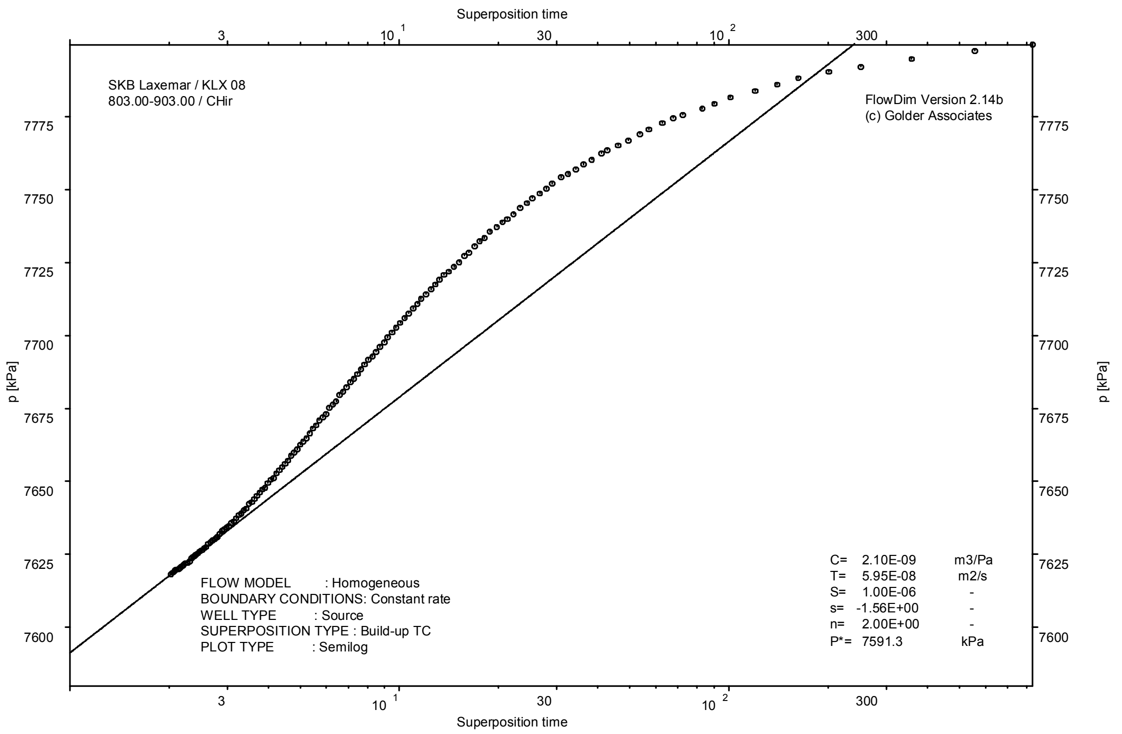
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

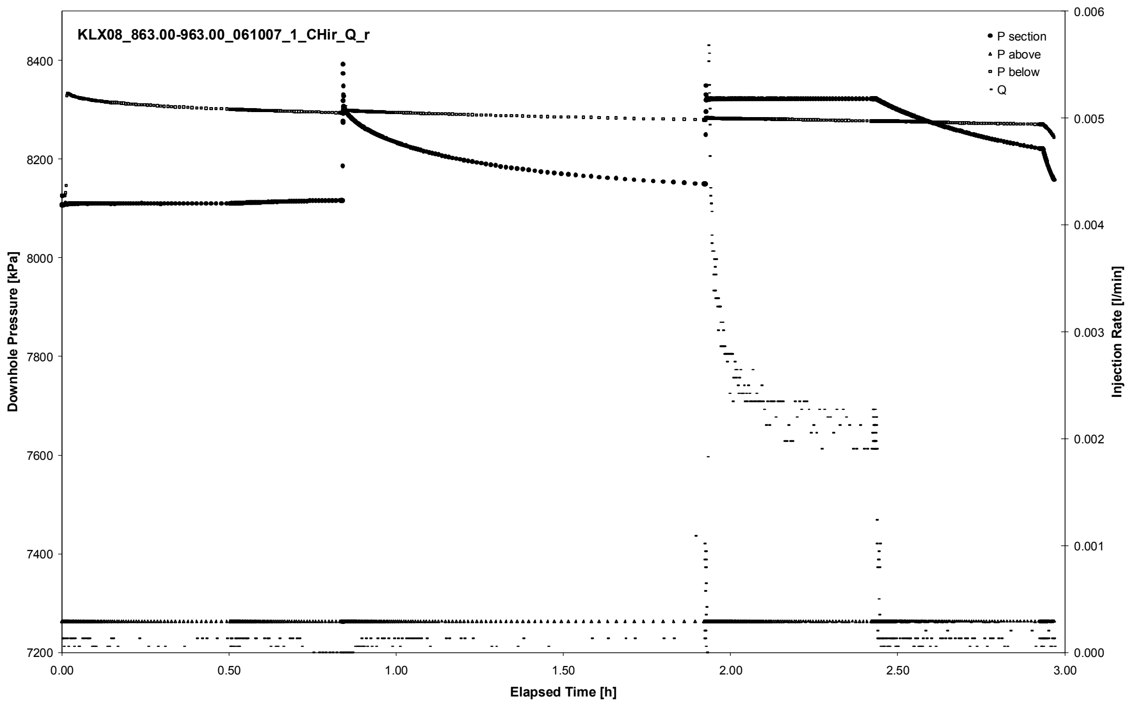


CHIR phase; HORNER match

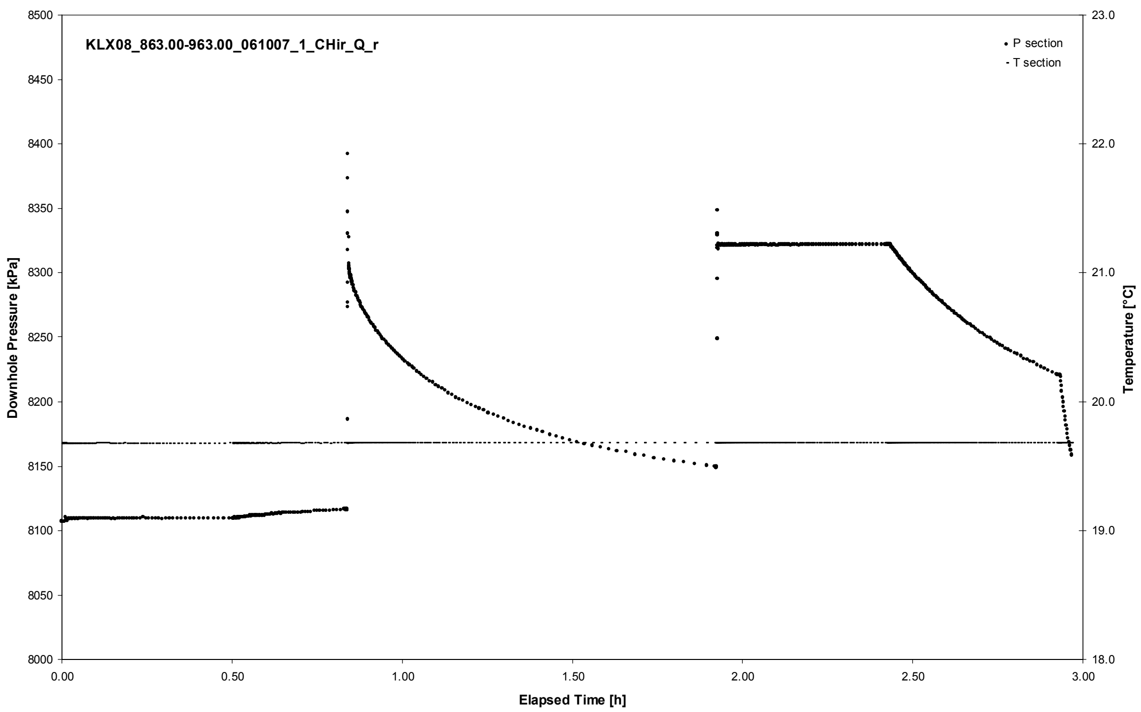
APPENDIX 2-9

Test 863.00 – 963.00 m

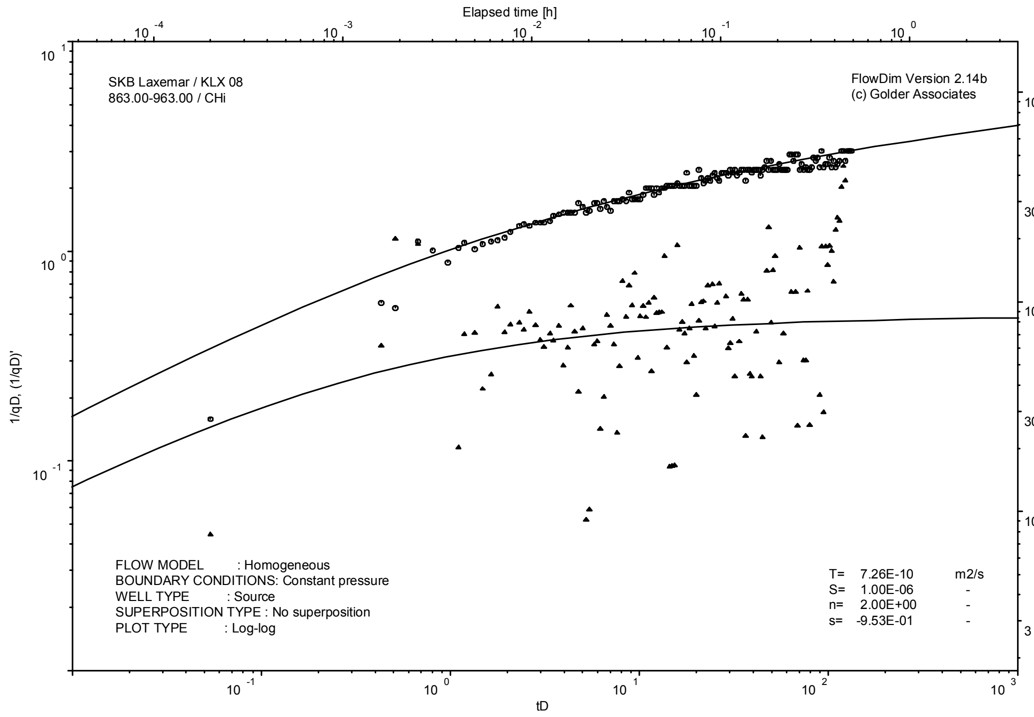
Analysis diagrams



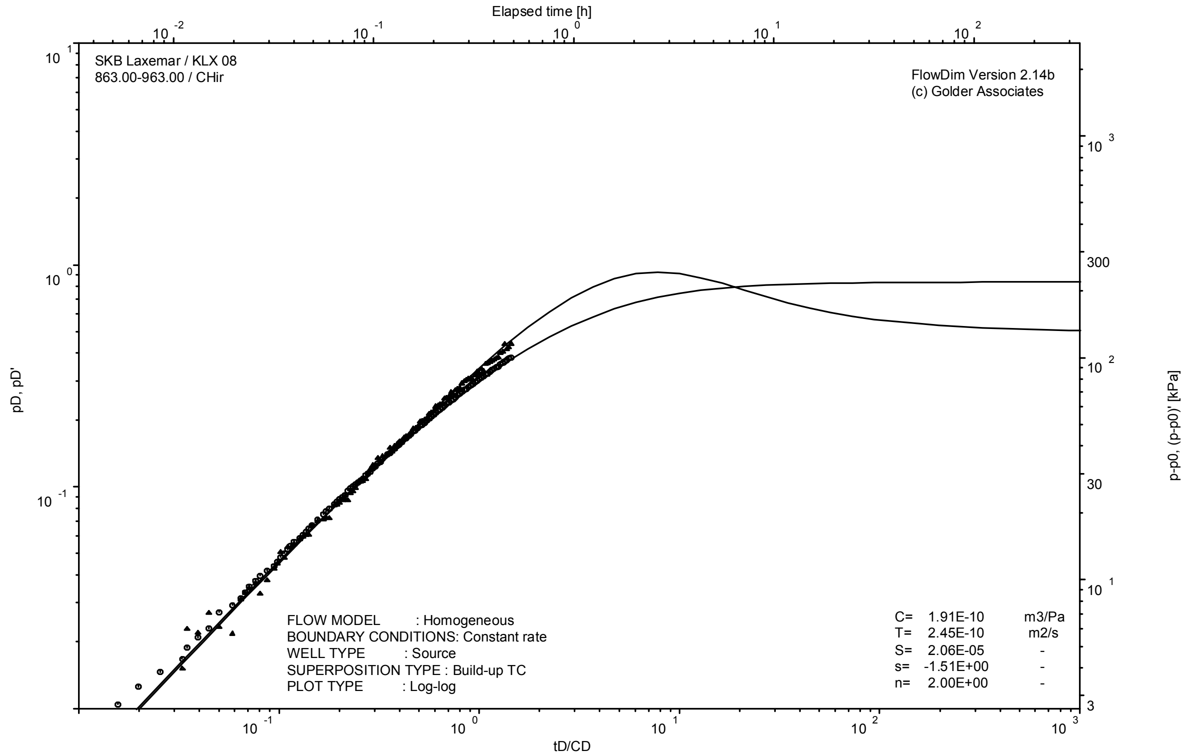
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

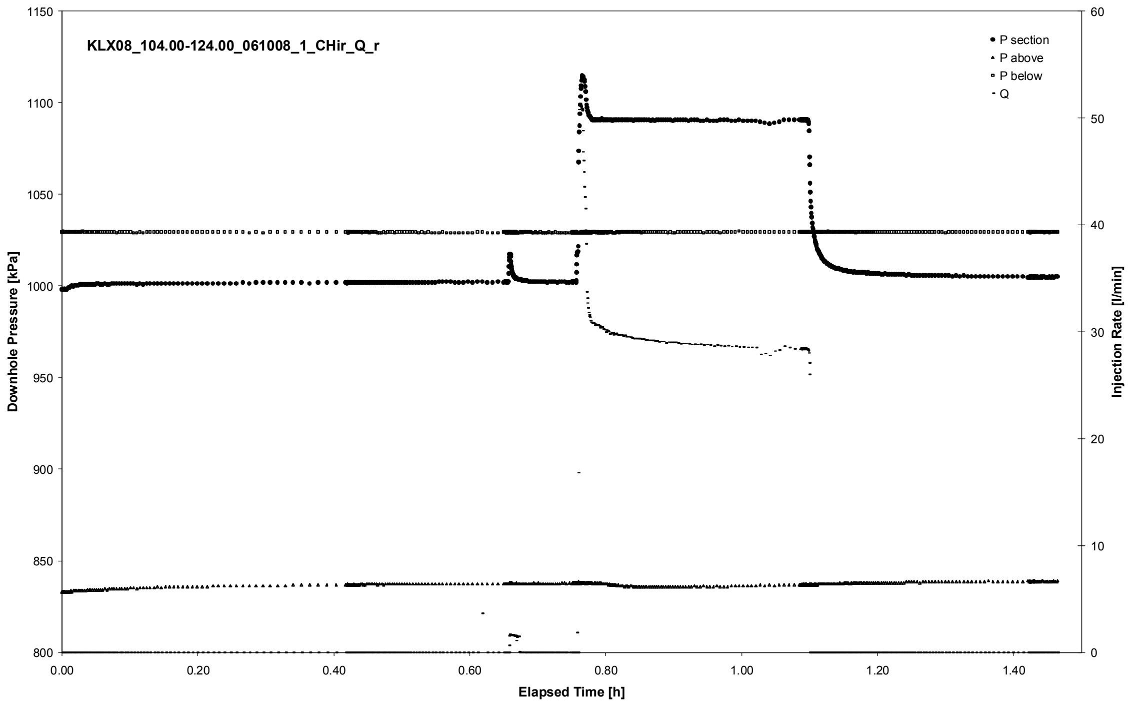
Not analysable

CHIR phase; HORNER match

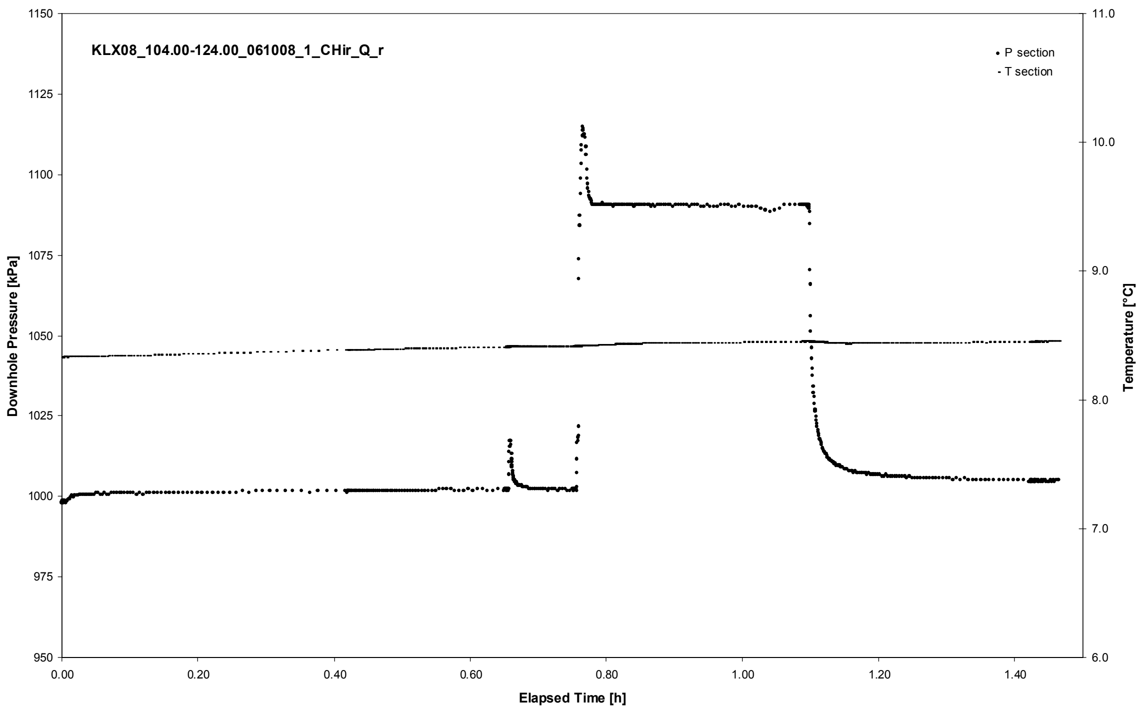
APPENDIX 2-10

Test 104.00 – 124.00 m

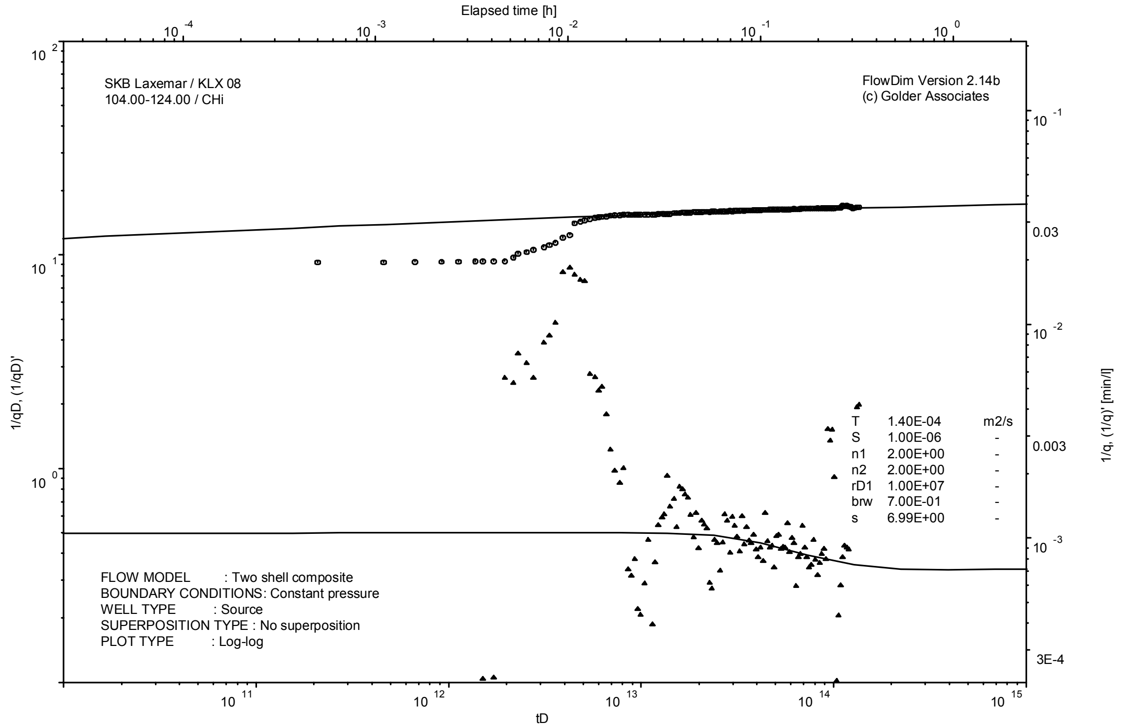
Analysis diagrams



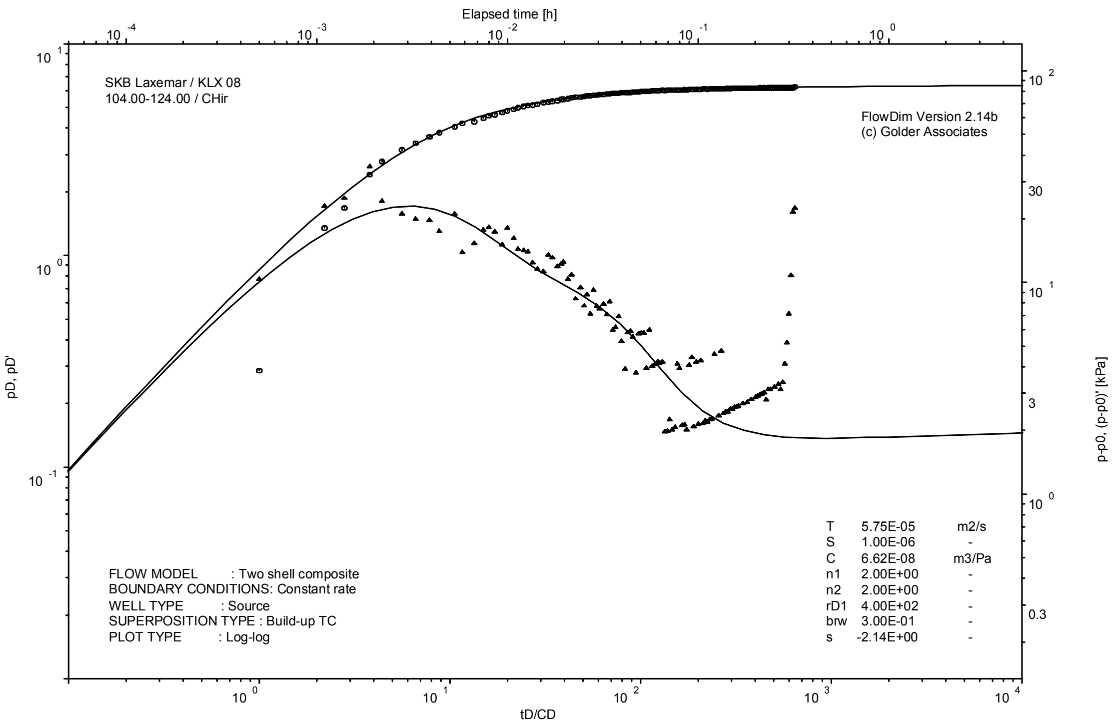
Pressure and flow rate vs. time; cartesian plot



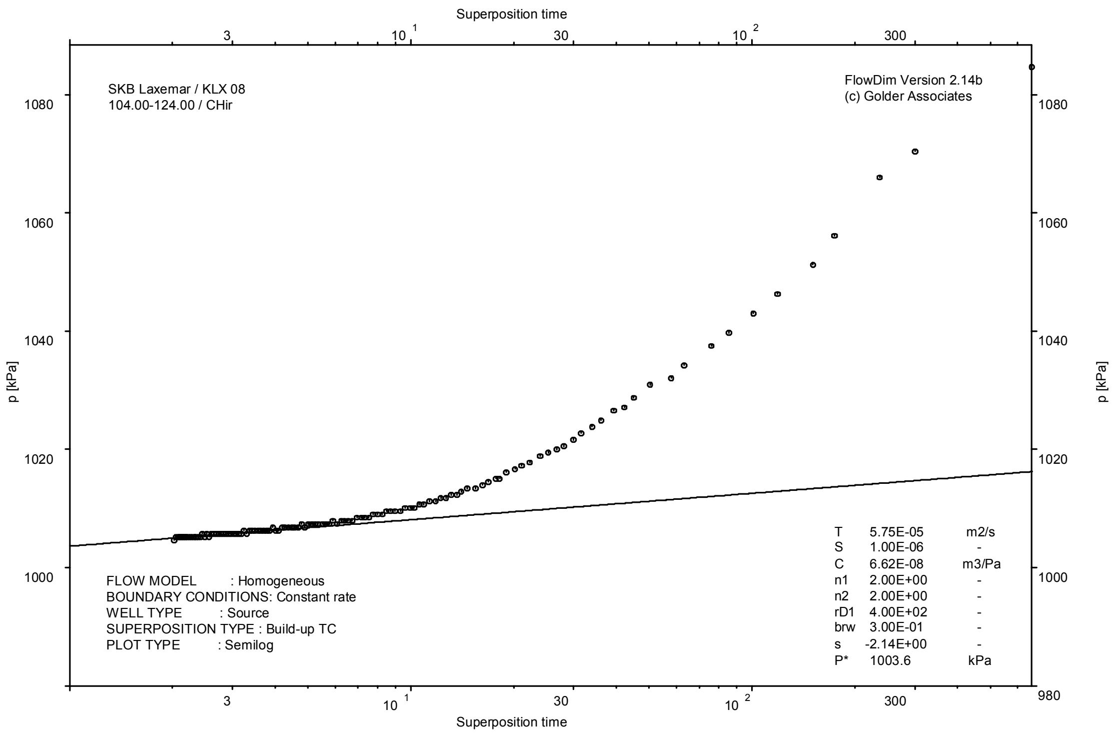
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

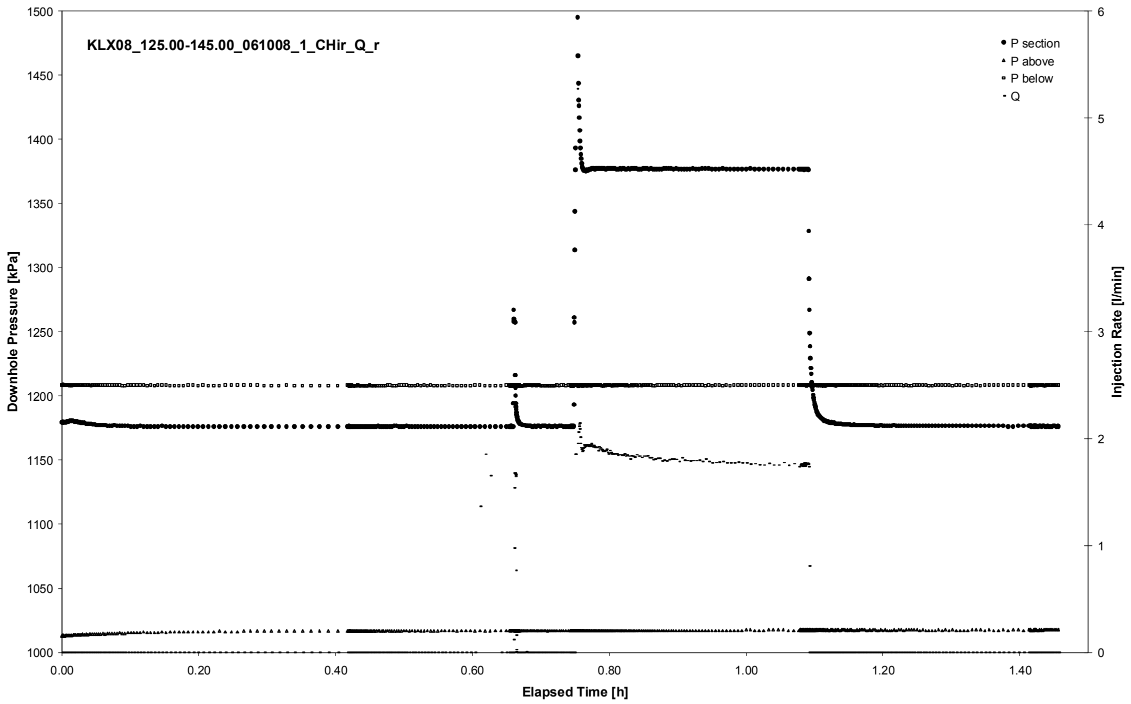


CHIR phase; HORNER match

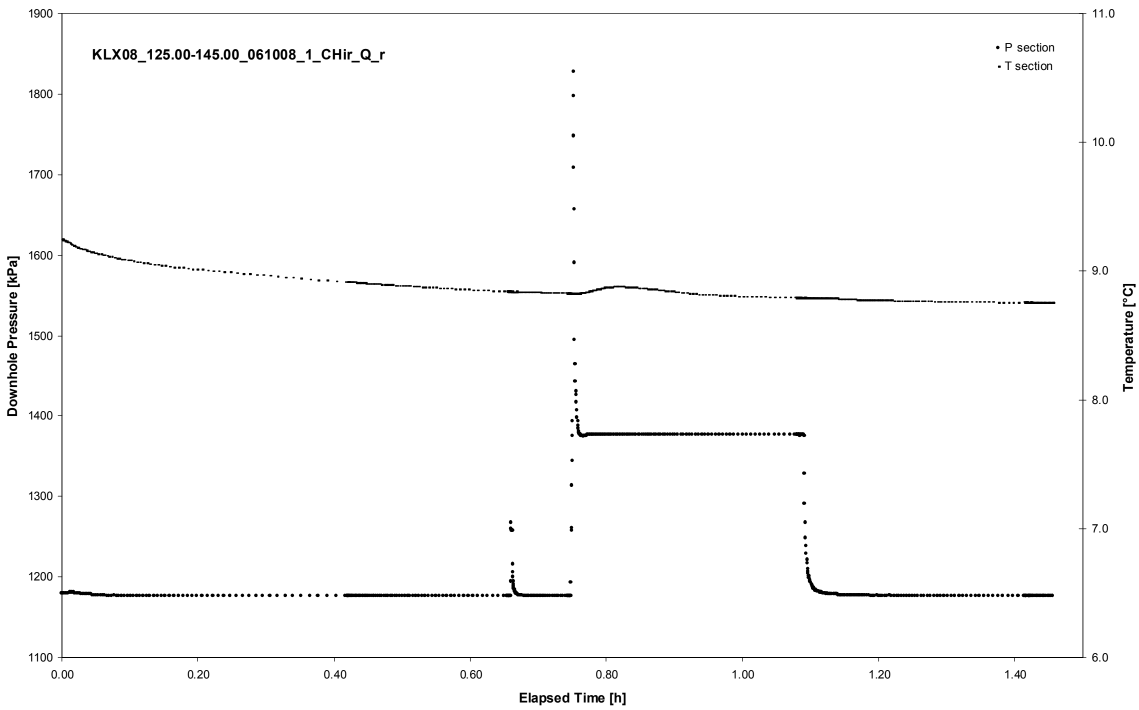
APPENDIX 2-11

Test 125.00 – 145.00 m

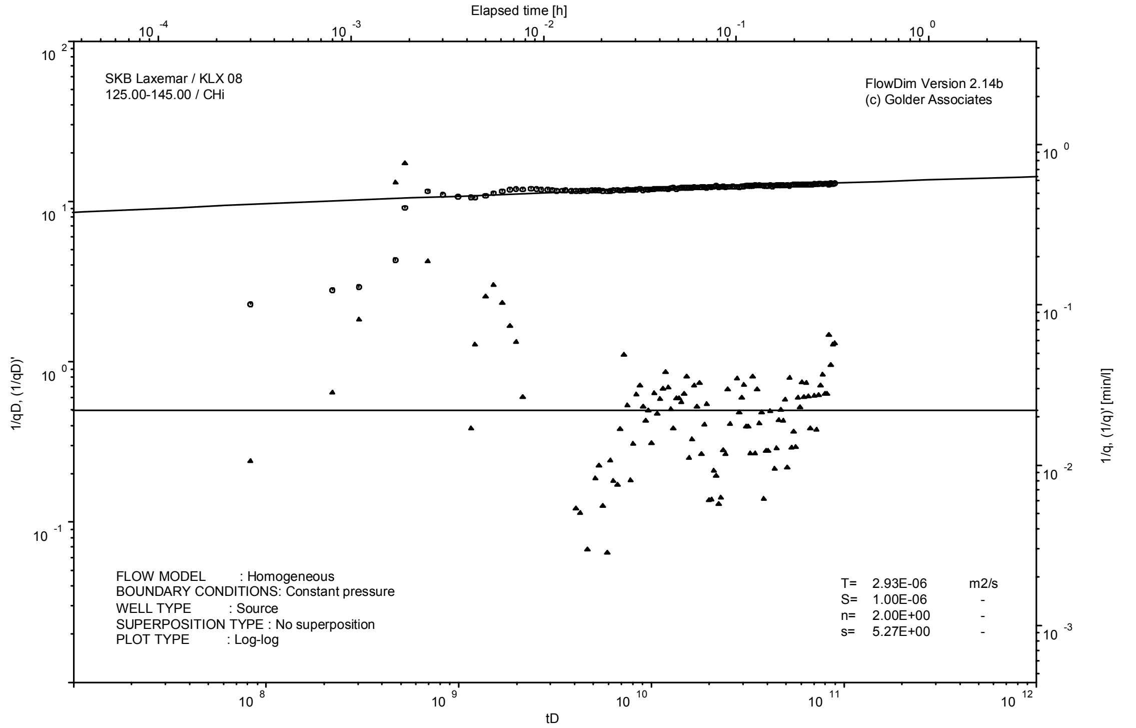
Analysis diagrams



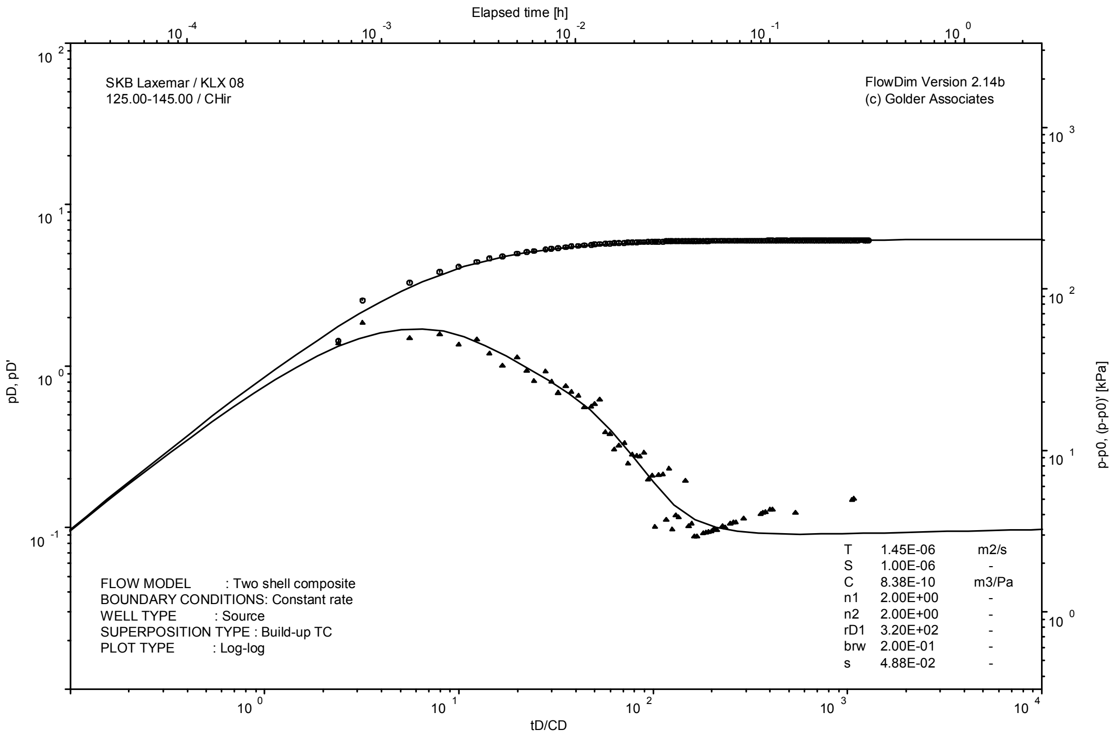
Pressure and flow rate vs. time; cartesian plot



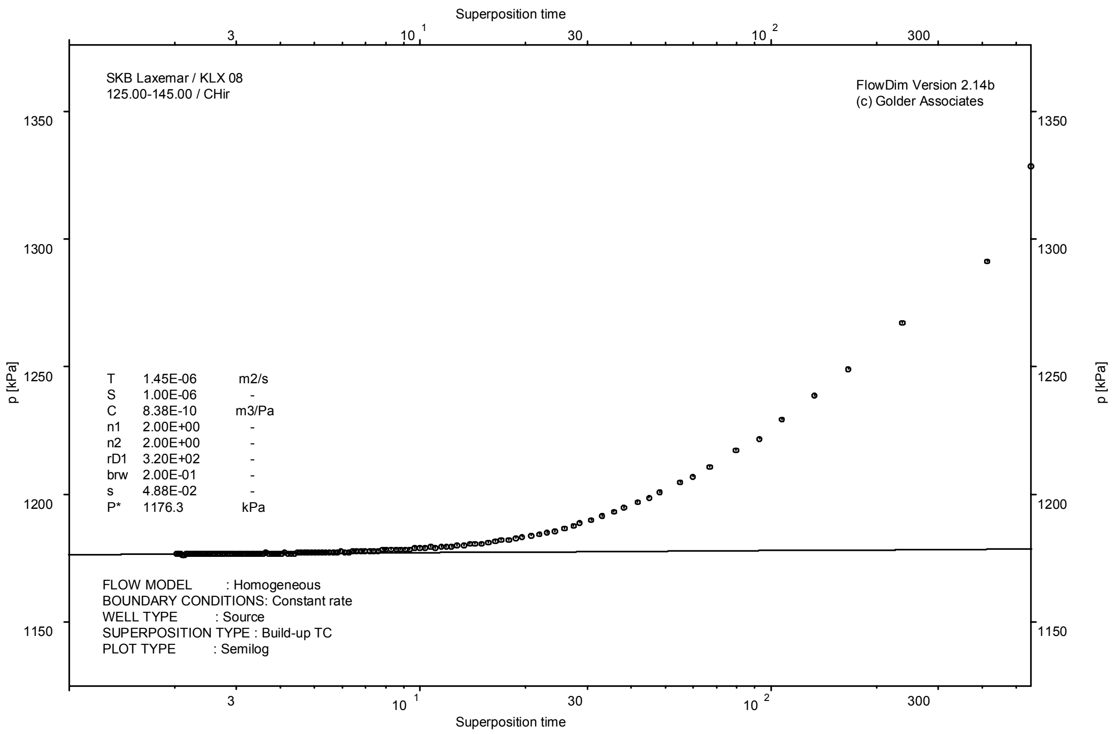
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

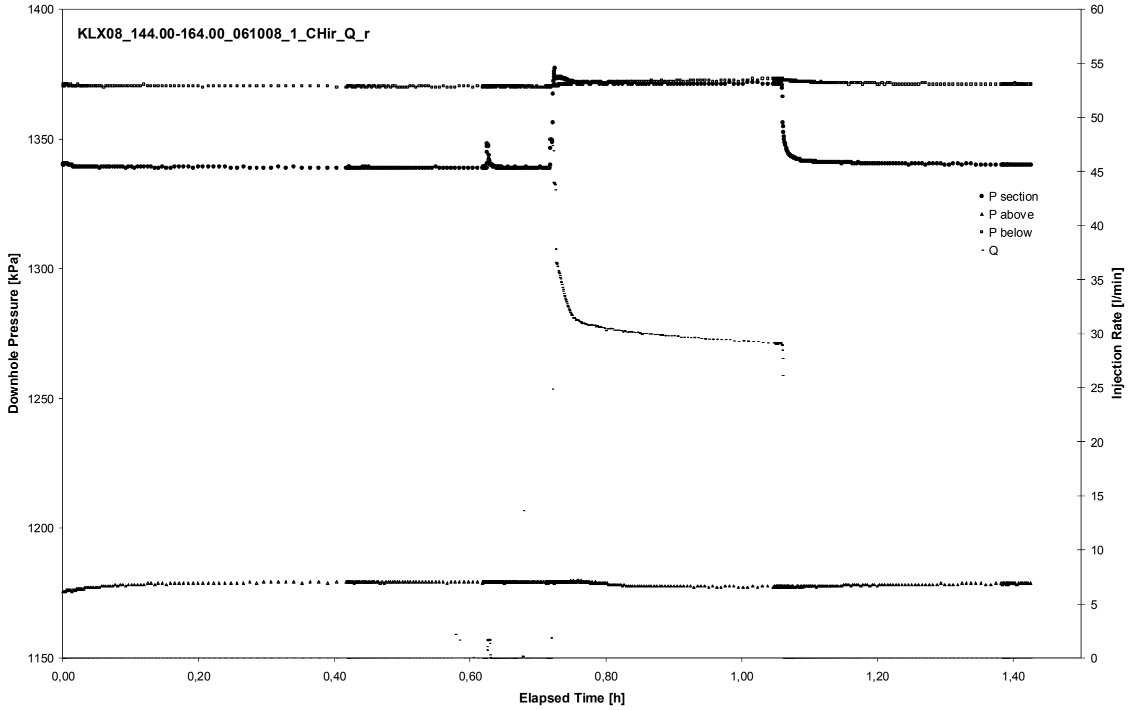


CHIR phase; HORNER match

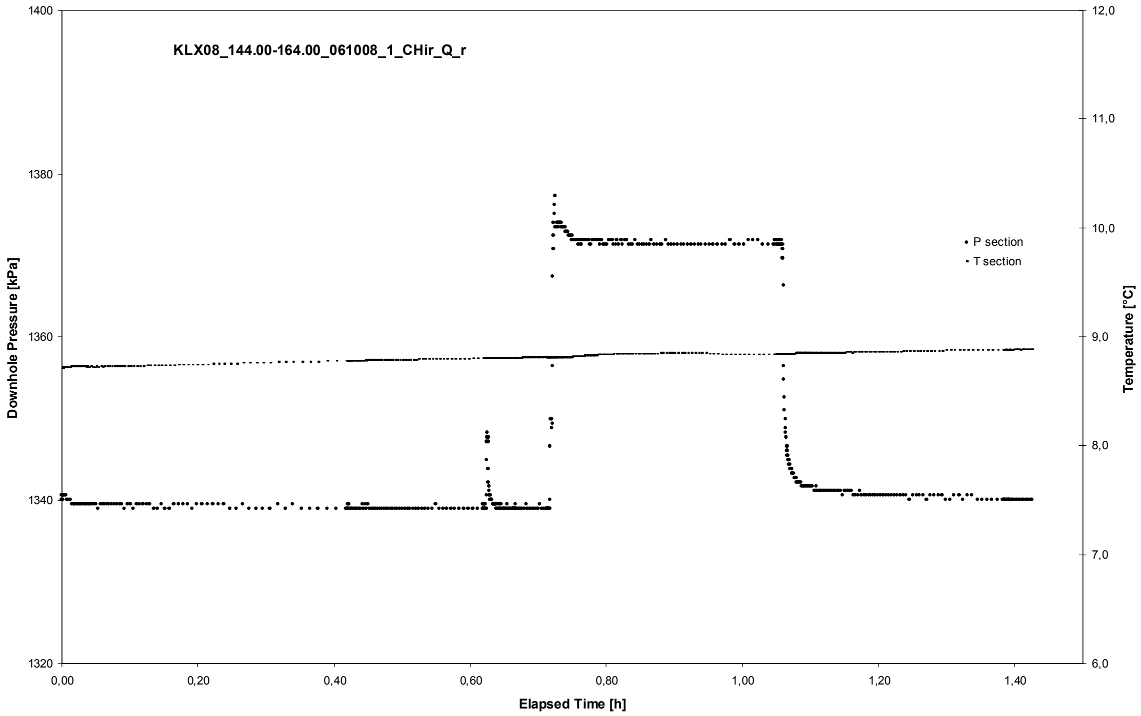
APPENDIX 2-12

Test 144.00 – 164.00 m

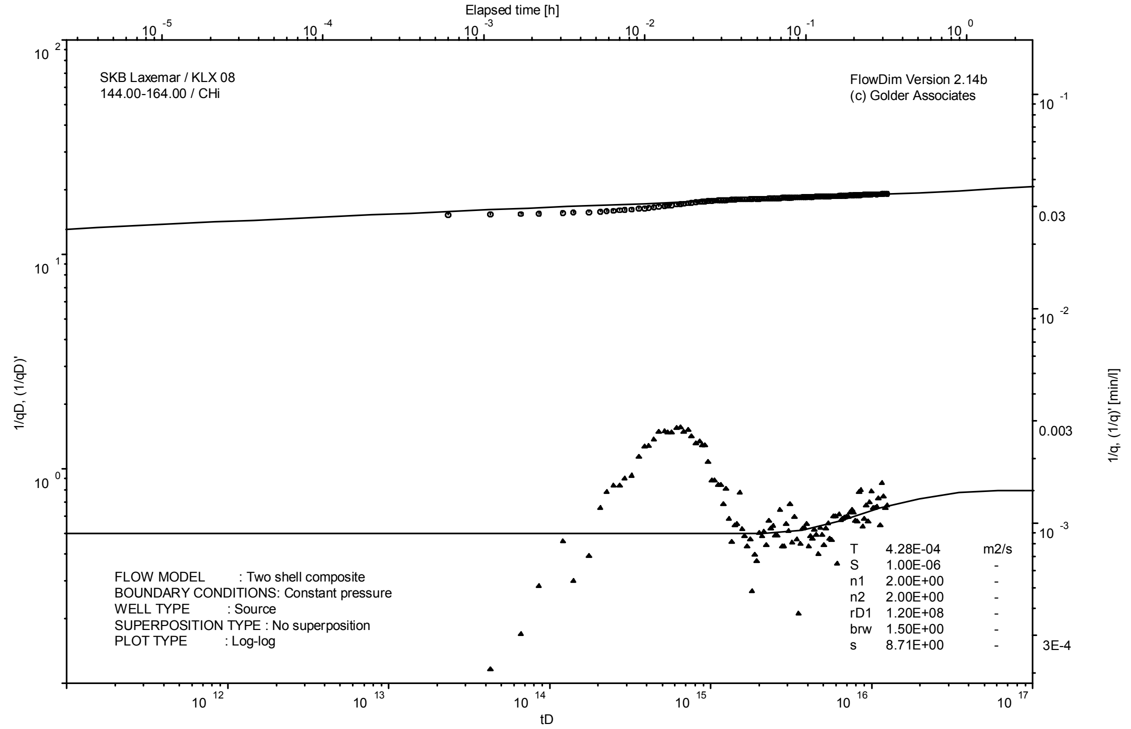
Analysis diagrams



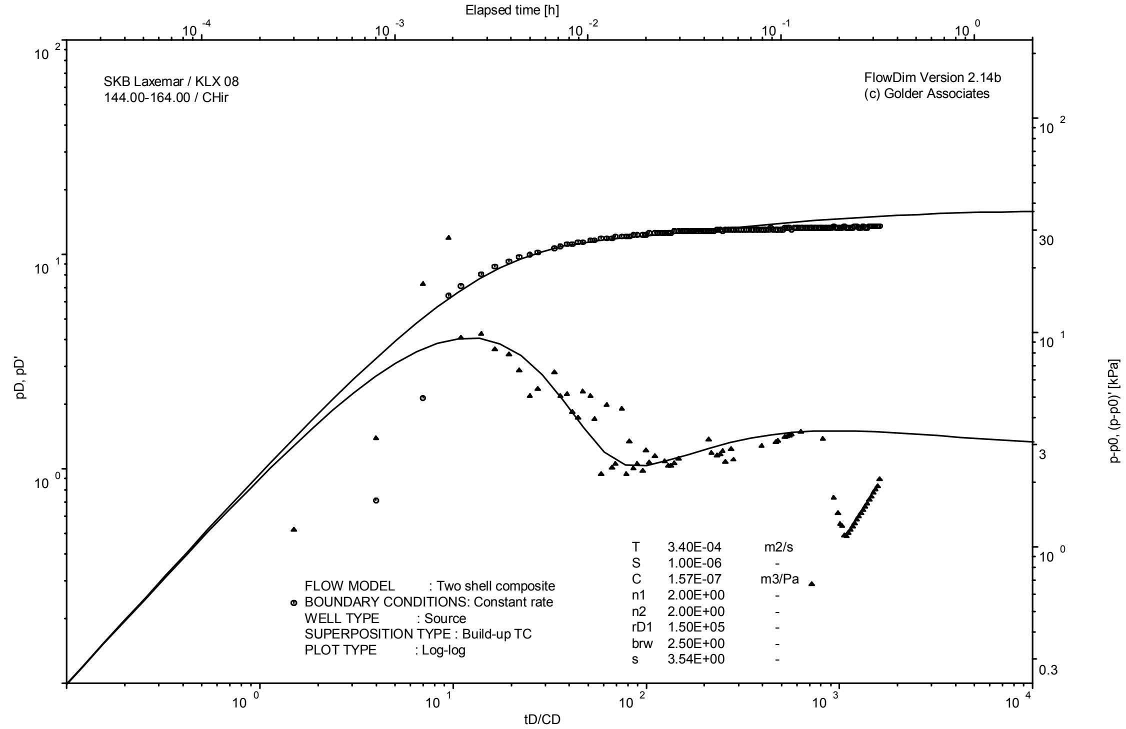
Pressure and flow rate vs. time; cartesian plot



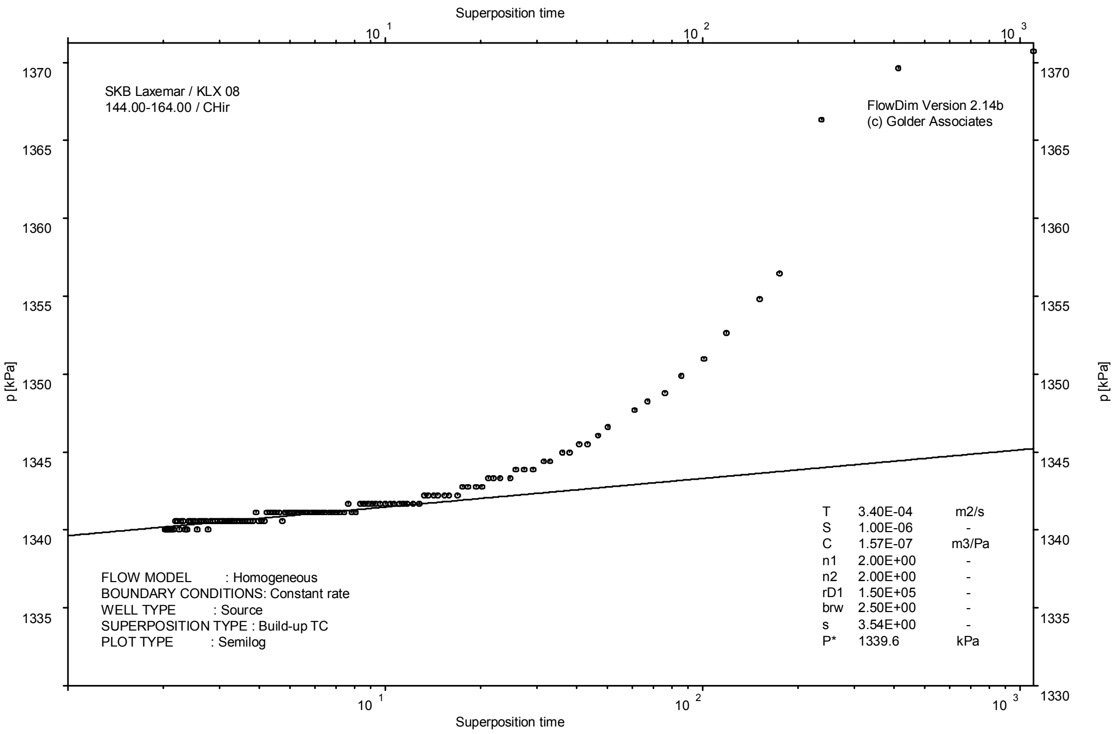
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

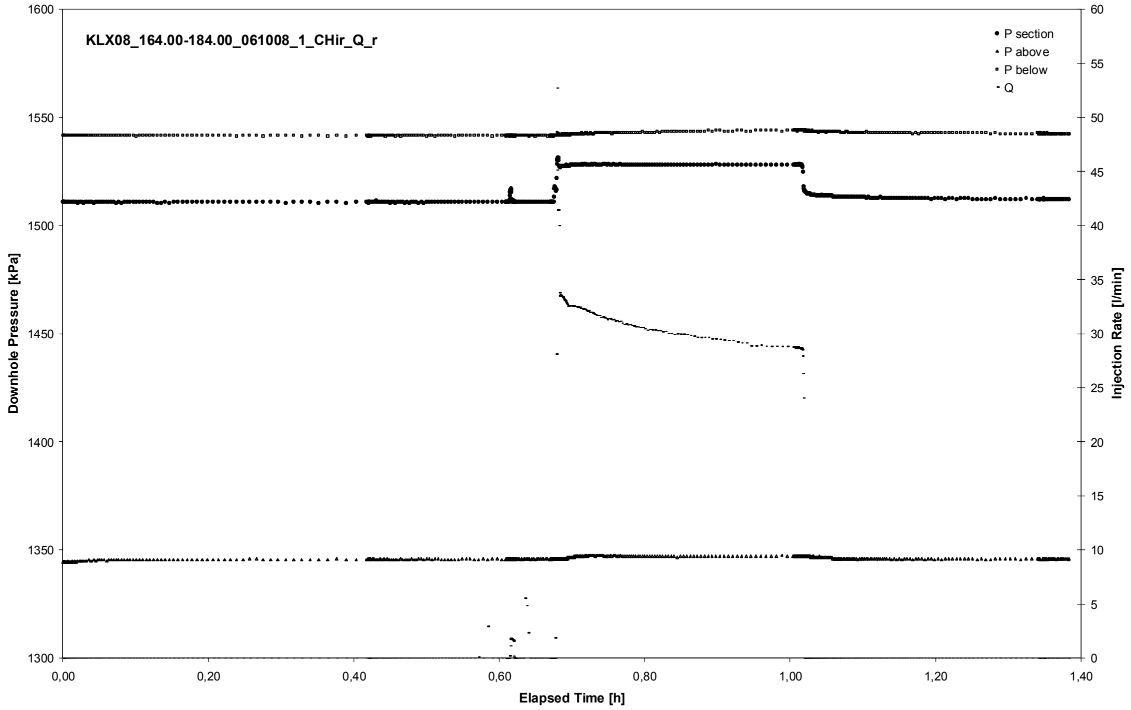


CHIR phase; HORNER match

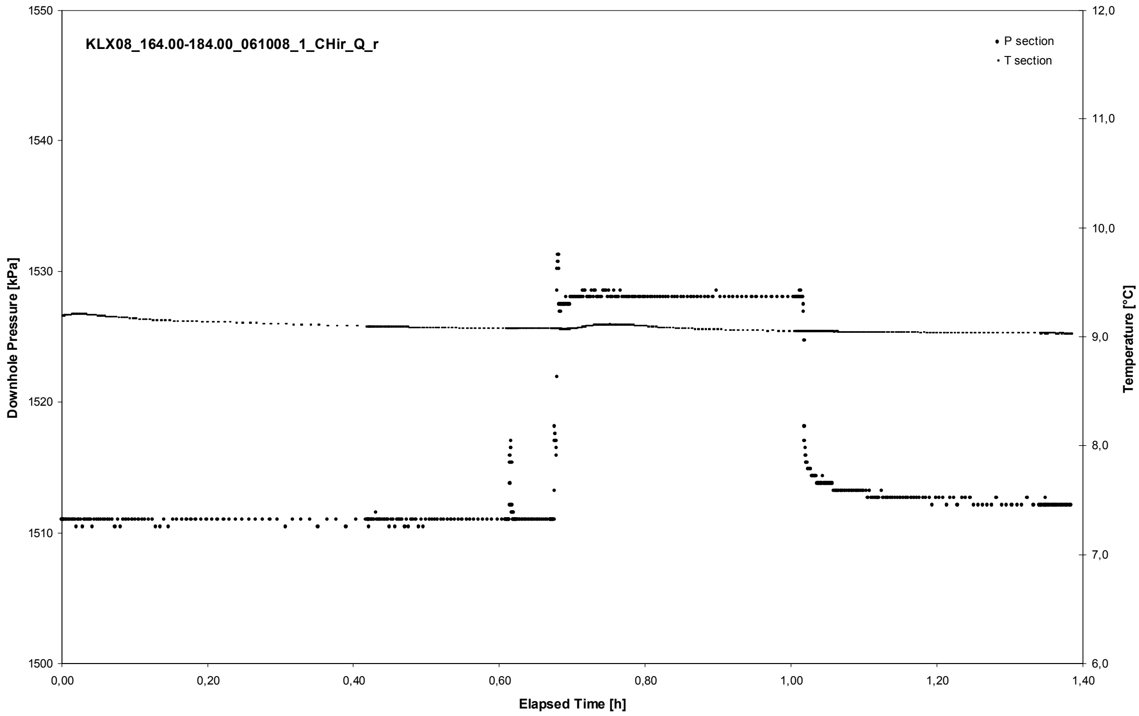
APPENDIX 2-13

Test 164.00 – 184.00 m

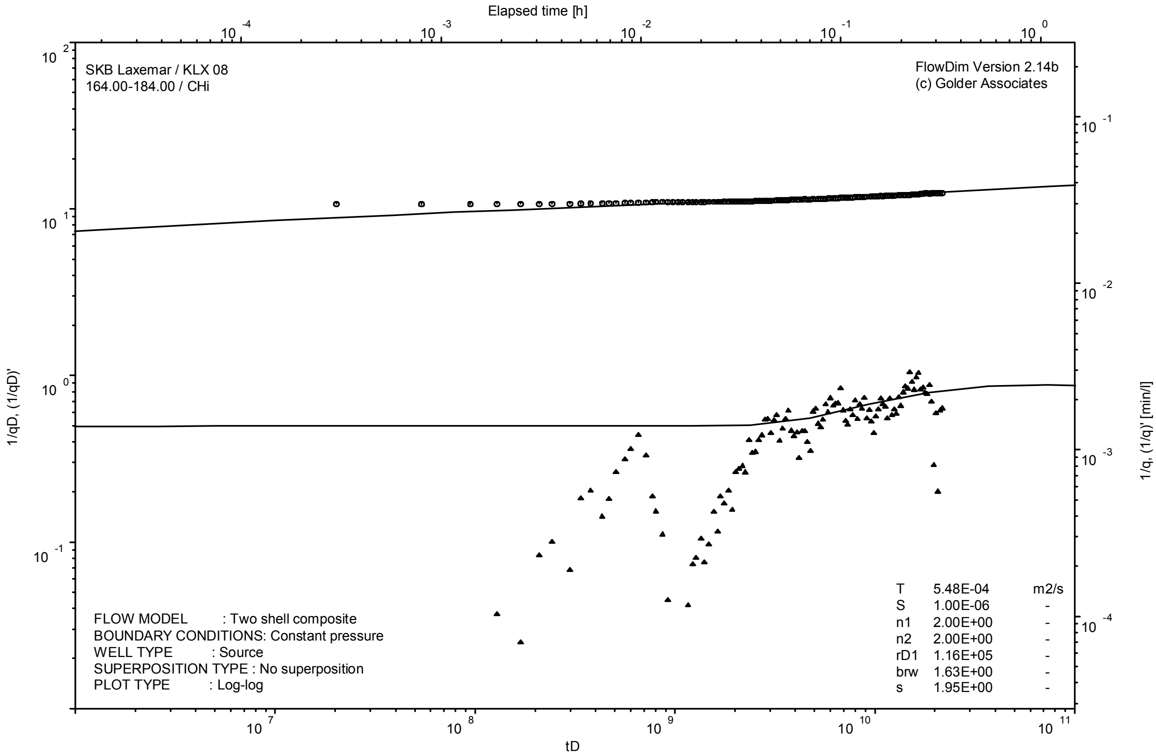
Analysis diagrams



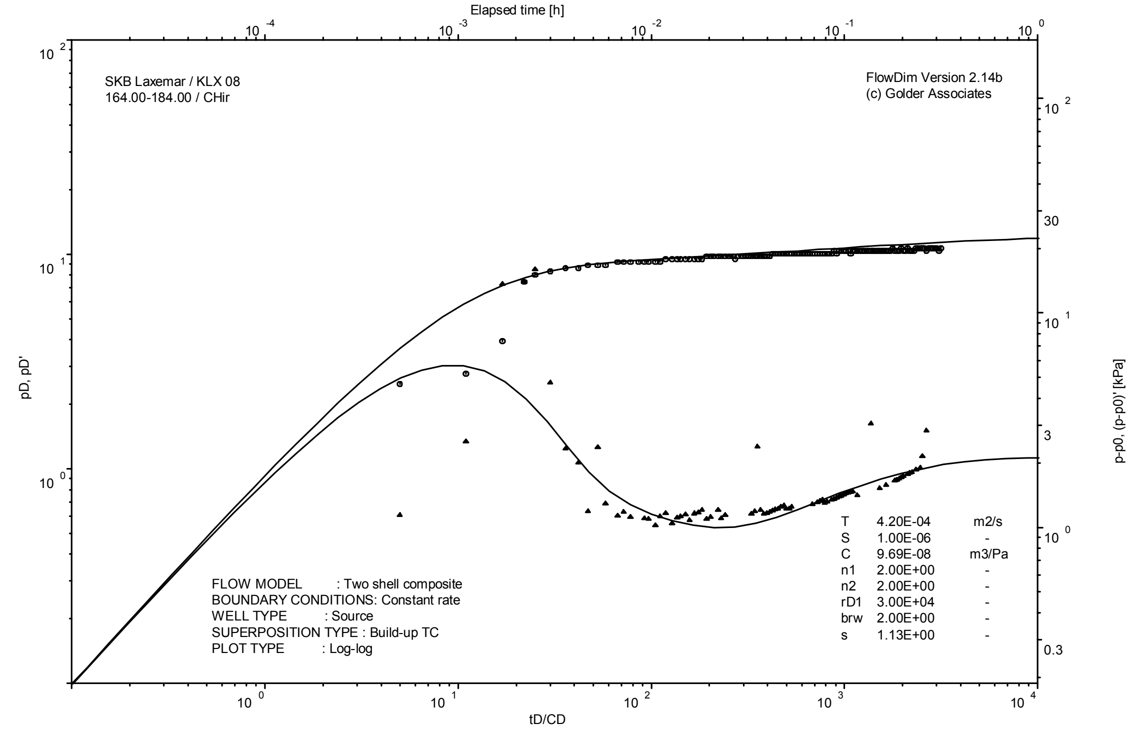
Pressure and flow rate vs. time; cartesian plot



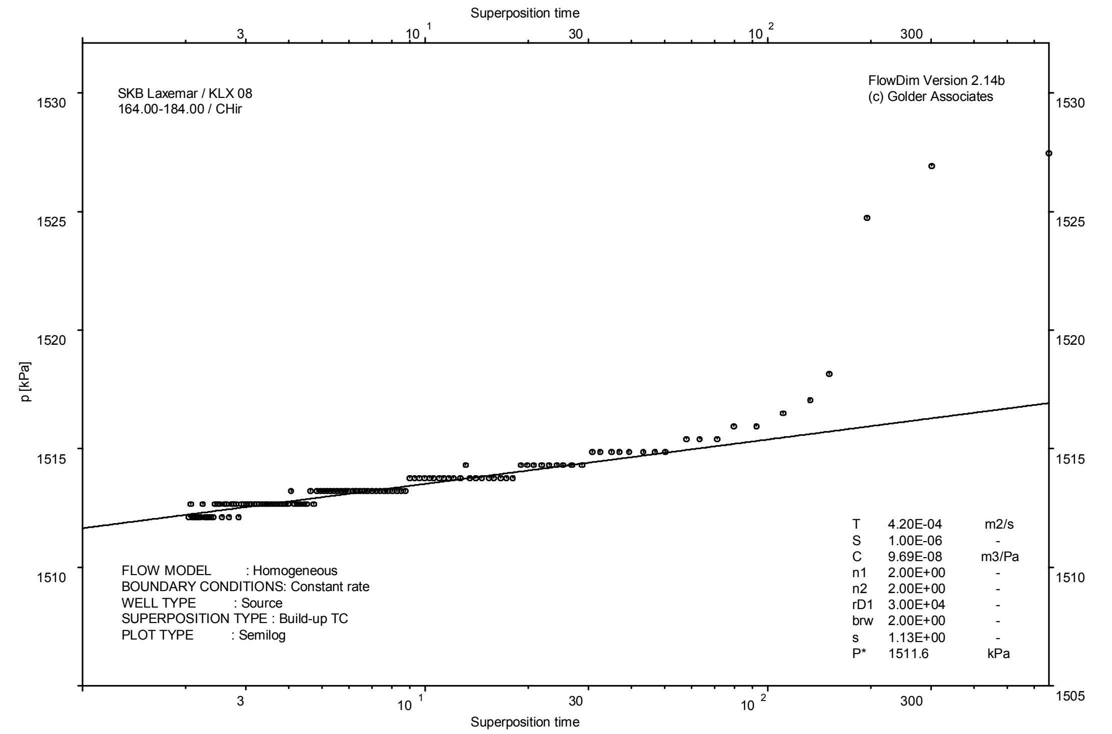
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

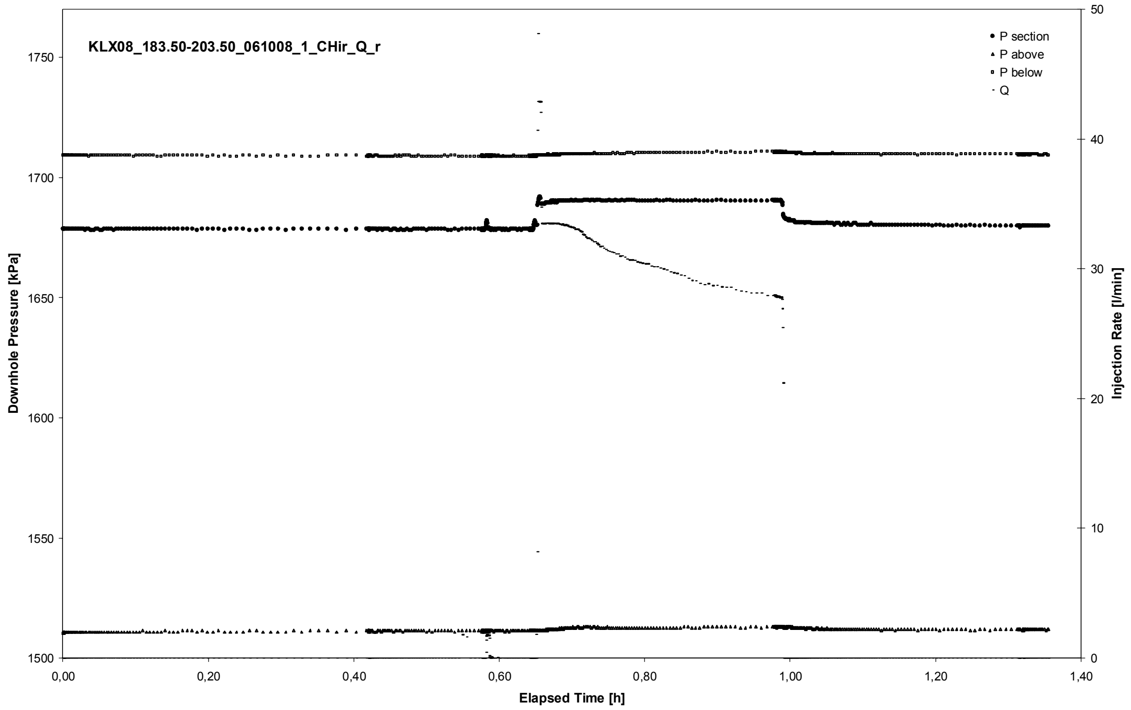


CHIR phase; HORNER match

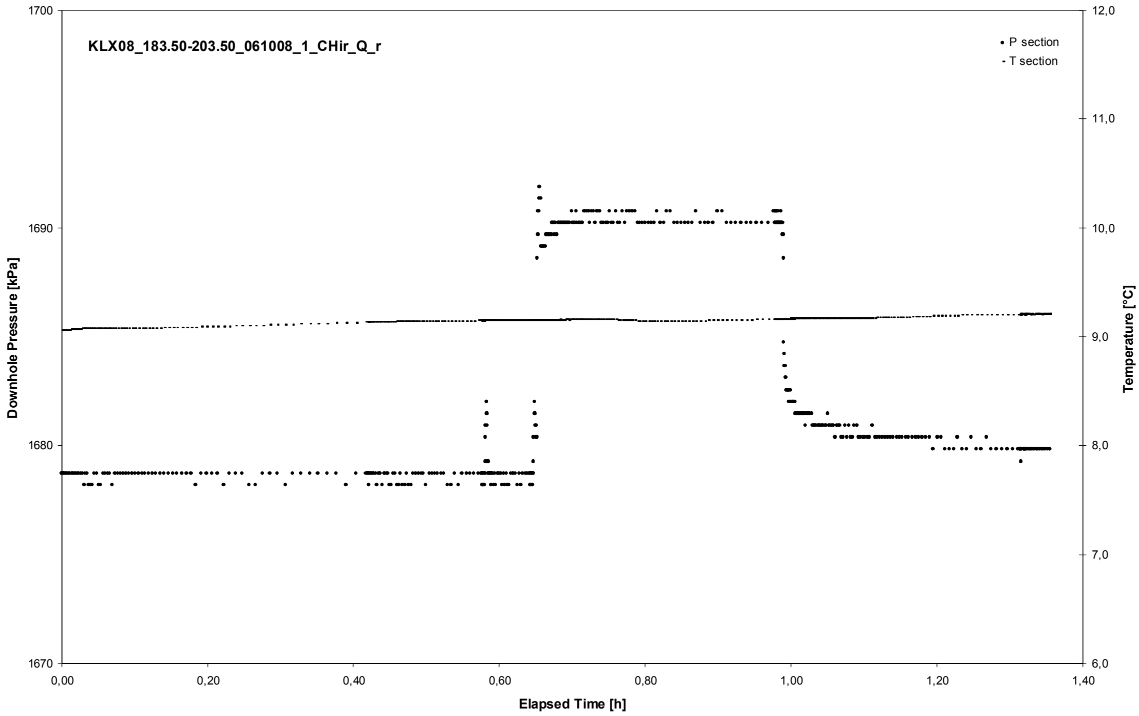
APPENDIX 2-14

Test 183.50 – 203.50 m

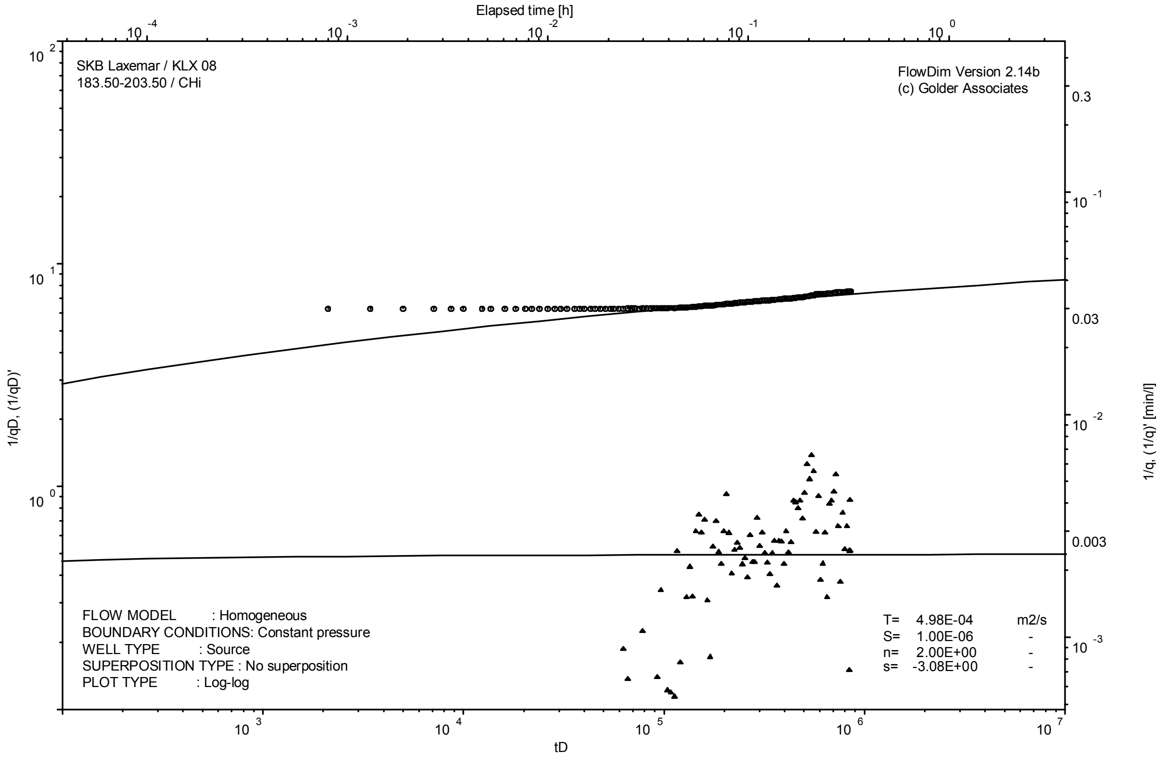
Analysis diagrams



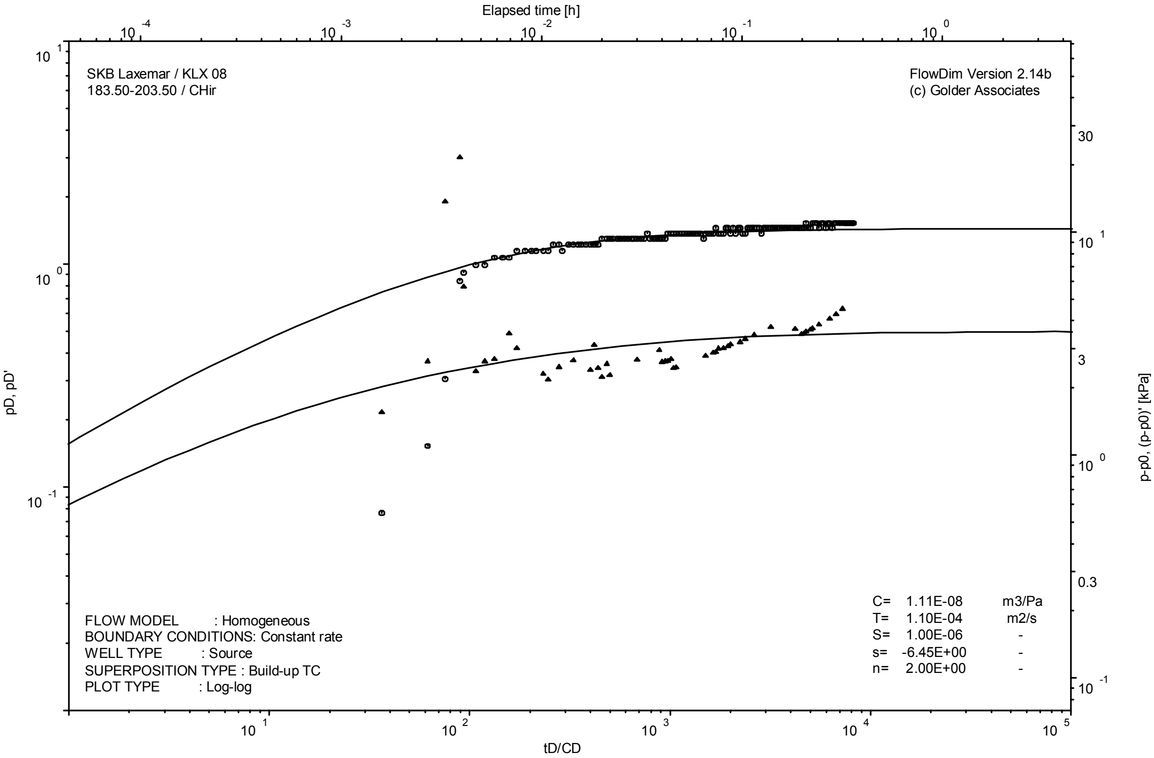
Pressure and flow rate vs. time; cartesian plot



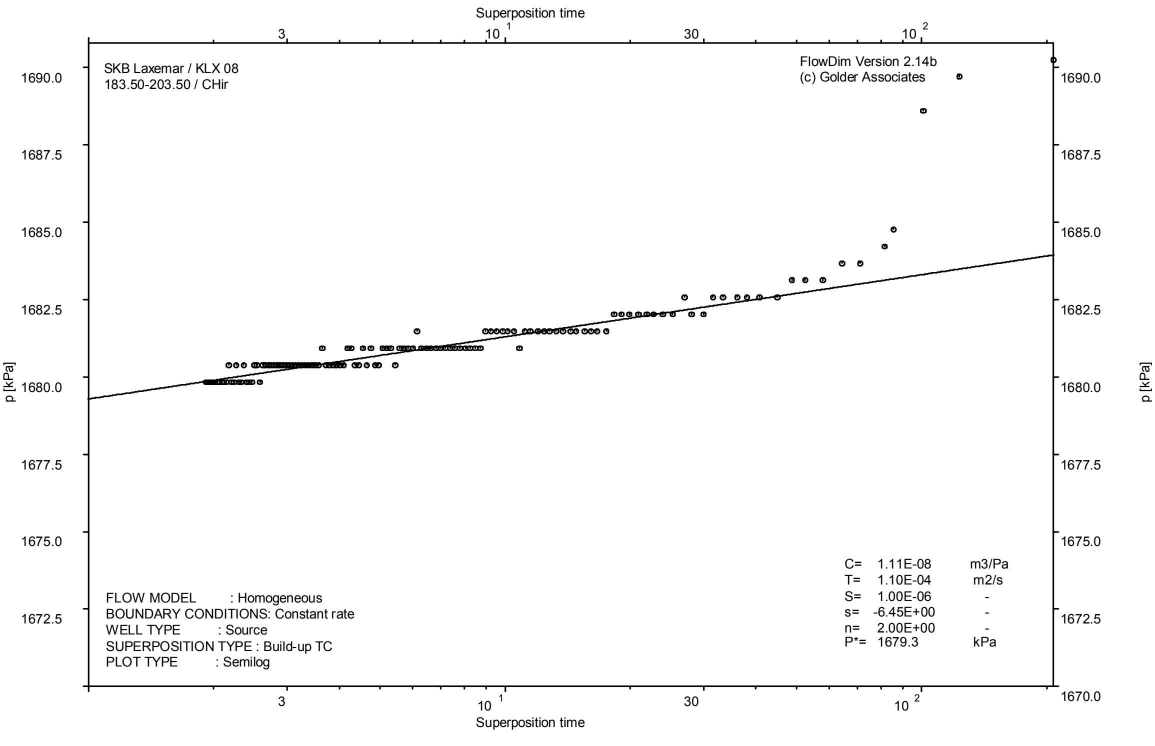
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

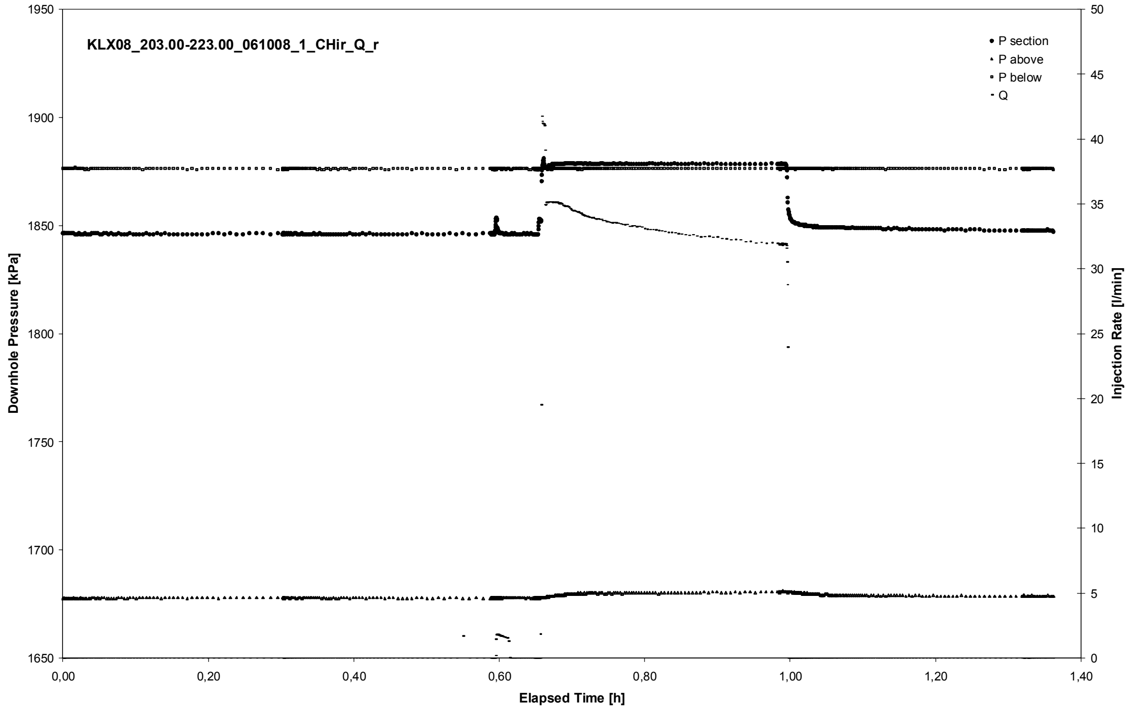


CHIR phase; HORNER match

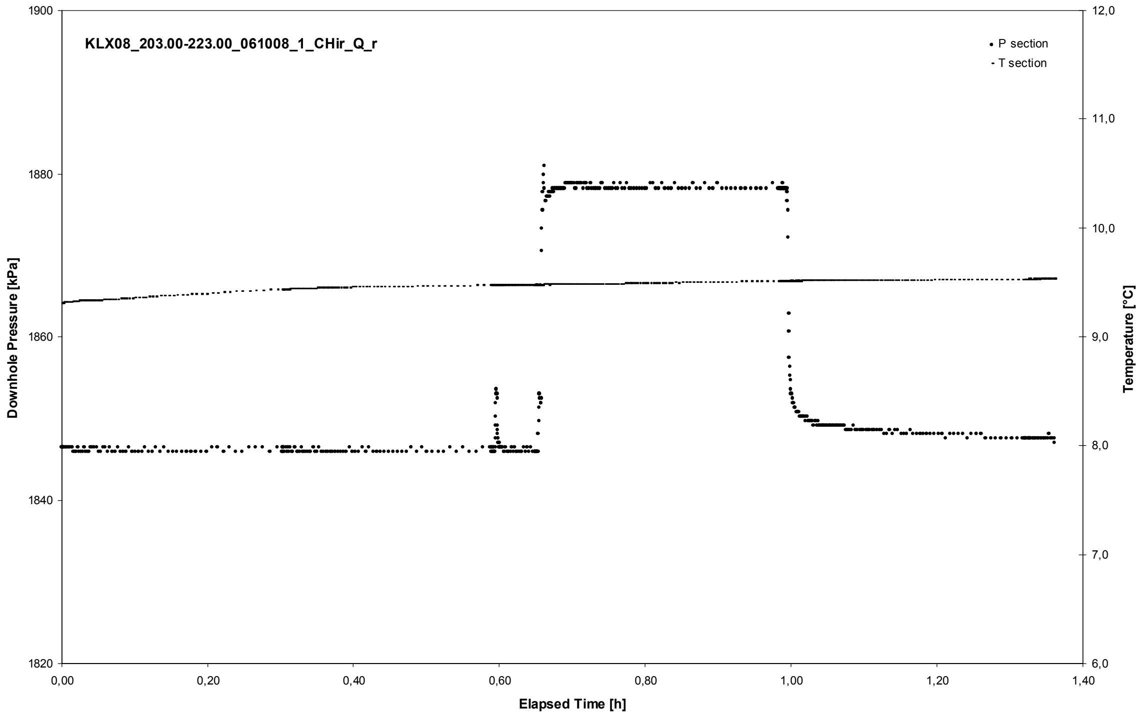
APPENDIX 2-15

Test 203.00 – 223.00 m

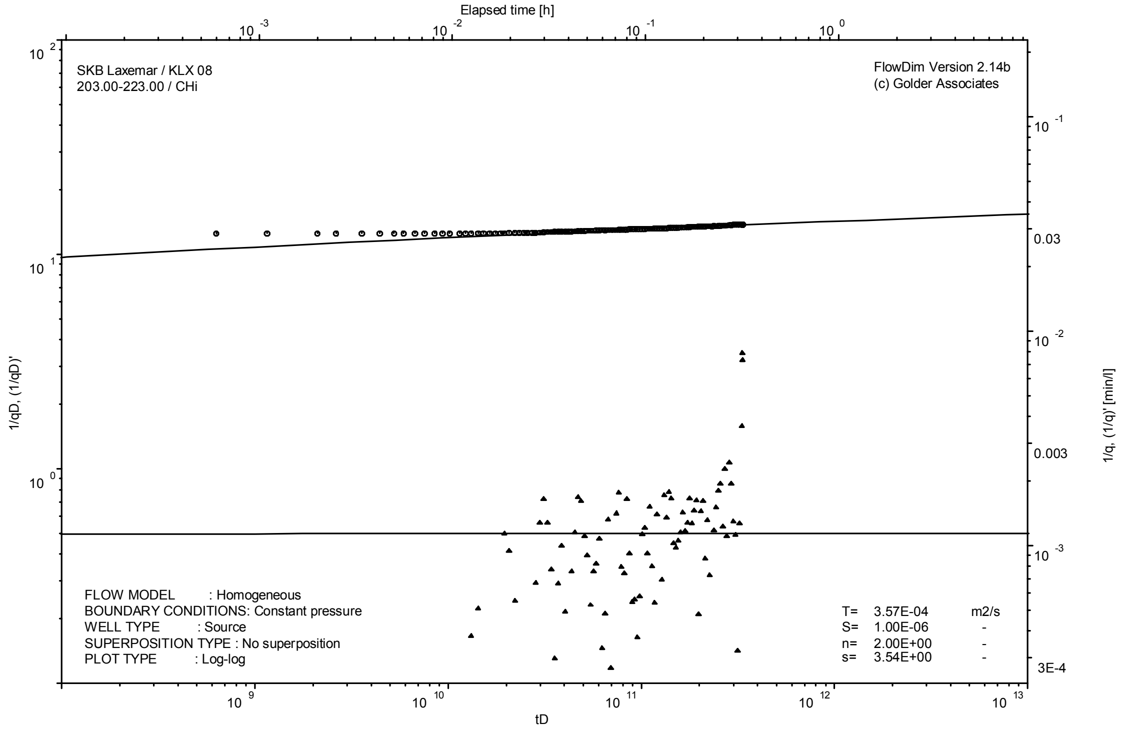
Analysis diagrams



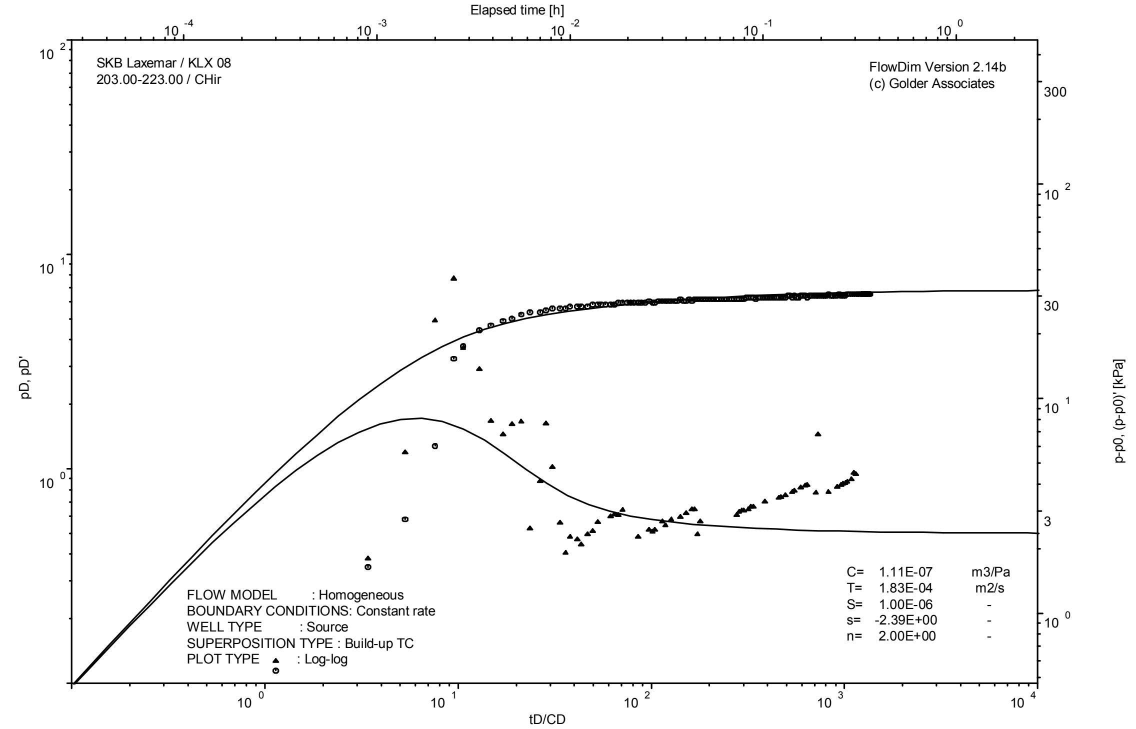
Pressure and flow rate vs. time; cartesian plot



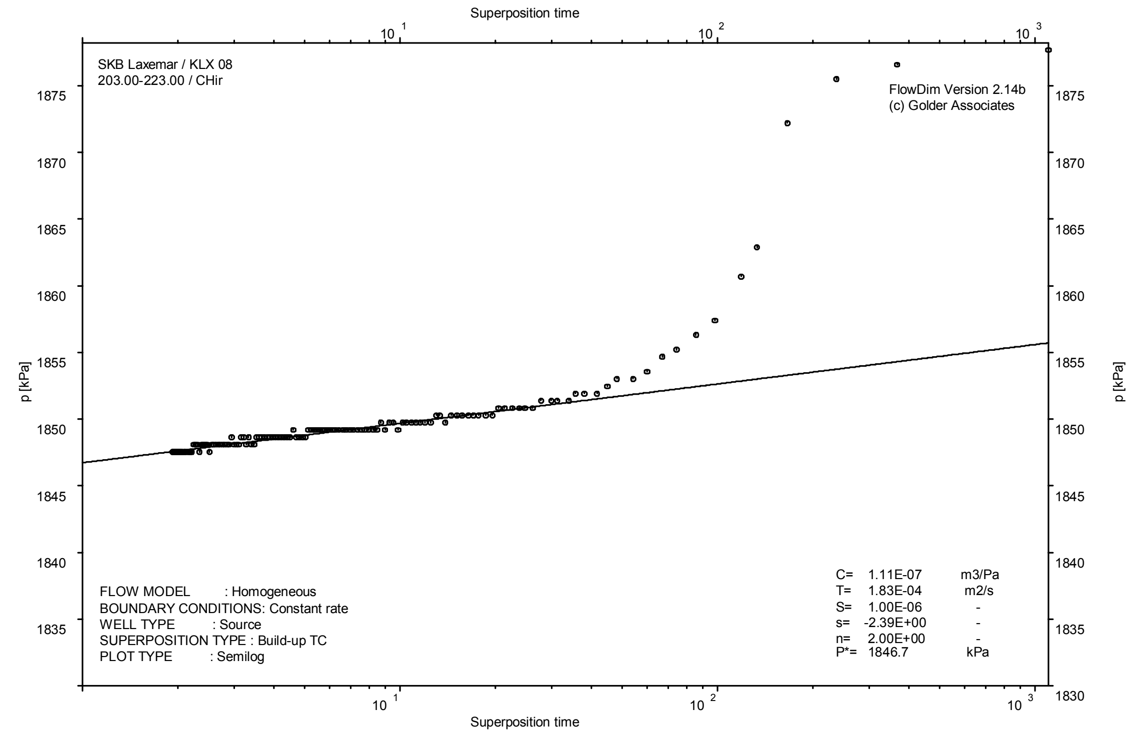
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

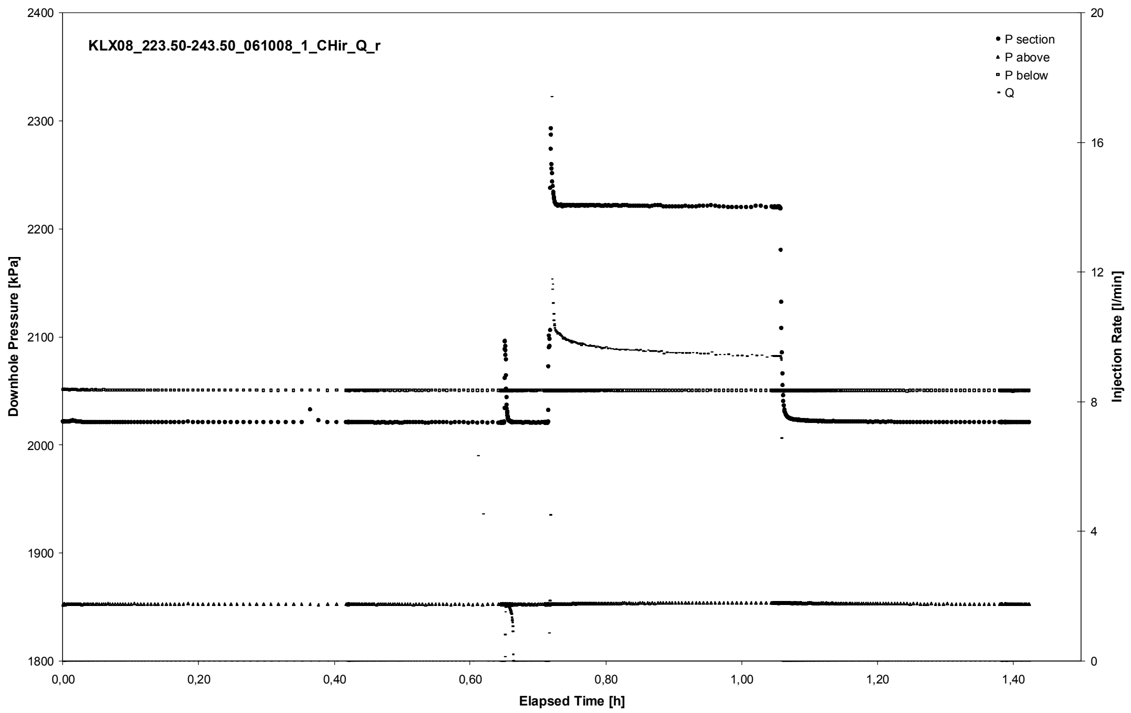


CHIR phase; HORNER match

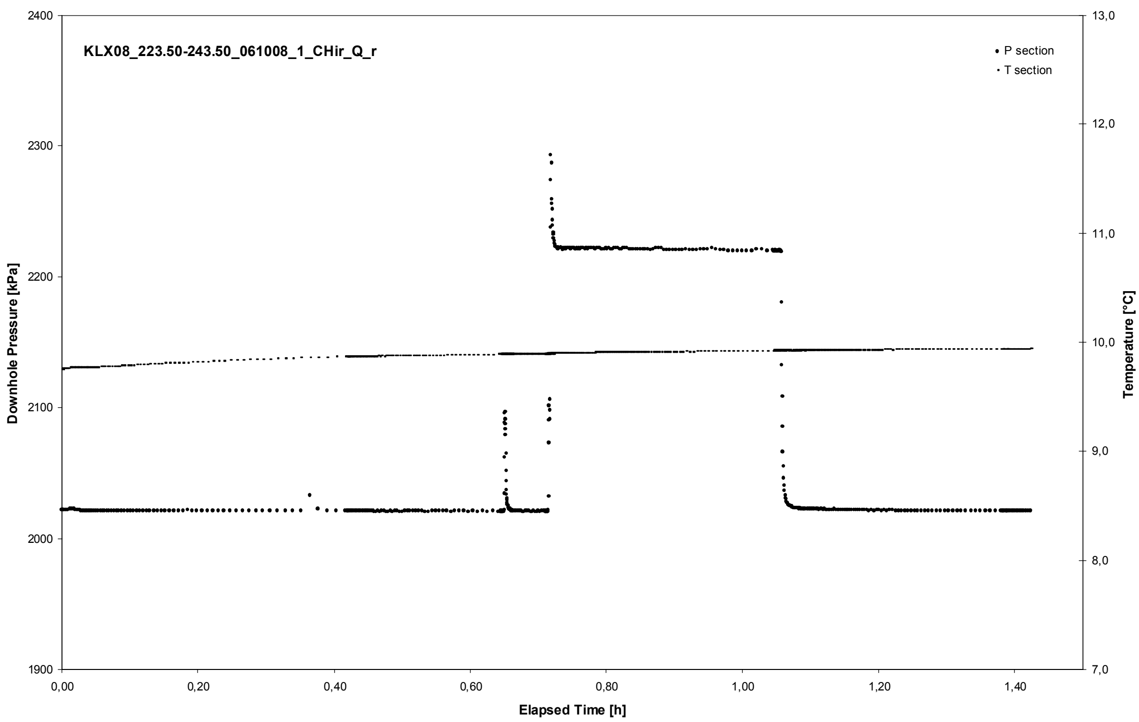
APPENDIX 2-16

Test 223.50 – 243.50 m

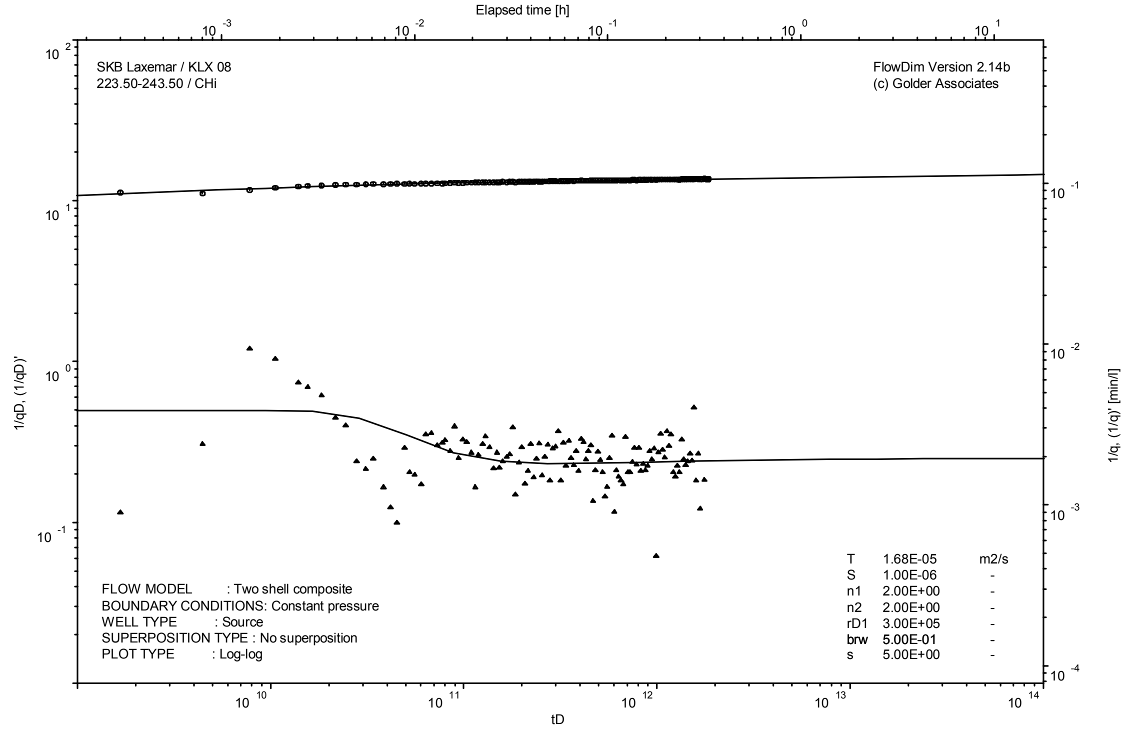
Analysis diagrams



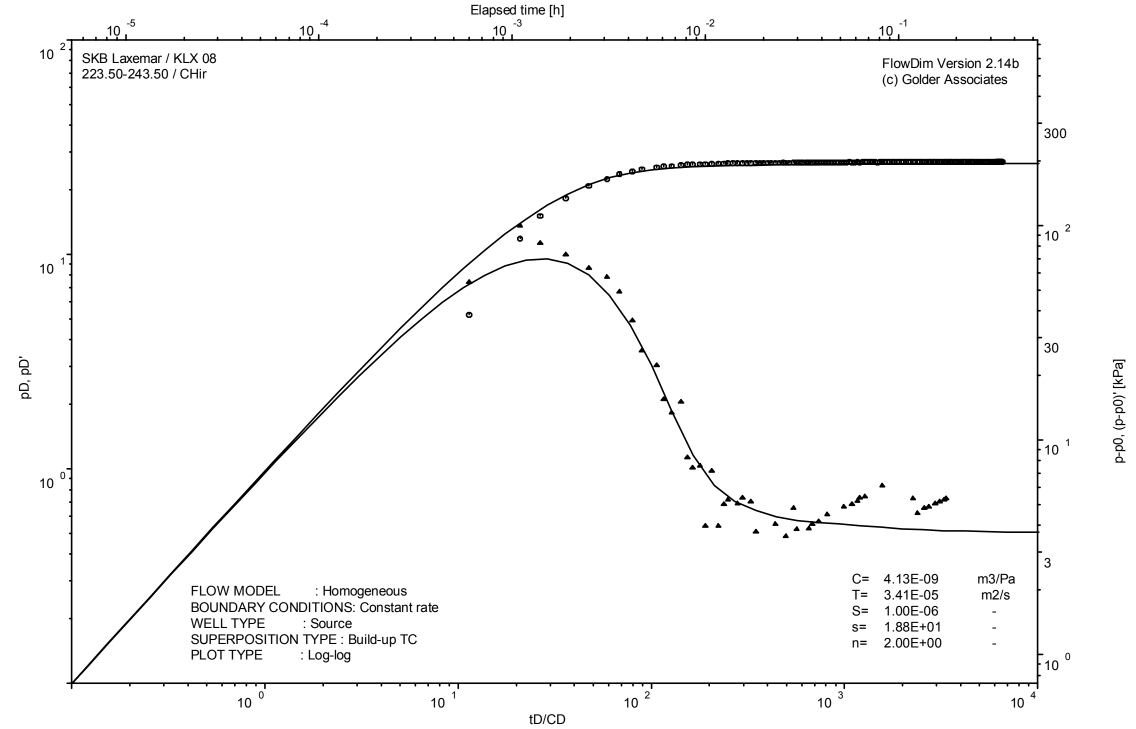
Pressure and flow rate vs. time; cartesian plot



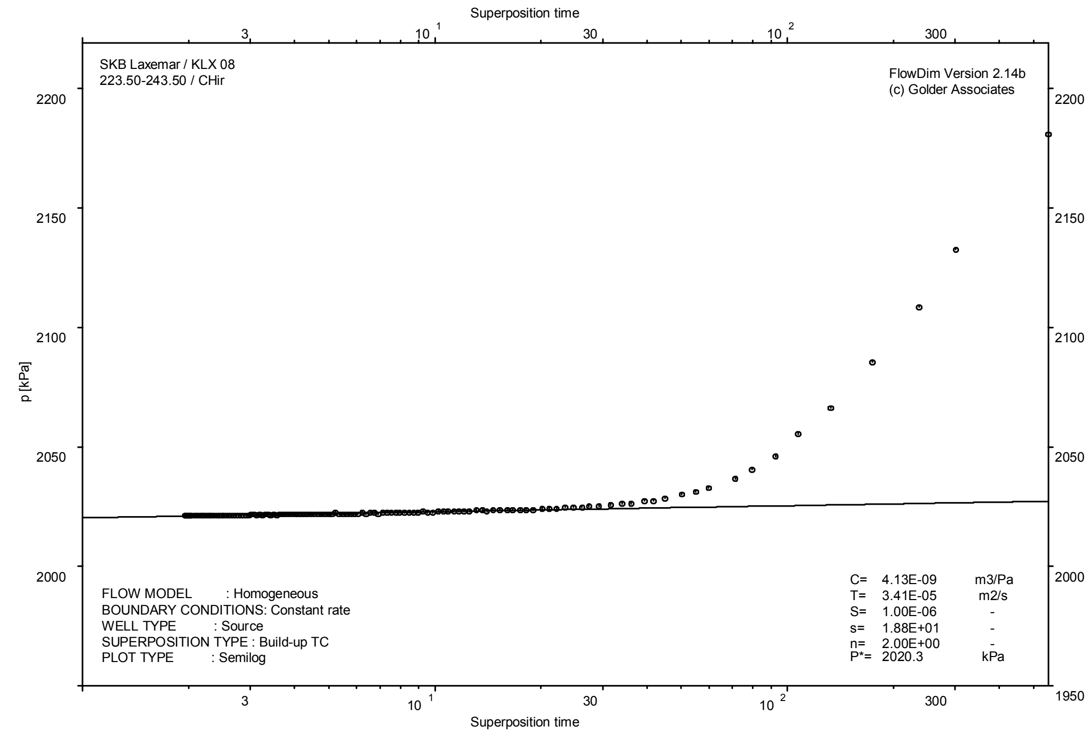
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

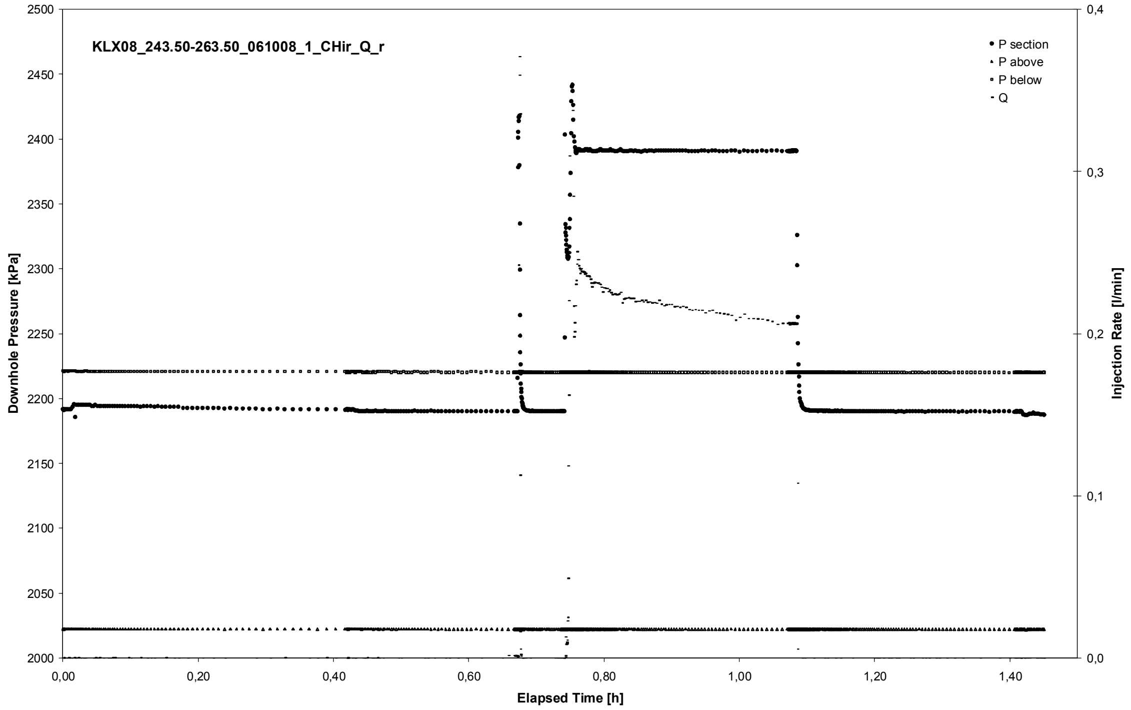


CHIR phase; HORNER match

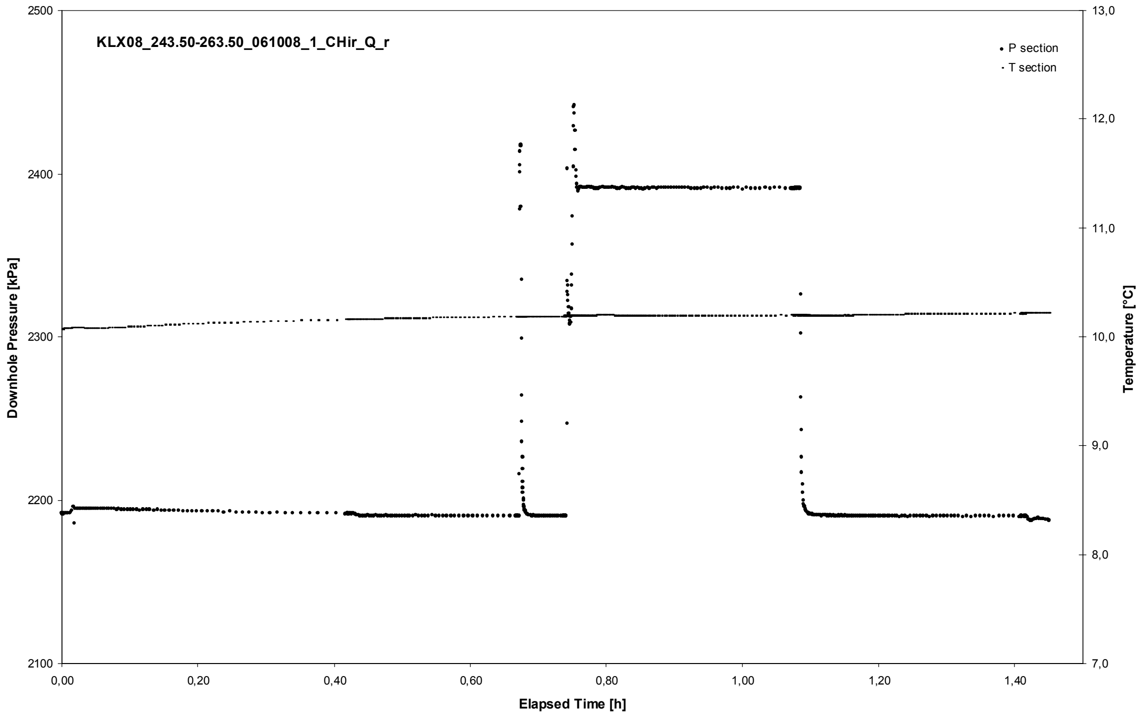
APPENDIX 2-17

Test 243.50 – 263.50 m

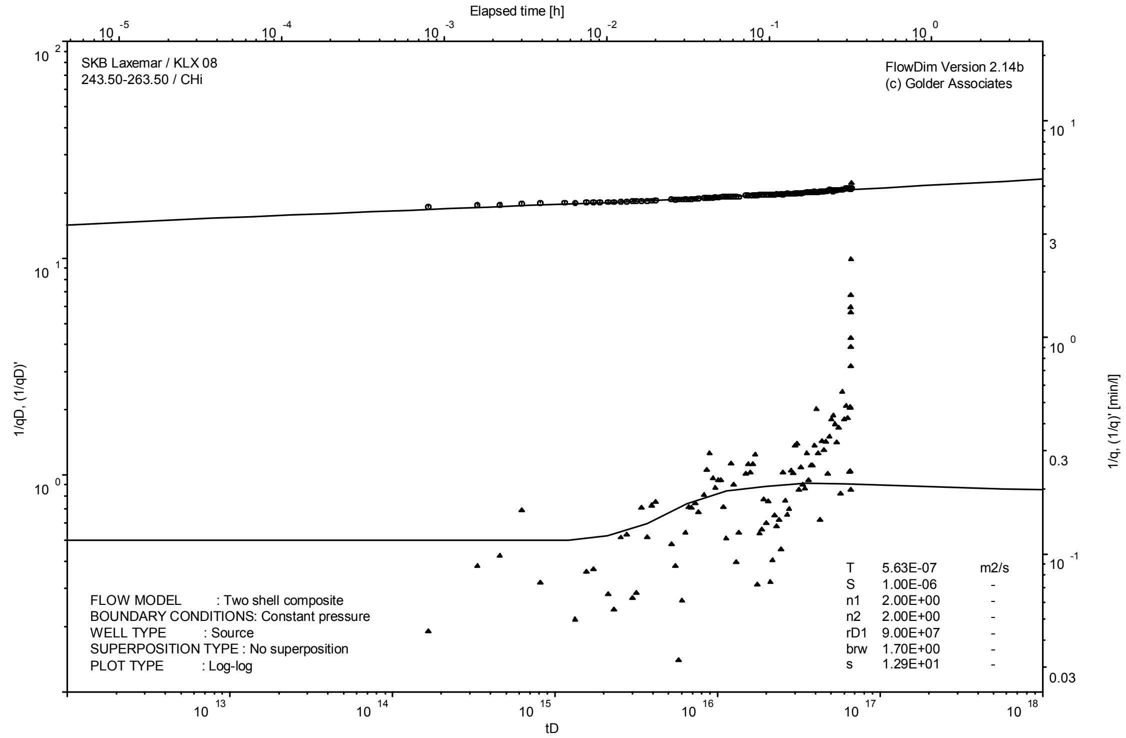
Analysis diagrams



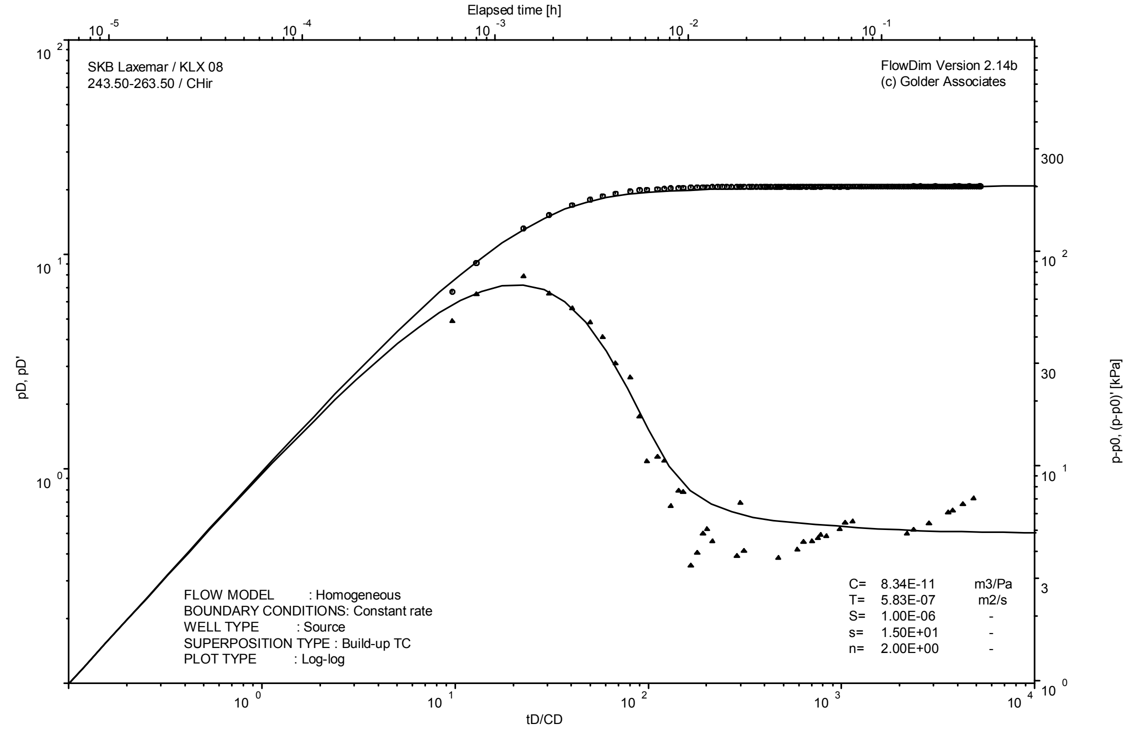
Pressure and flow rate vs. time; cartesian plot



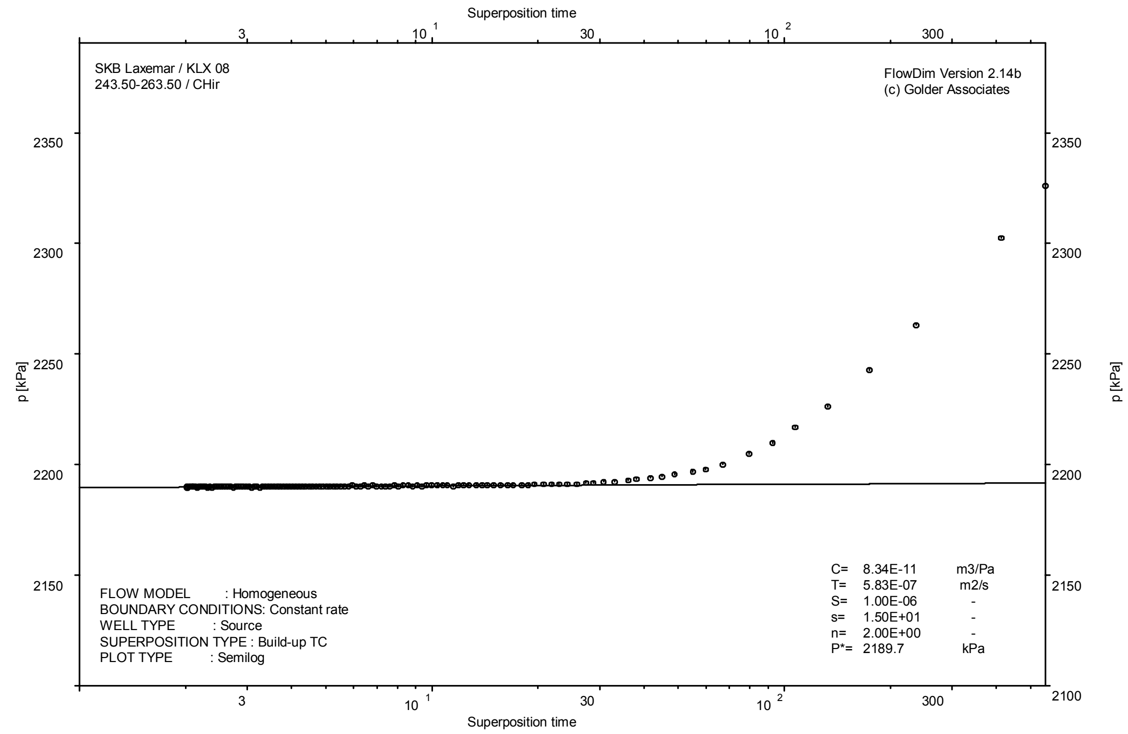
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

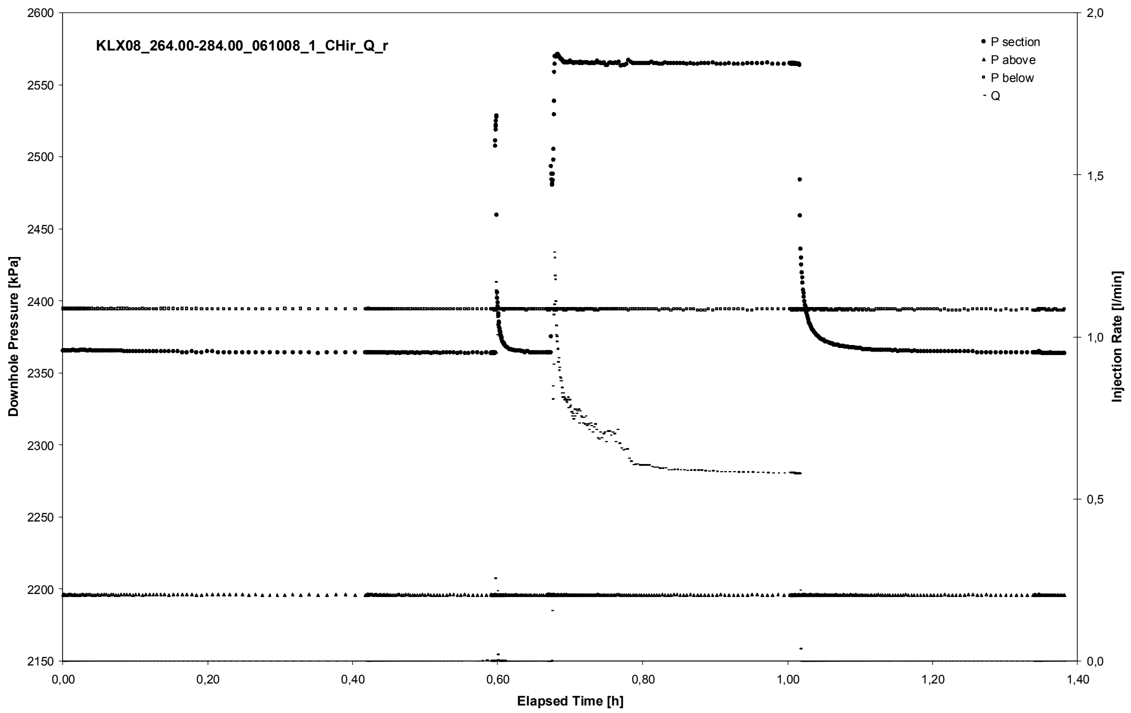


CHIR phase; HORNER match

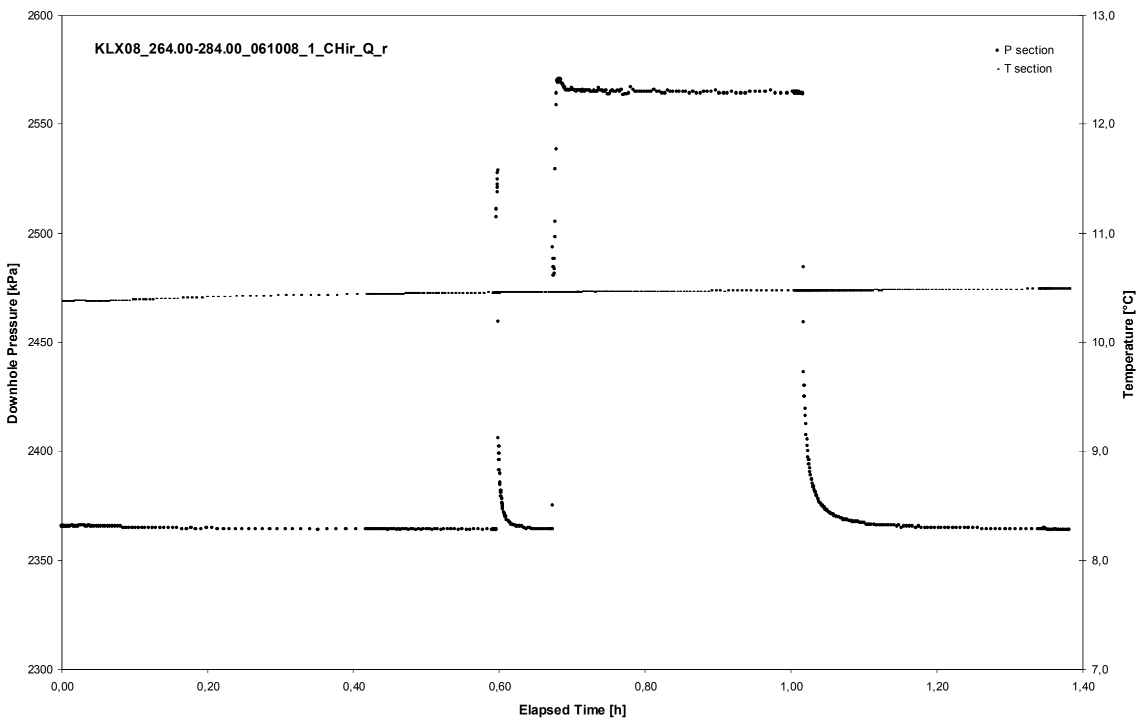
APPENDIX 2-18

Test 264.00 – 284.00 m

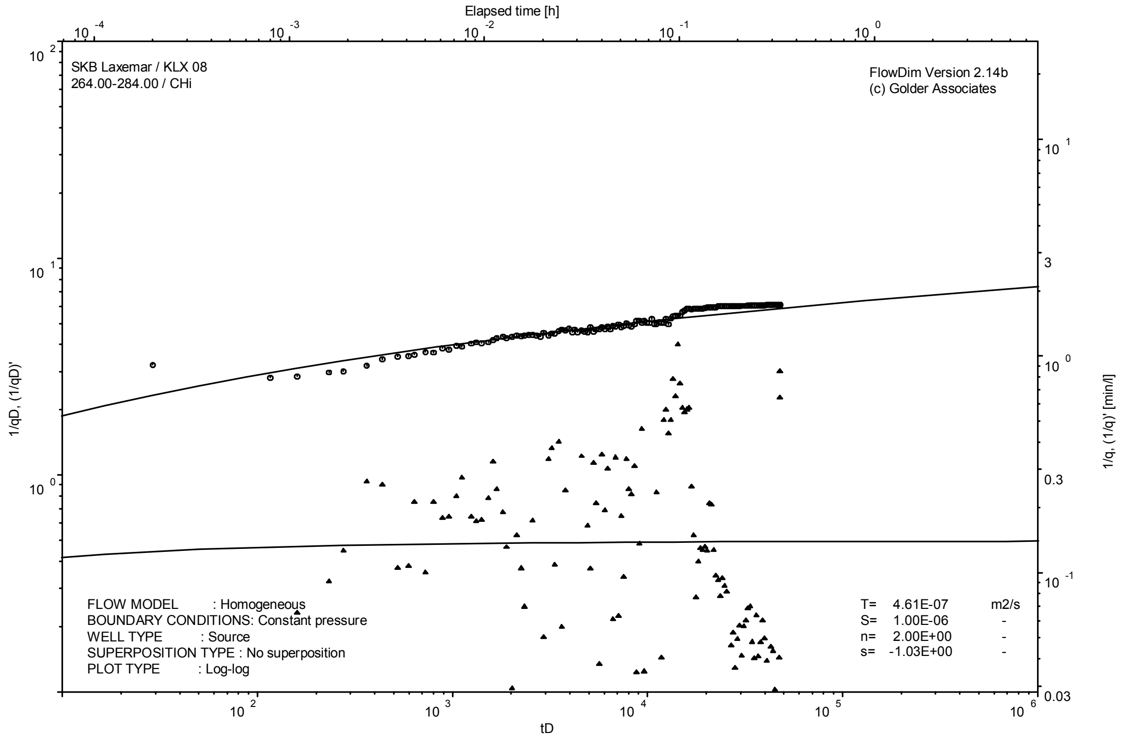
Analysis diagrams



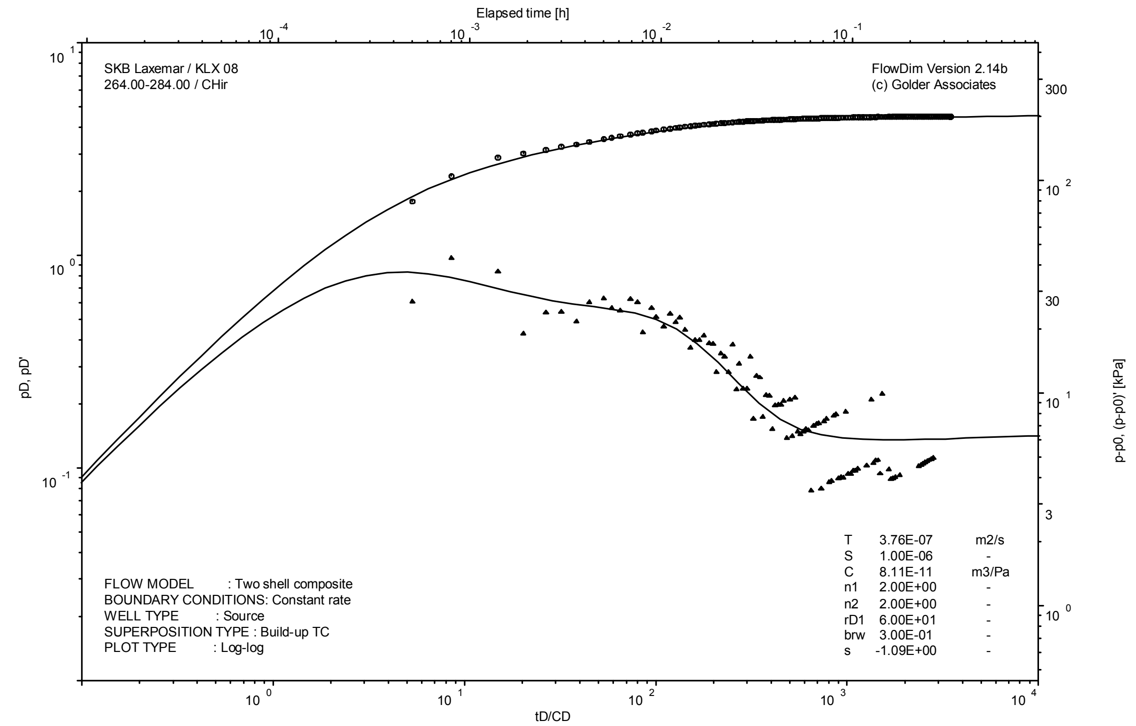
Pressure and flow rate vs. time; cartesian plot



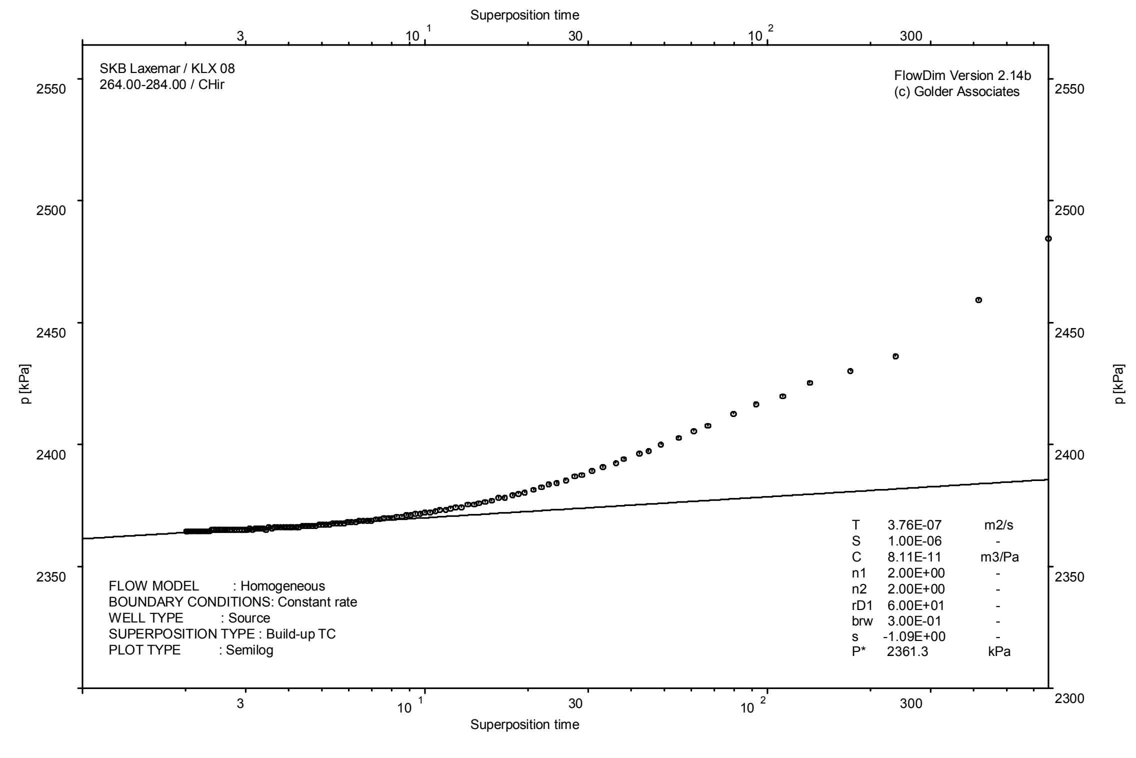
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

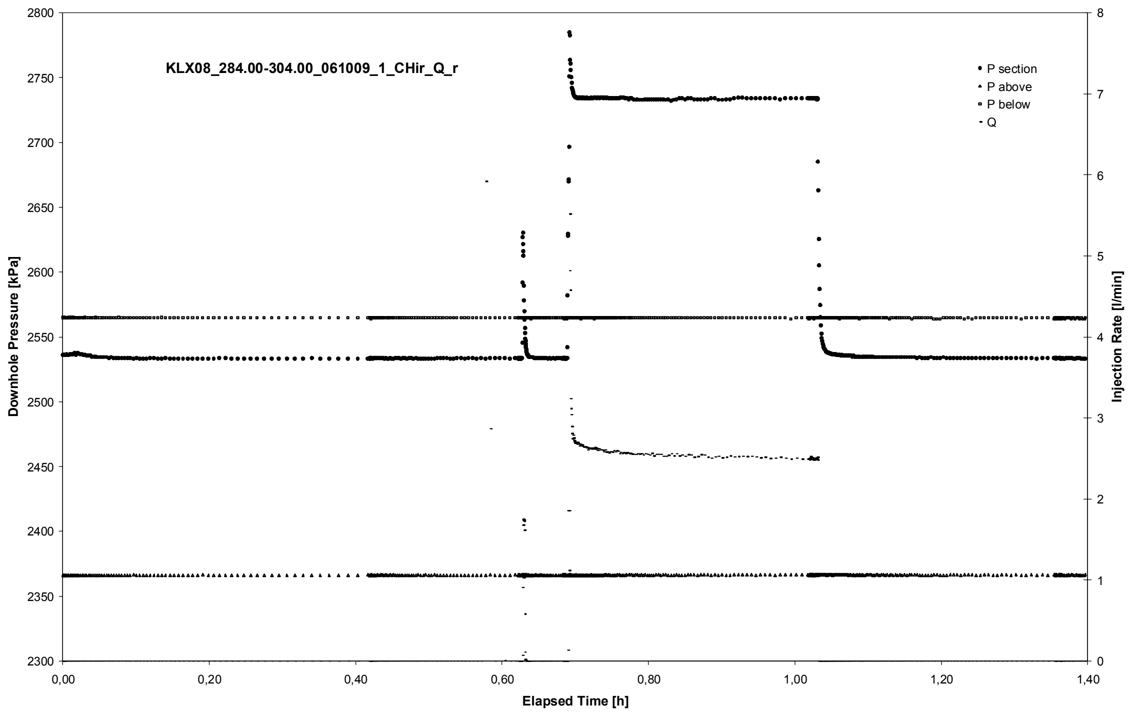


CHIR phase; HORNER match

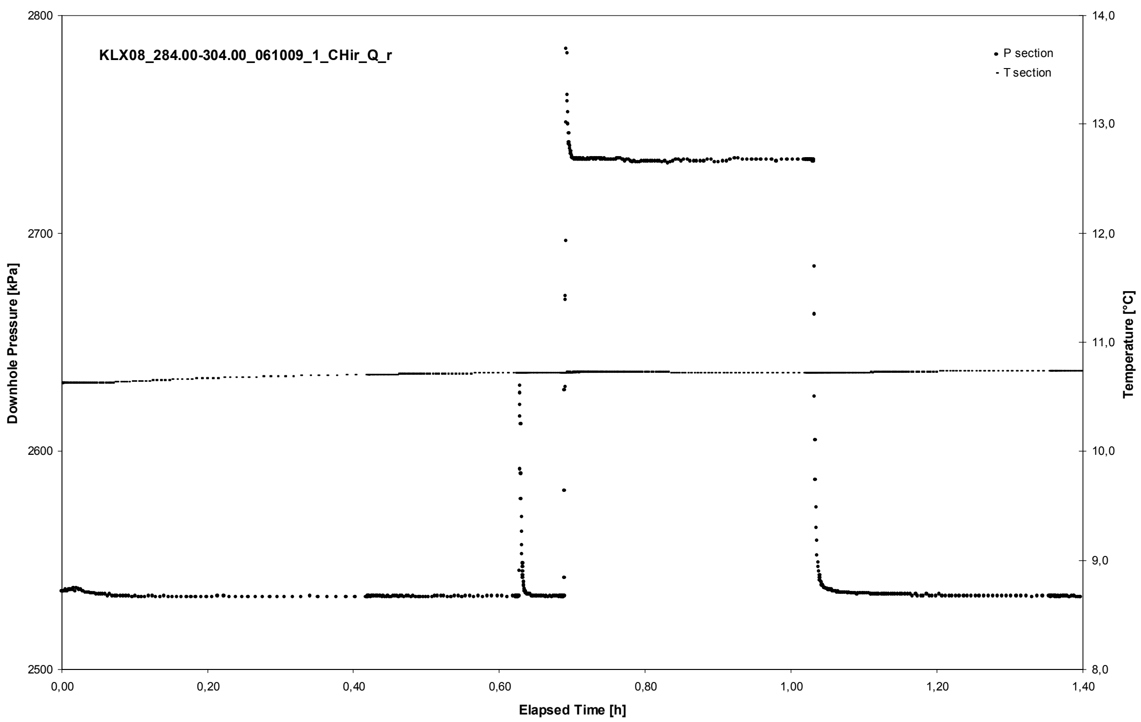
APPENDIX 2-19

Test 284.00 – 304.00 m

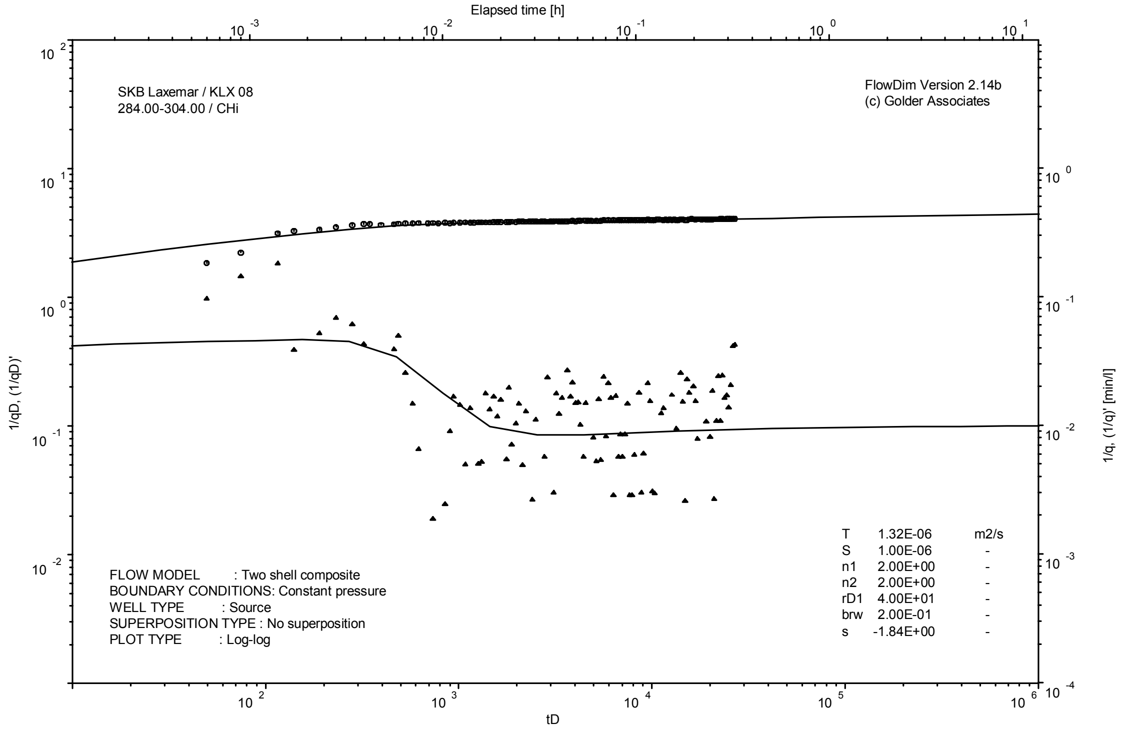
Analysis diagrams



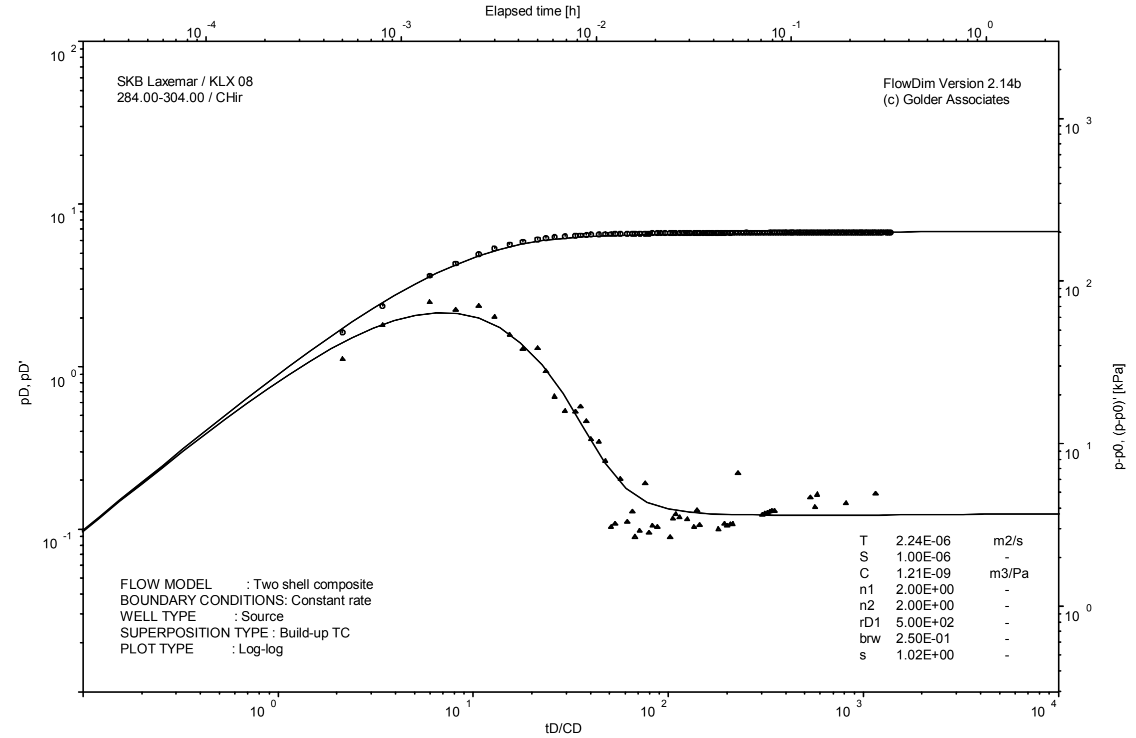
Pressure and flow rate vs. time; cartesian plot



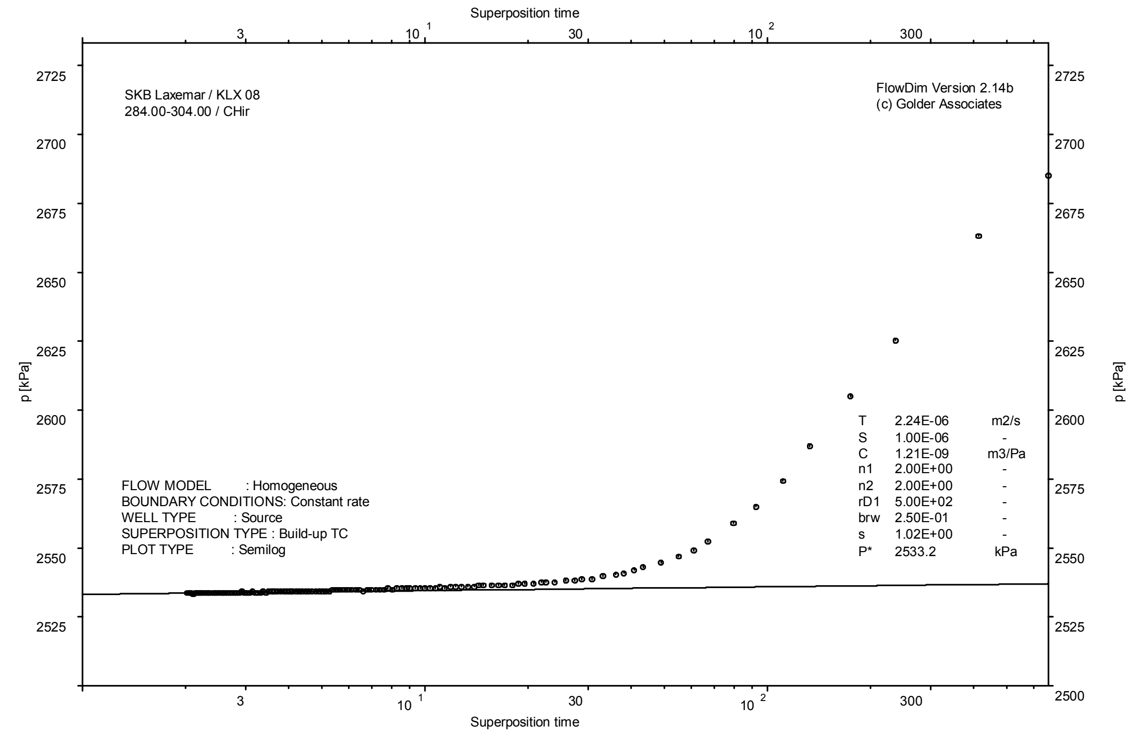
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

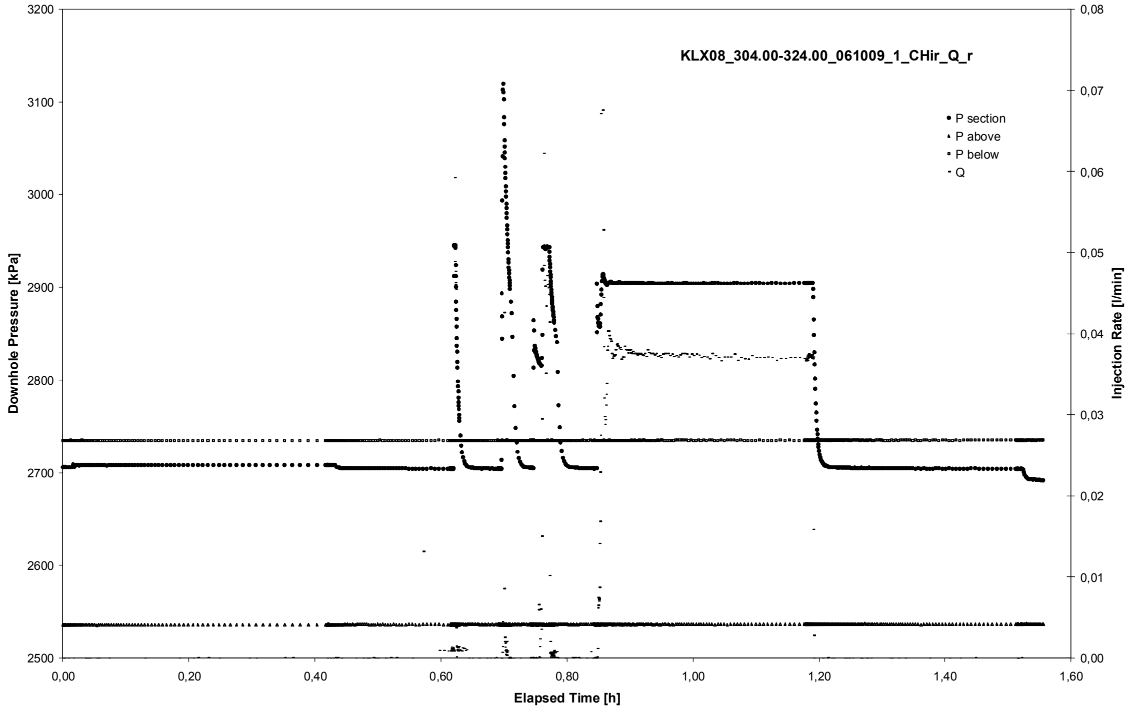


CHIR phase; HORNER match

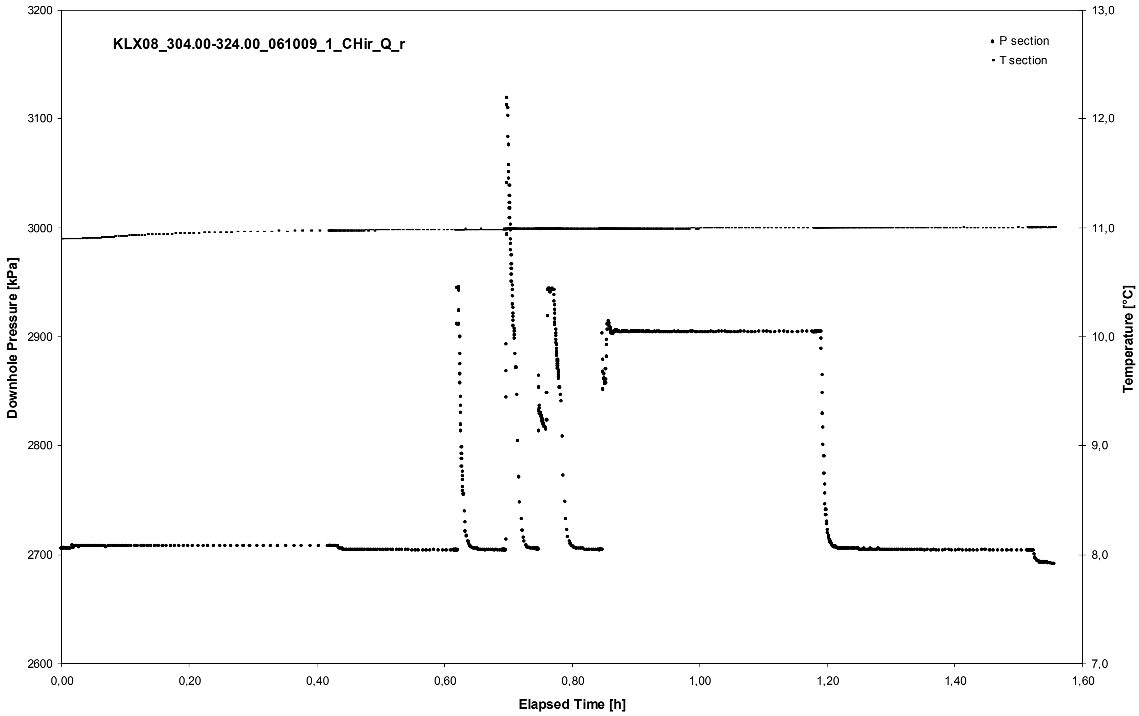
APPENDIX 2-20

Test 304.00 – 324.00 m

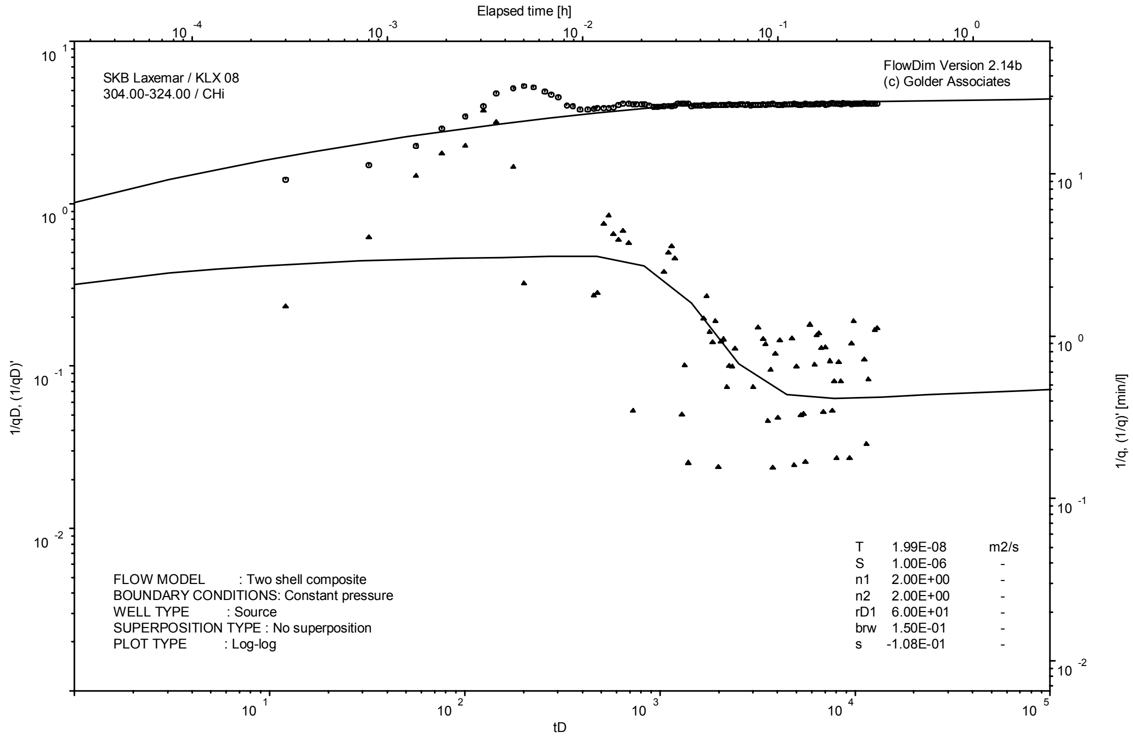
Analysis diagrams



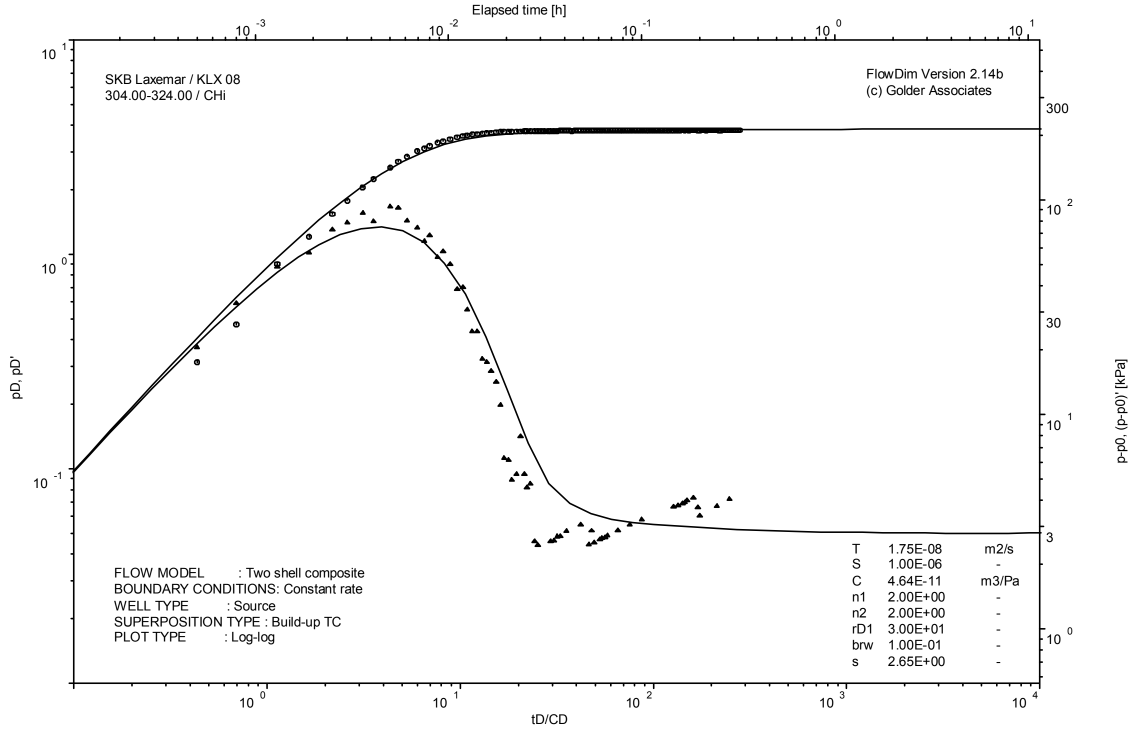
Pressure and flow rate vs. time; cartesian plot



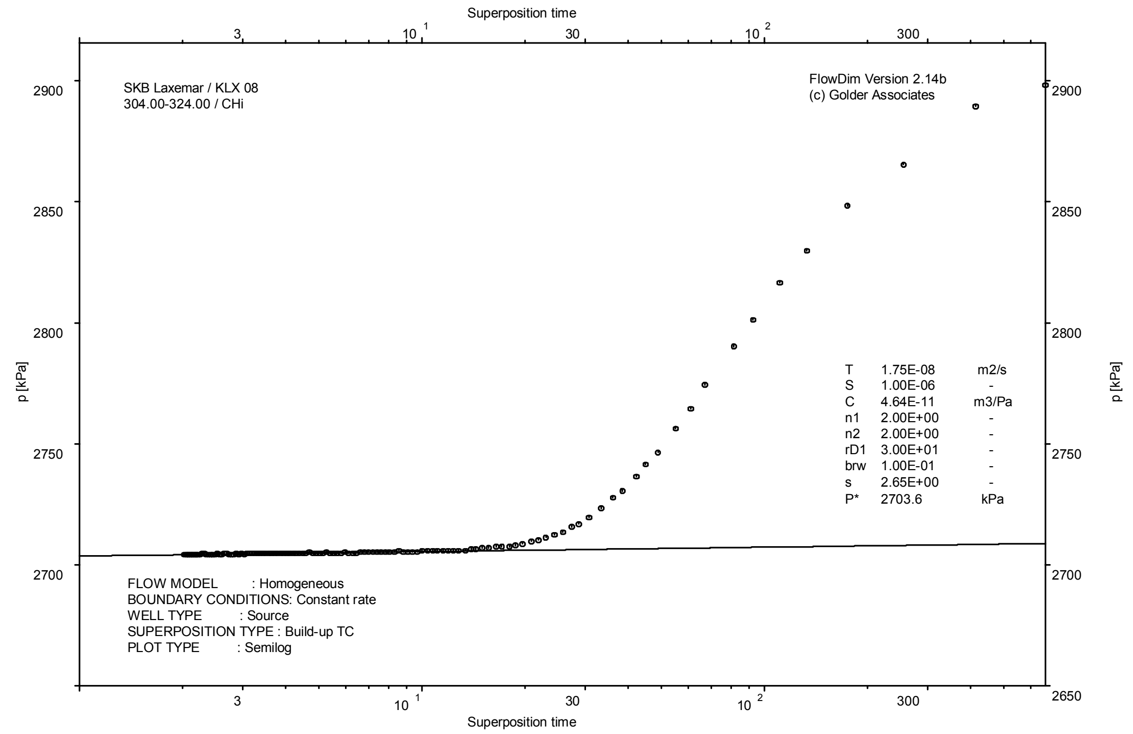
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

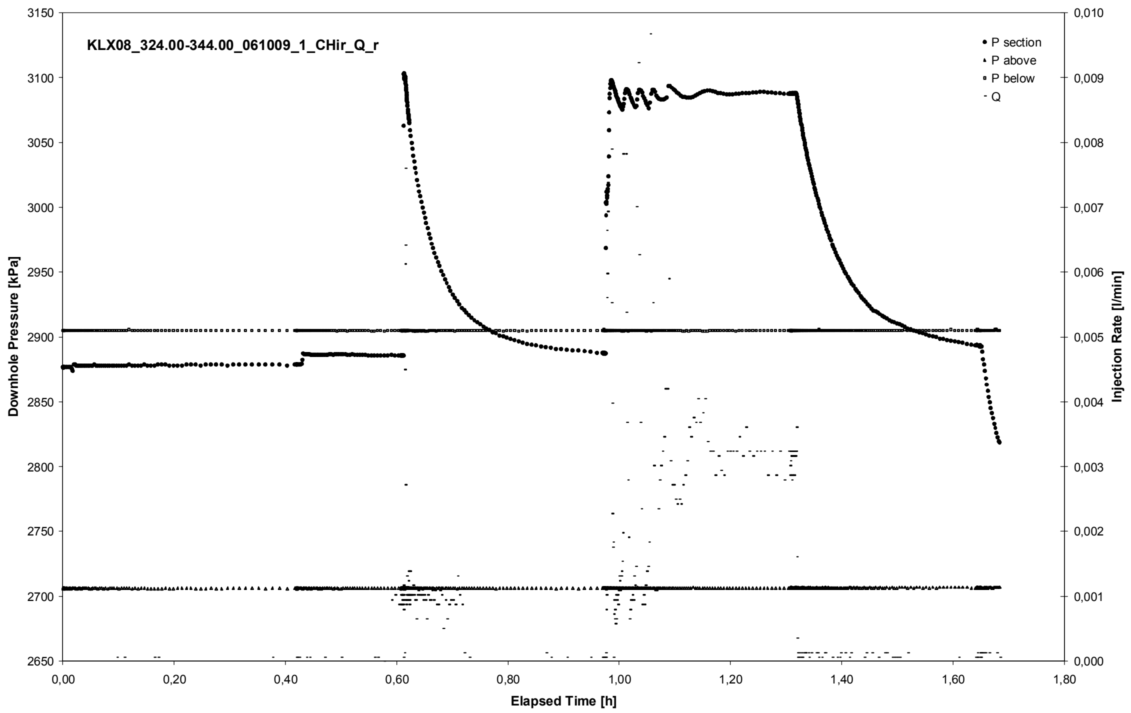


CHIR phase; HORNER match

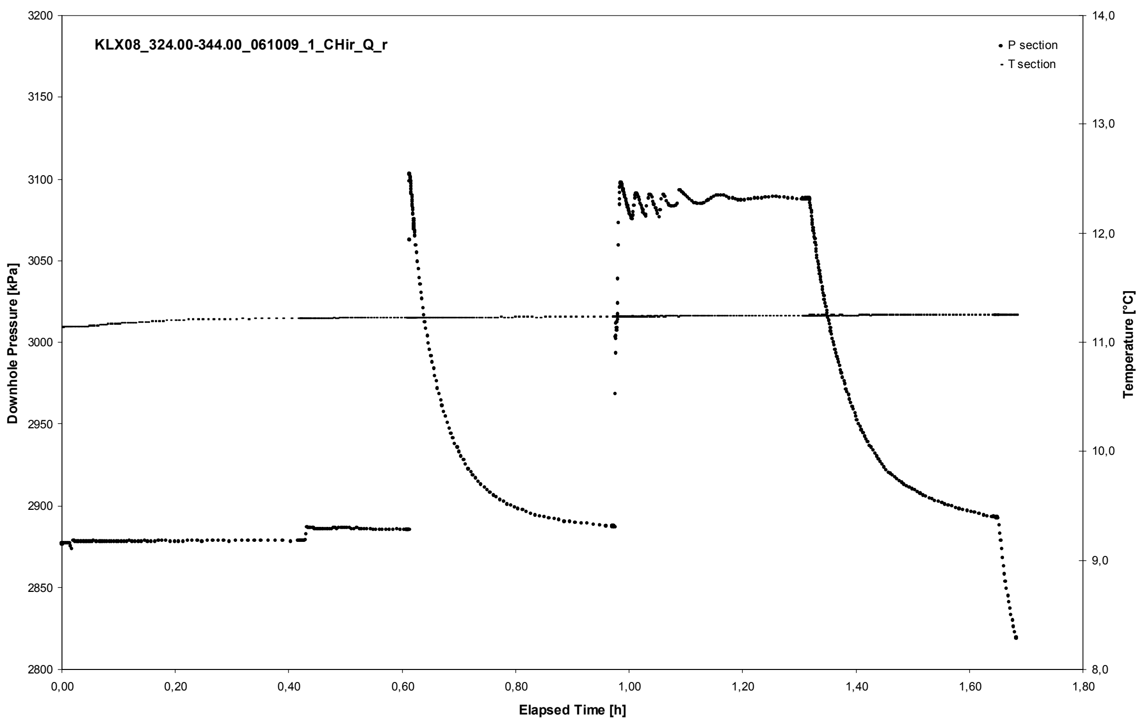
APPENDIX 2-21

Test 324.00 – 344.00 m

Analysis diagrams



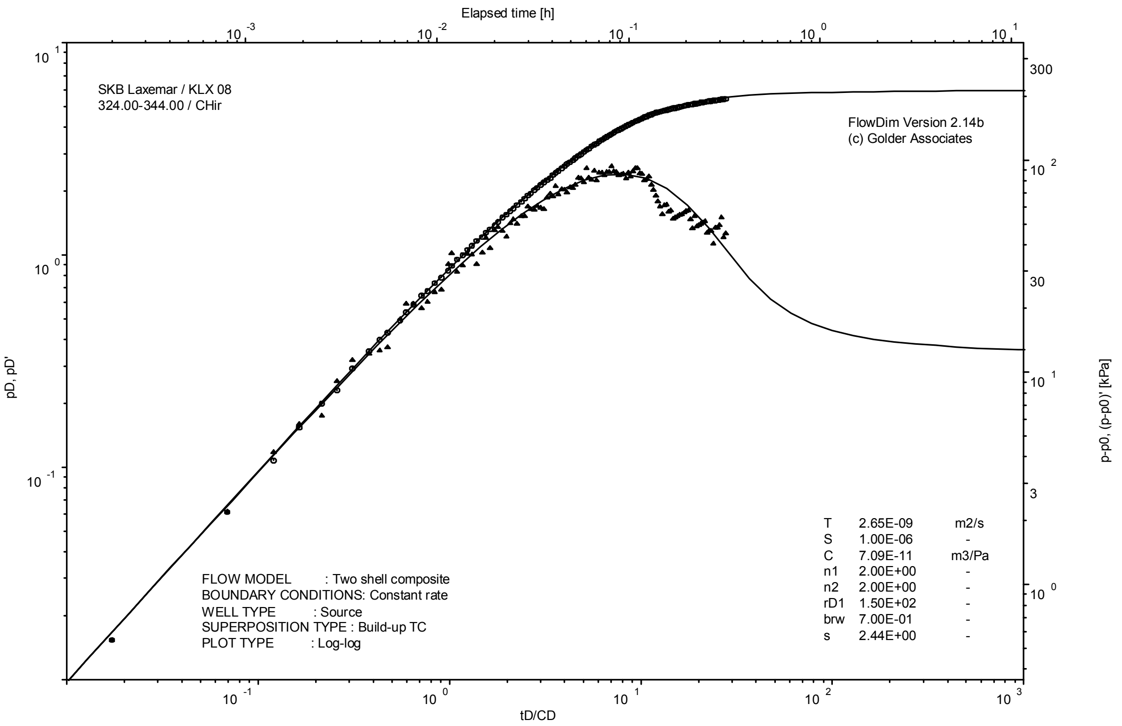
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot

Not Analysed

CHI phase; log-log match



CHIR phase; log-log match

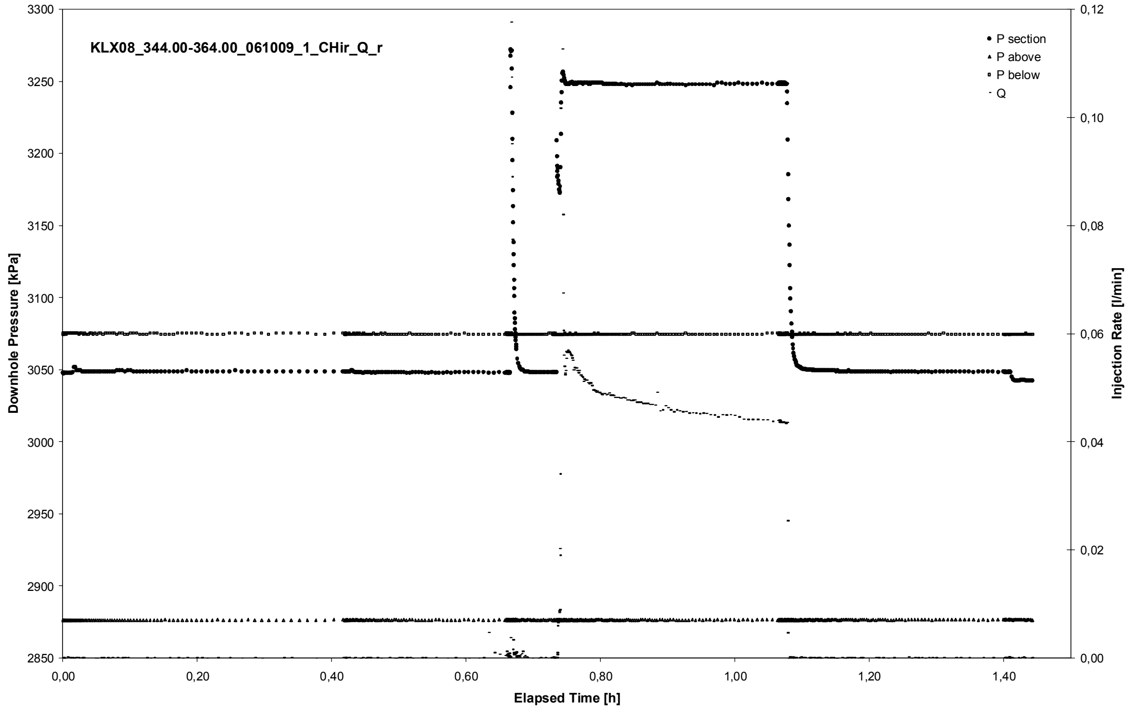
Not analysable

CHIR phase; HORNER match

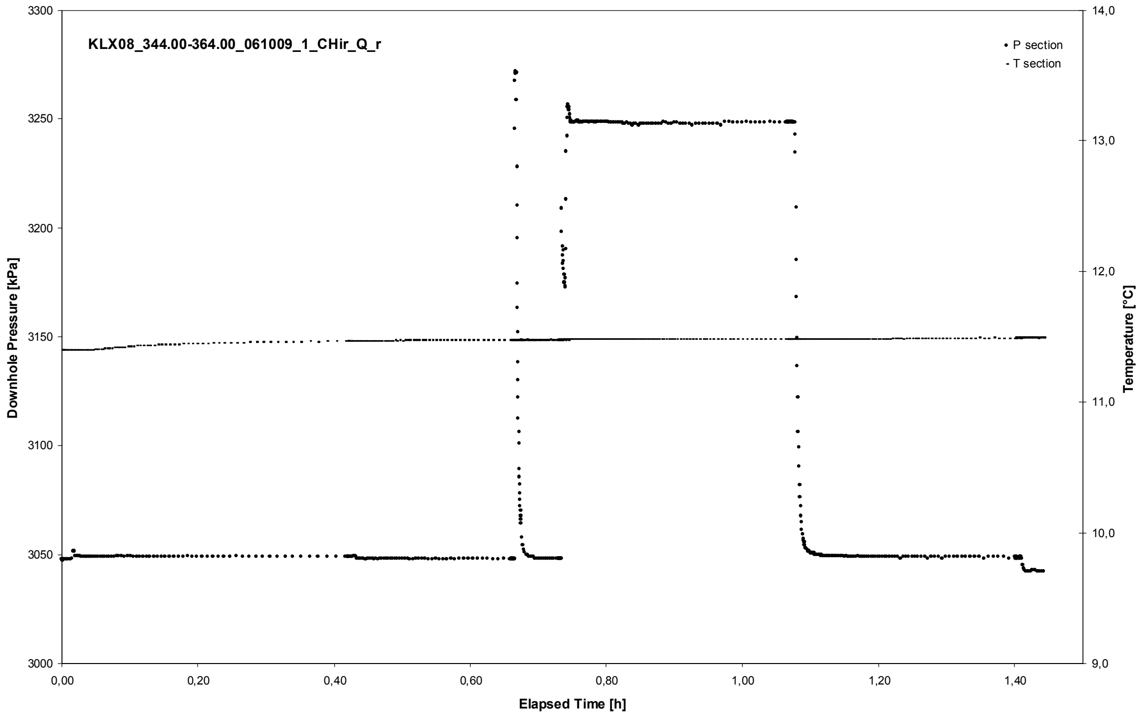
APPENDIX 2-22

Test 344.00 – 364.00 m

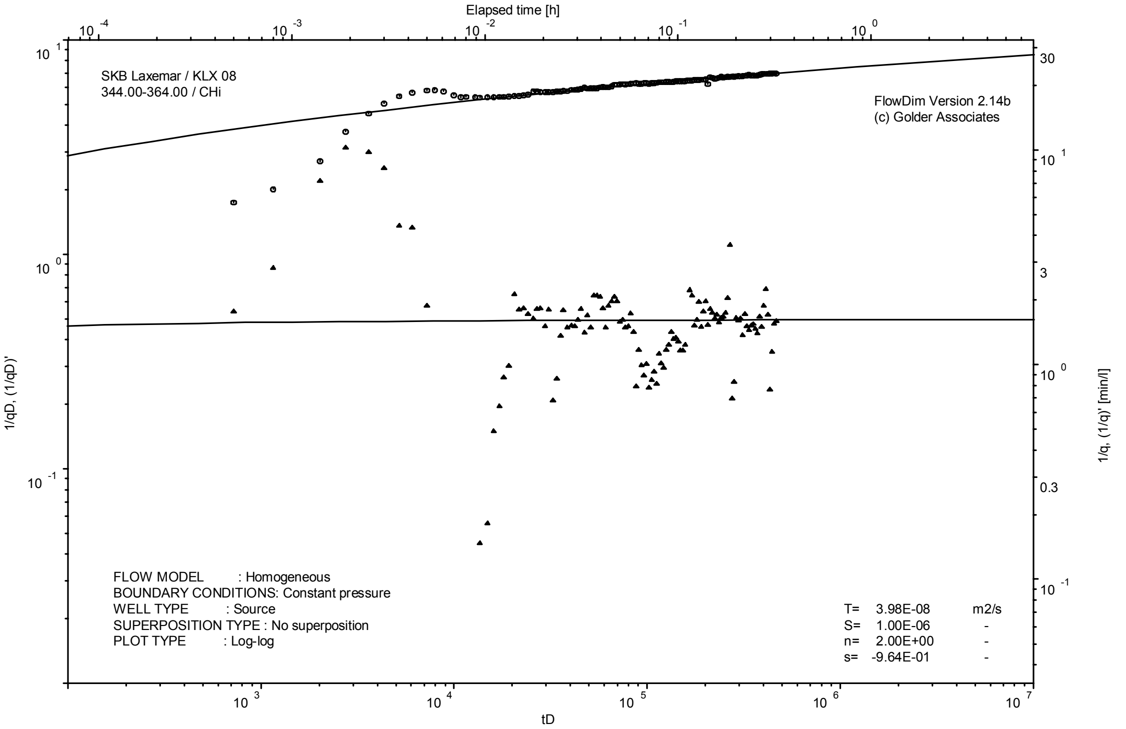
Analysis diagrams



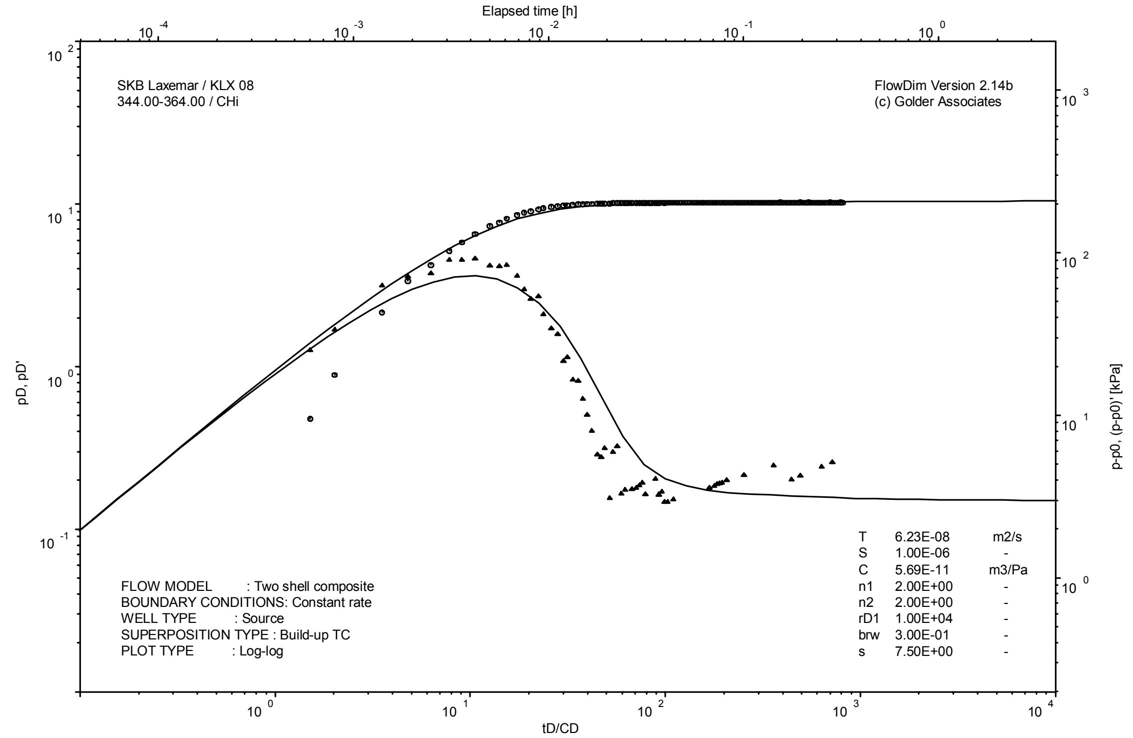
Pressure and flow rate vs. time; cartesian plot



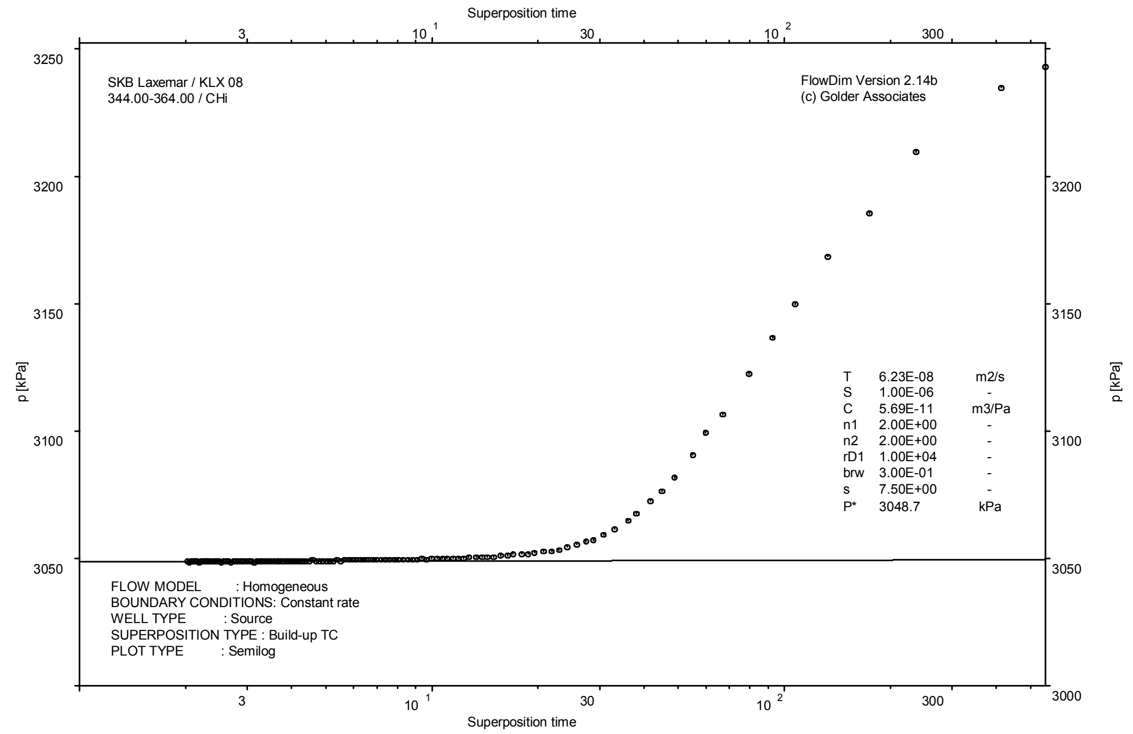
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

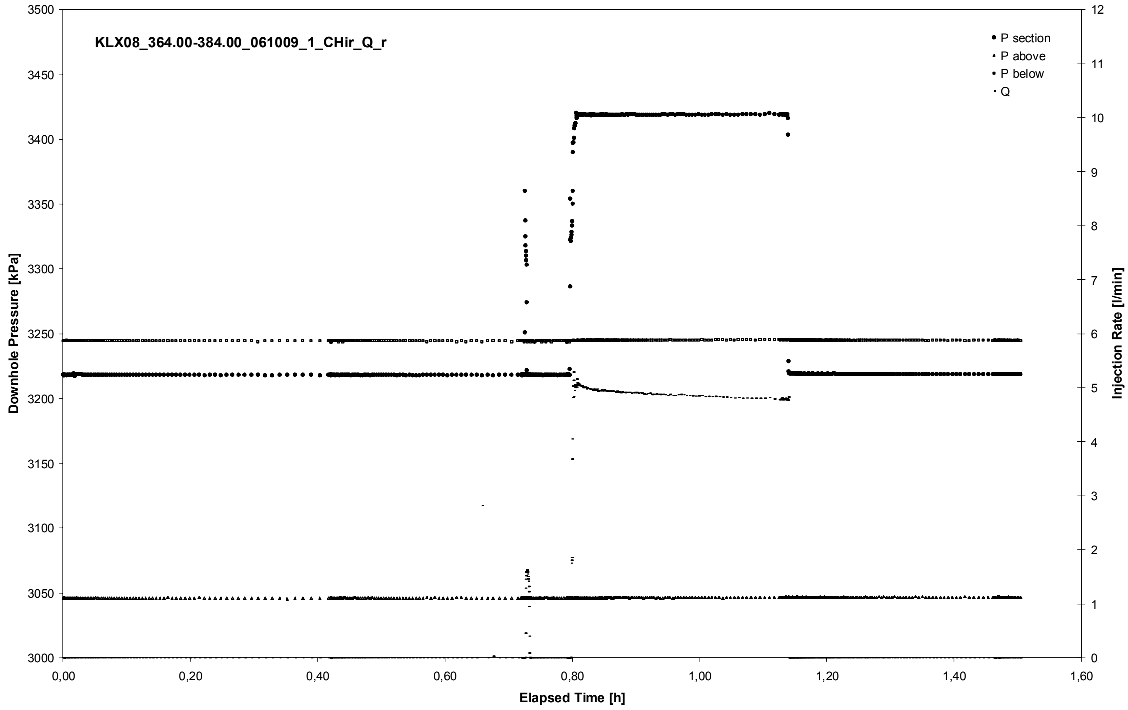


CHIR phase; HORNER match

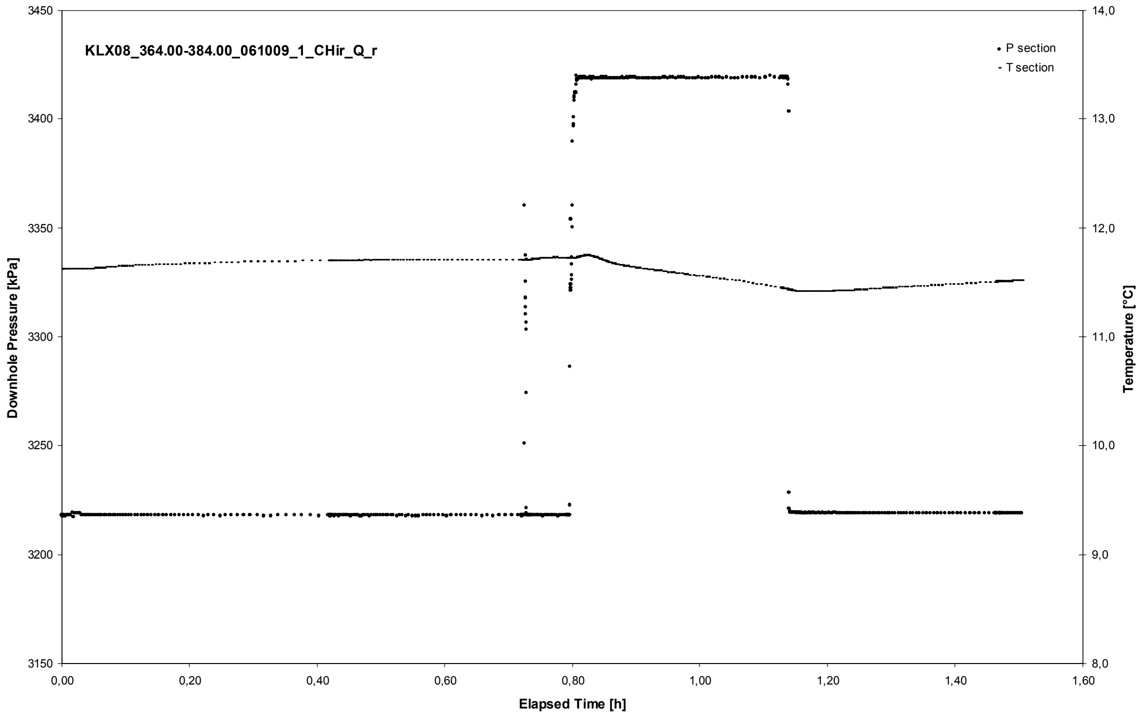
APPENDIX 2-23

Test 364.00 – 384.00 m

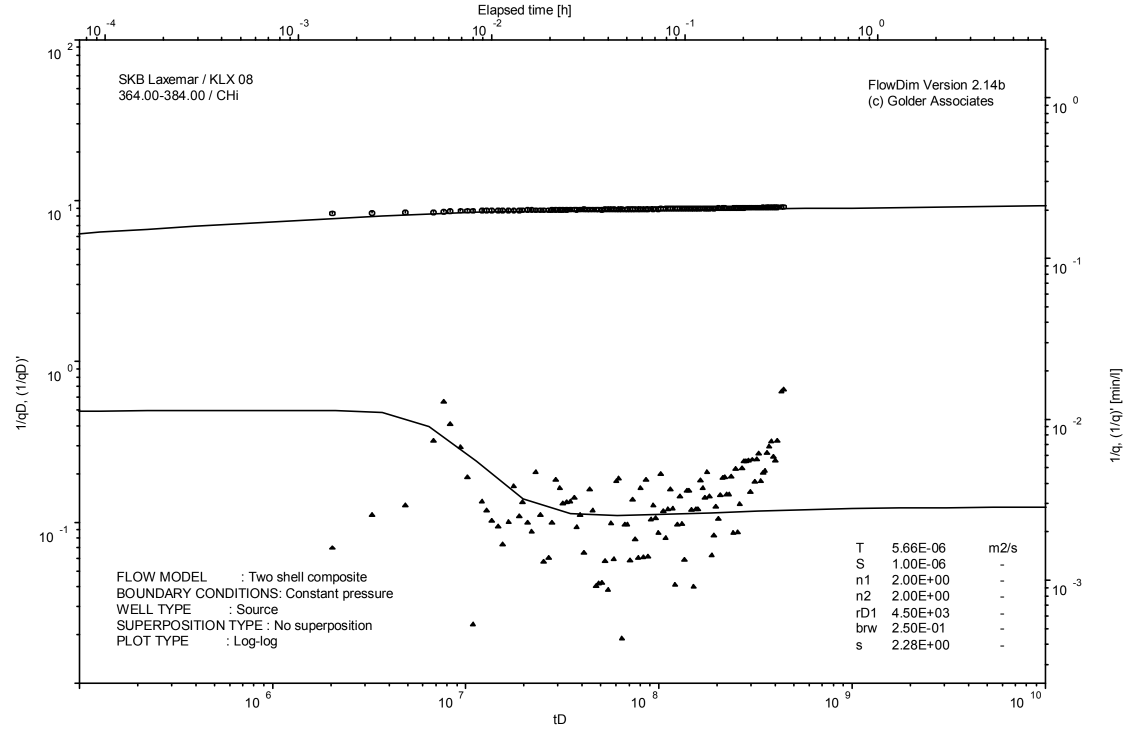
Analysis diagrams



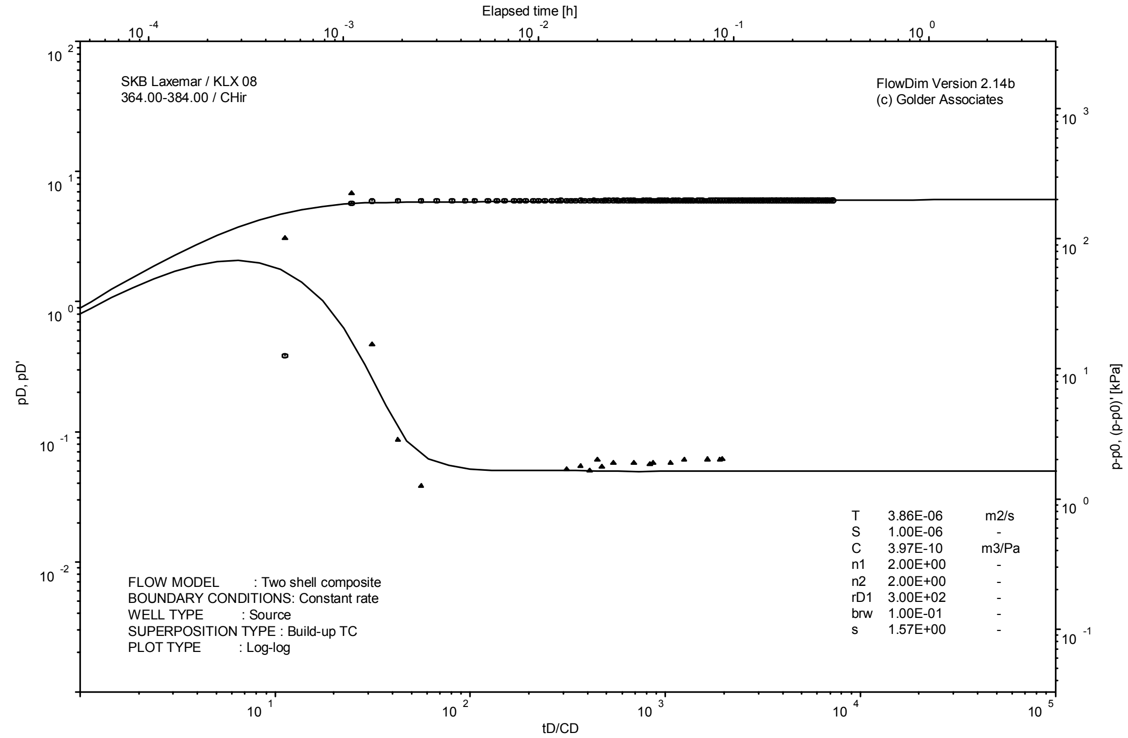
Pressure and flow rate vs. time; cartesian plot



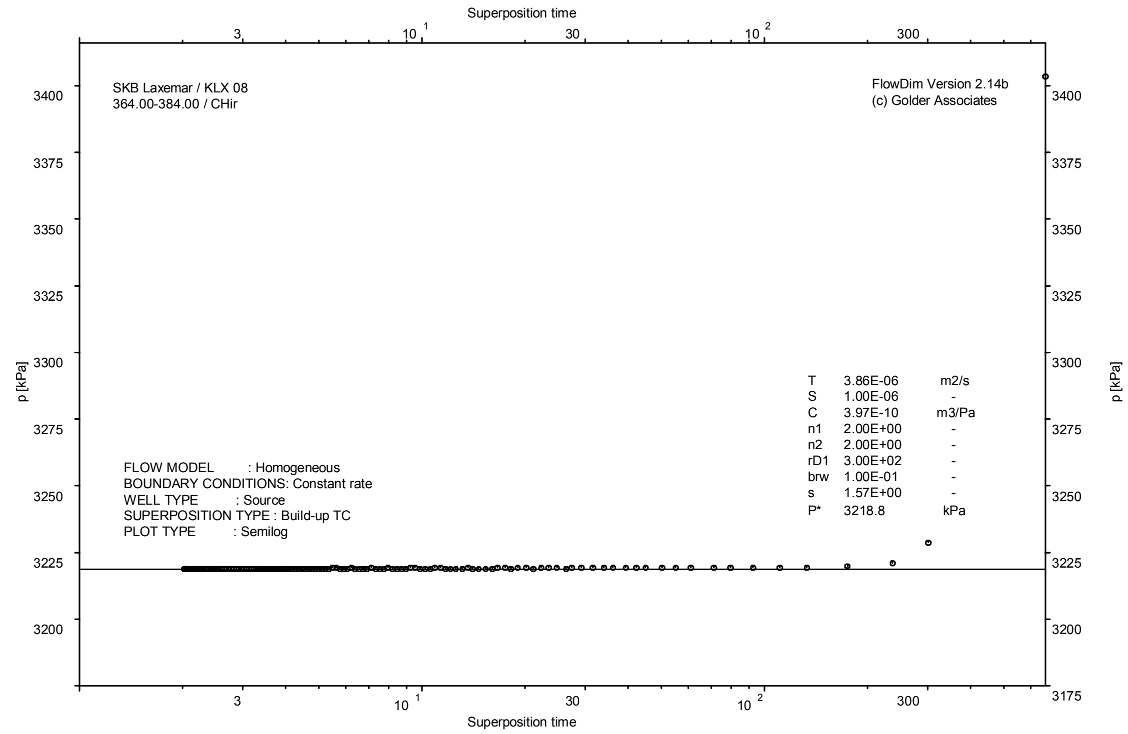
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

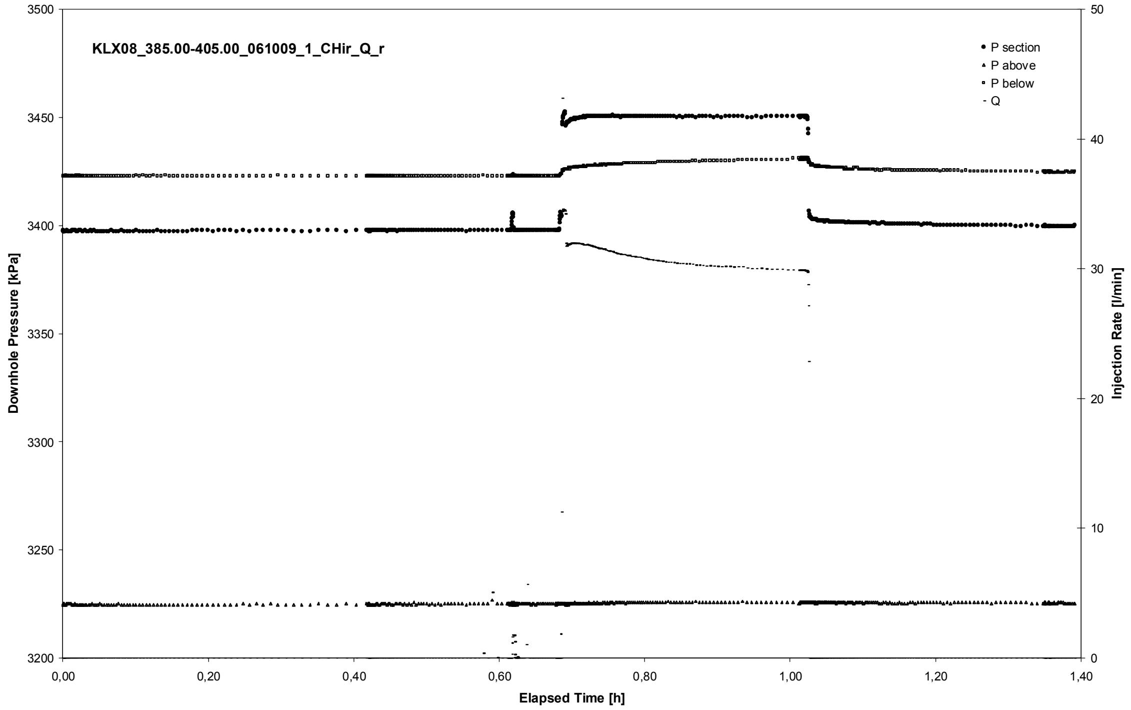


CHIR phase; HORNER match

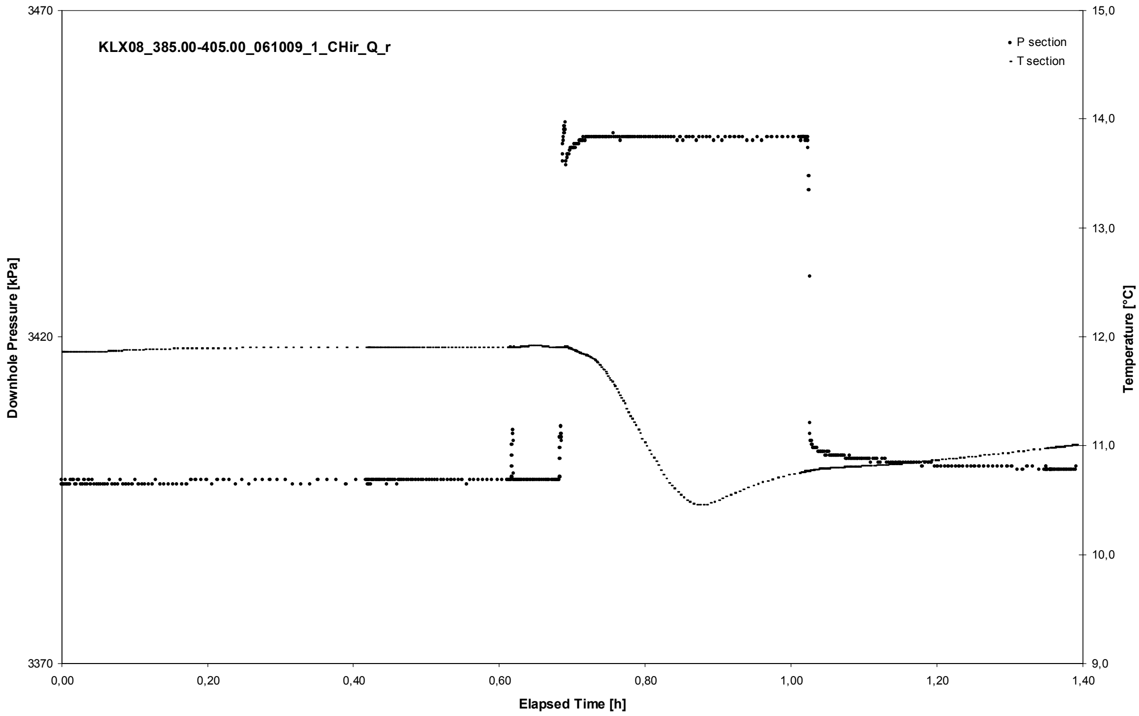
APPENDIX 2-24

Test 385.00 – 405.00 m

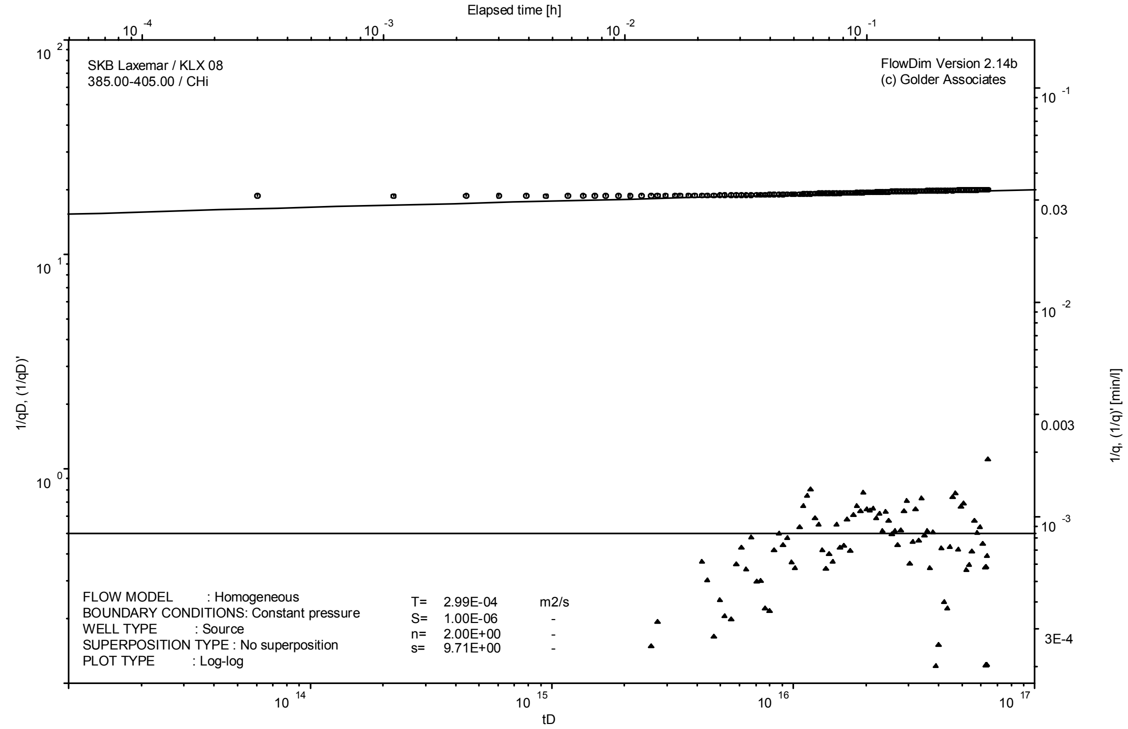
Analysis diagrams



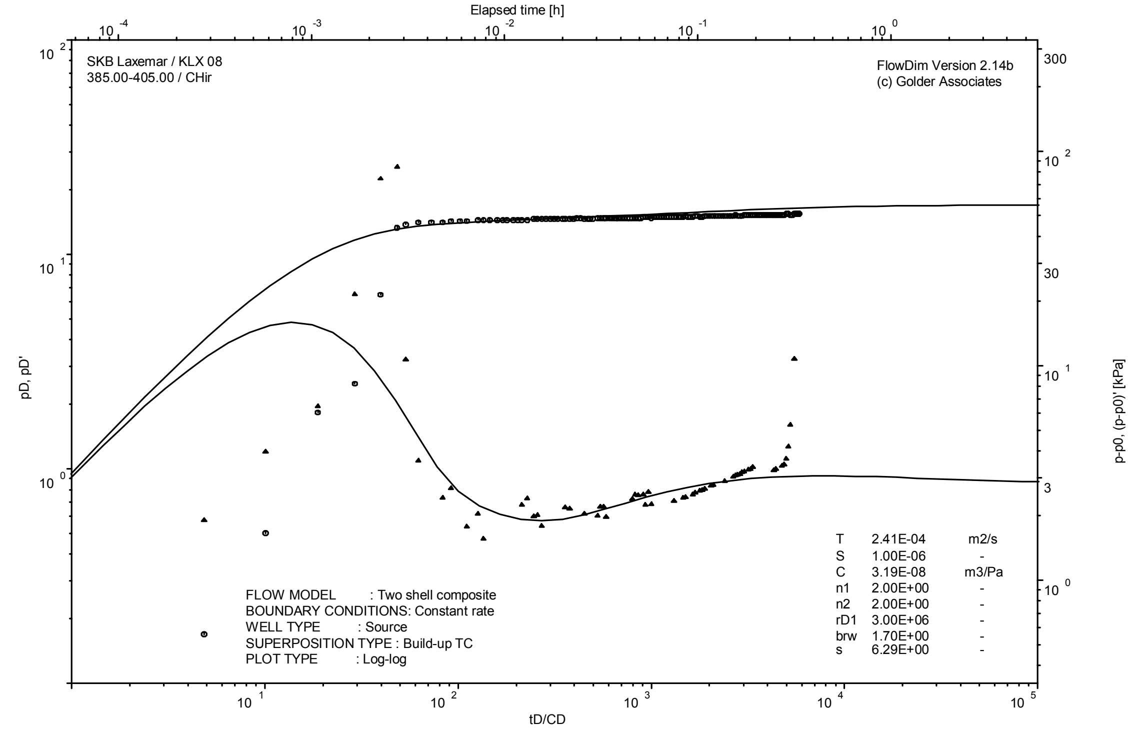
Pressure and flow rate vs. time; cartesian plot



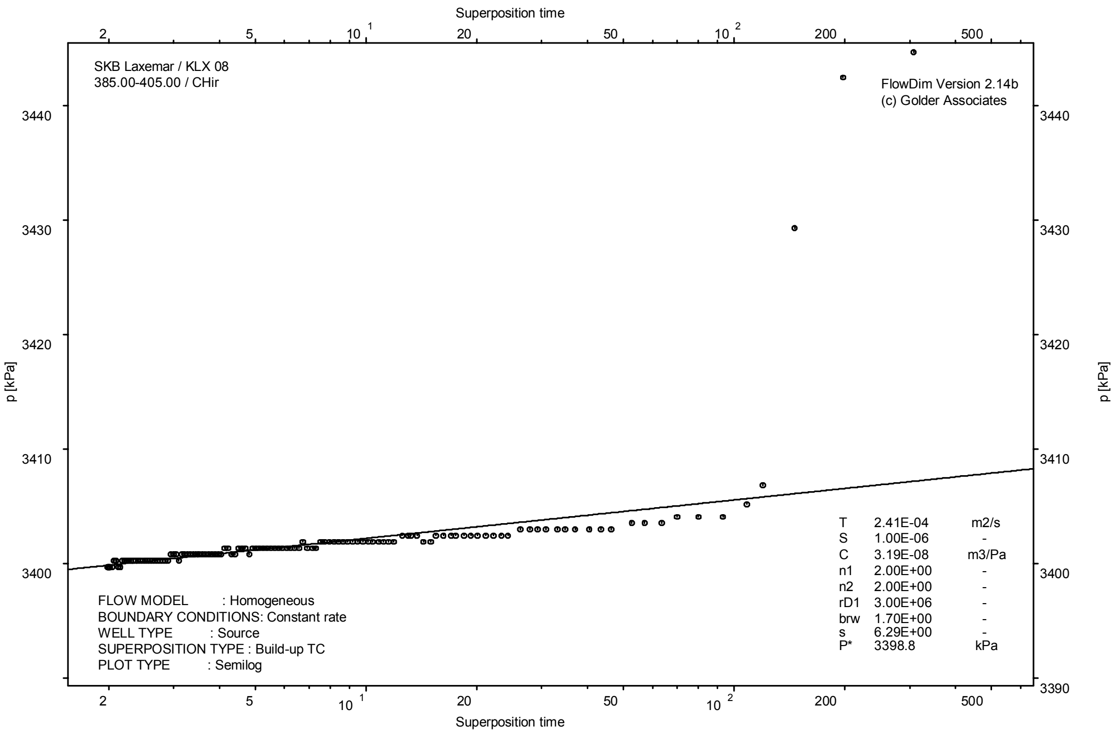
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

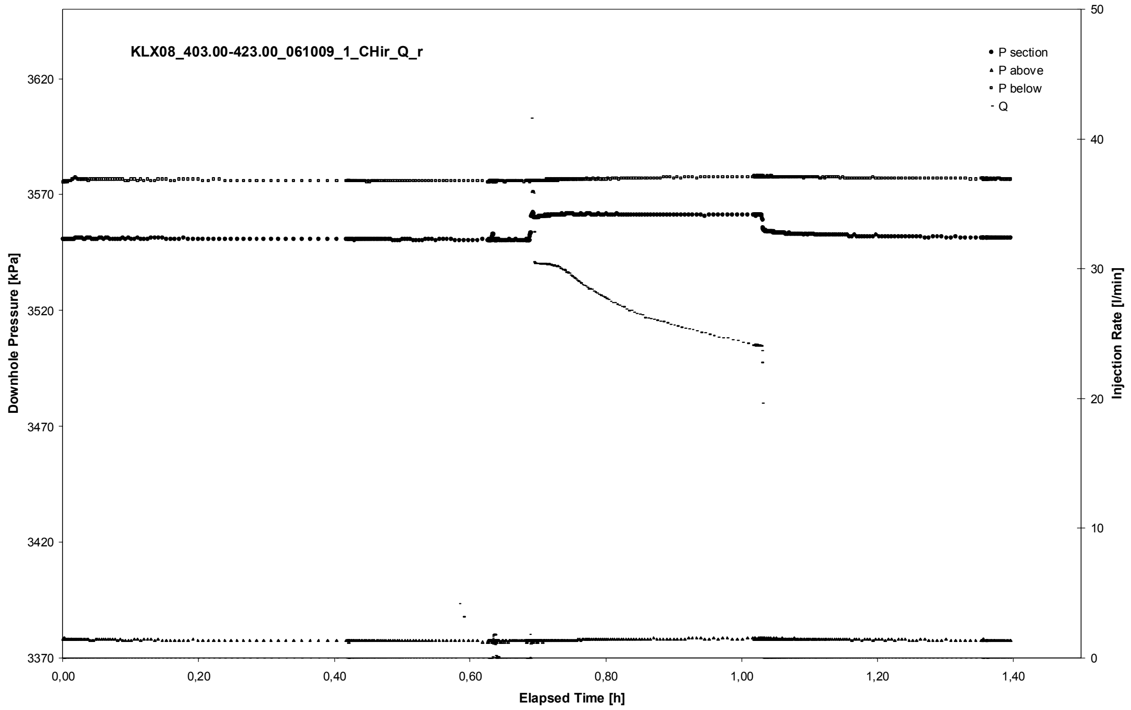


CHIR phase; HORNER match

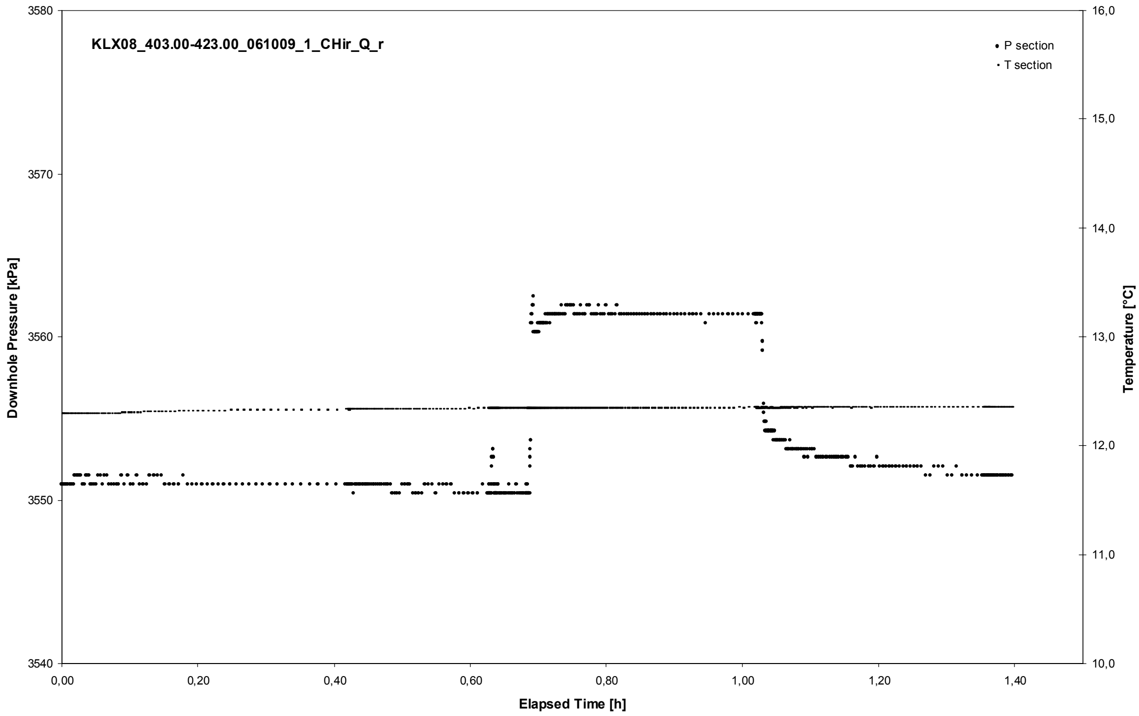
APPENDIX 2-25

Test 403.00 – 423.00 m

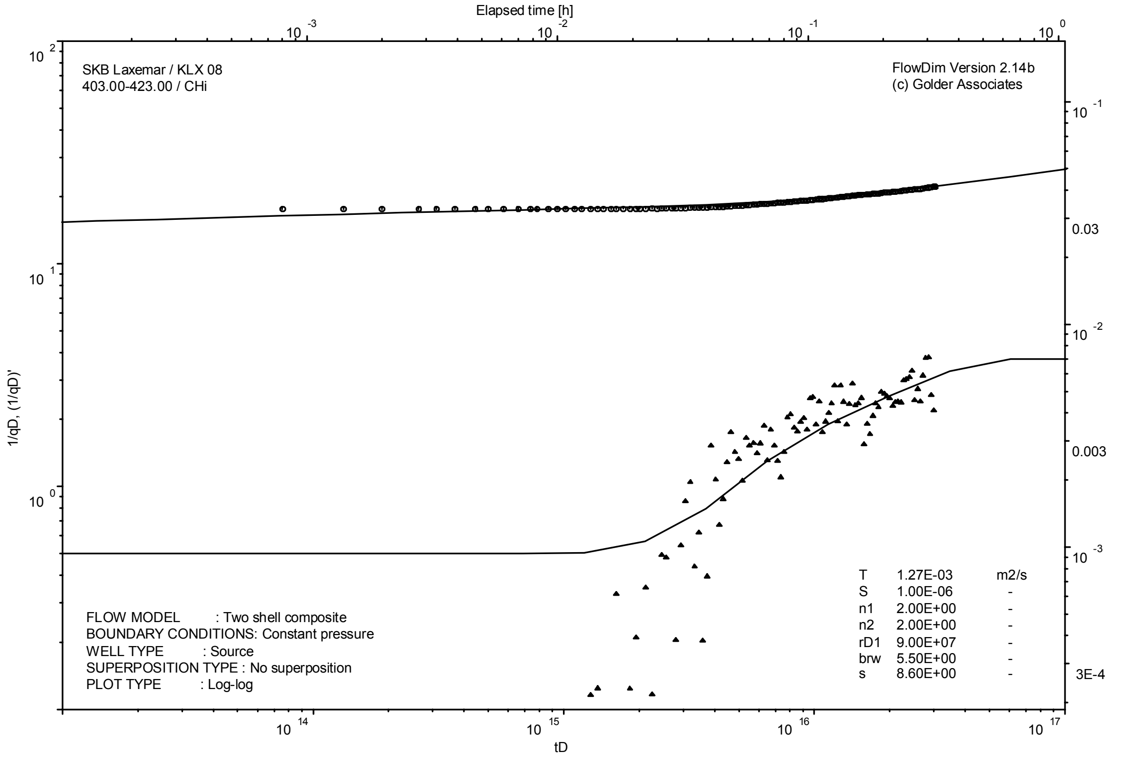
Analysis diagrams



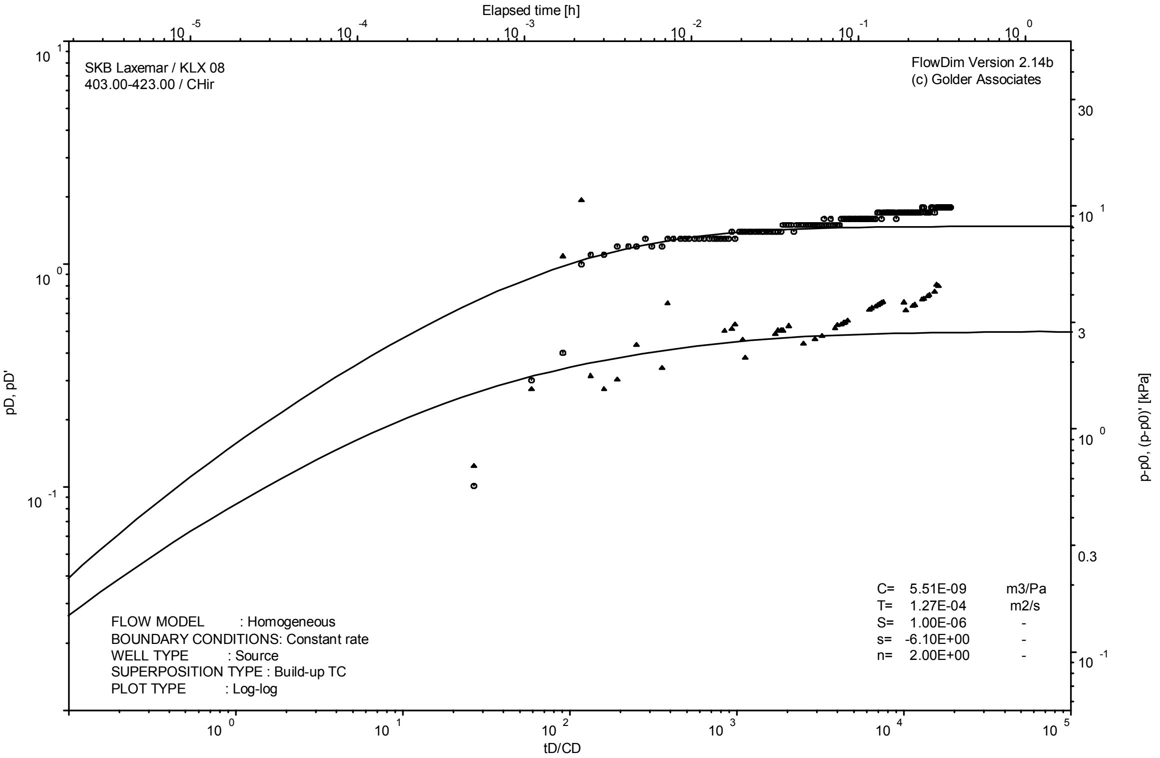
Pressure and flow rate vs. time; cartesian plot



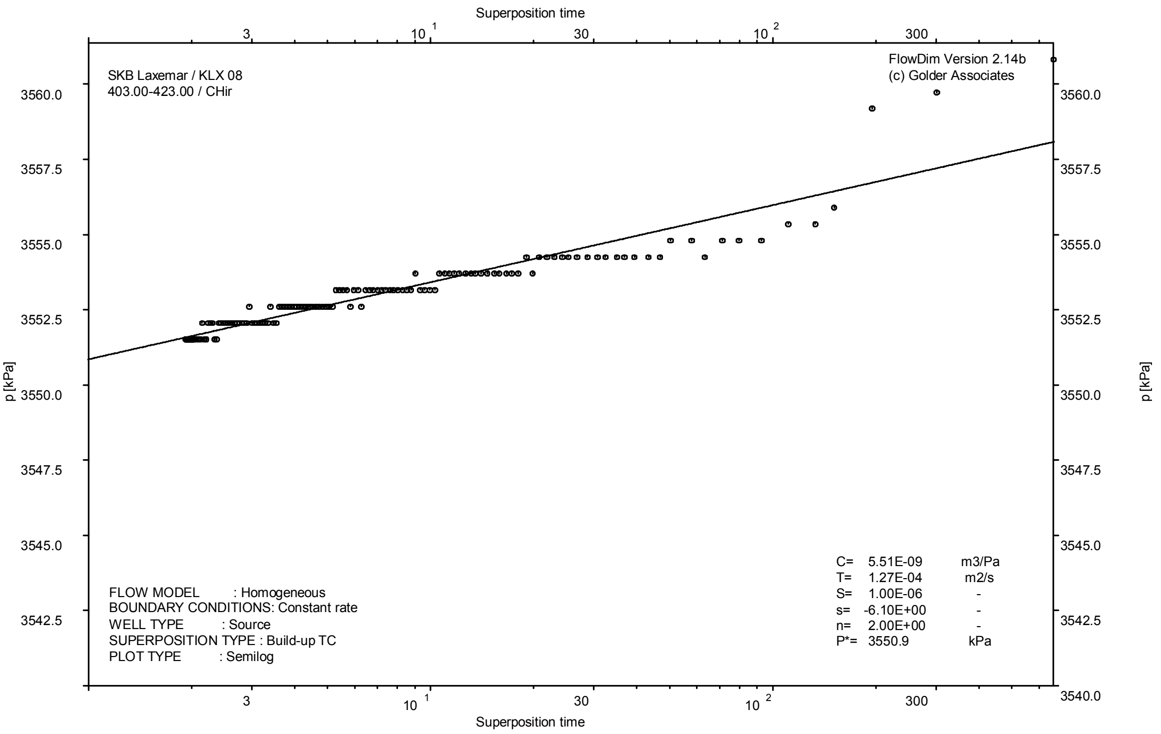
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

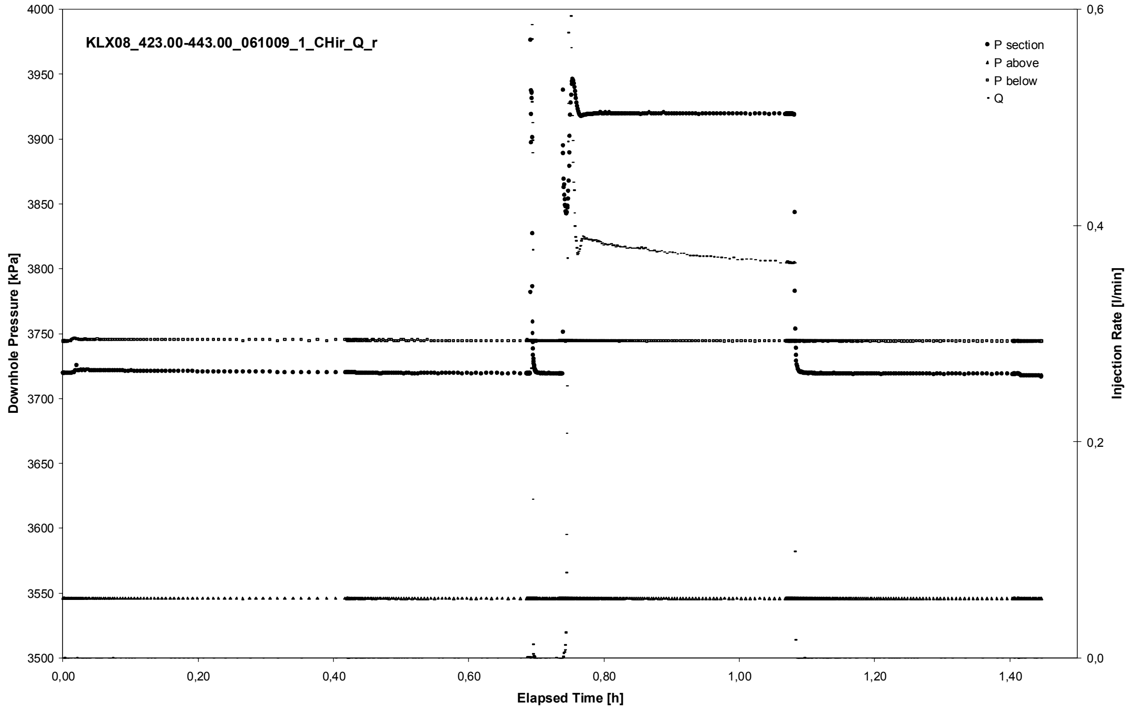


CHIR phase; HORNER match

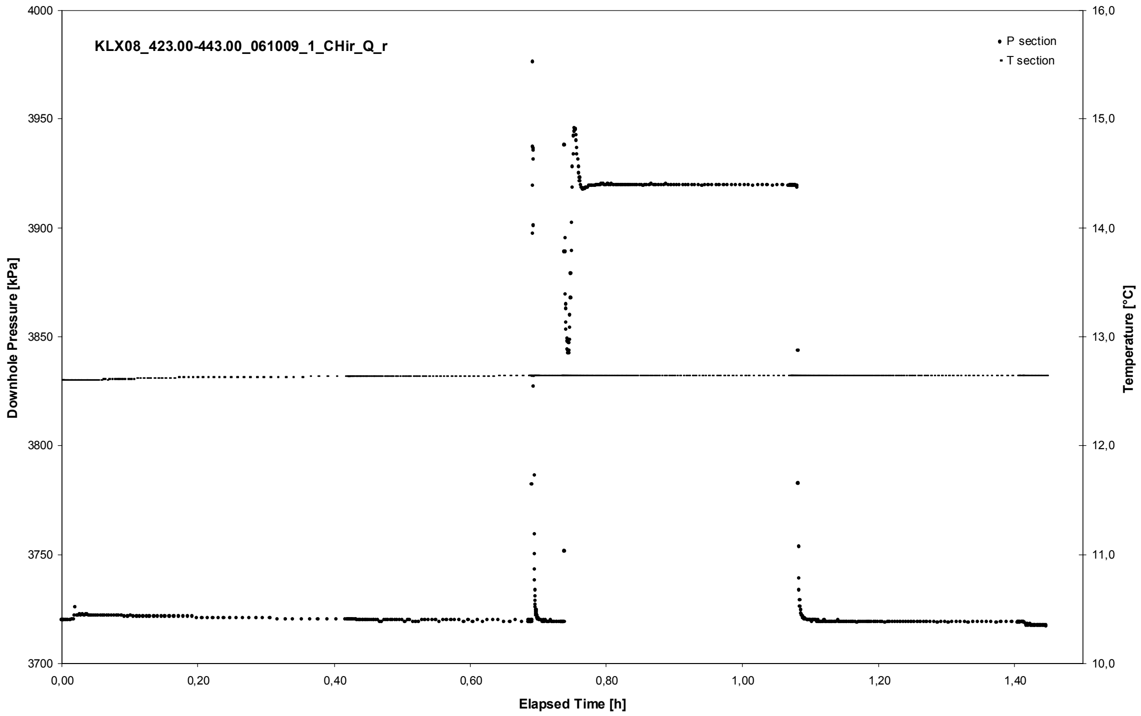
APPENDIX 2-26

Test 423.00 – 443.00 m

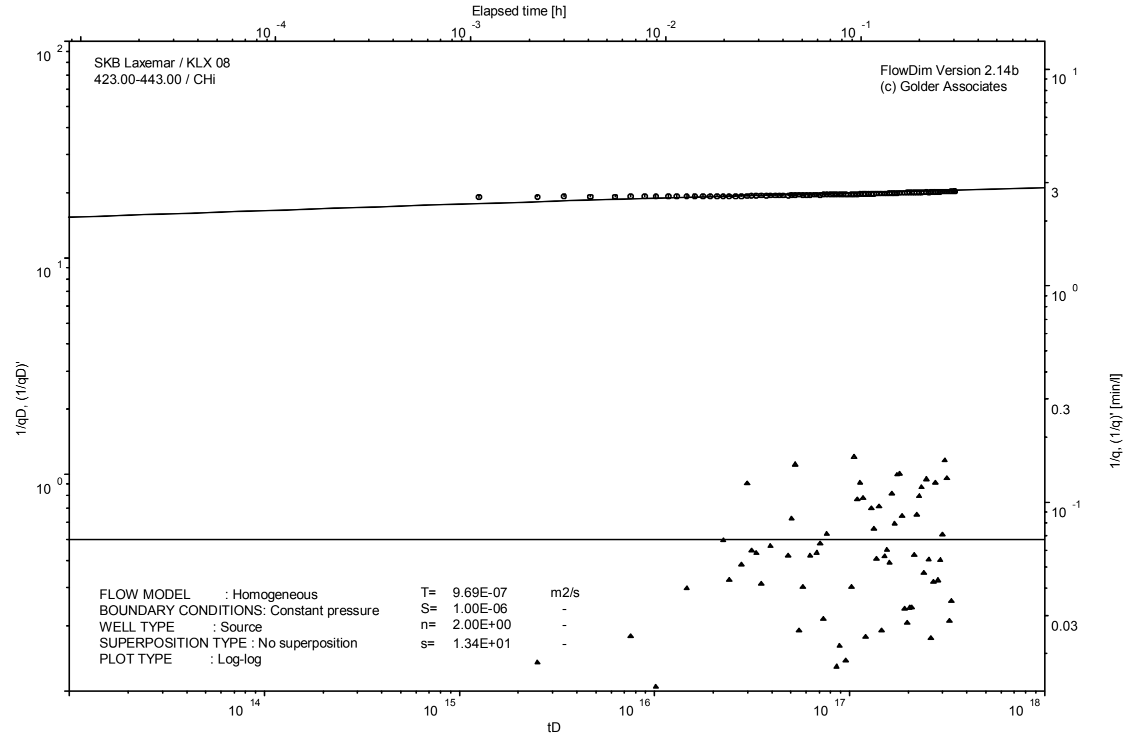
Analysis diagrams



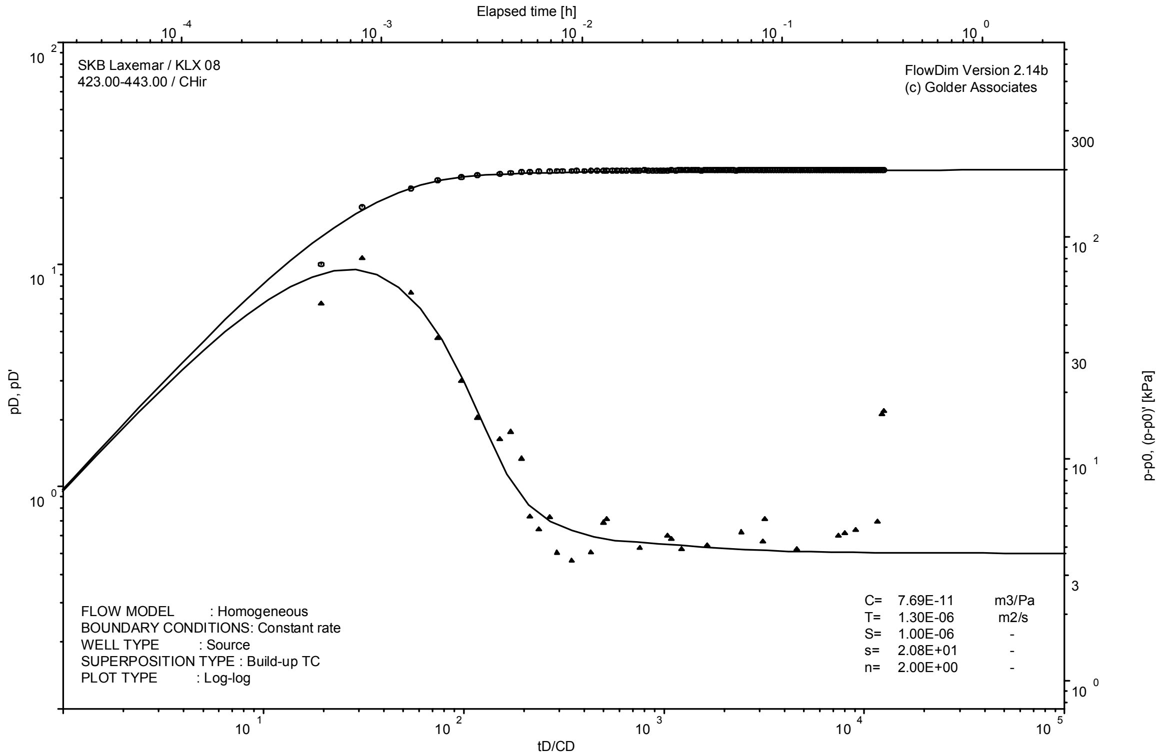
Pressure and flow rate vs. time; cartesian plot



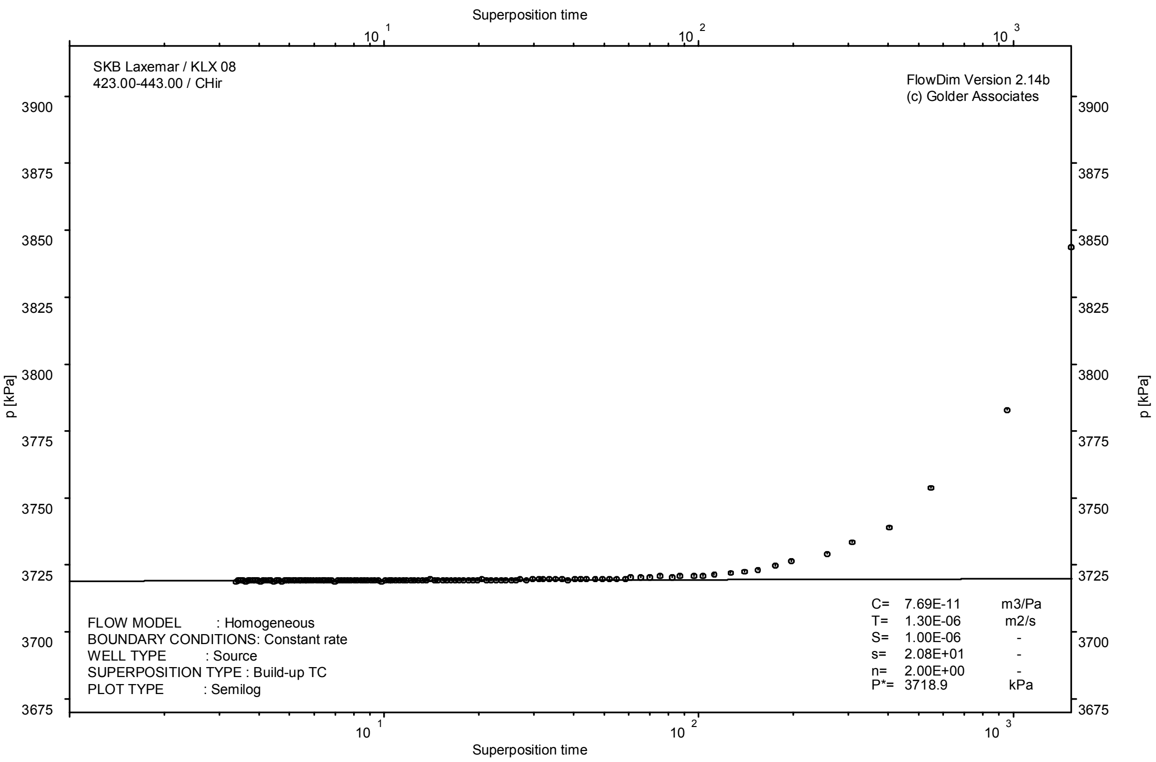
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

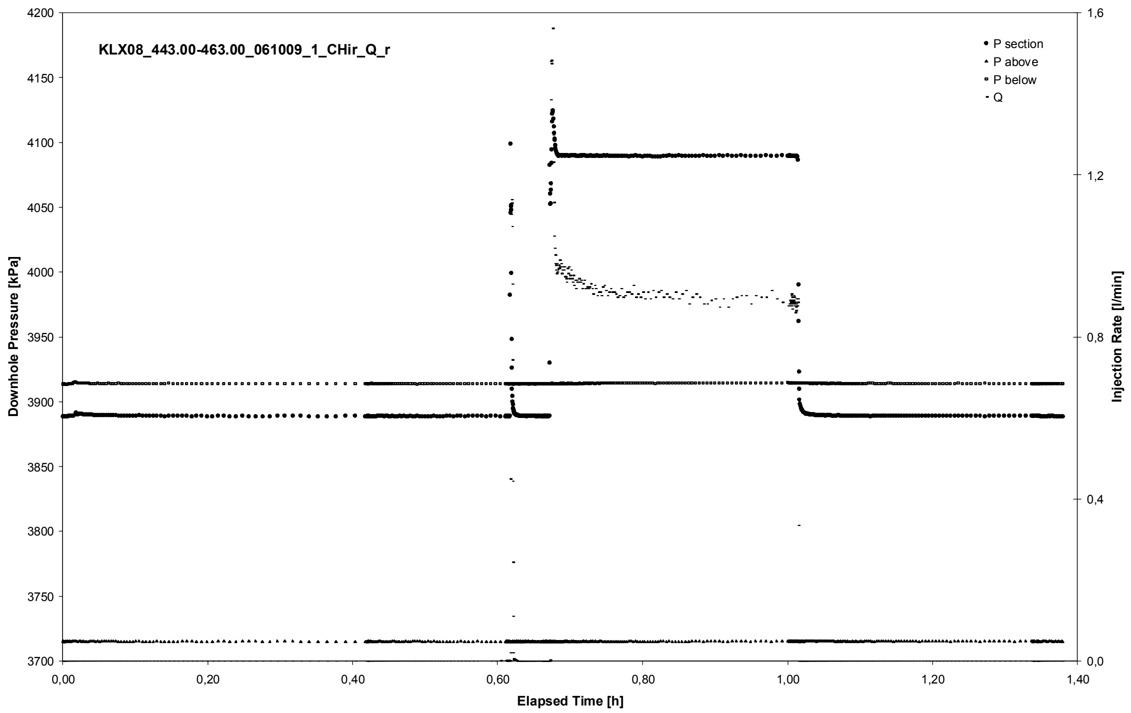


CHIR phase; HORNER match

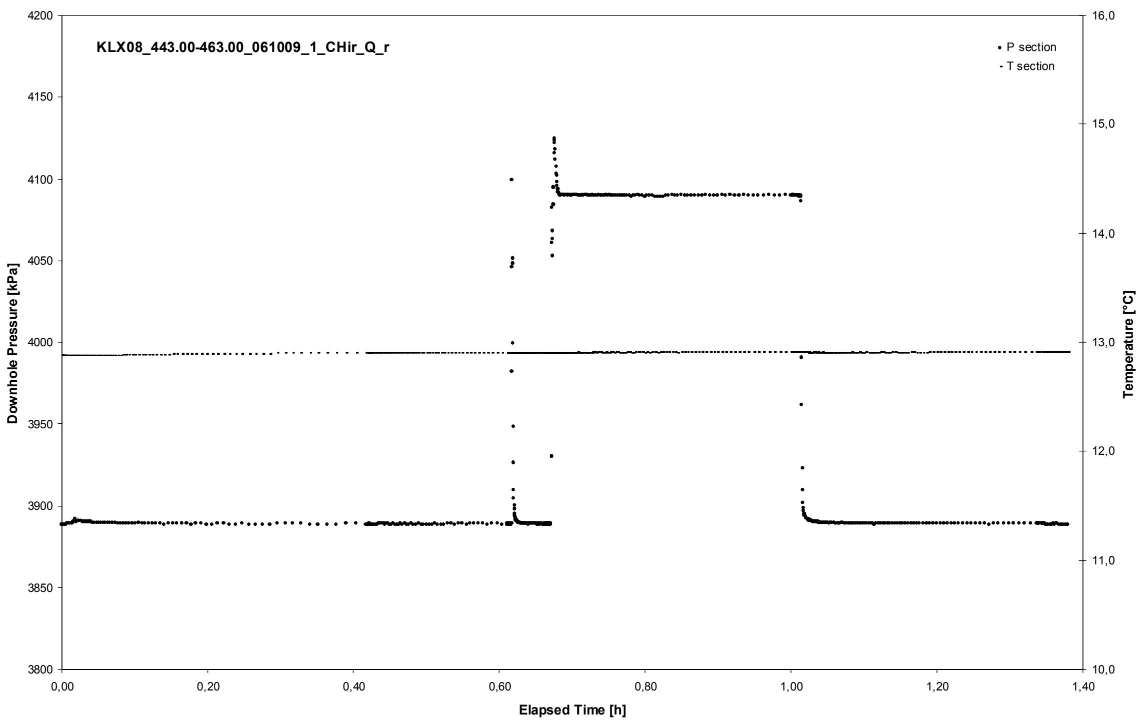
APPENDIX 2-27

Test 443.00 – 463.00 m

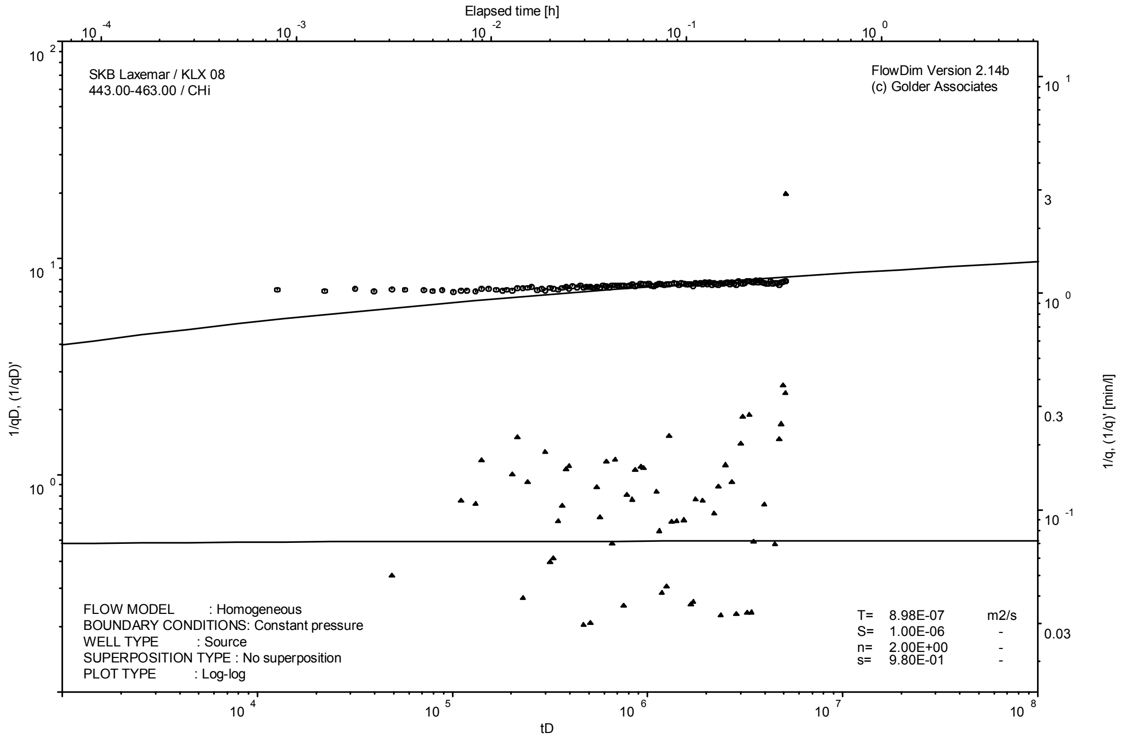
Analysis diagrams



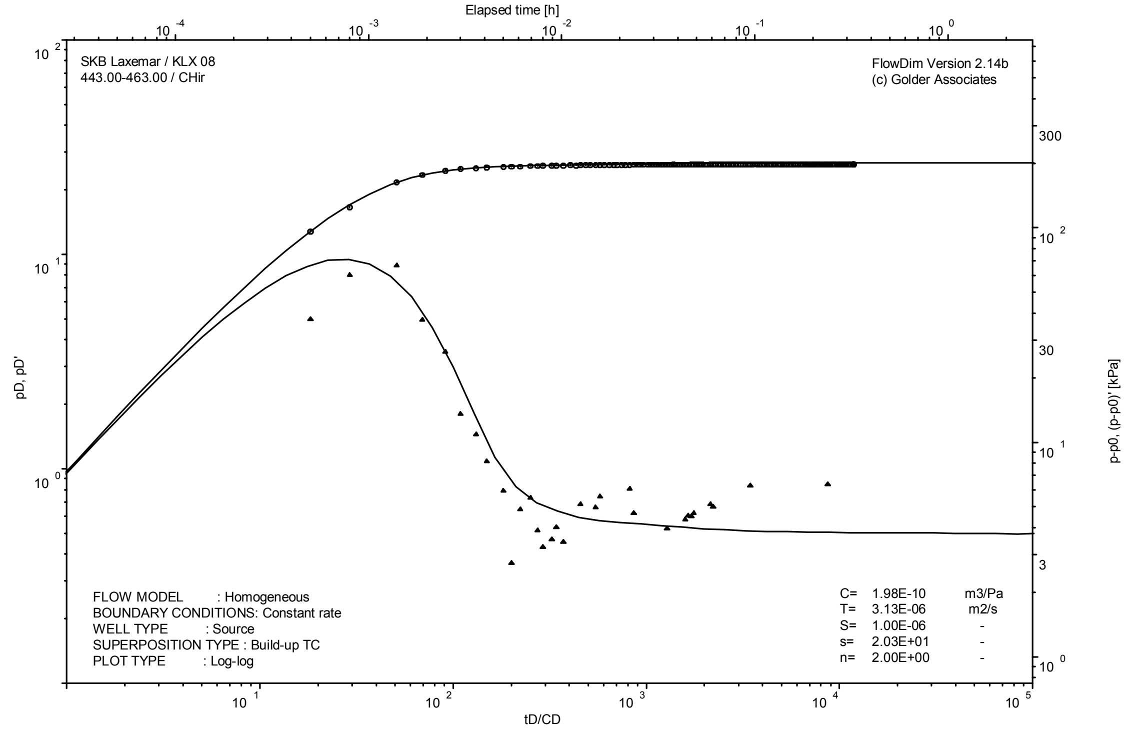
Pressure and flow rate vs. time; cartesian plot



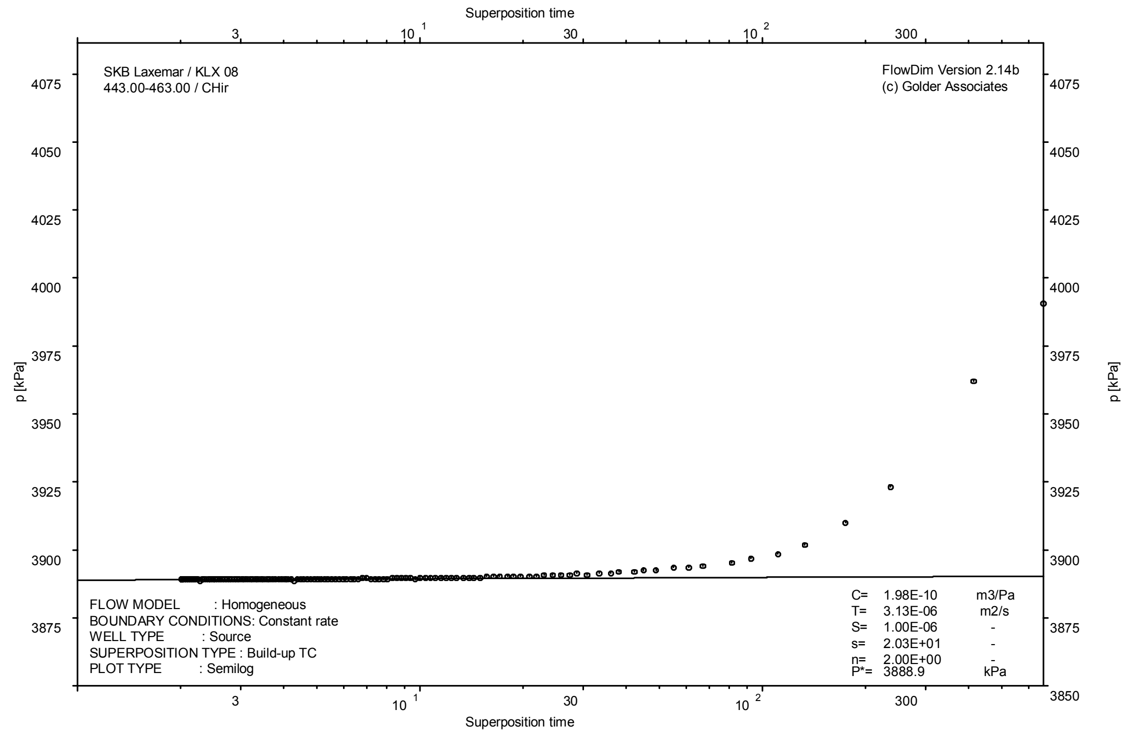
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

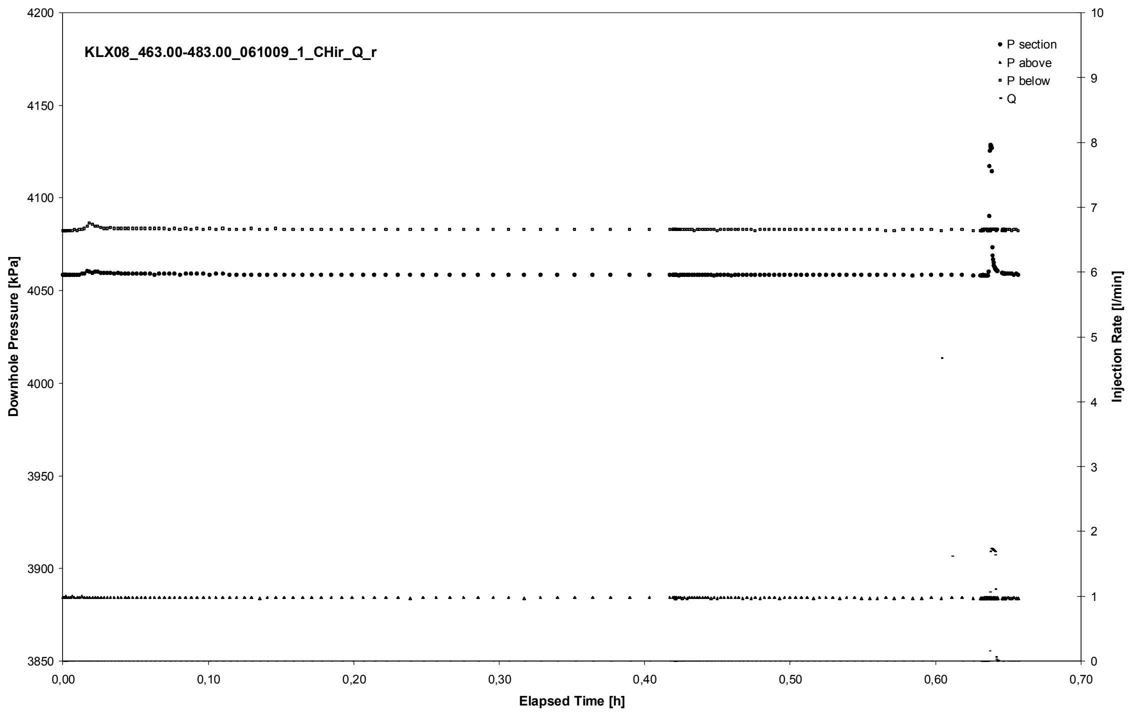


CHIR phase; HORNER match

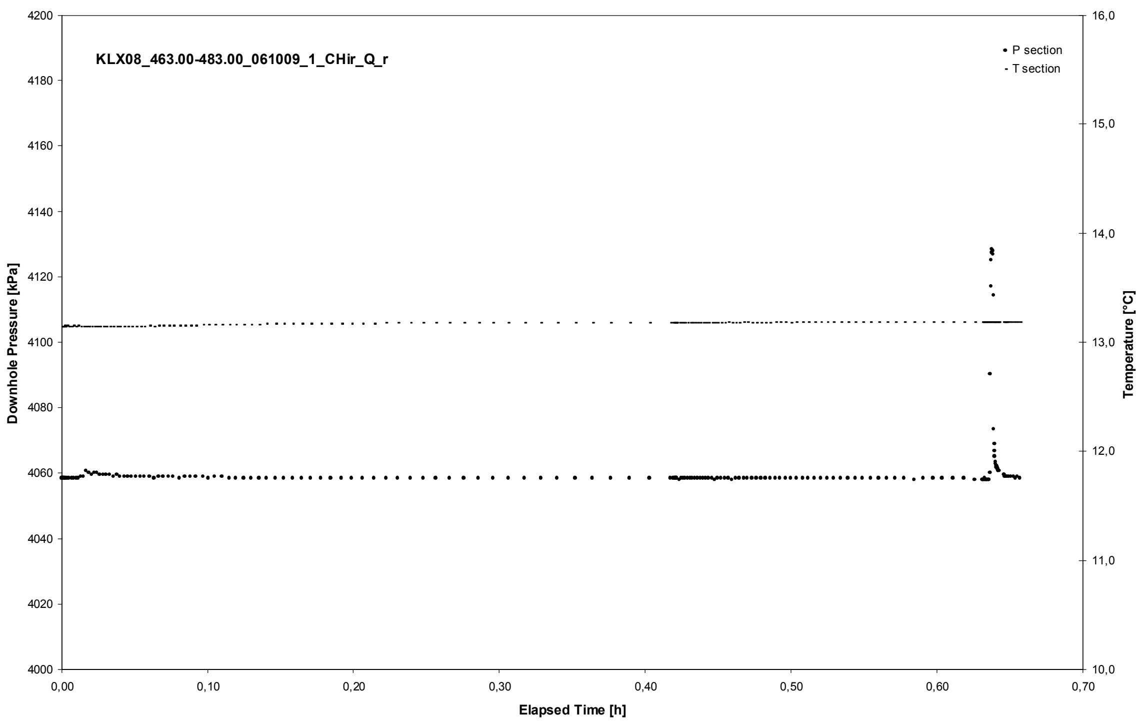
APPENDIX 2-28

Test 463.00 – 483.00 m

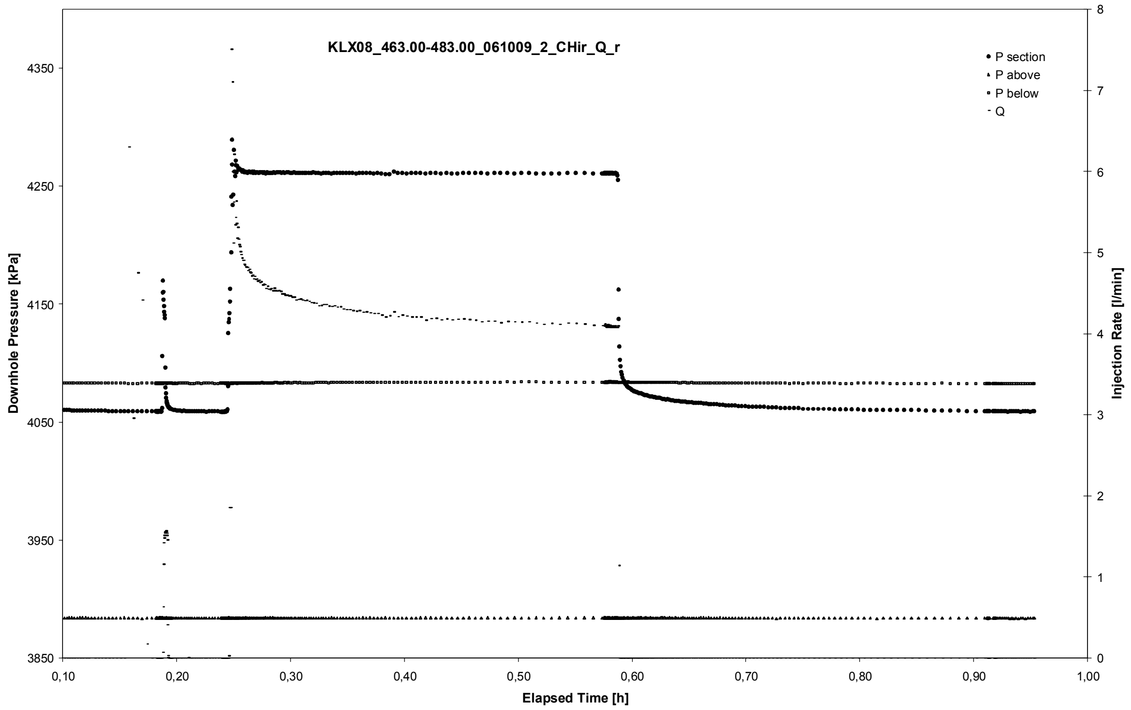
Analysis diagrams



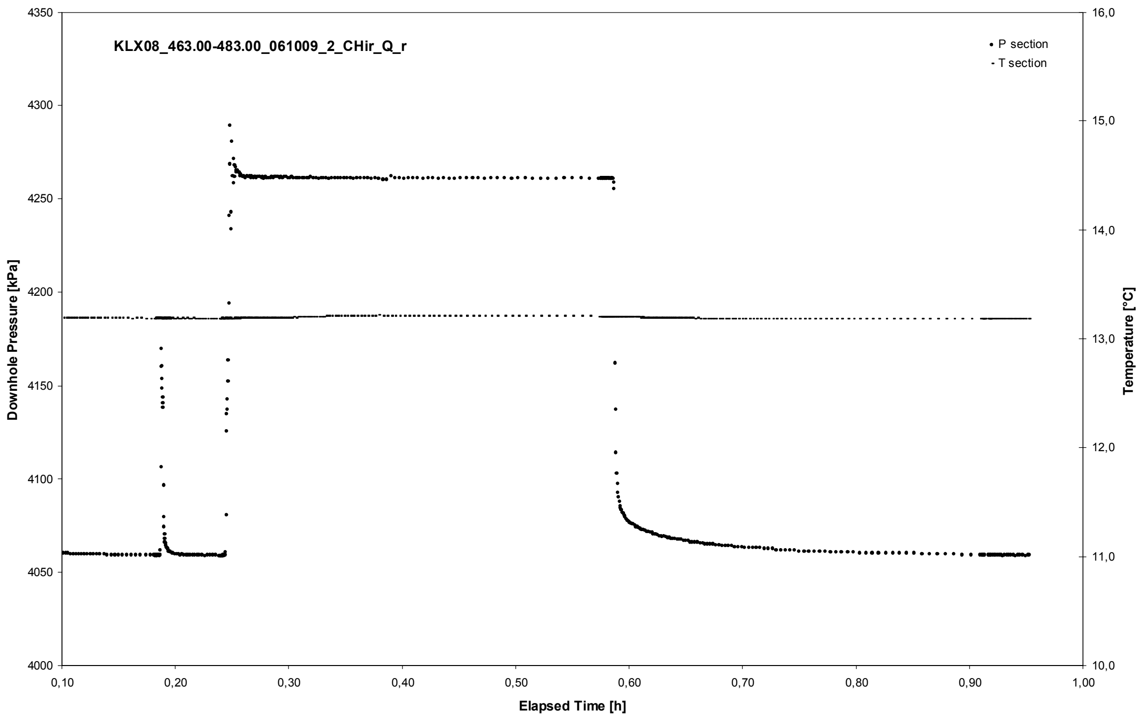
Pressure and flow rate vs. time; cartesian plot (test repeated)



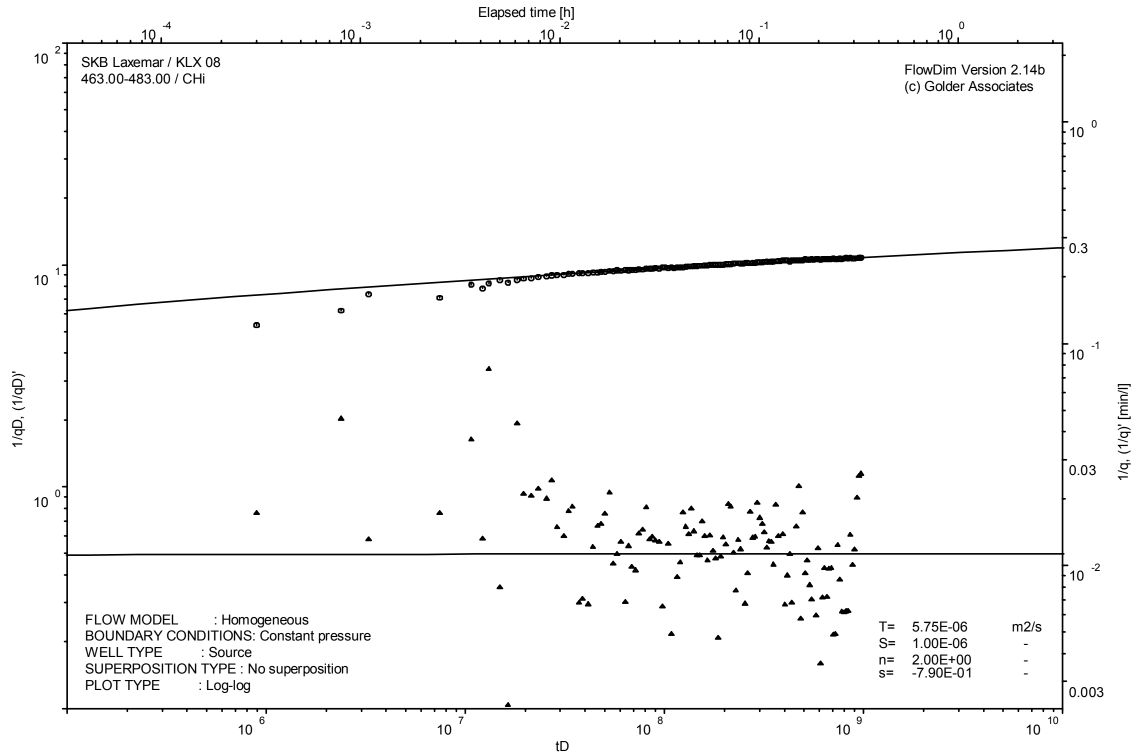
Interval pressure and temperature vs. time; cartesian plot (test repeated)



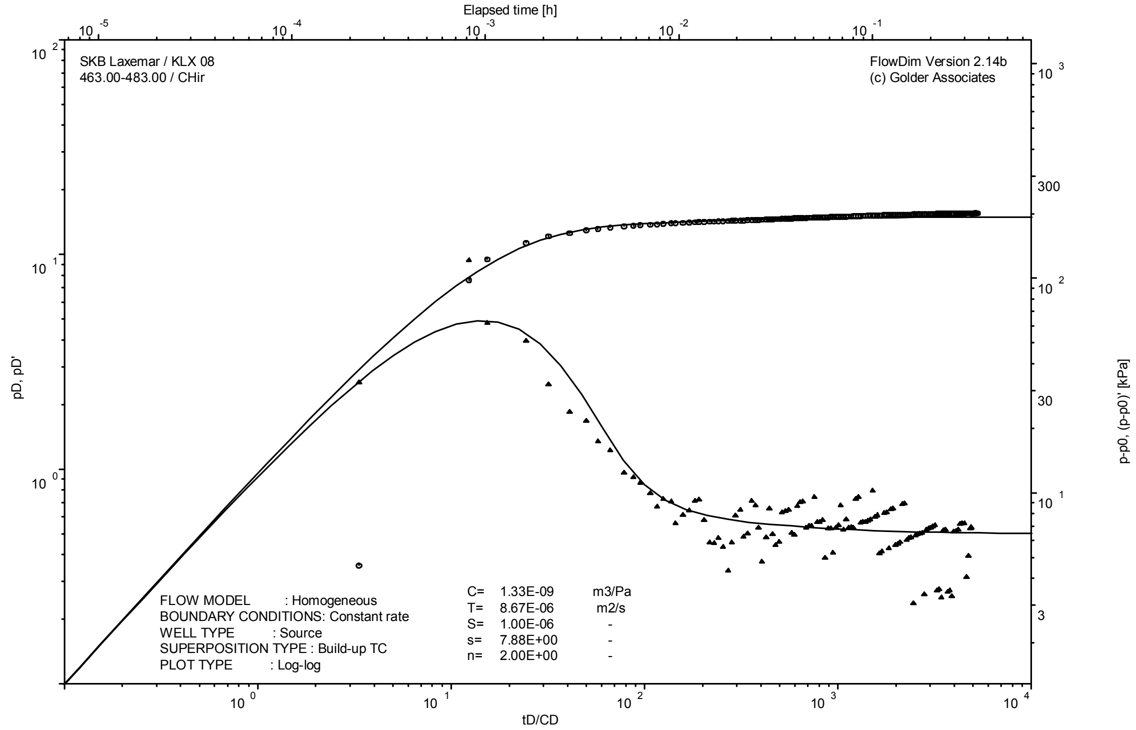
Pressure and flow rate vs. time; cartesian plot (analysed)



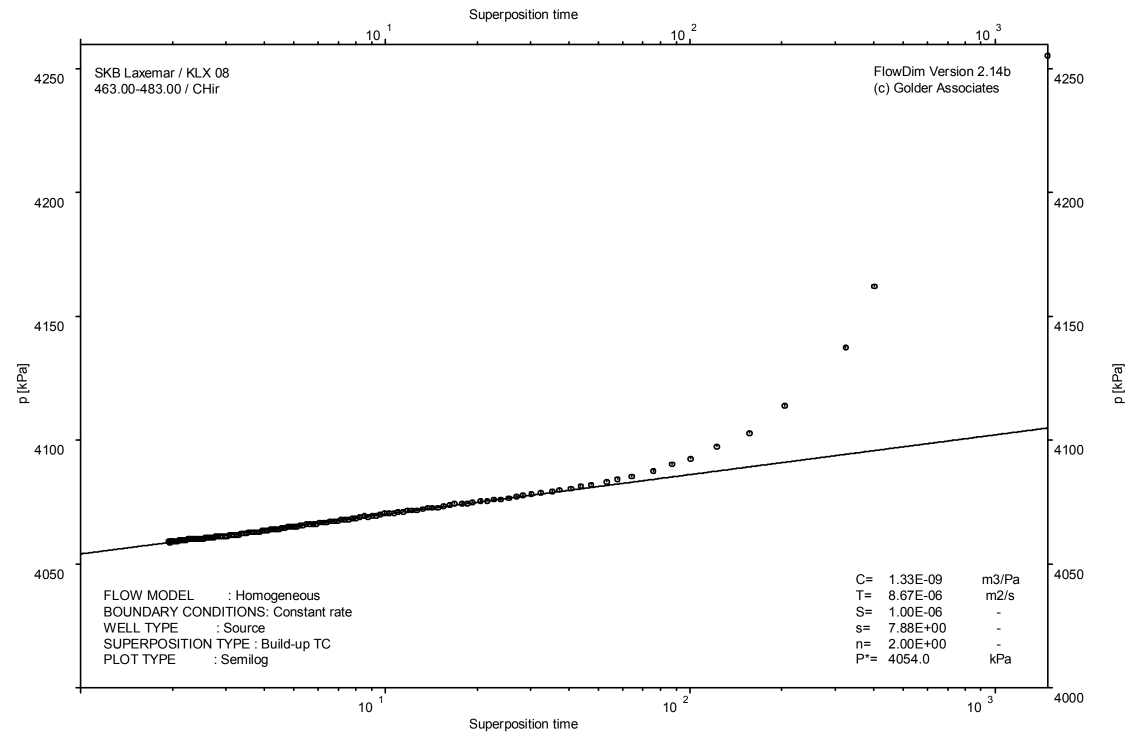
Interval pressure and temperature vs. time; cartesian plot (analysed)



CHI phase; log-log match



CHIR phase; log-log match

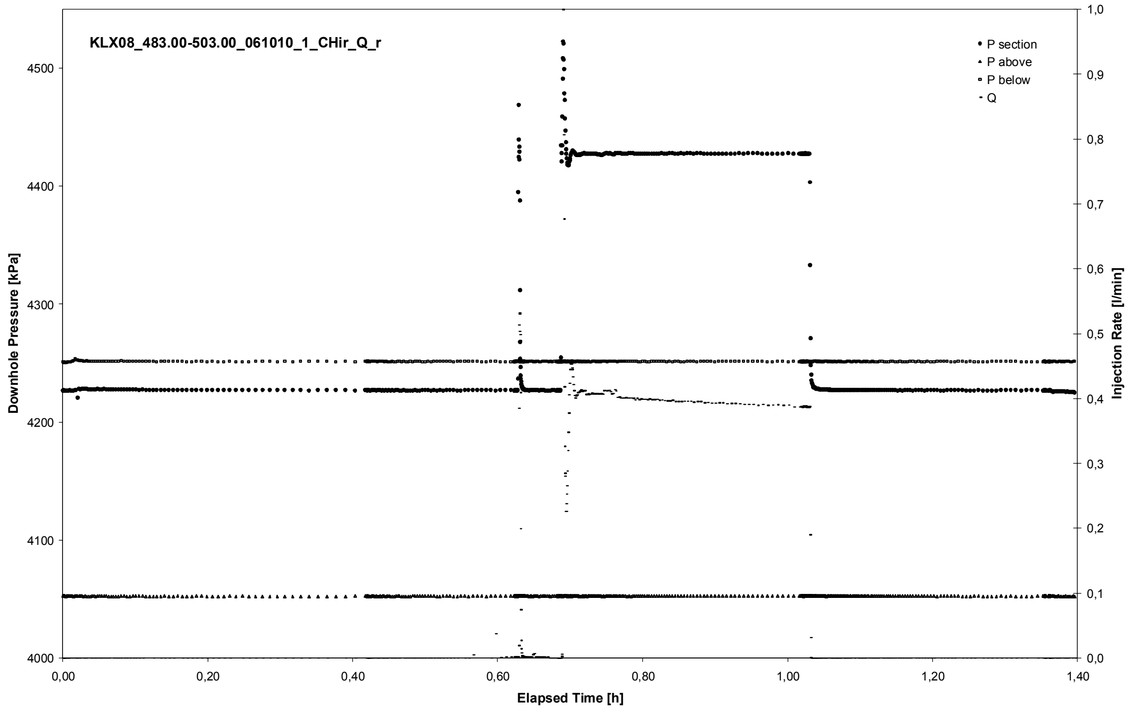


CHIR phase; HORNER match

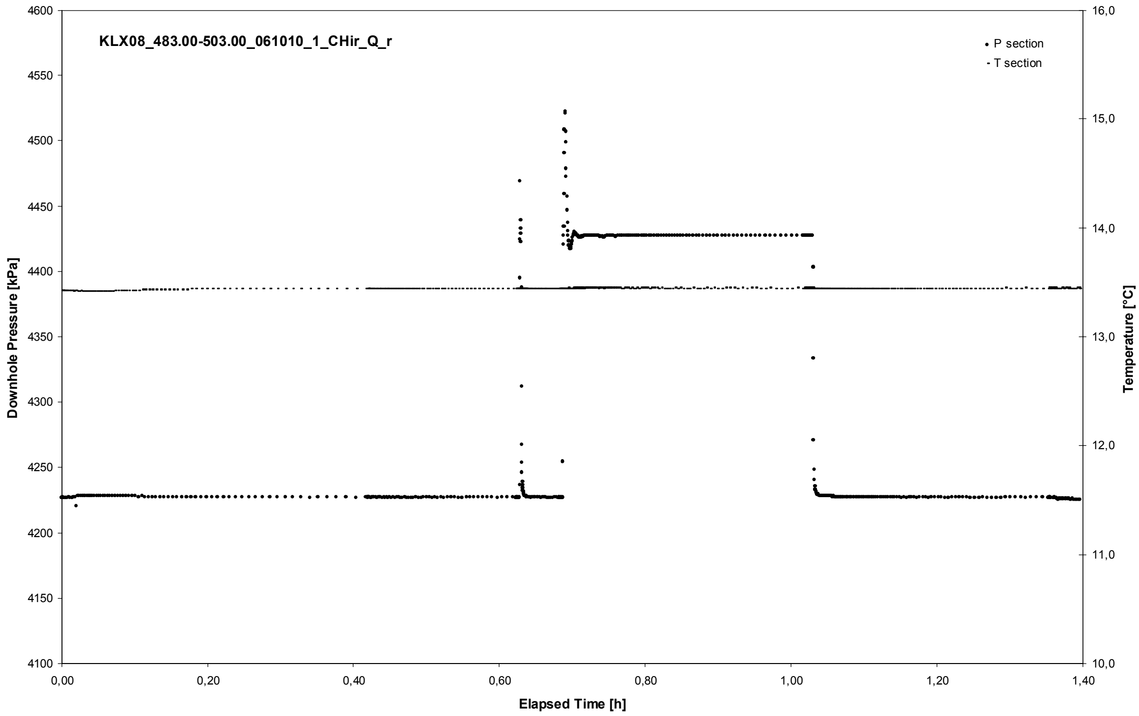
APPENDIX 2-29

Test 483.00 – 503.00 m

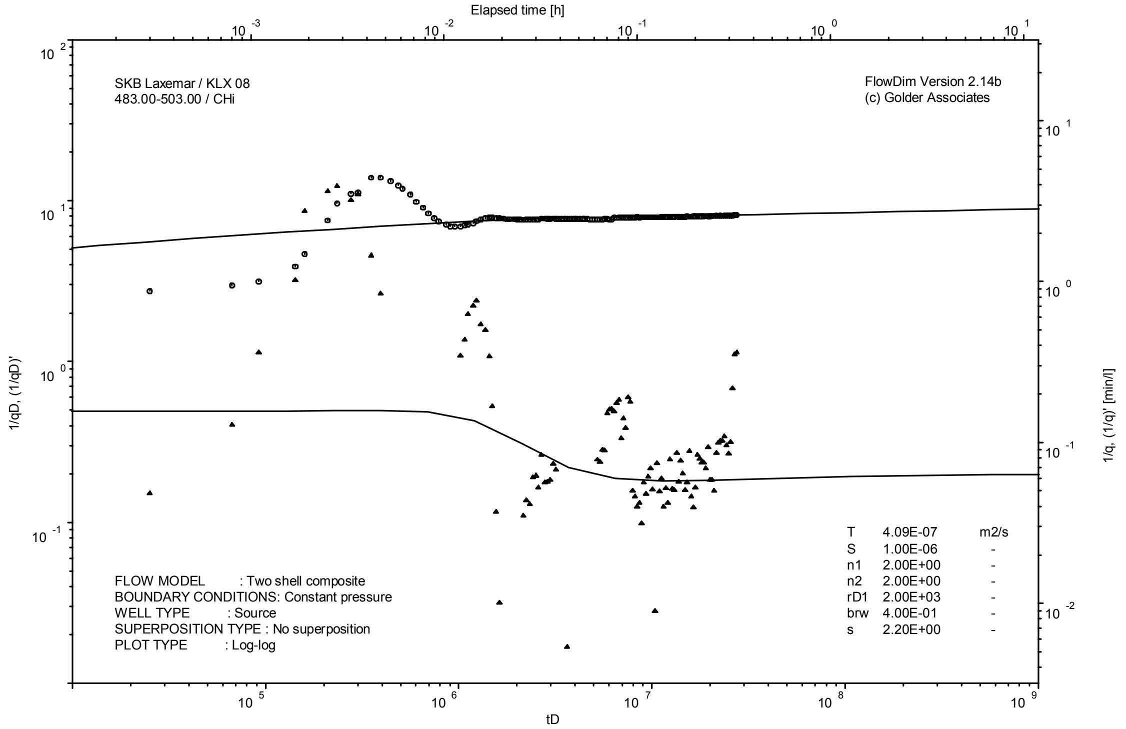
Analysis diagrams



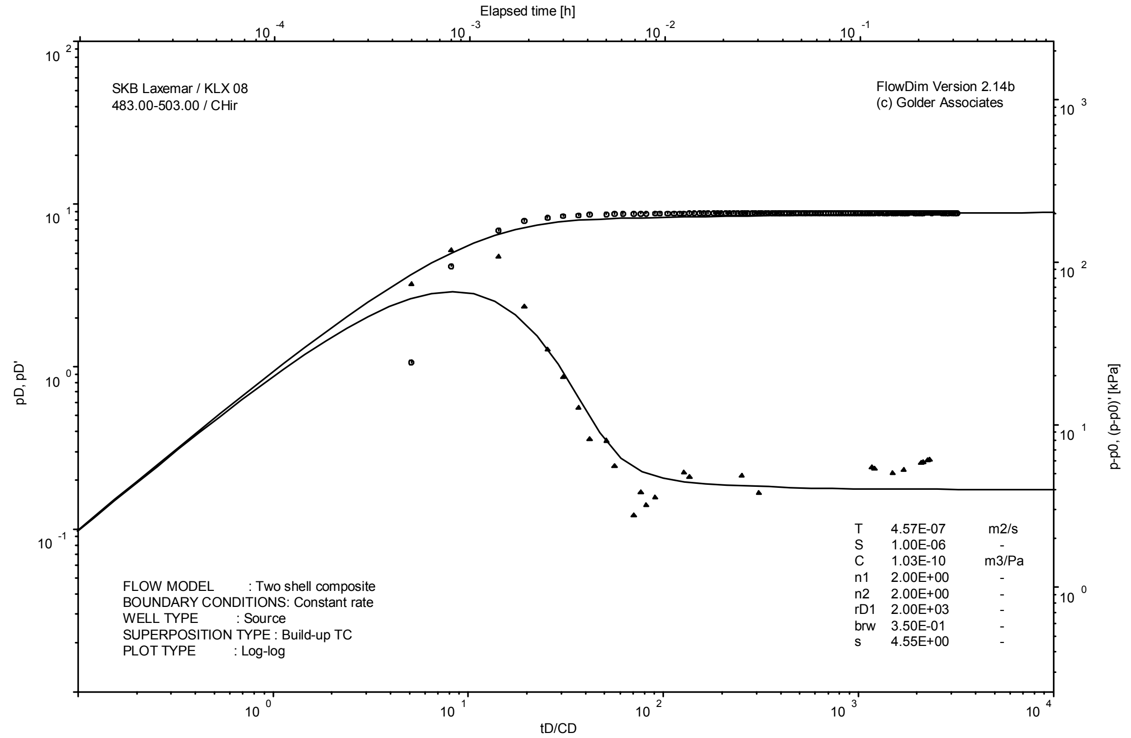
Pressure and flow rate vs. time; cartesian plot



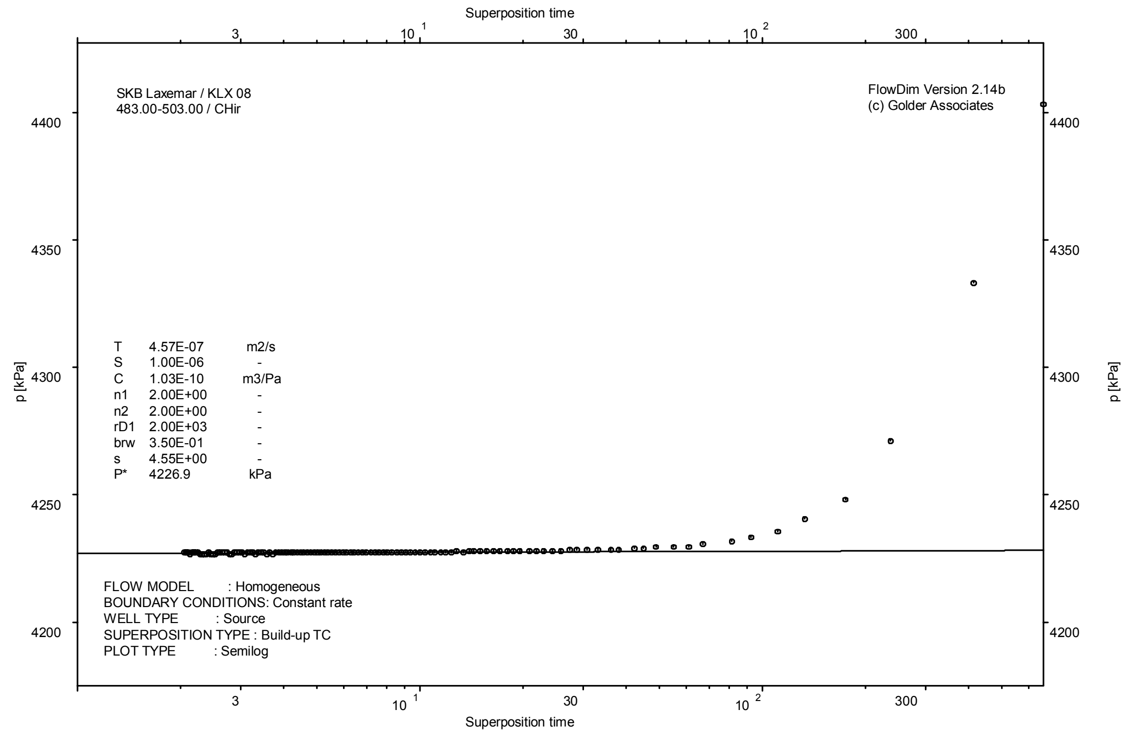
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

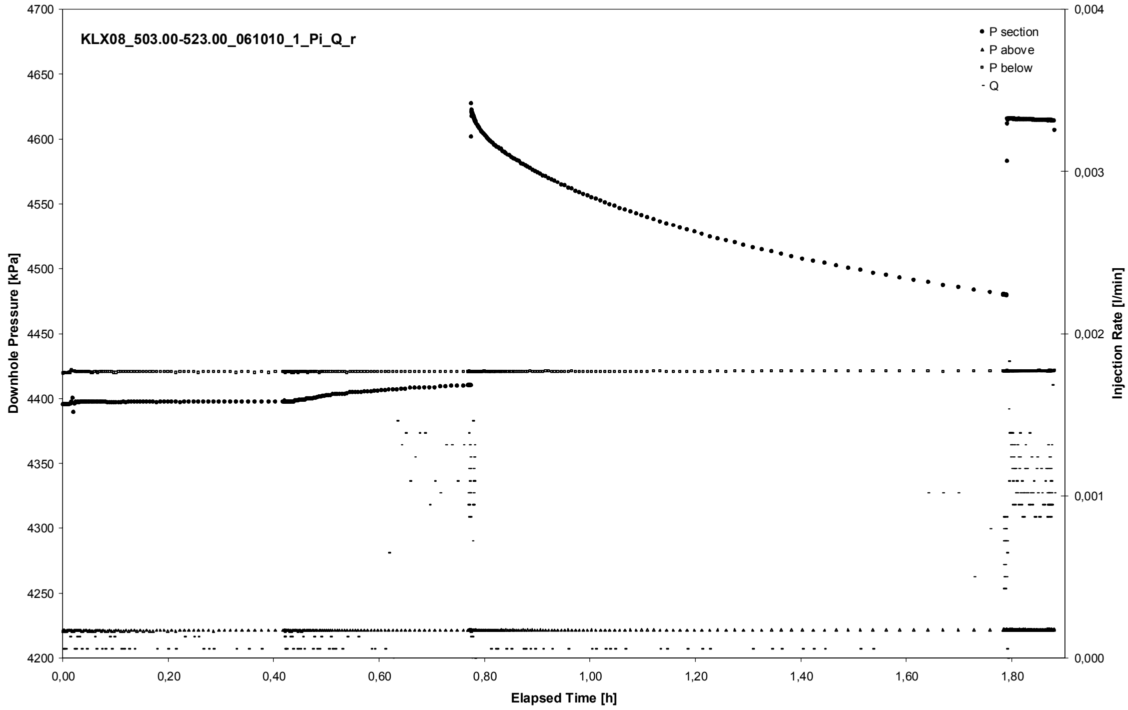


CHIR phase; HORNER match

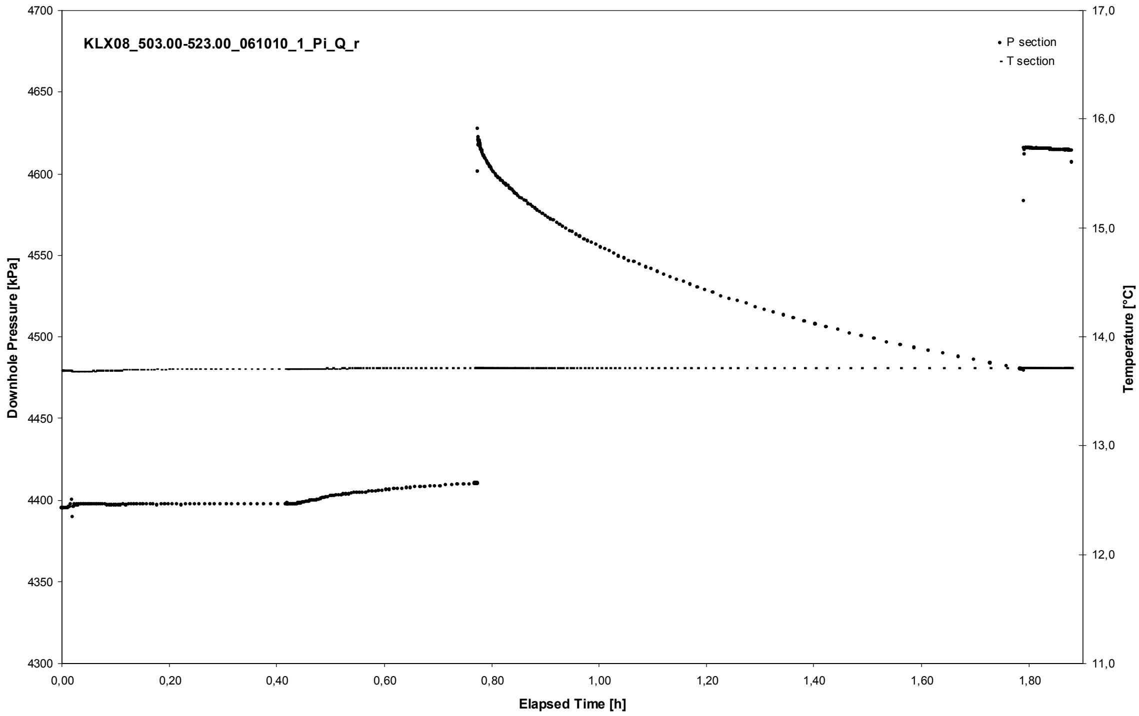
APPENDIX 2-30

Test 503.00 – 523.00 m

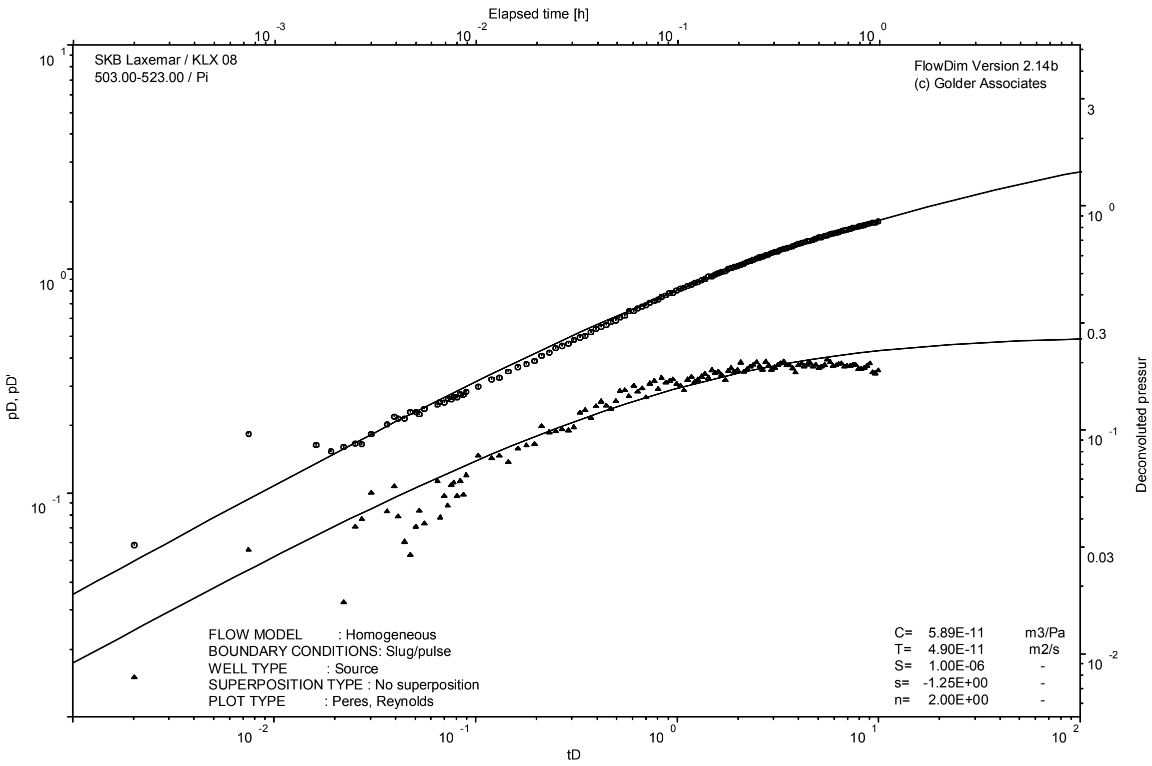
Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot

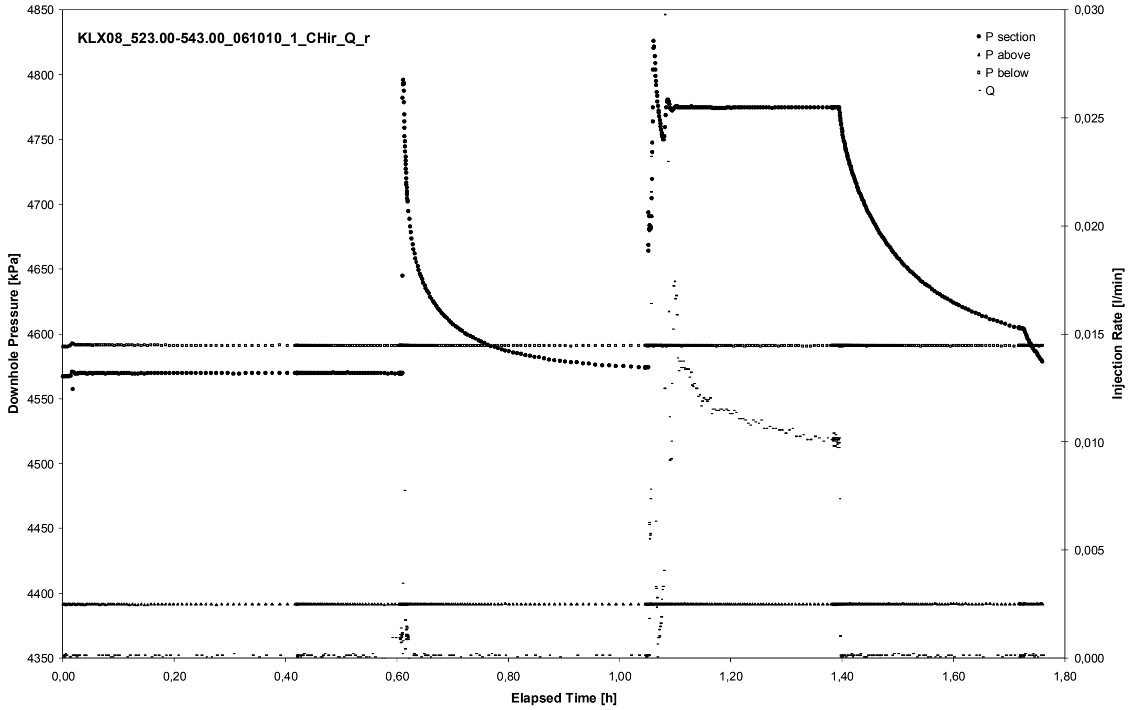


Pulse injection; deconvolution match

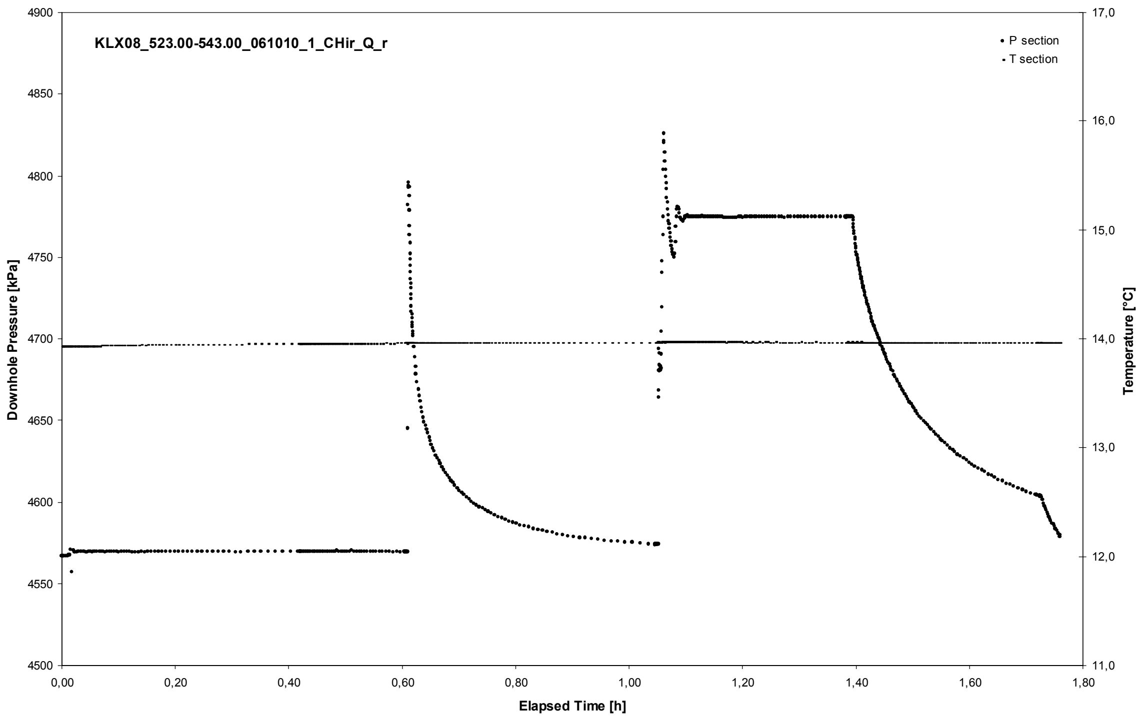
APPENDIX 2-31

Test 523.00 – 543.00 m

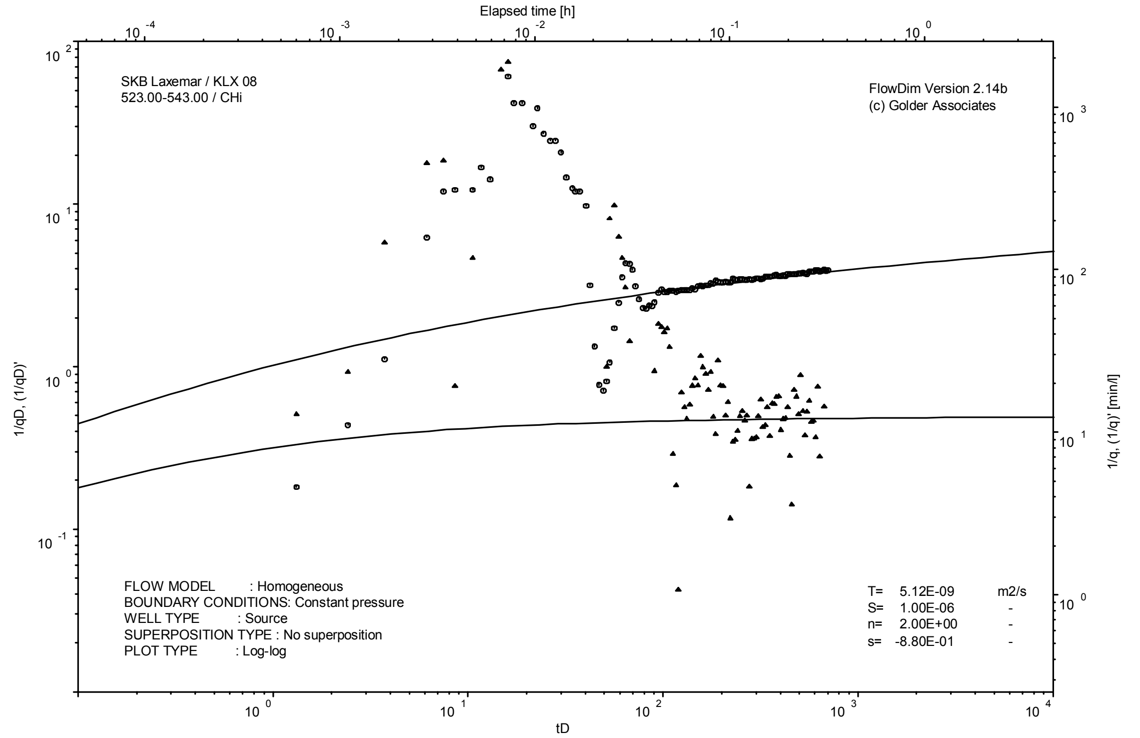
Analysis diagrams



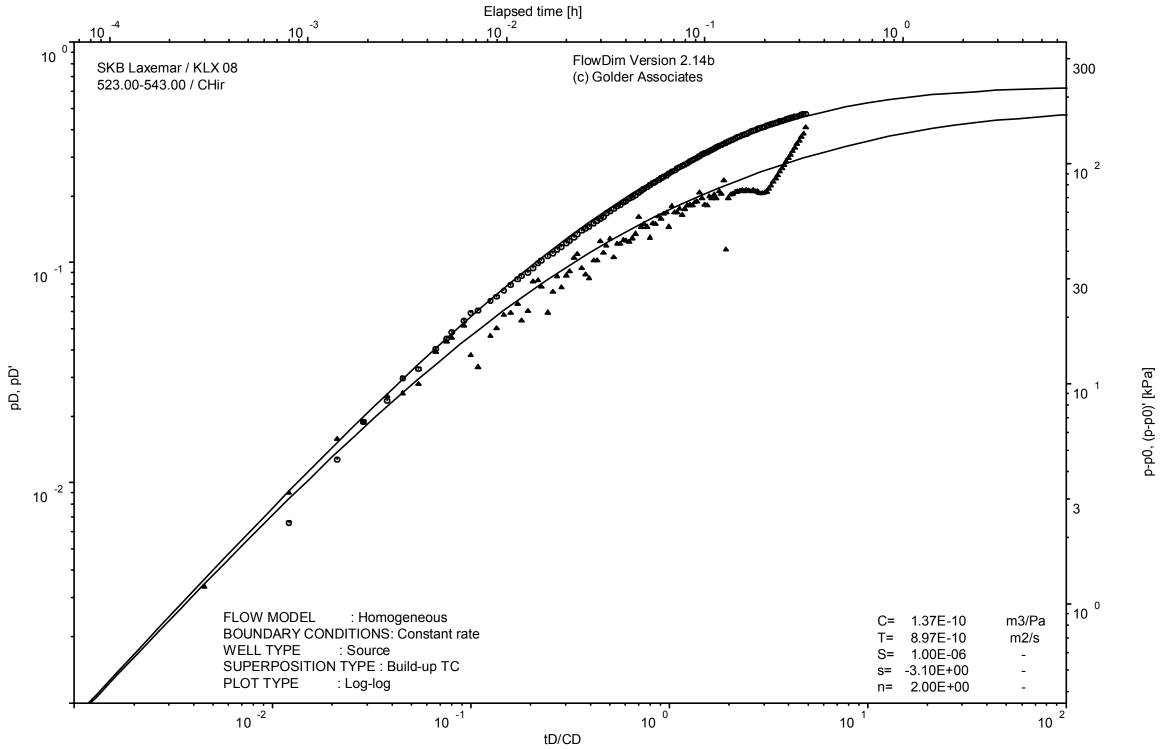
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

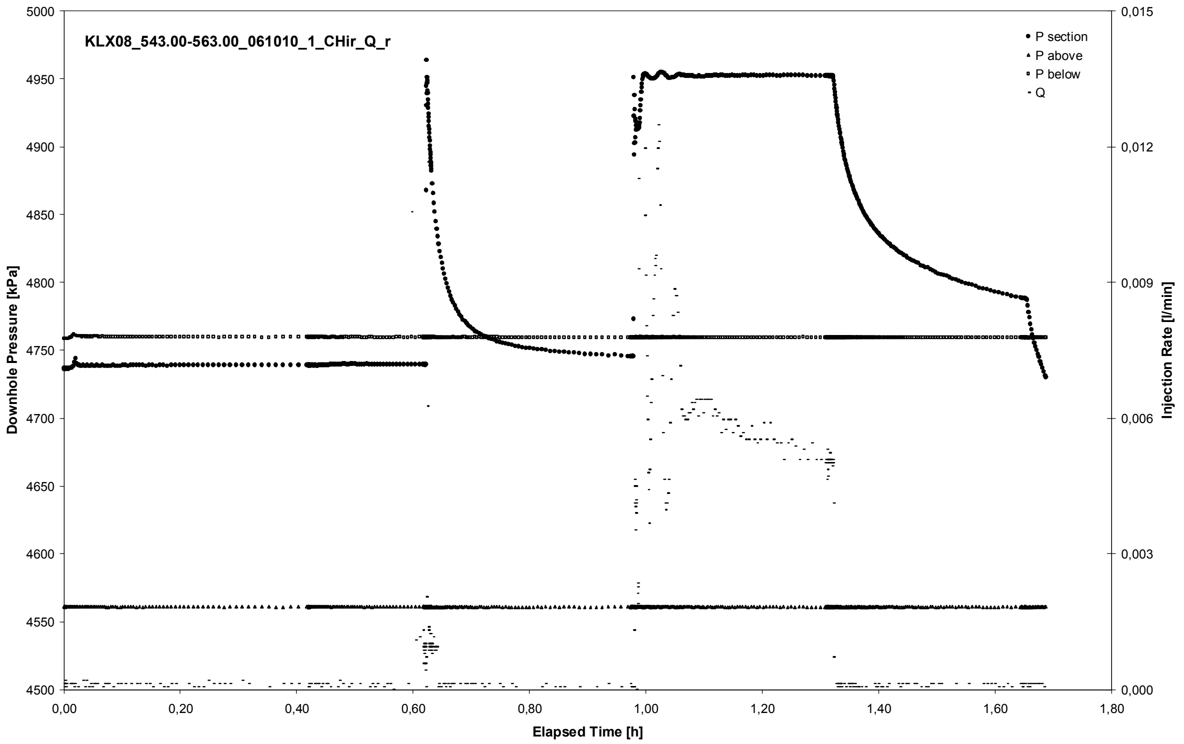
Not analysable

CHIR phase; HORNER match

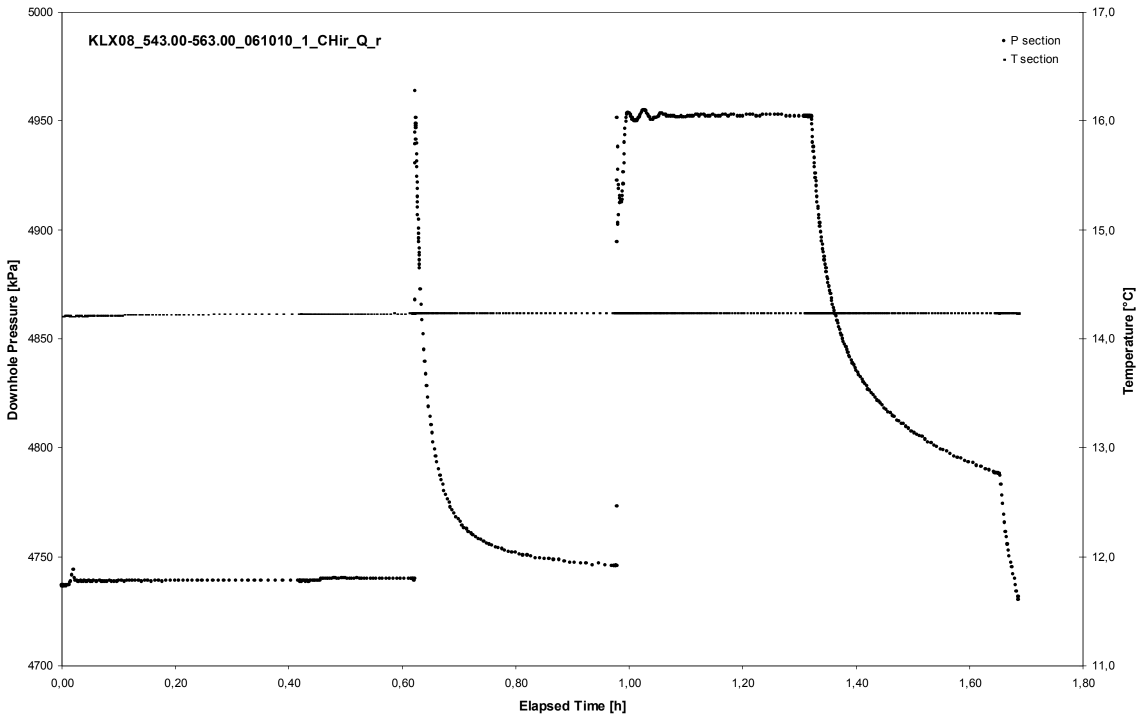
APPENDIX 2-32

Test 543.00 – 563.00 m

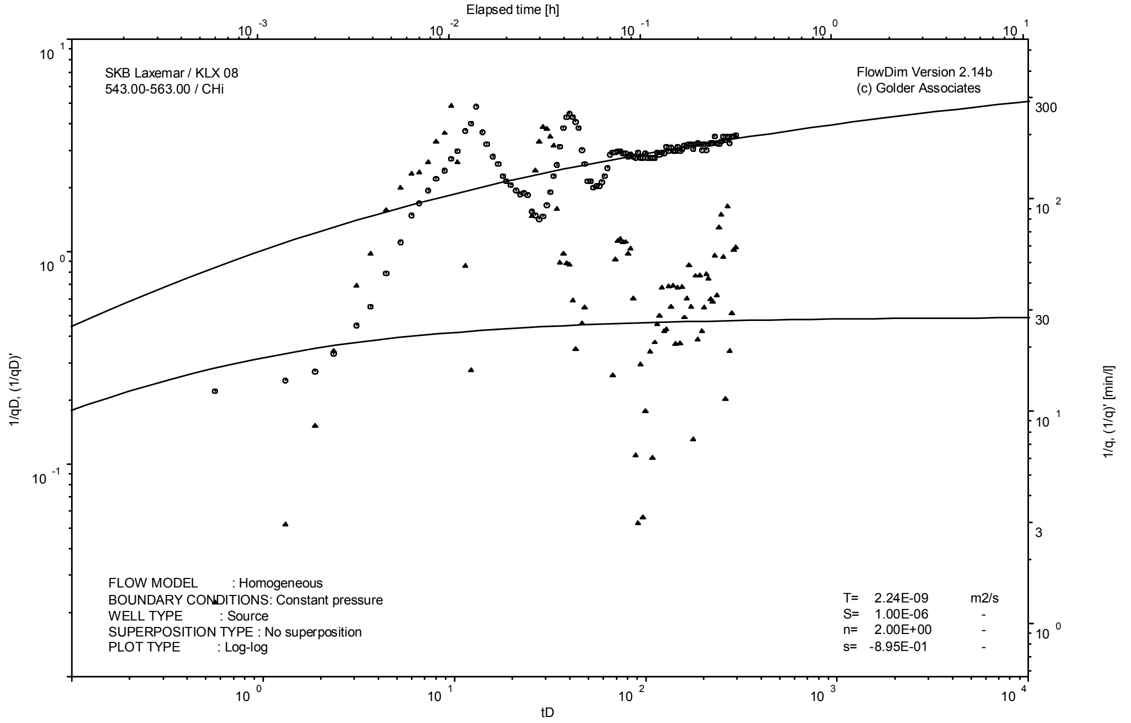
Analysis diagrams



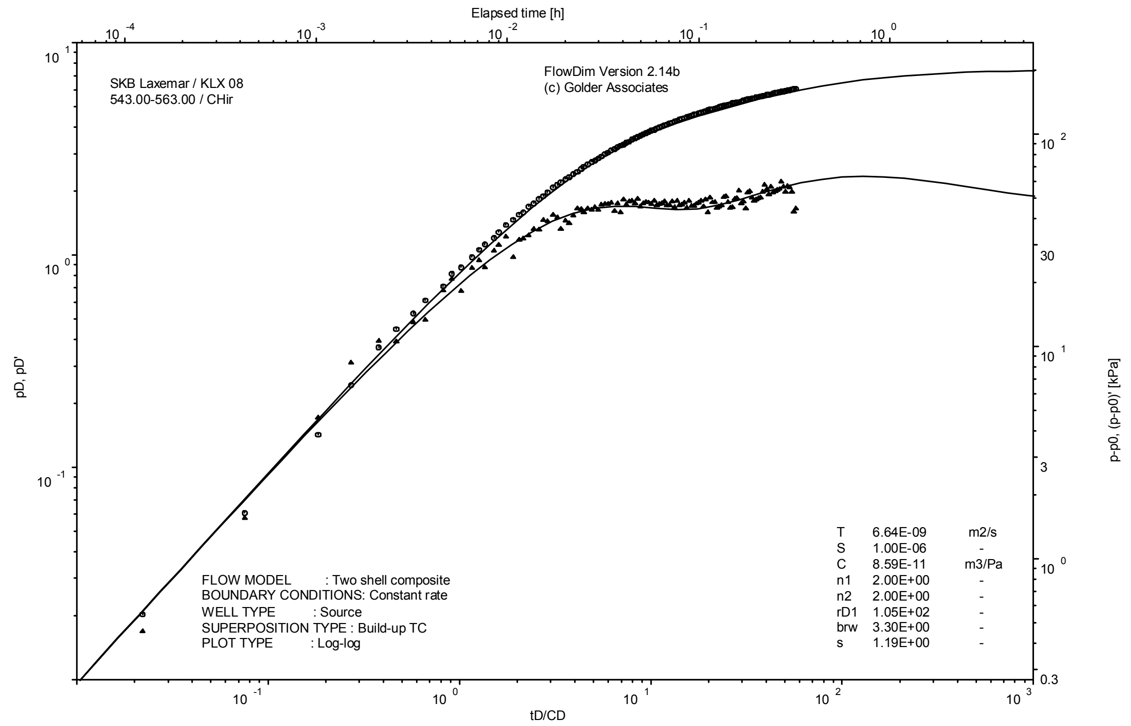
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

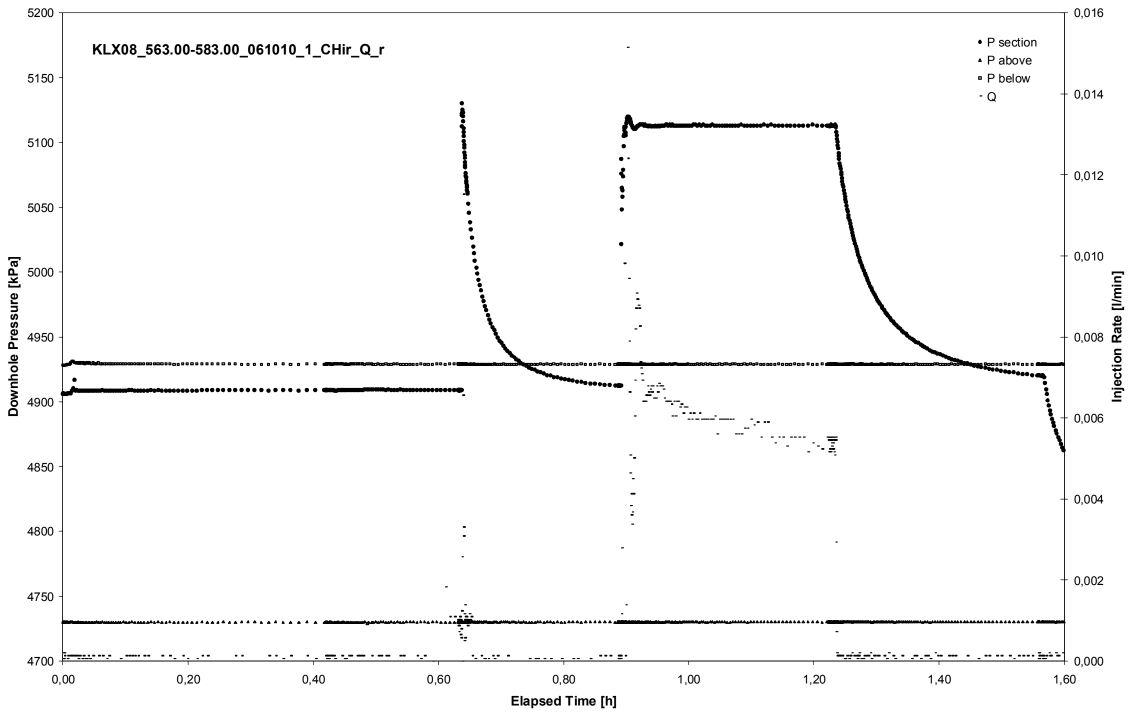
Not analysable

CHIR phase; HORNER match

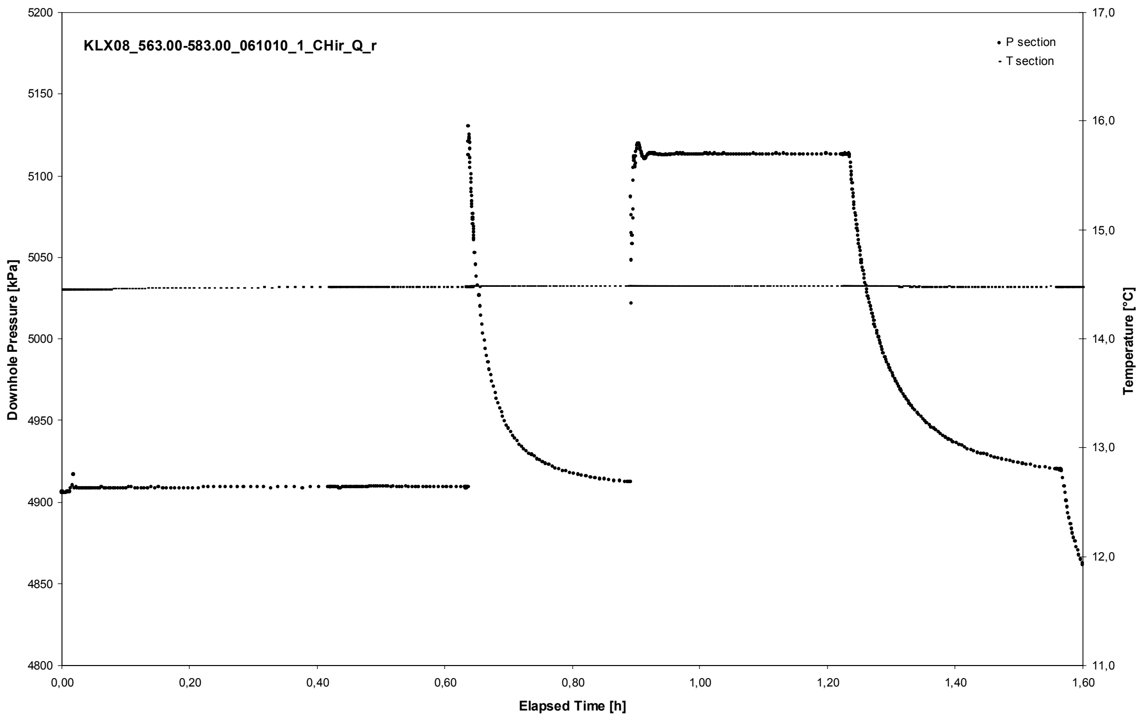
APPENDIX 2-33

Test 563.00 – 583.00 m

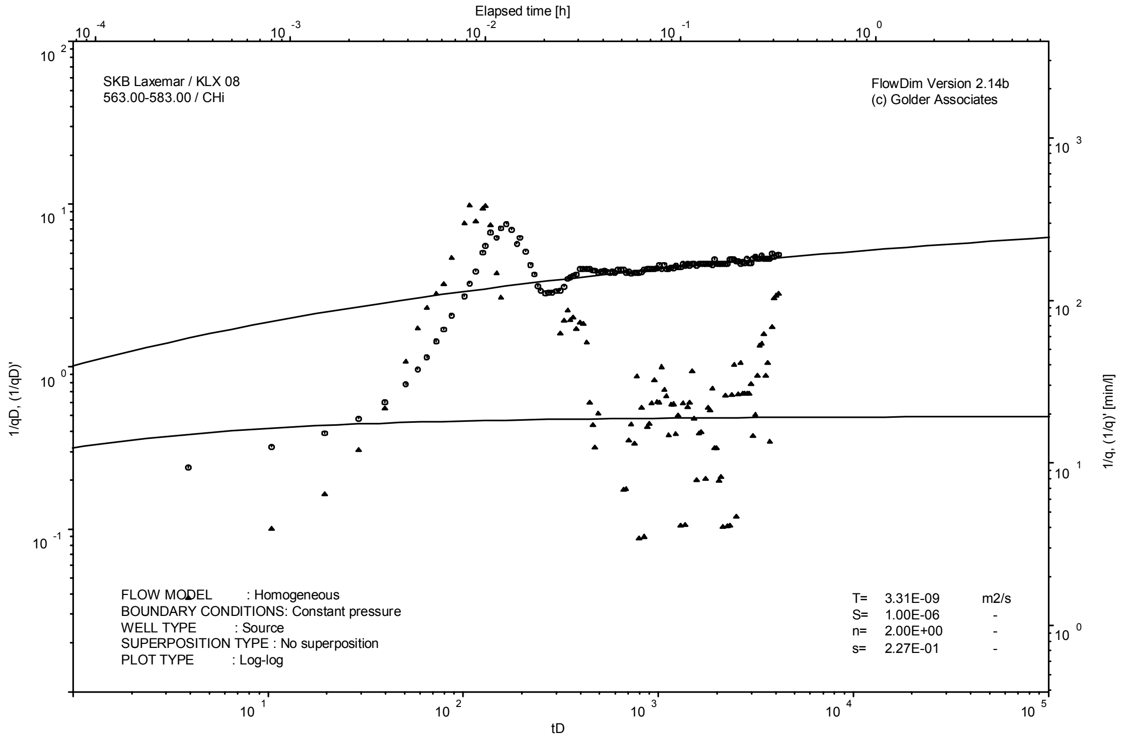
Analysis diagrams



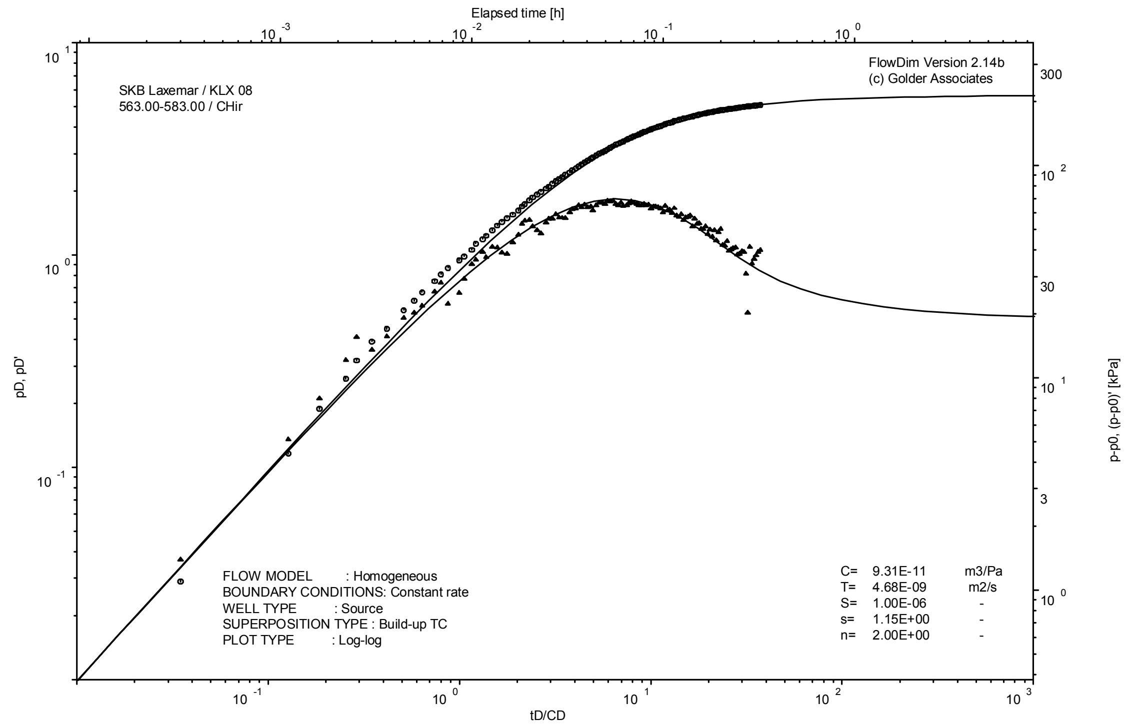
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

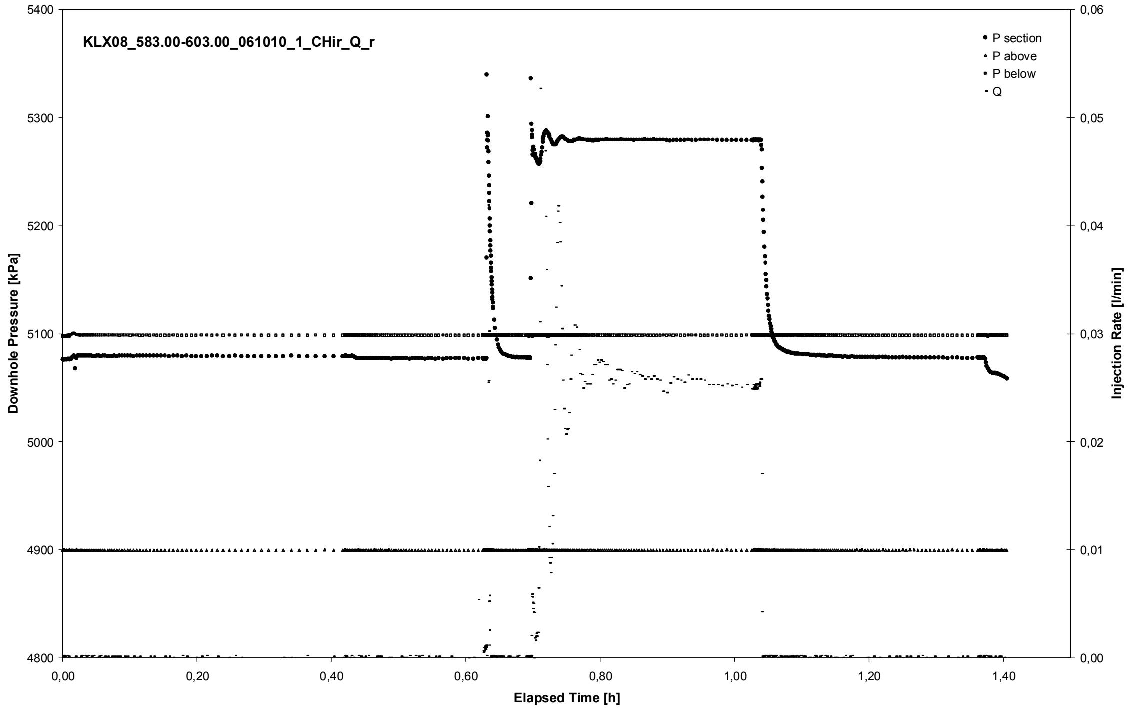
Not analysable

CHIR phase; HORNER match

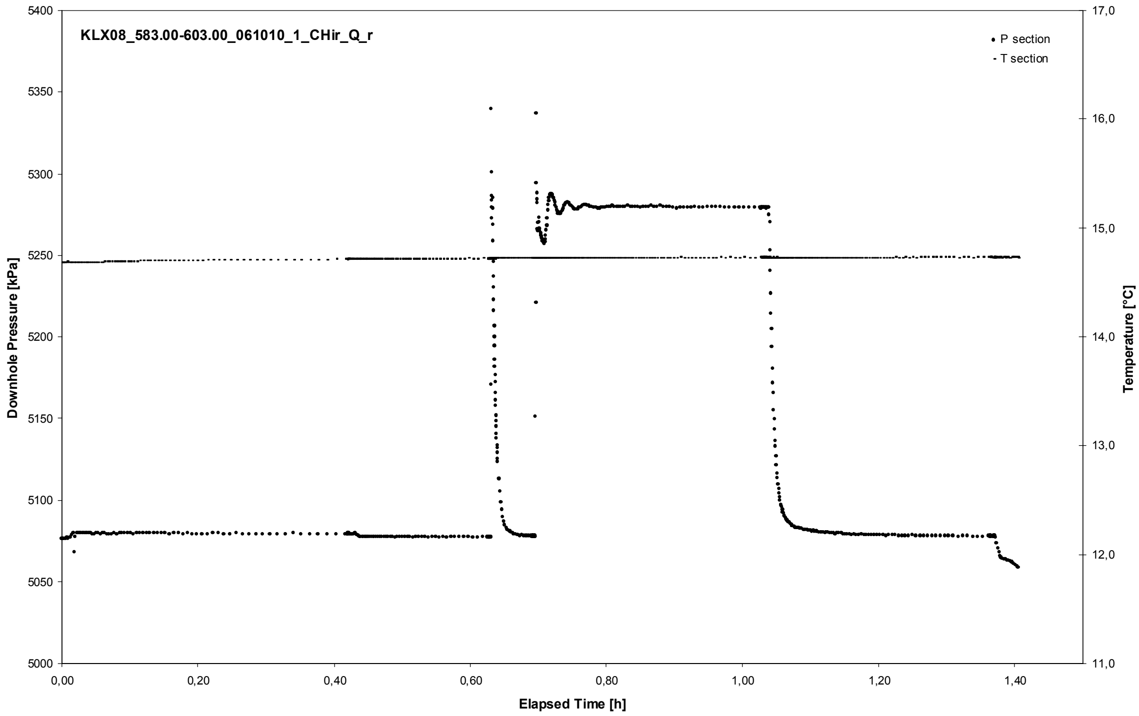
APPENDIX 2-34

Test 583.00 – 603.00 m

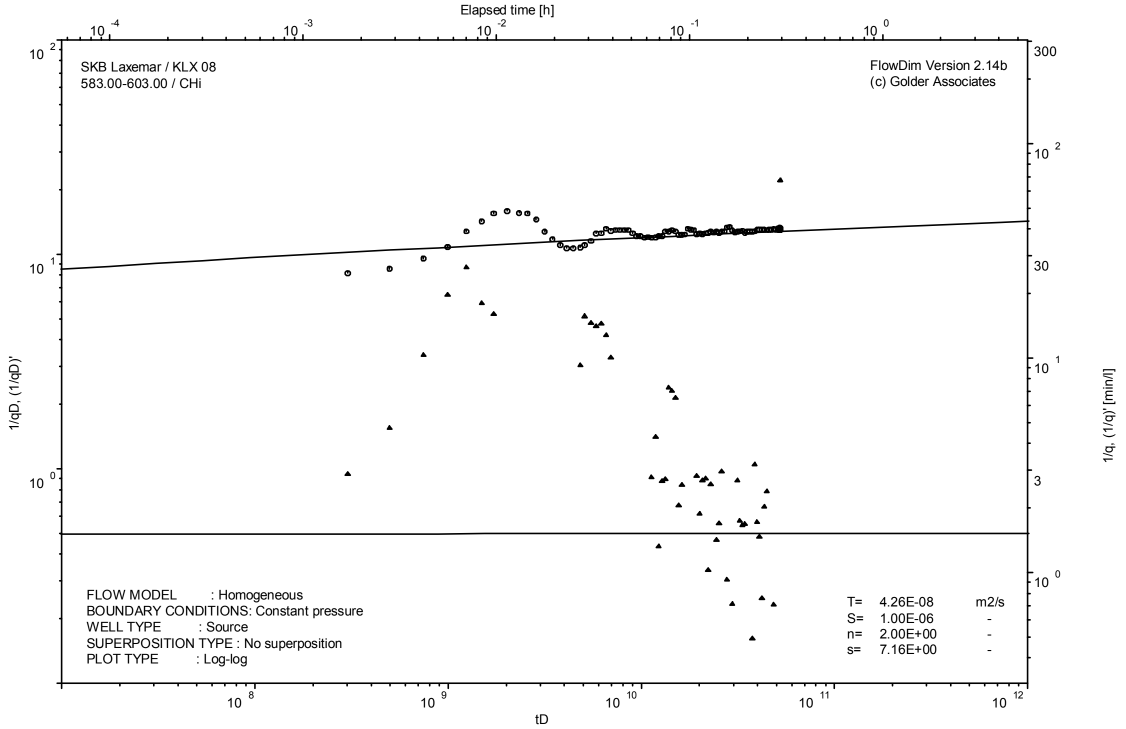
Analysis diagrams



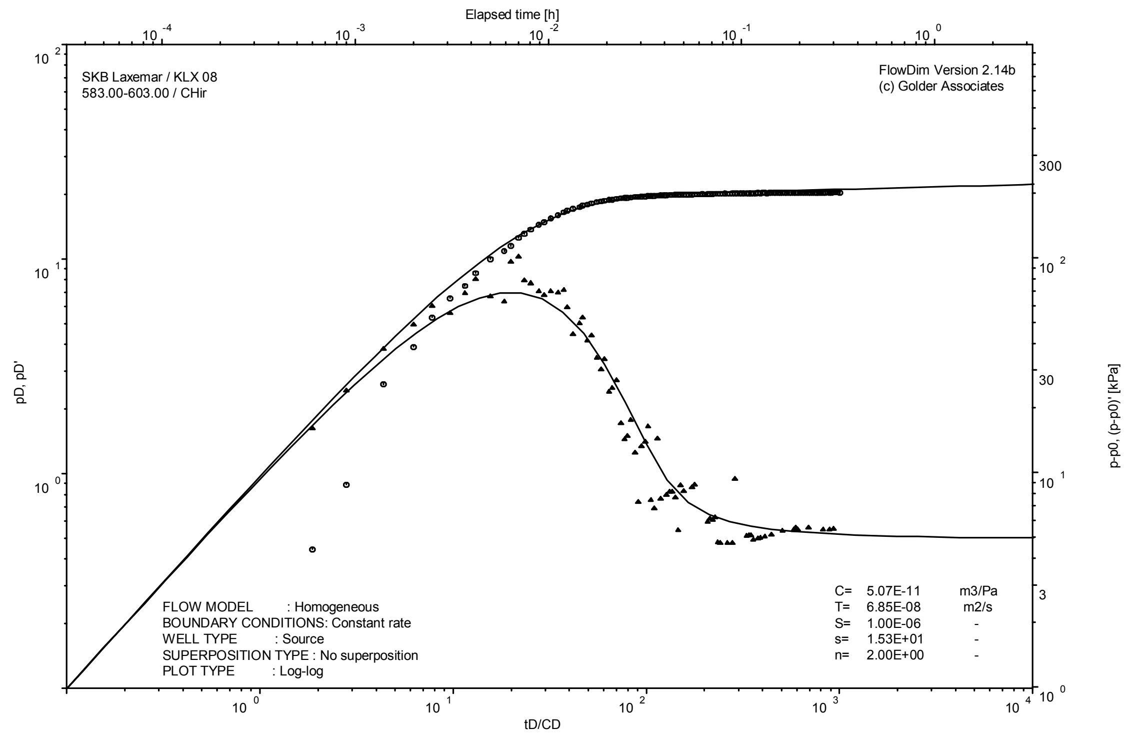
Pressure and flow rate vs. time; cartesian plot



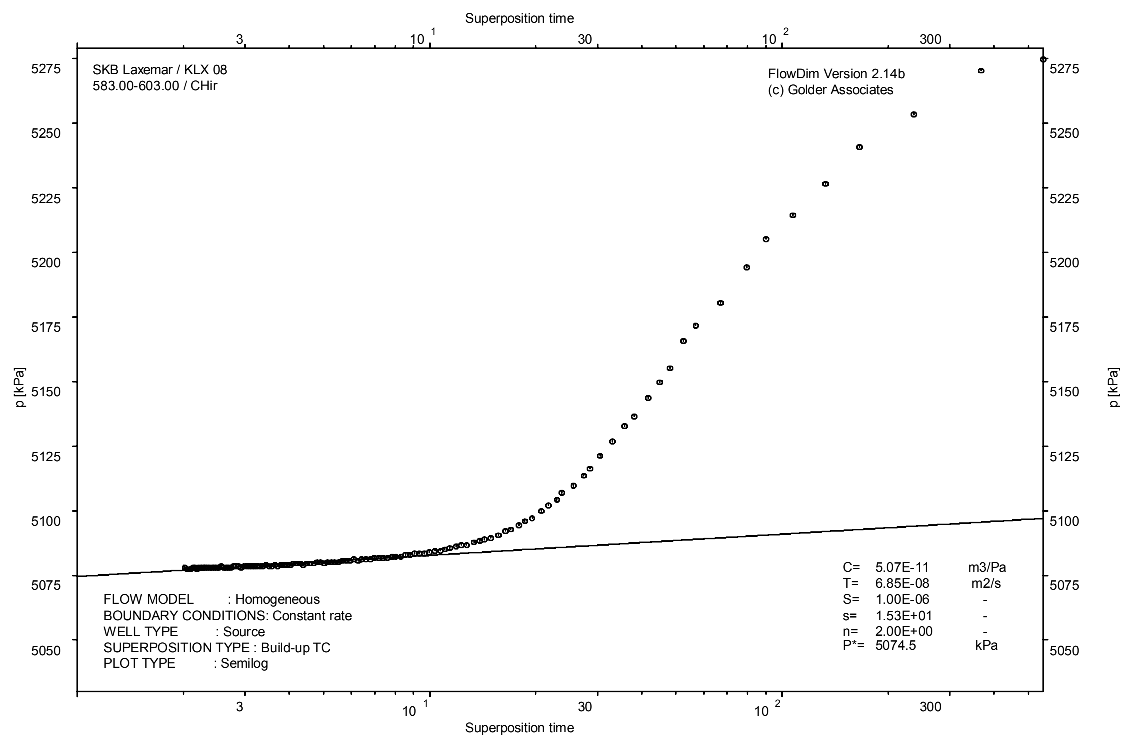
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

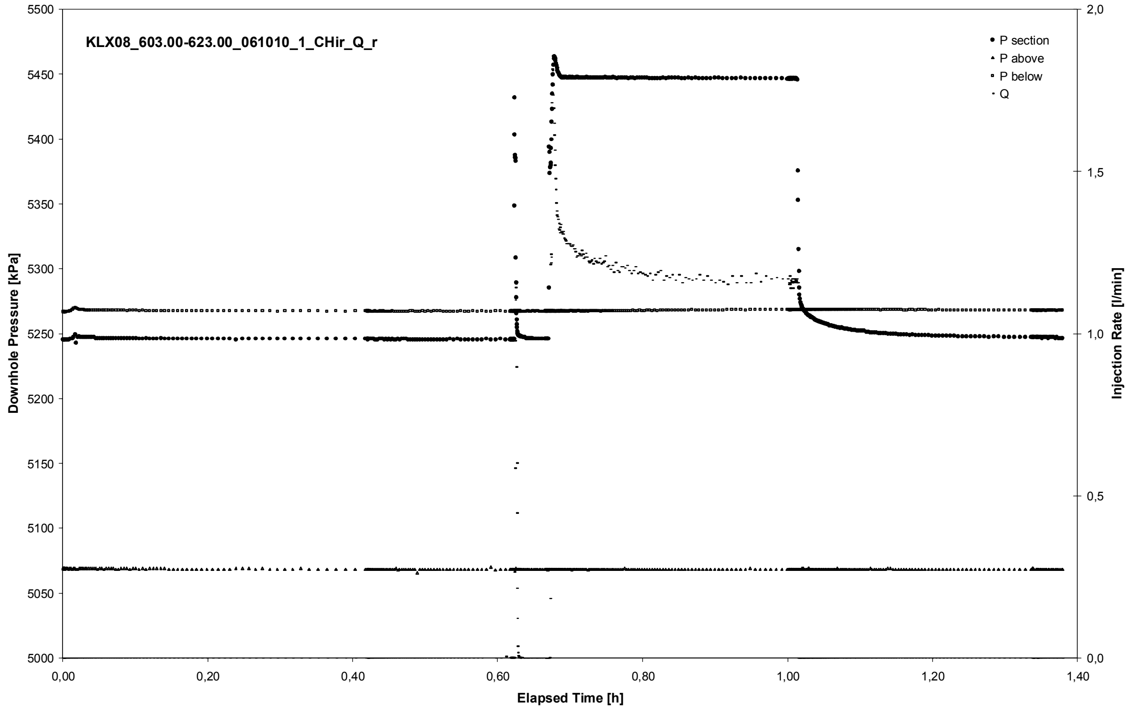


CHIR phase; HORNER match

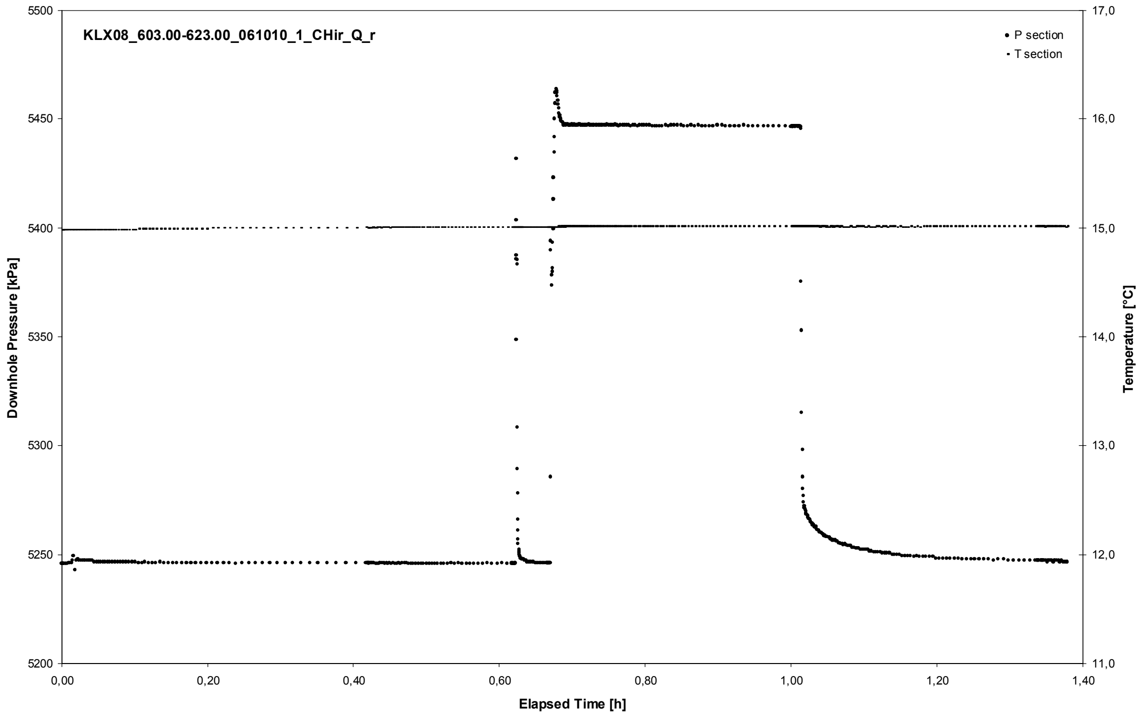
APPENDIX 2-35

Test 603.00 – 623.00 m

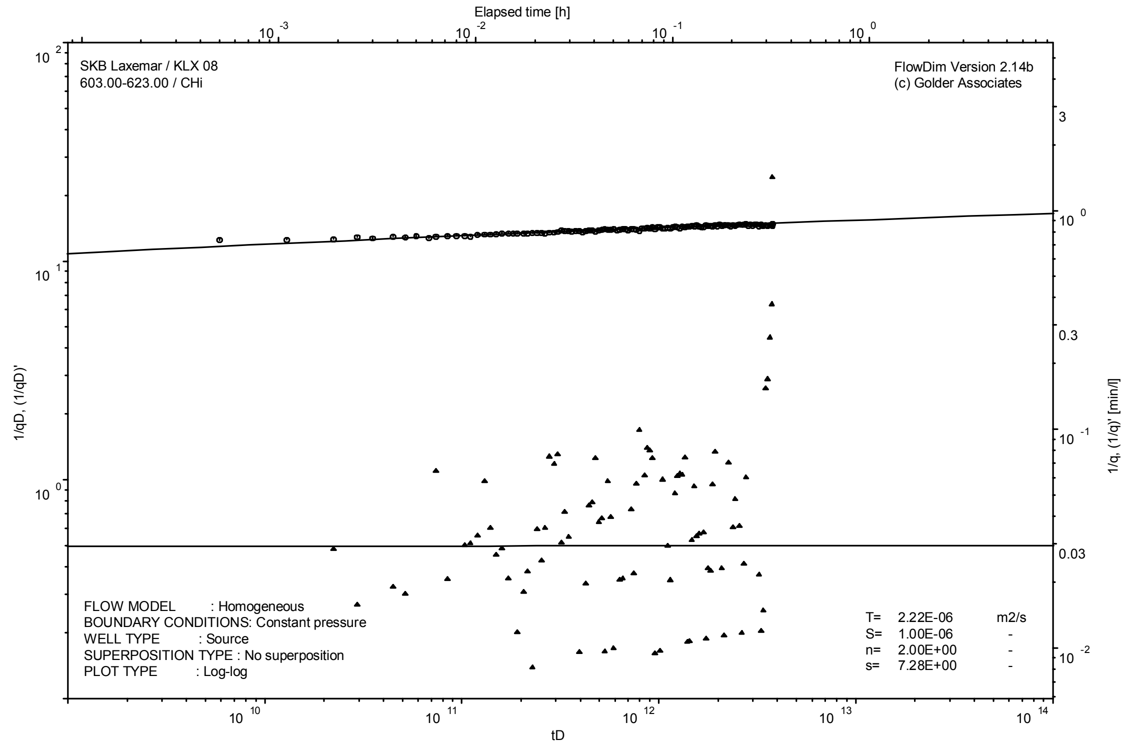
Analysis diagrams



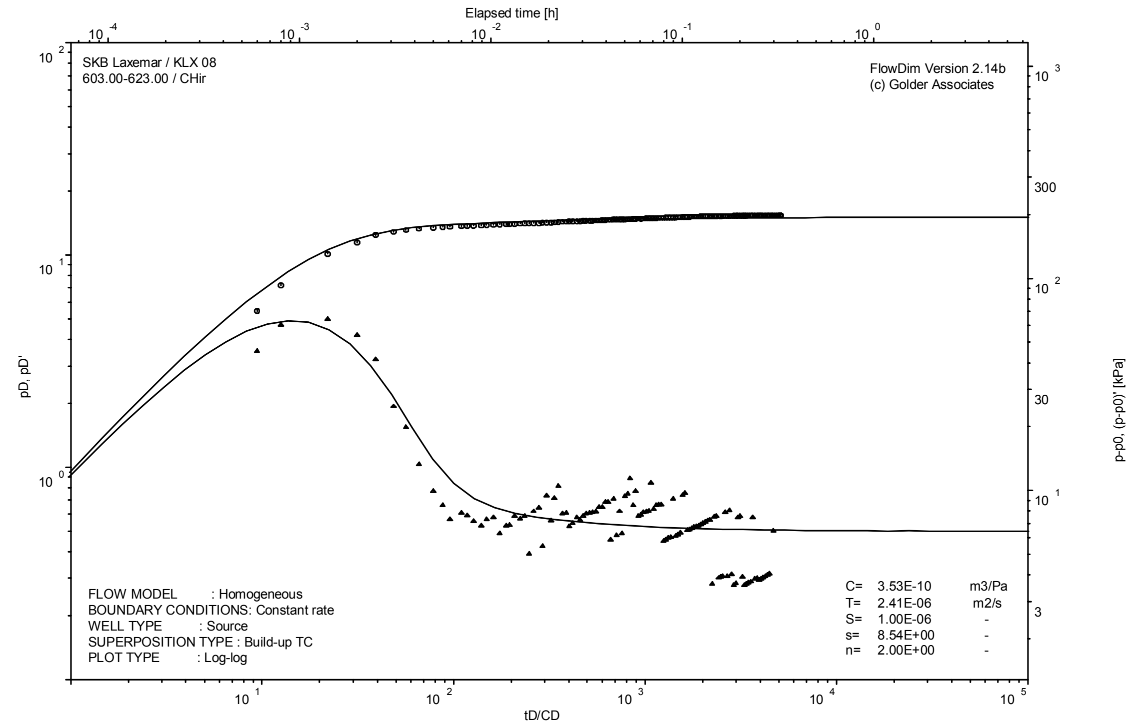
Pressure and flow rate vs. time; cartesian plot



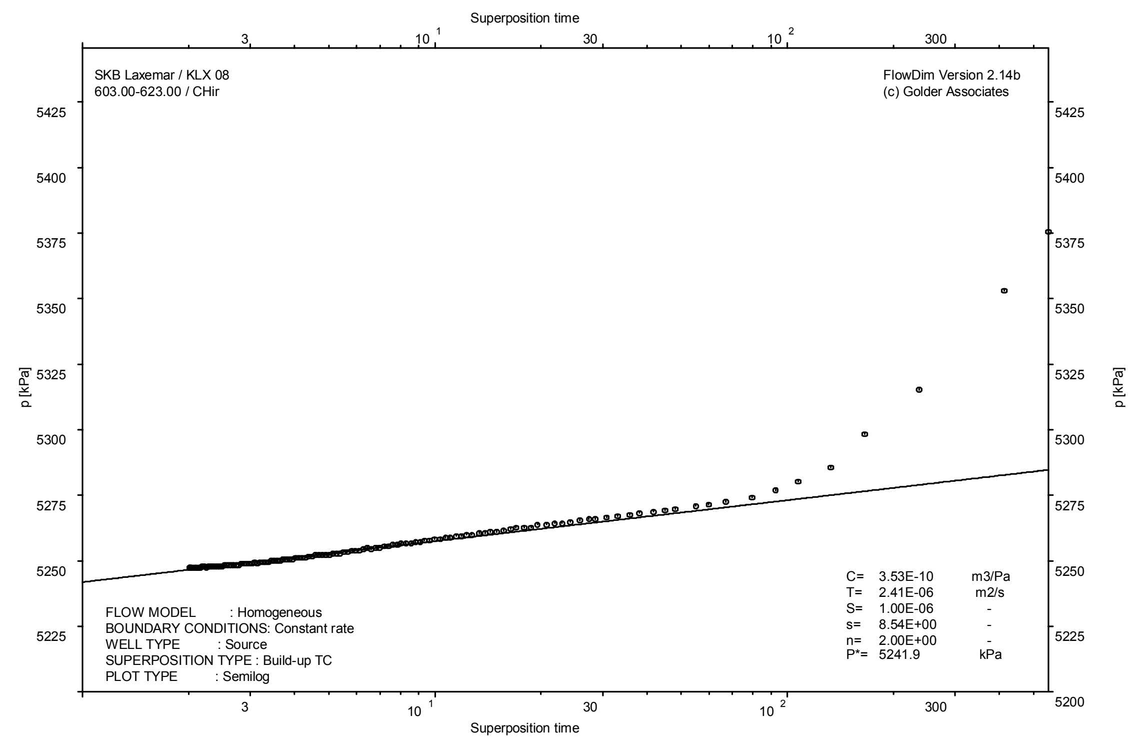
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

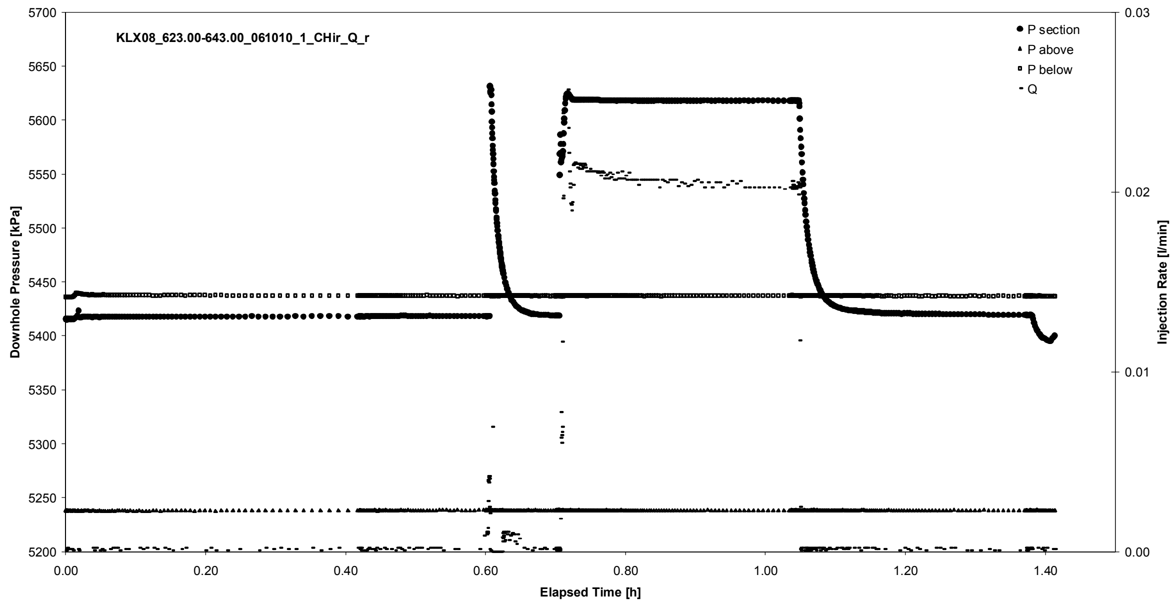


CHIR phase; HORNER match

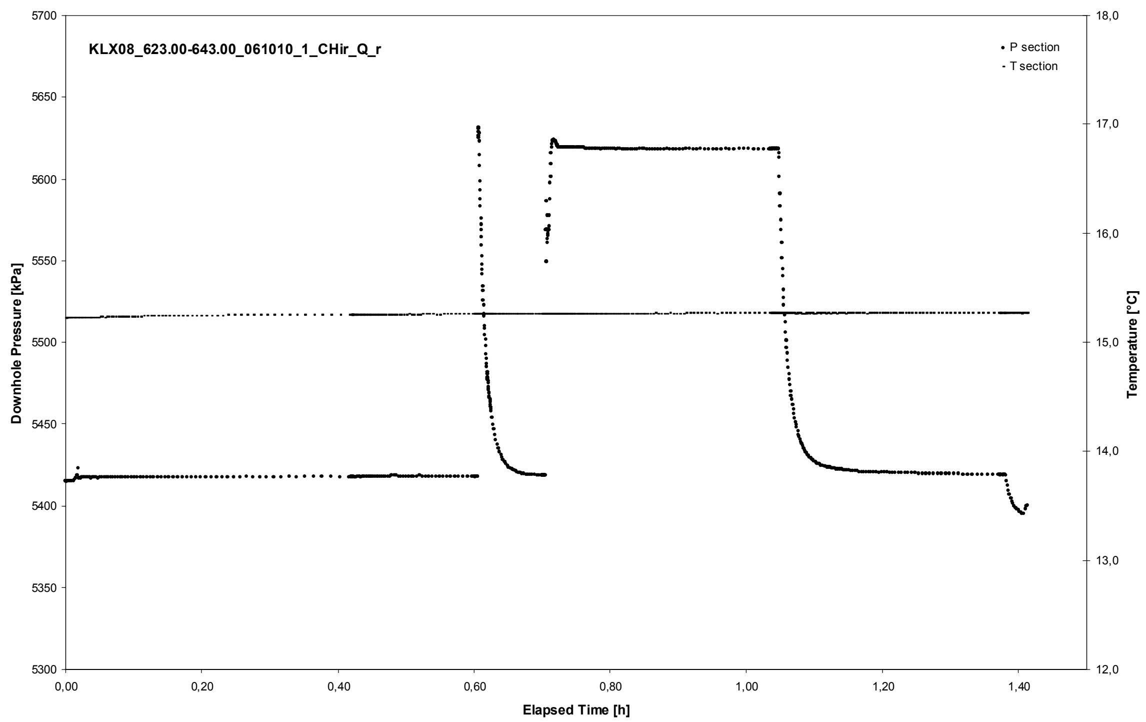
APPENDIX 2-36

Test 623.00 – 643.00 m

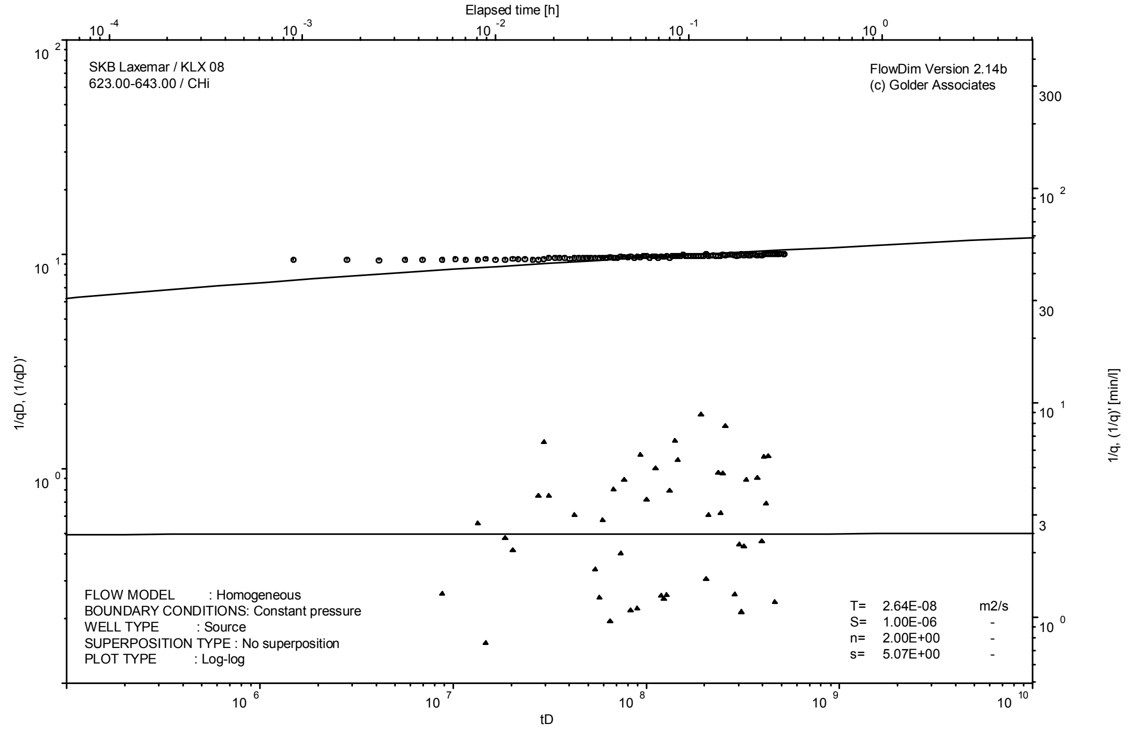
Analysis diagrams



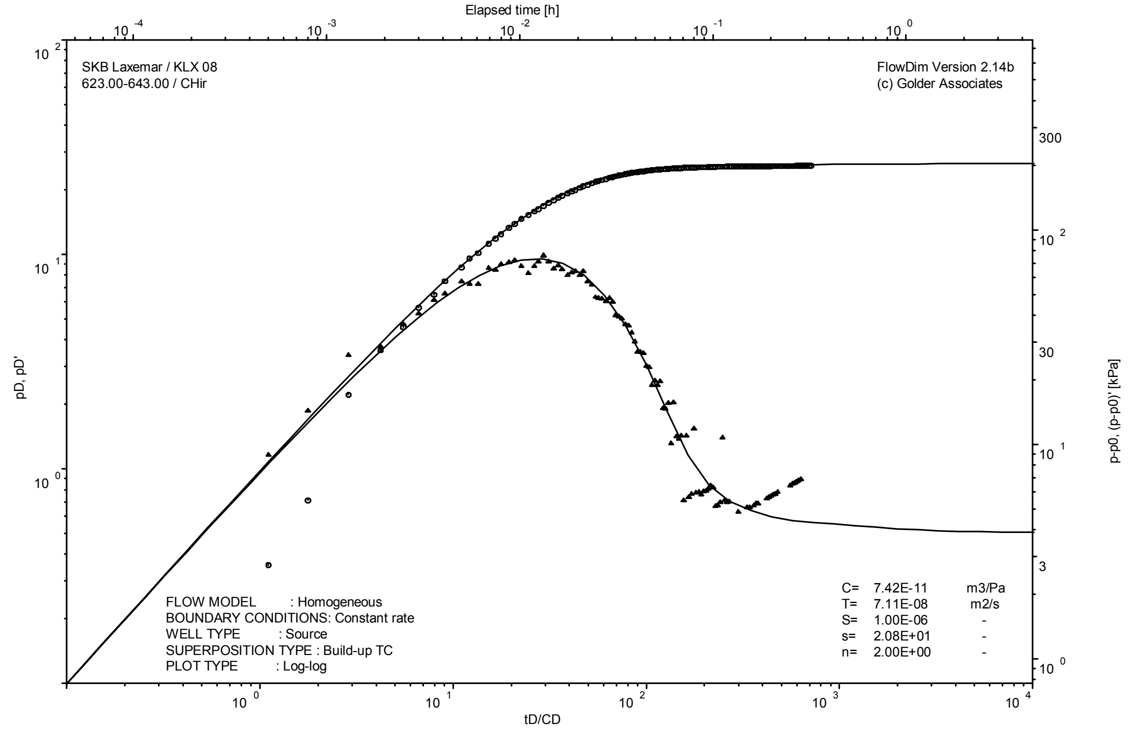
Pressure and flow rate vs. time; cartesian plot



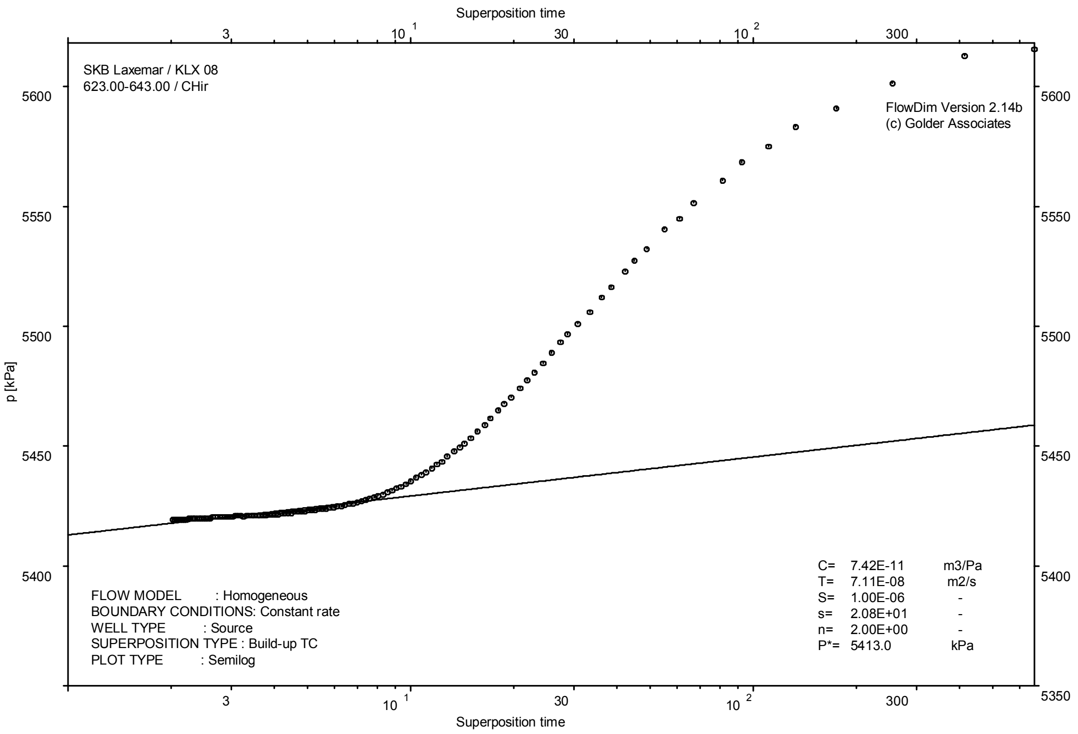
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

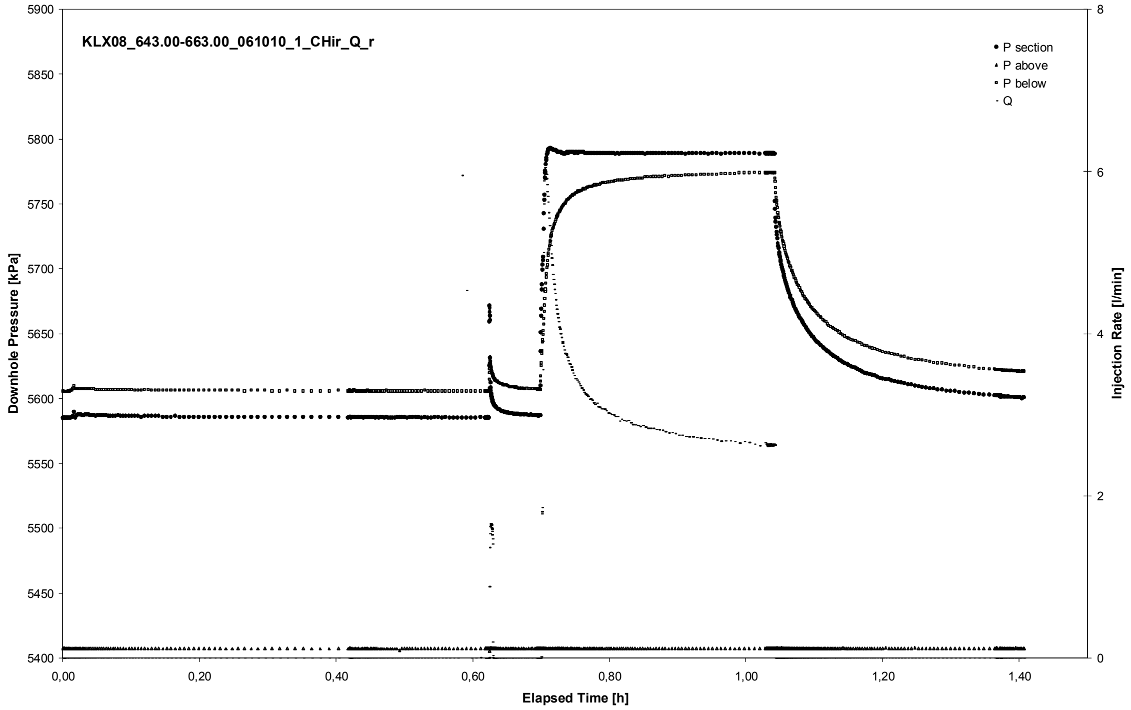


CHIR phase; HORNER match

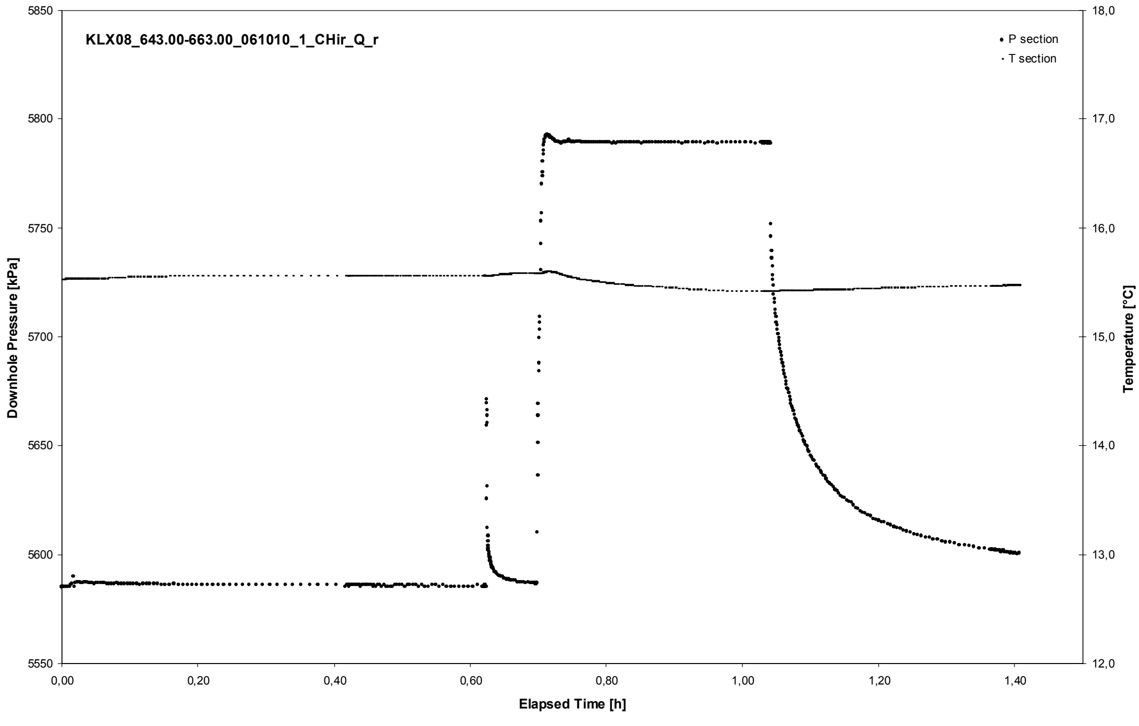
APPENDIX 2-37

Test 643.00 – 663.00 m

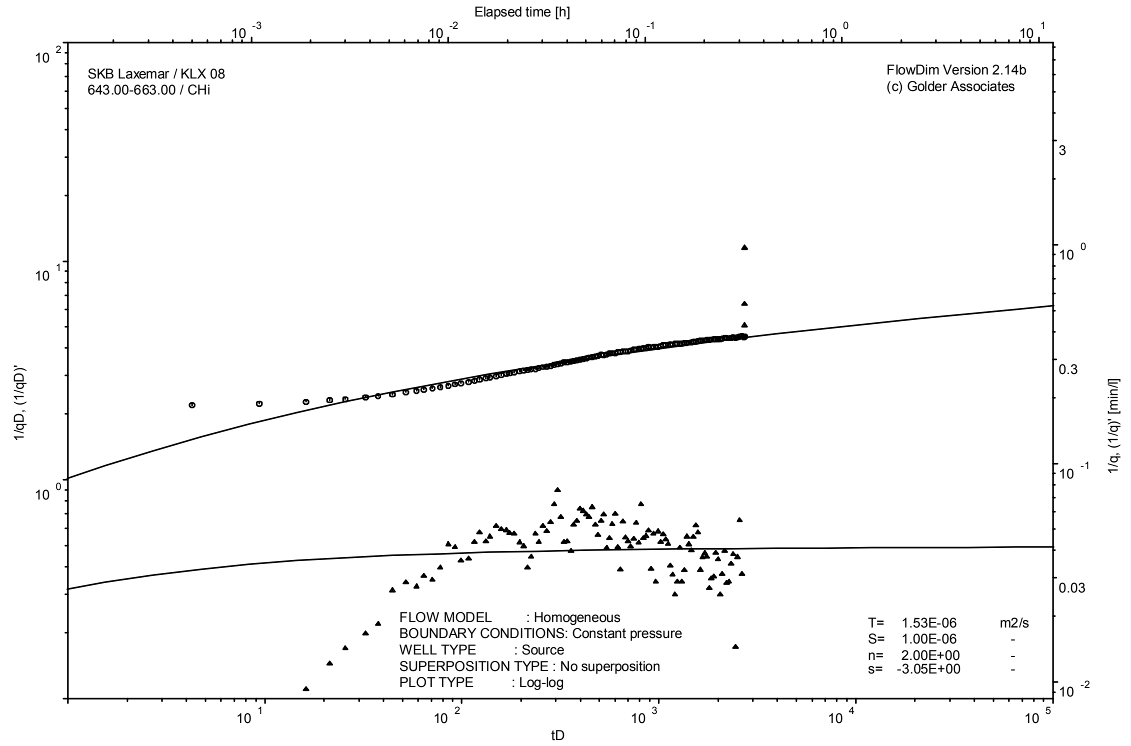
Analysis diagrams



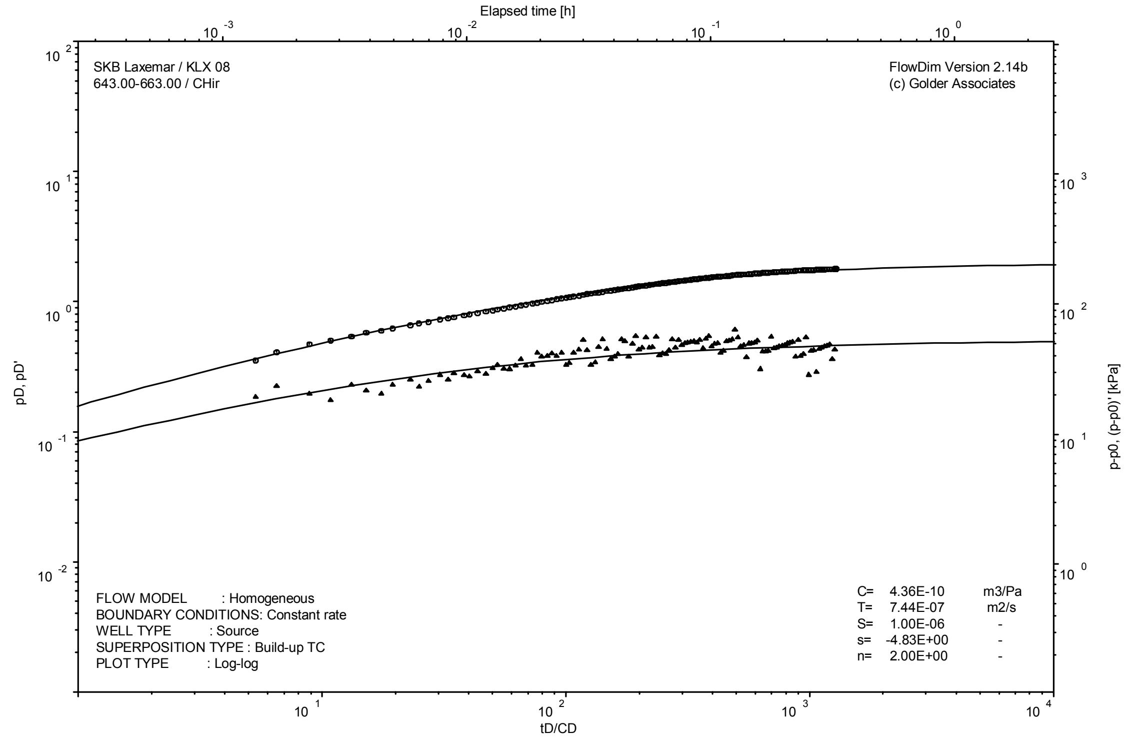
Pressure and flow rate vs. time; cartesian plot



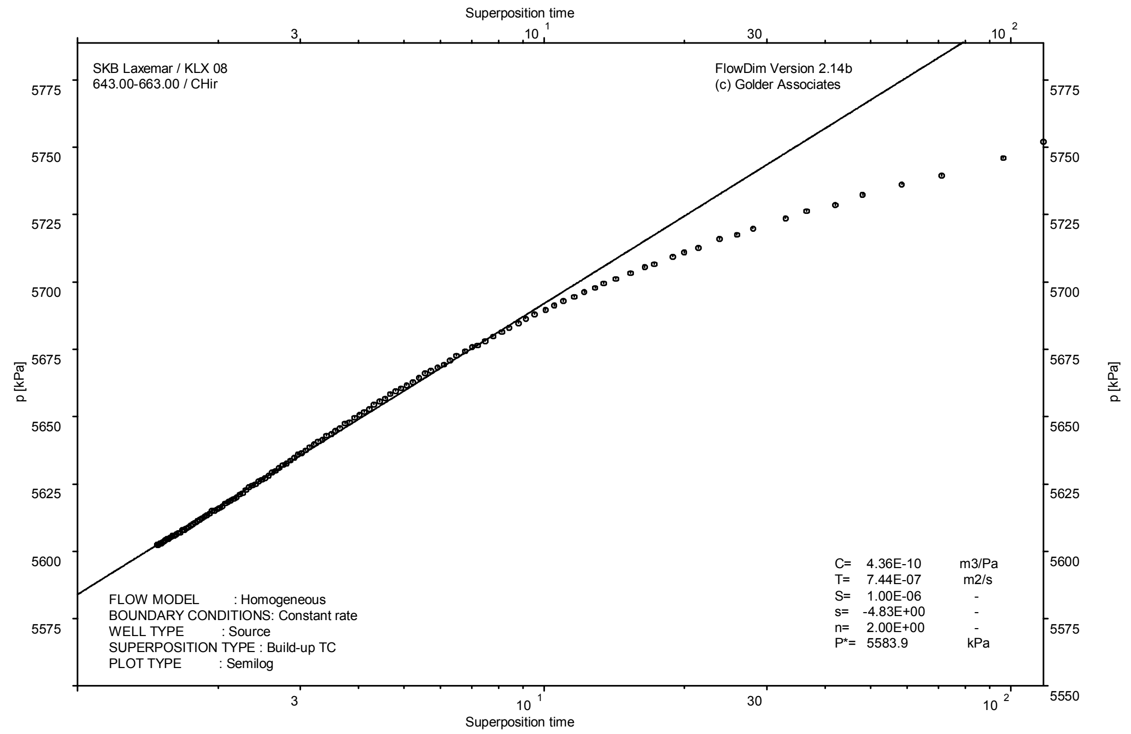
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

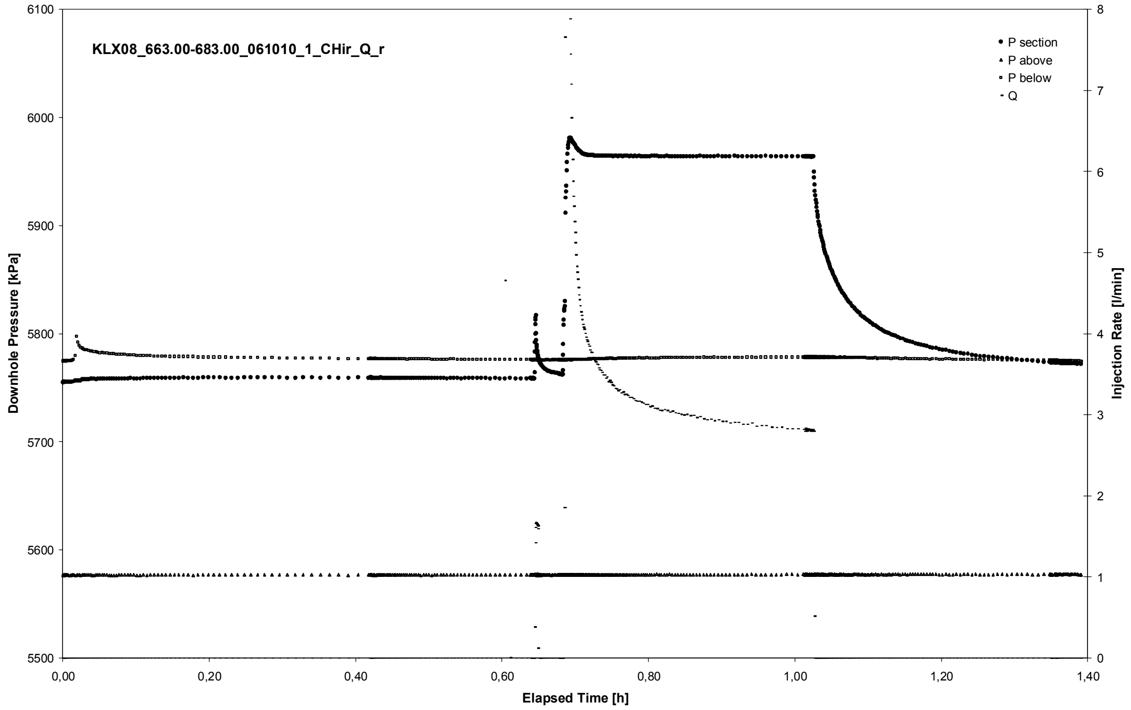


CHIR phase; HORNER match

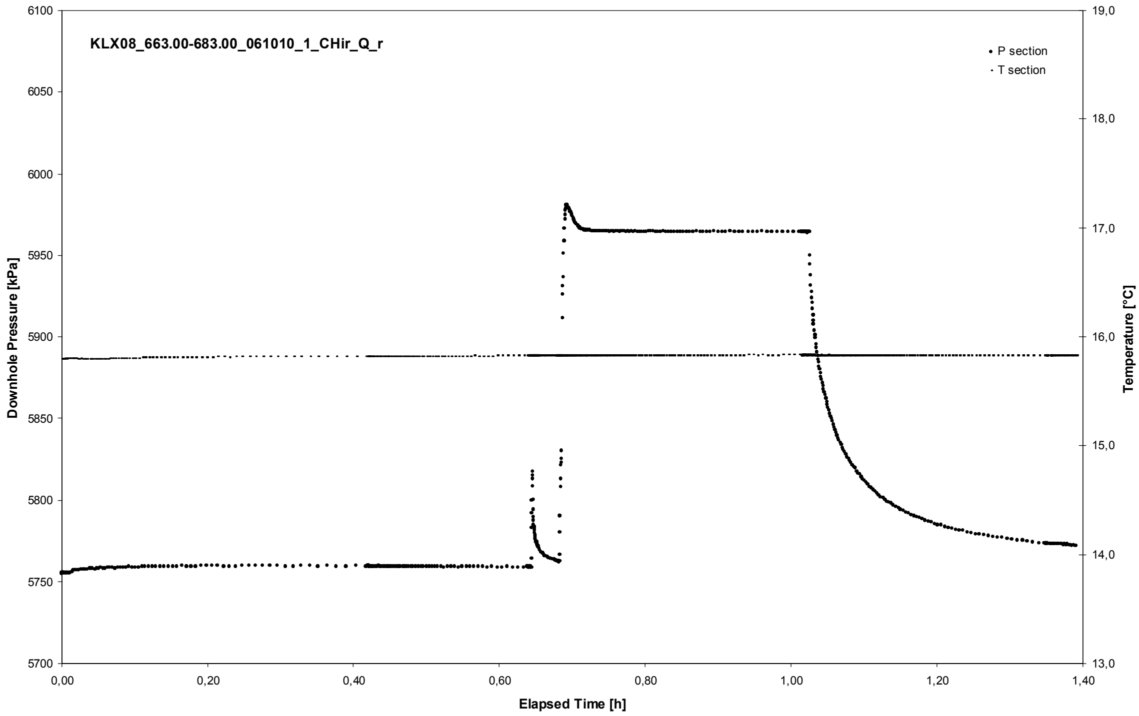
APPENDIX 2-38

Test 663.00 – 683.00 m

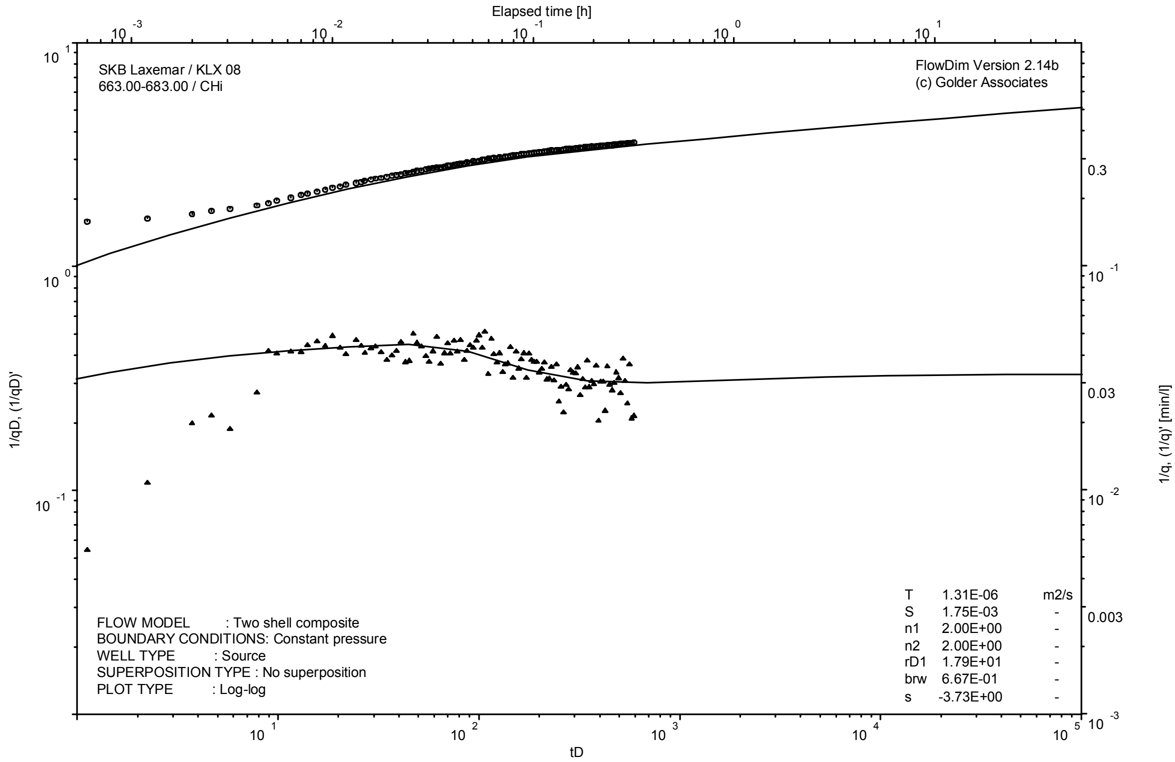
Analysis diagrams



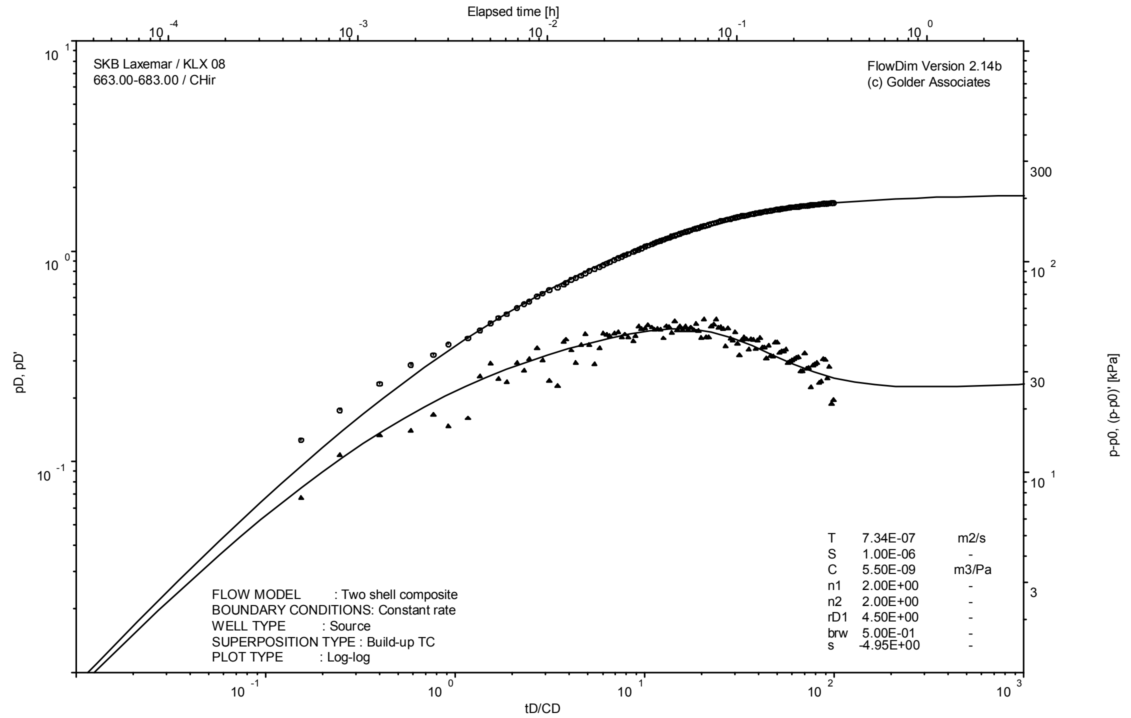
Pressure and flow rate vs. time; cartesian plot



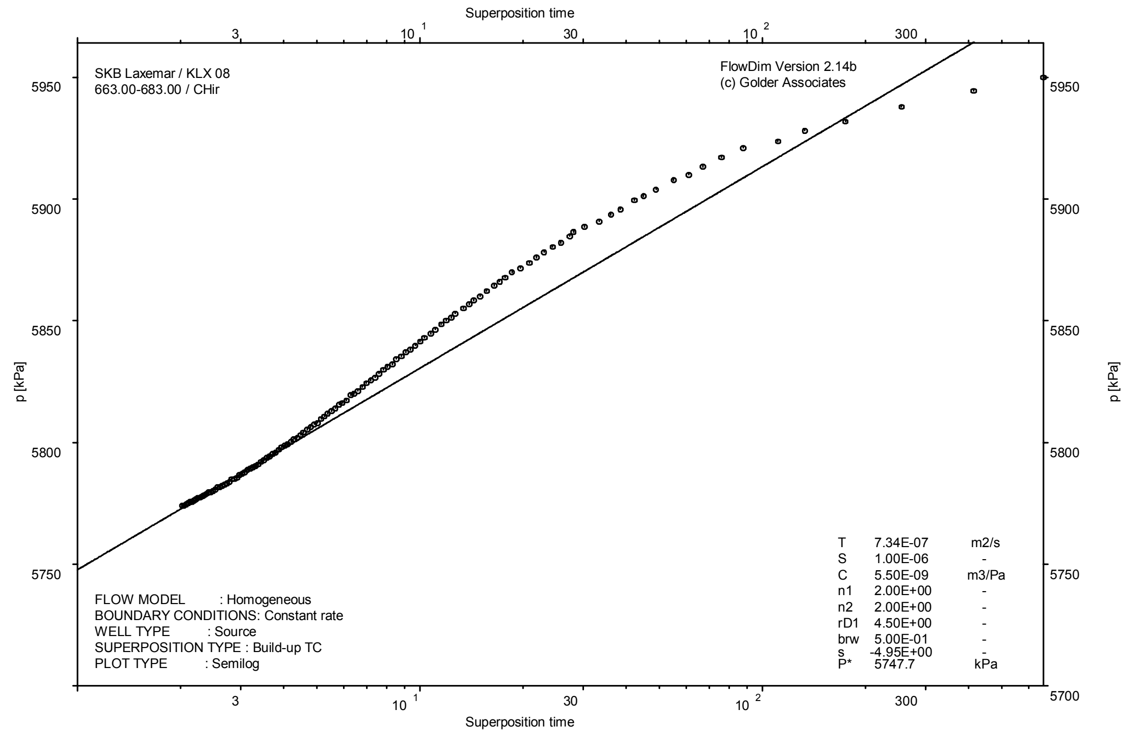
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

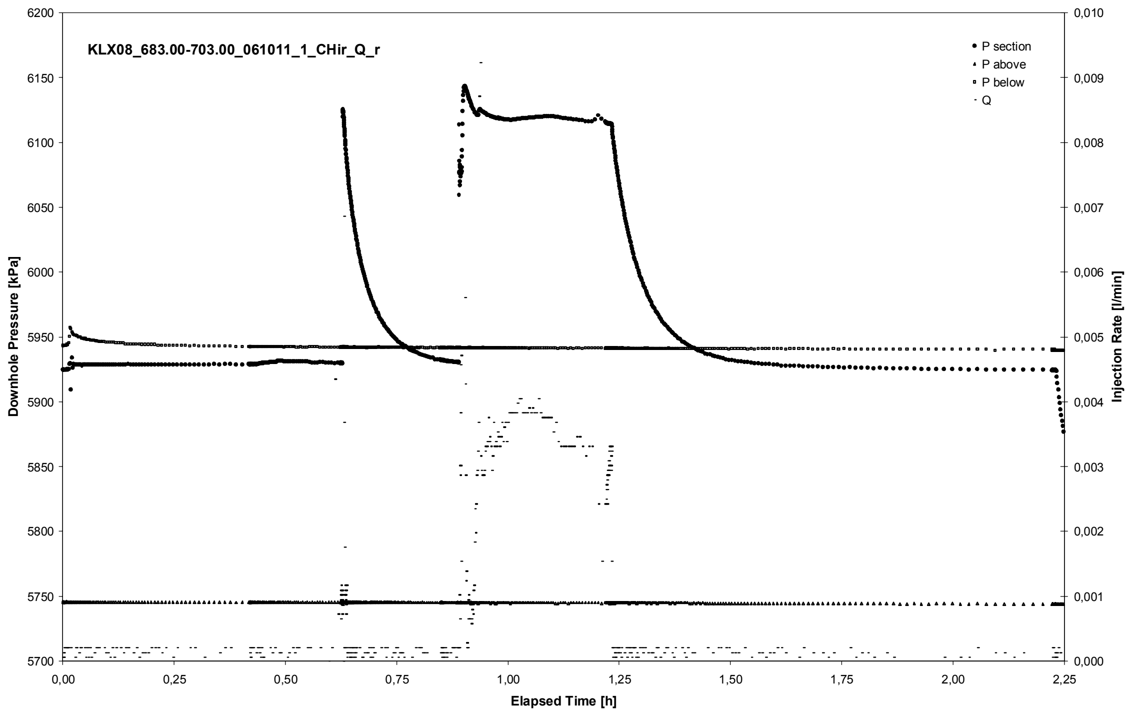


CHIR phase; HORNER match

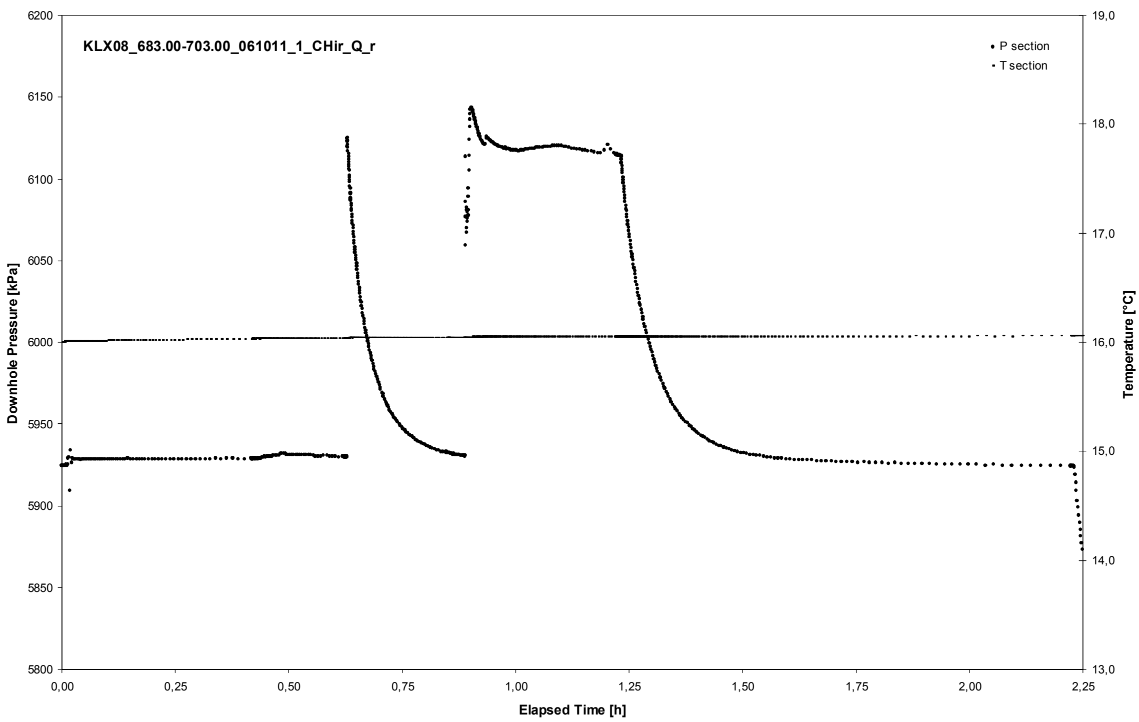
APPENDIX 2-39

Test 683.00 – 703.00 m

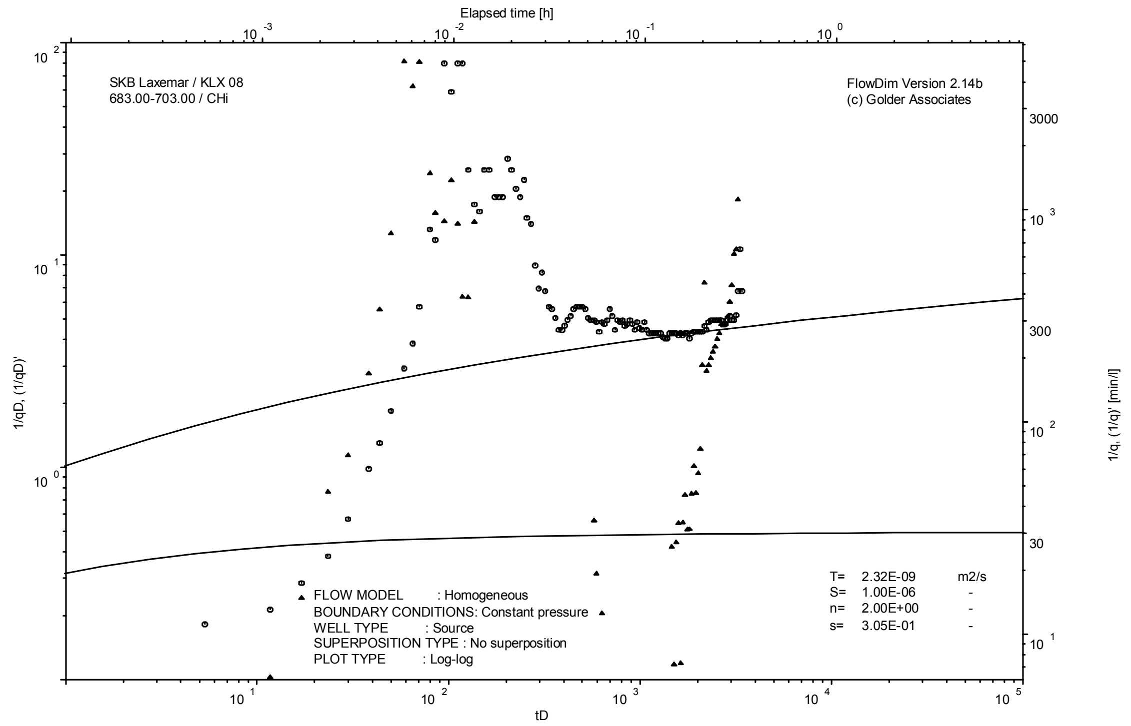
Analysis diagrams



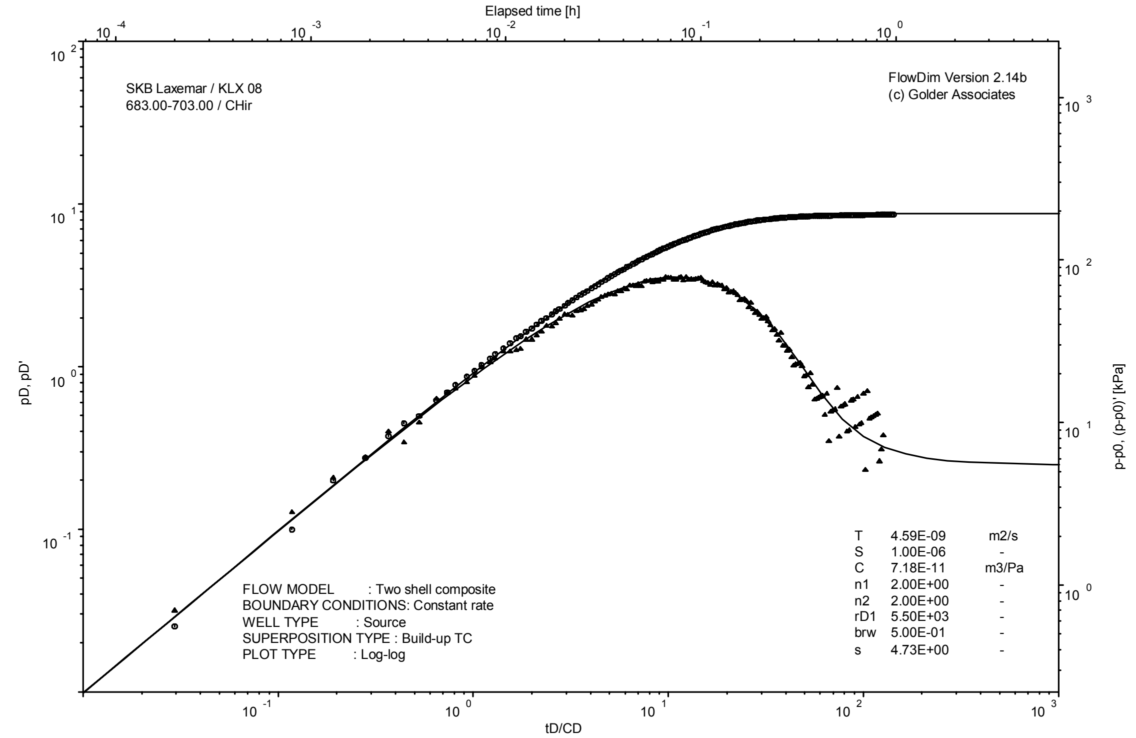
Pressure and flow rate vs. time; cartesian plot



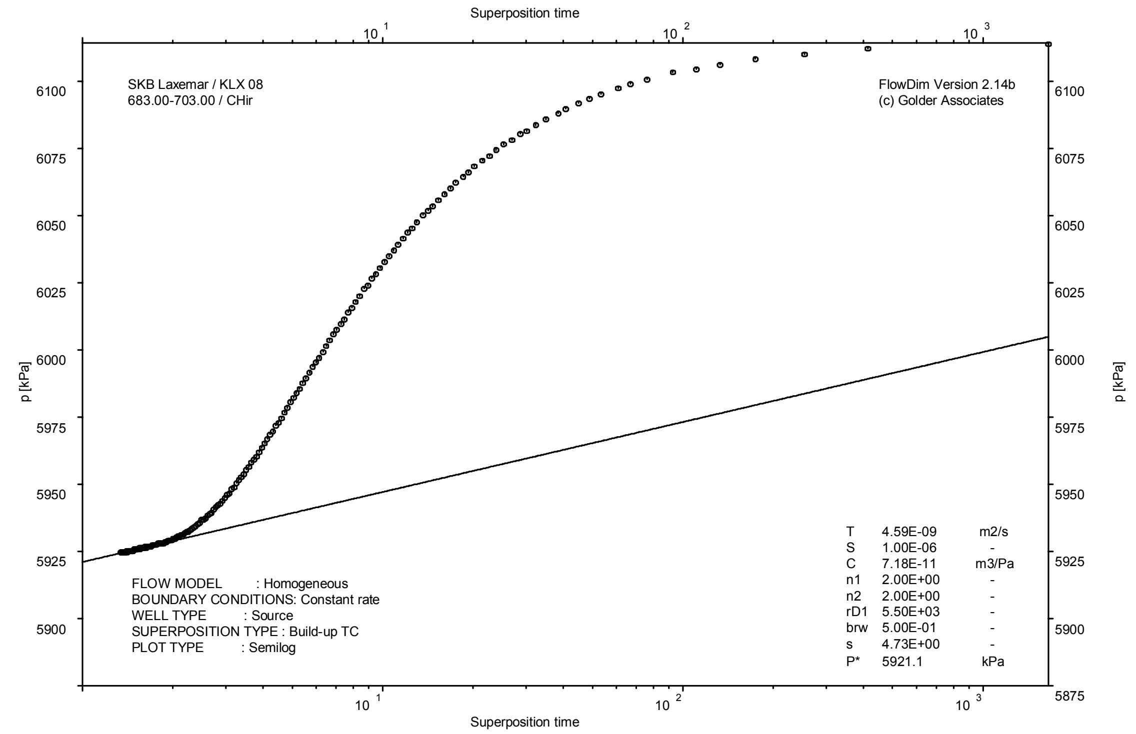
Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

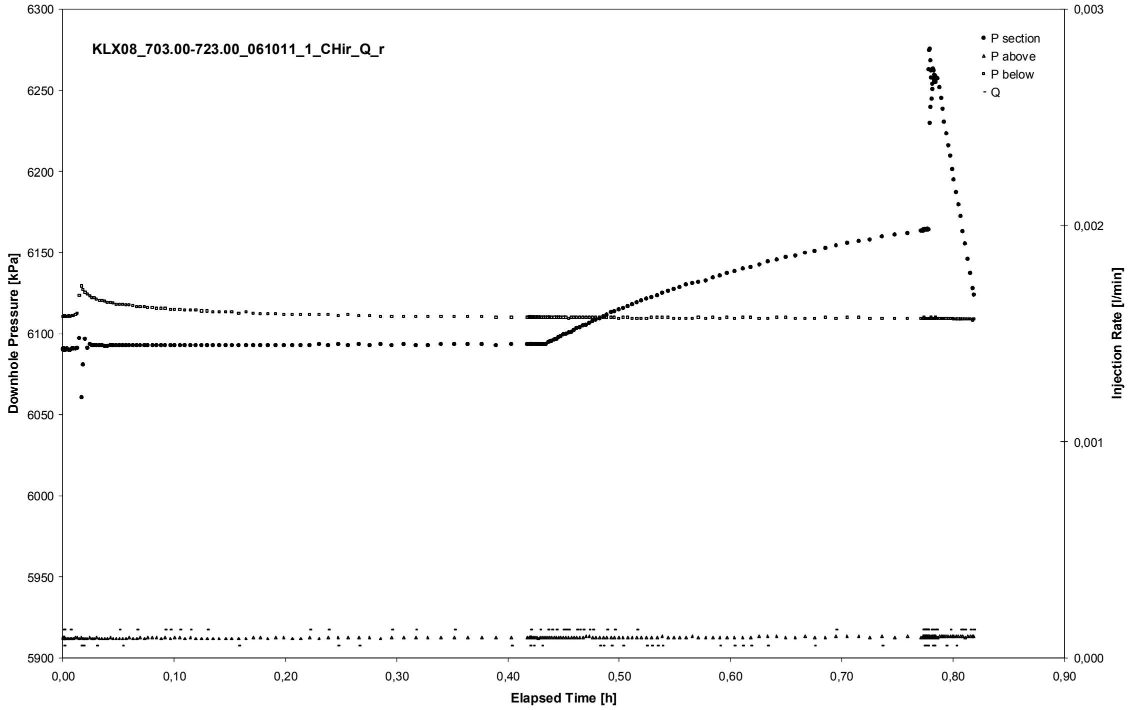


CHIR phase; HORNER match

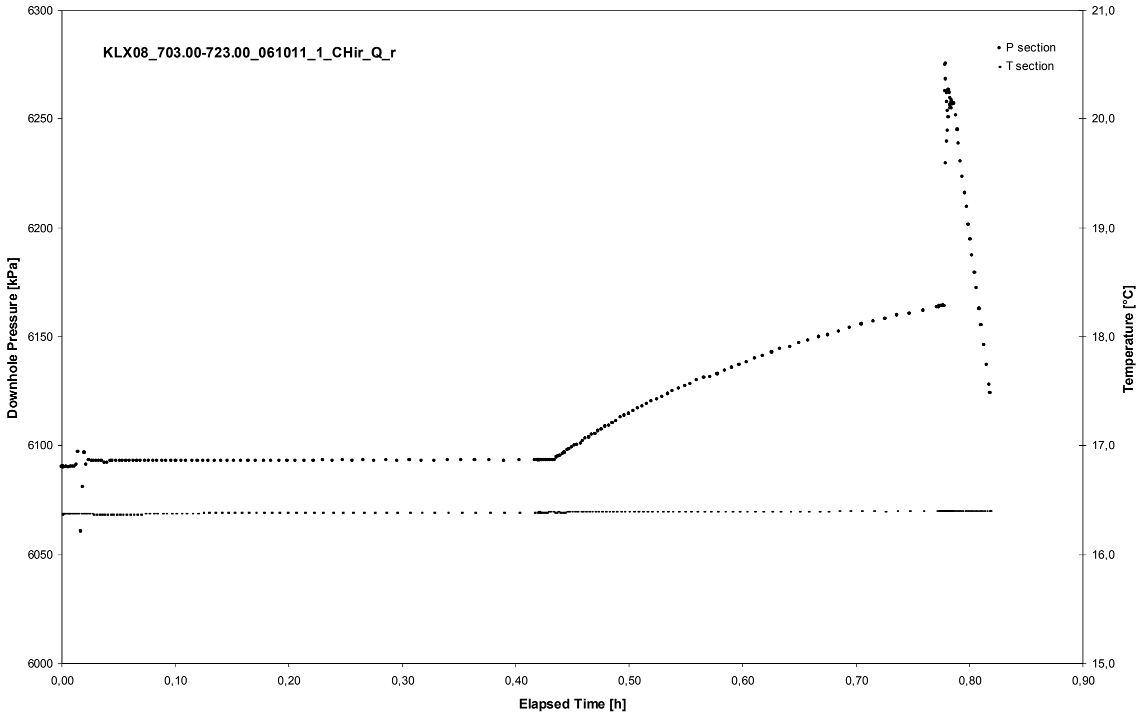
APPENDIX 2-40

Test 703.00 – 723.00 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

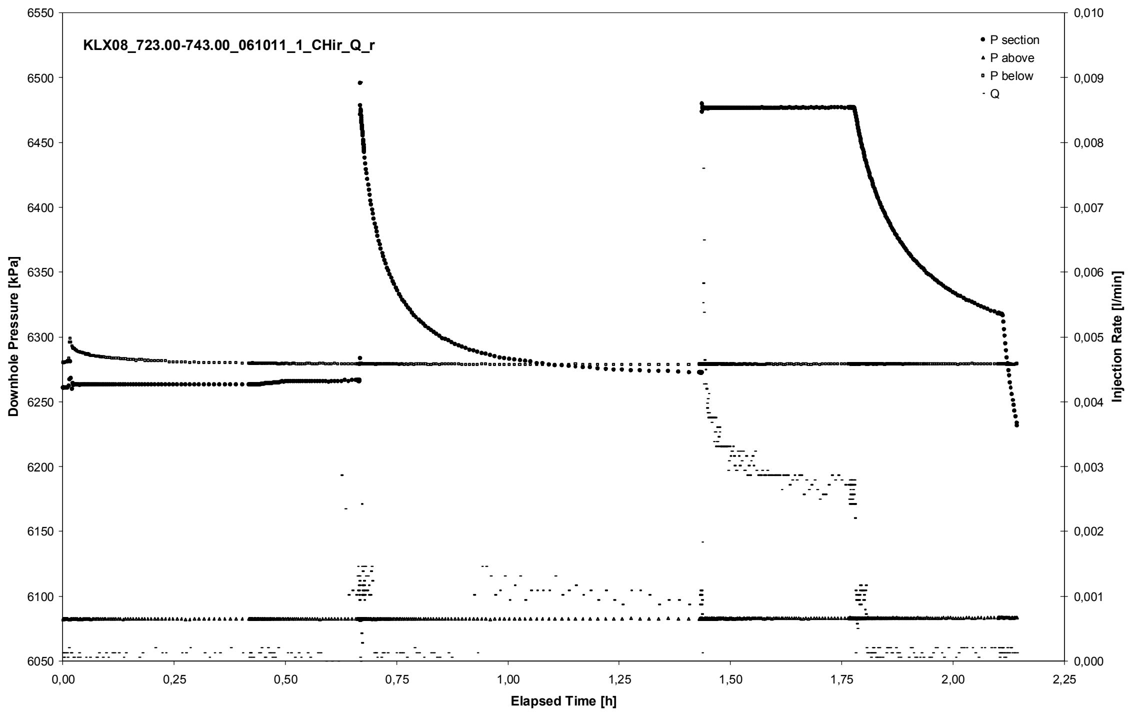
Not Analysed

CHIR phase; HORNER match

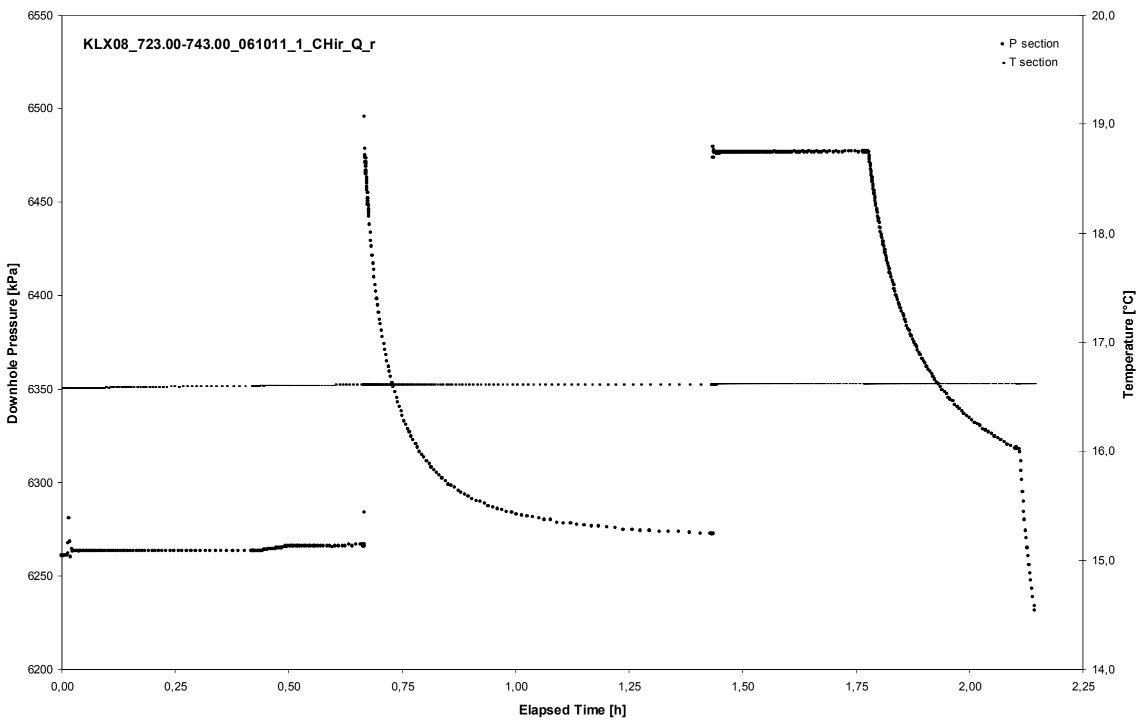
APPENDIX 2-41

Test 723.00 – 743.00 m

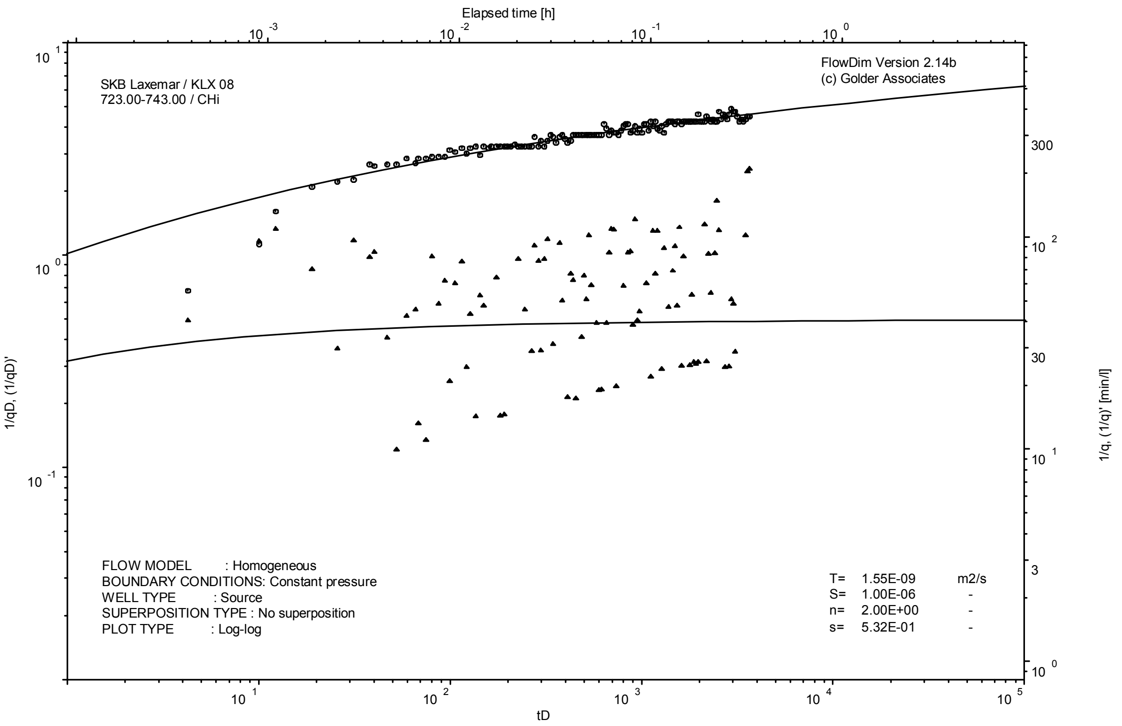
Analysis diagrams



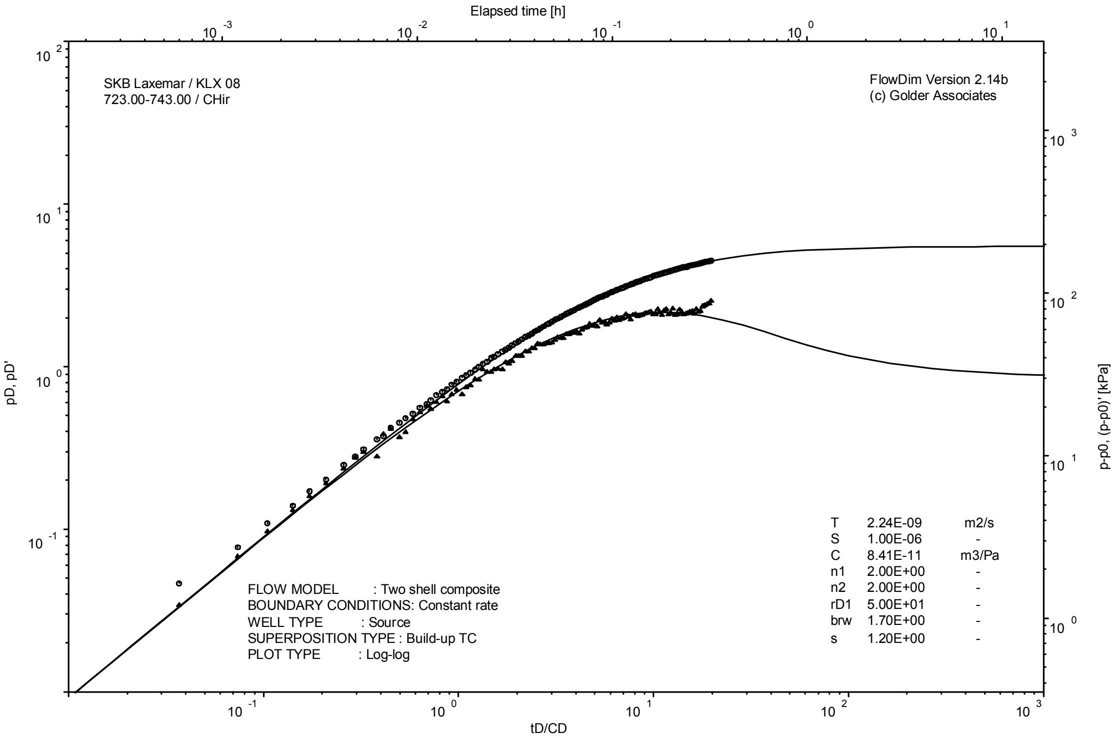
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

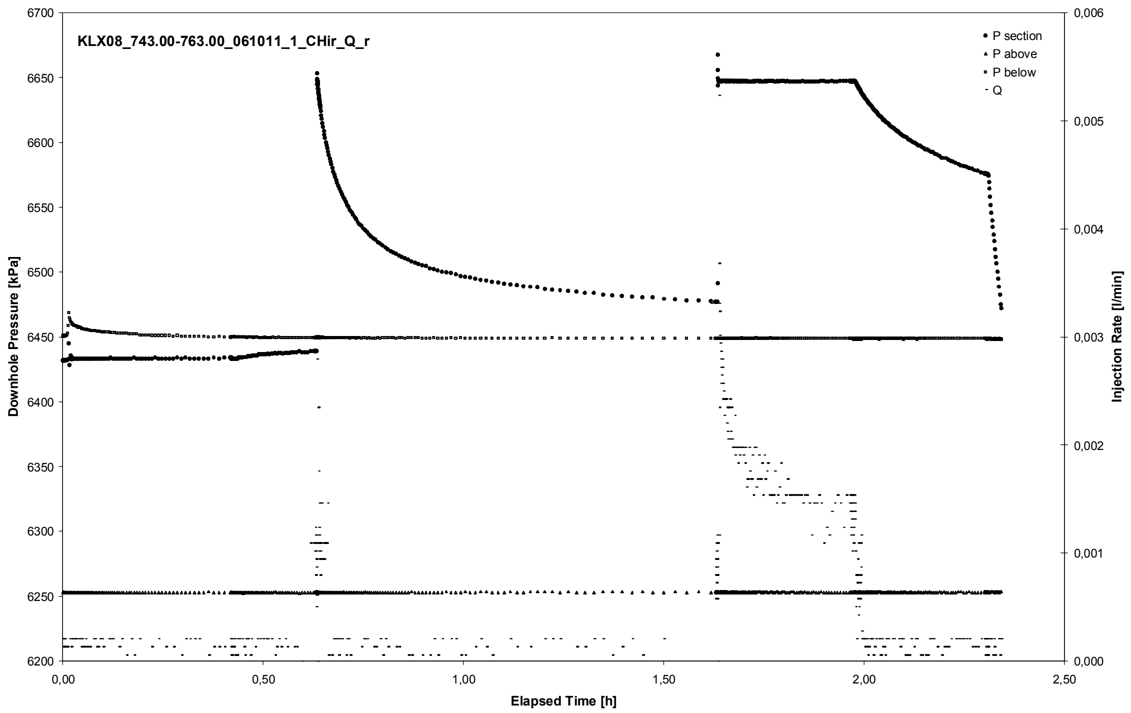
Not analysable

CHIR phase; HORNER match

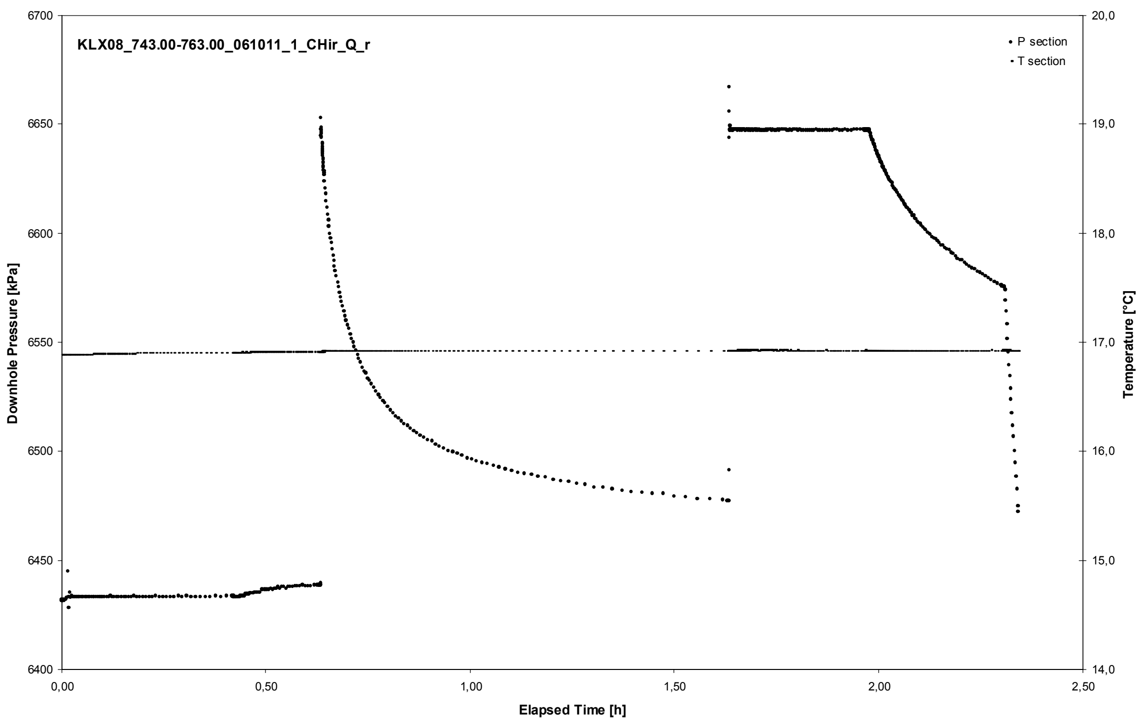
APPENDIX 2-42

Test 743.00 – 763.00 m

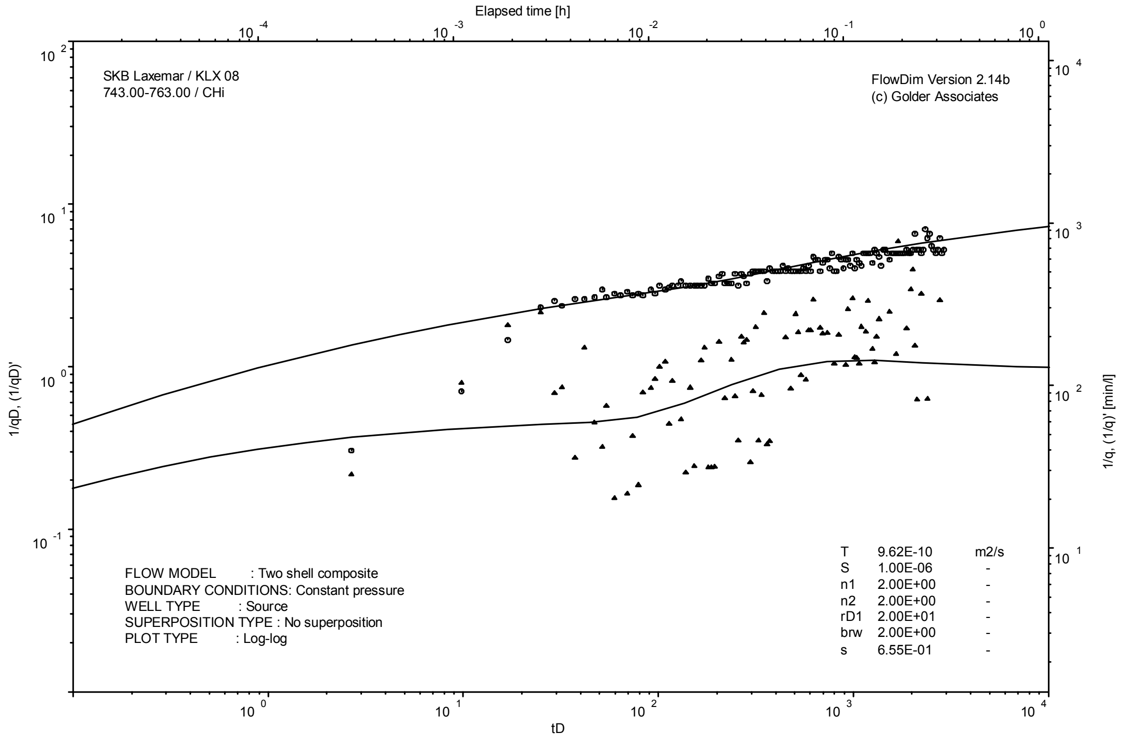
Analysis diagrams



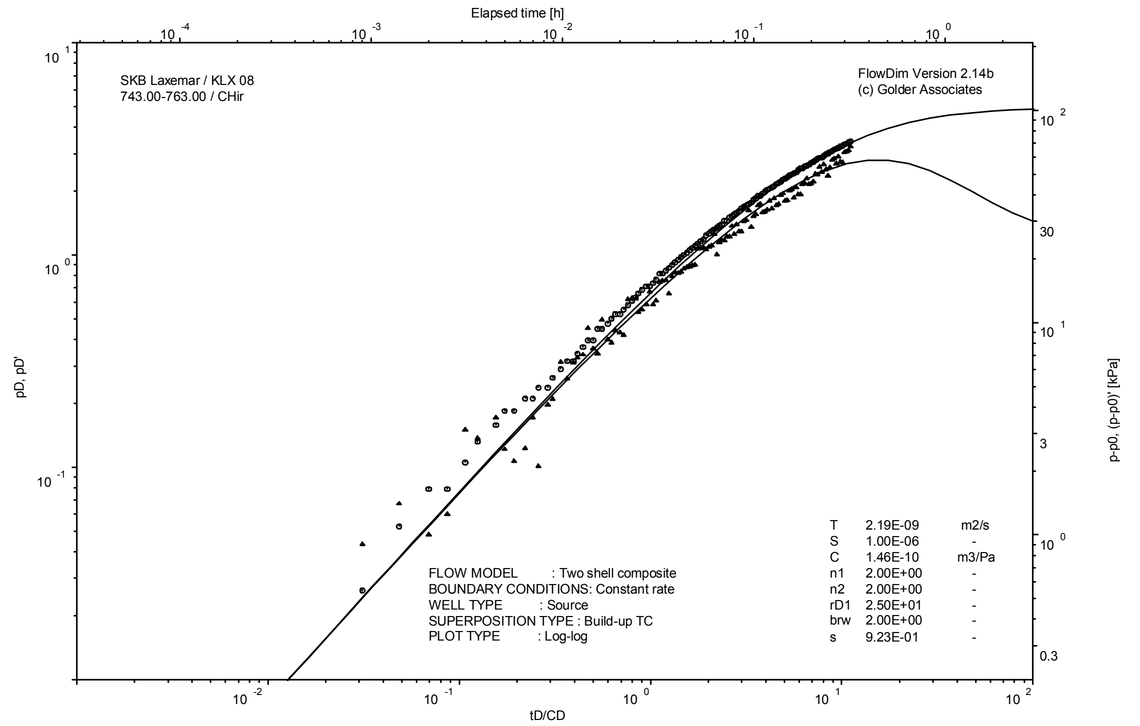
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

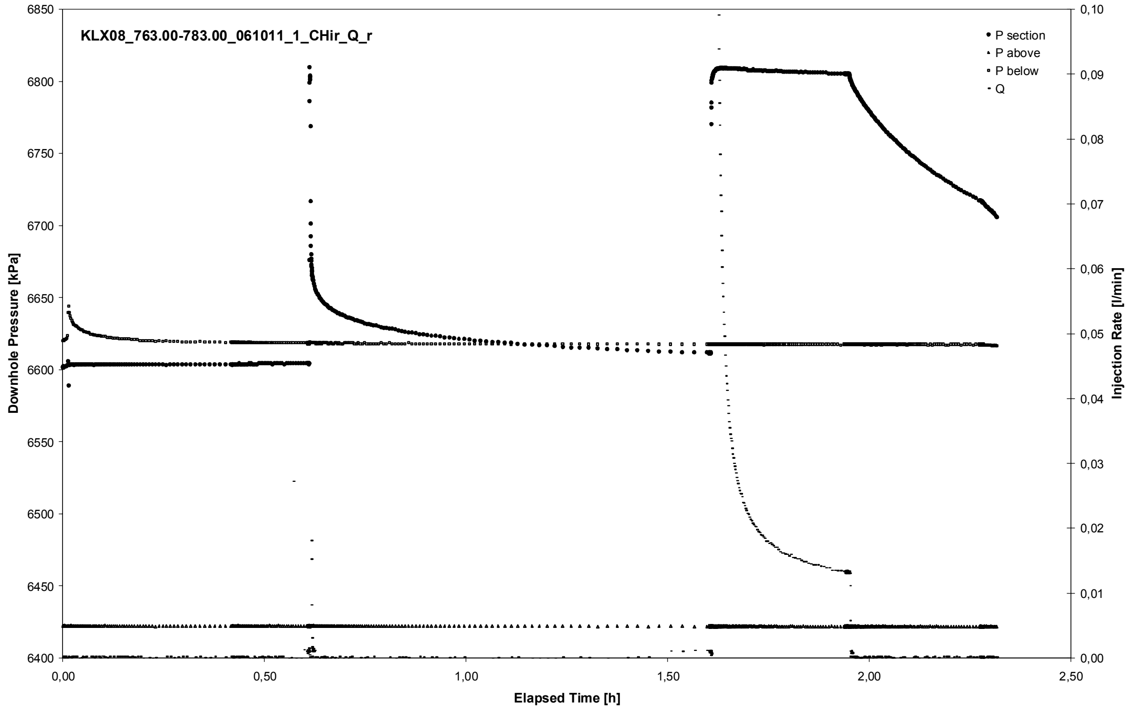
Not analysable

CHIR phase; HORNER match

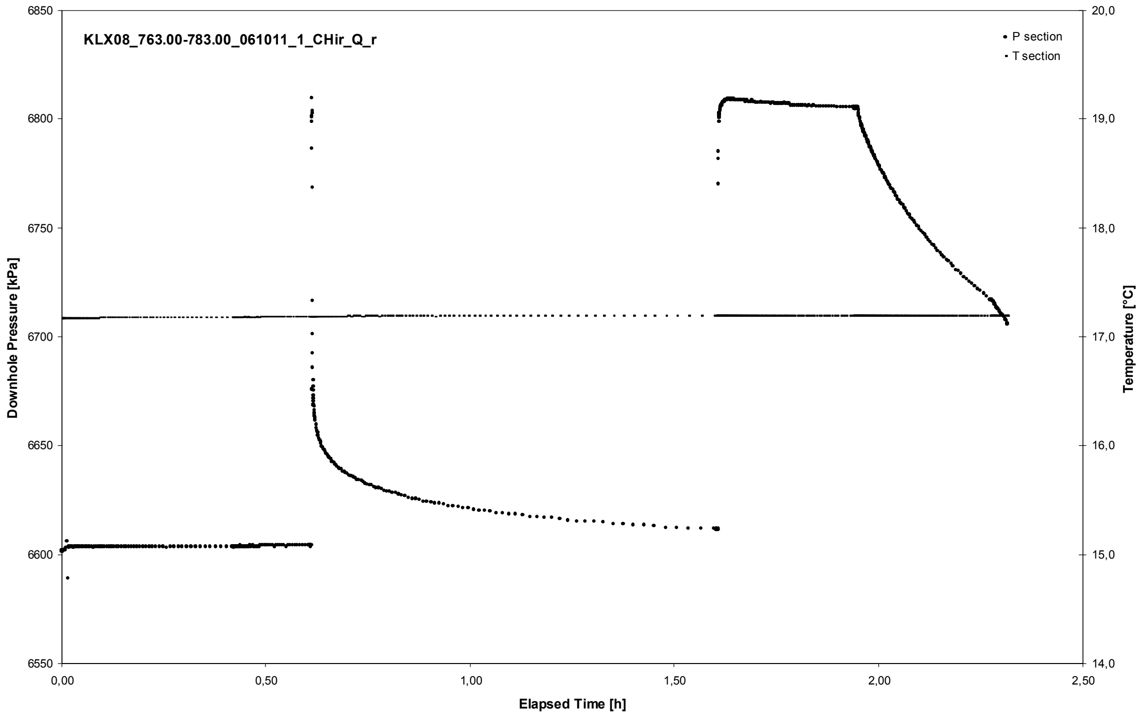
APPENDIX 2-43

Test 763.00 – 783.00 m

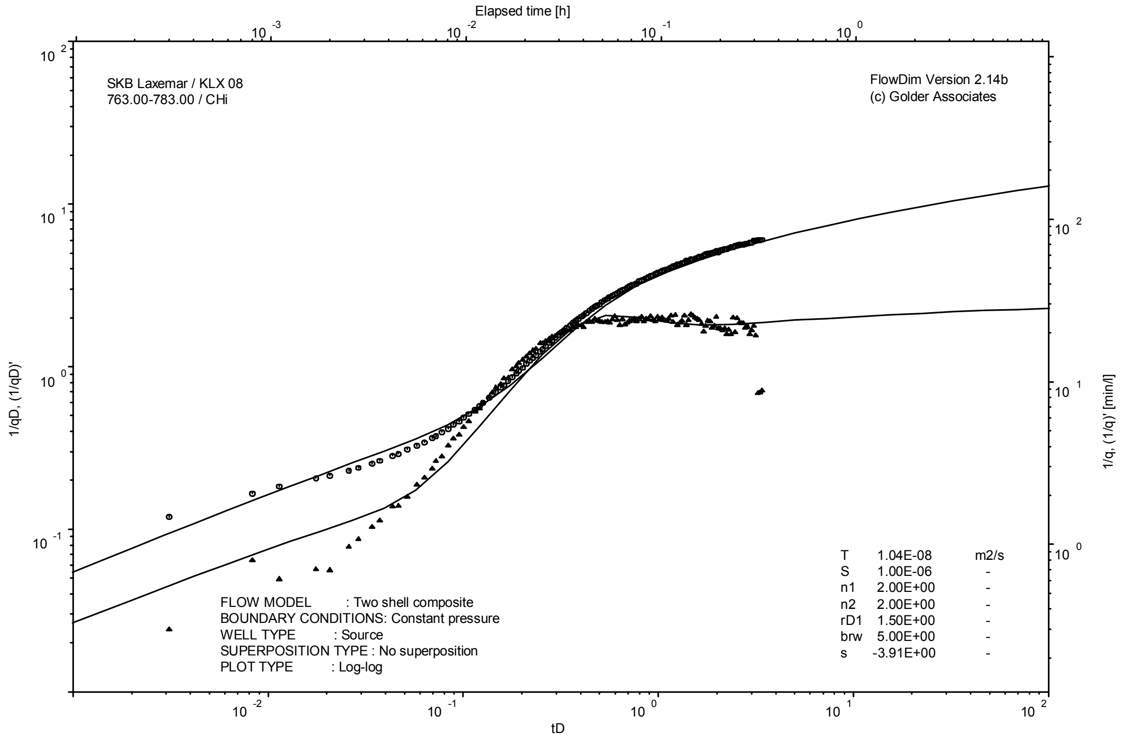
Analysis diagrams



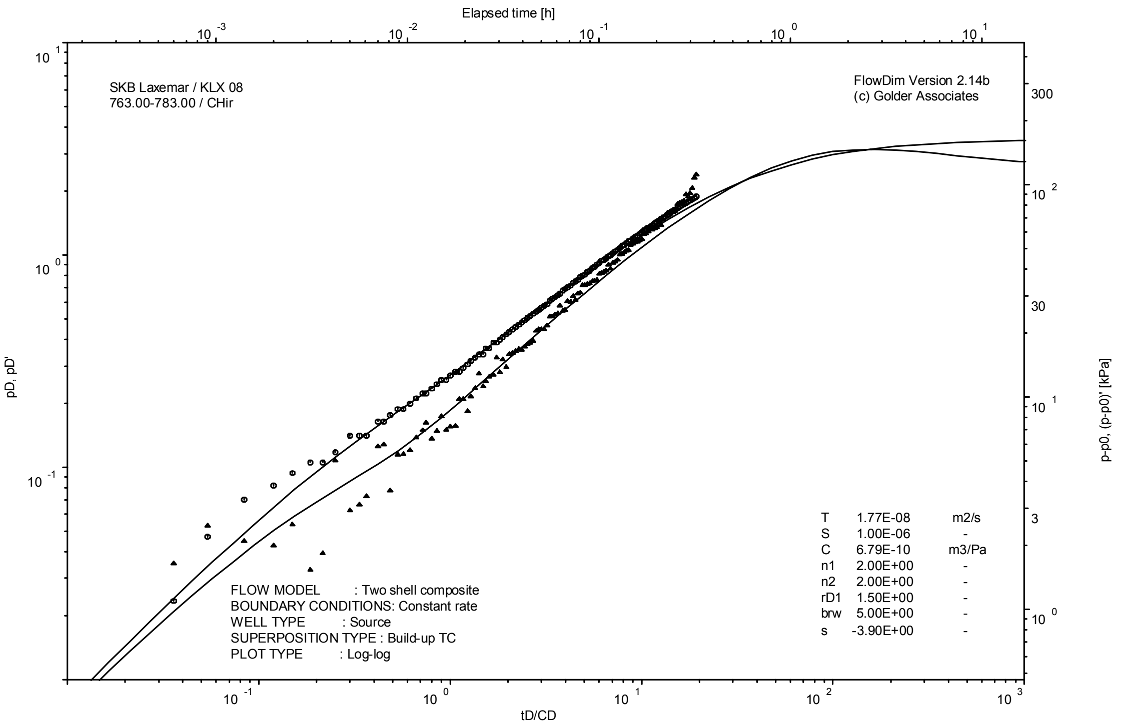
Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot



CHI phase; log-log match



CHIR phase; log-log match

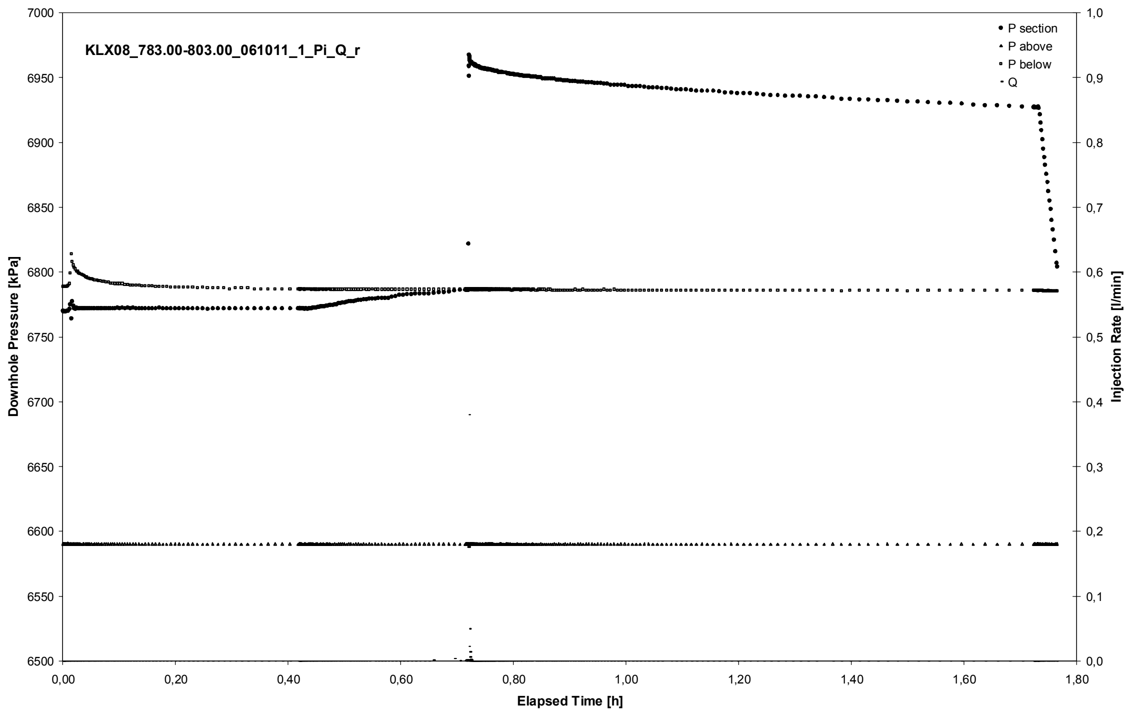
Not analysable

CHIR phase; HORNER match

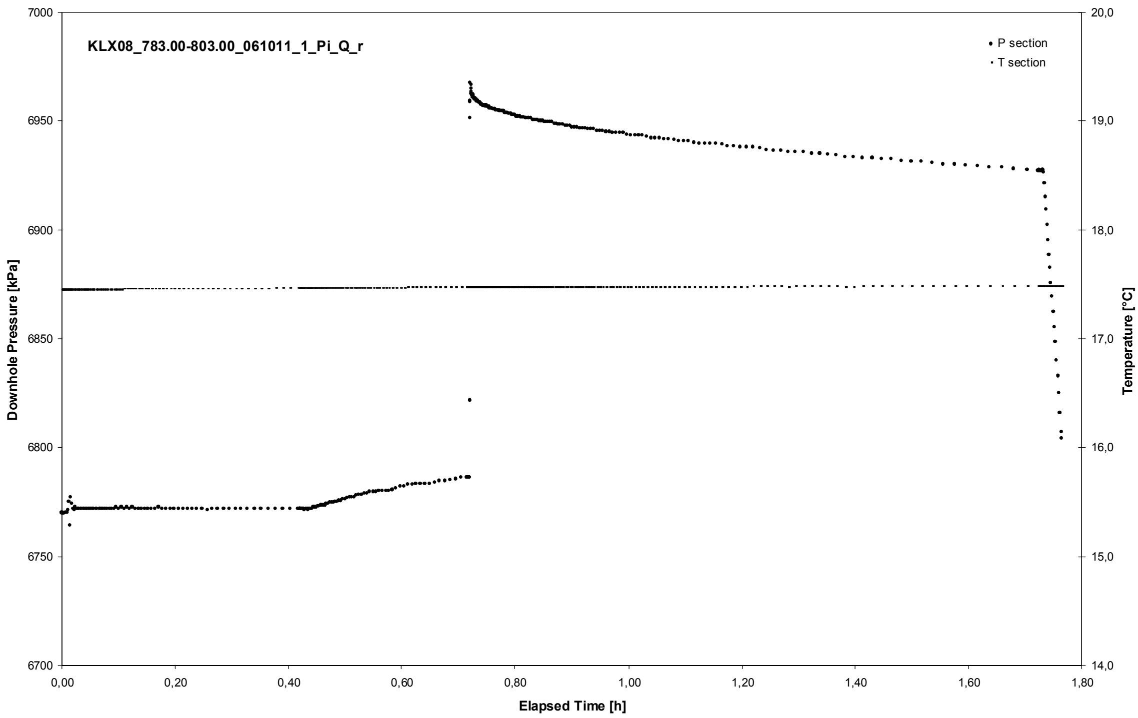
APPENDIX 2-44

Test 783.00 – 803.00 m

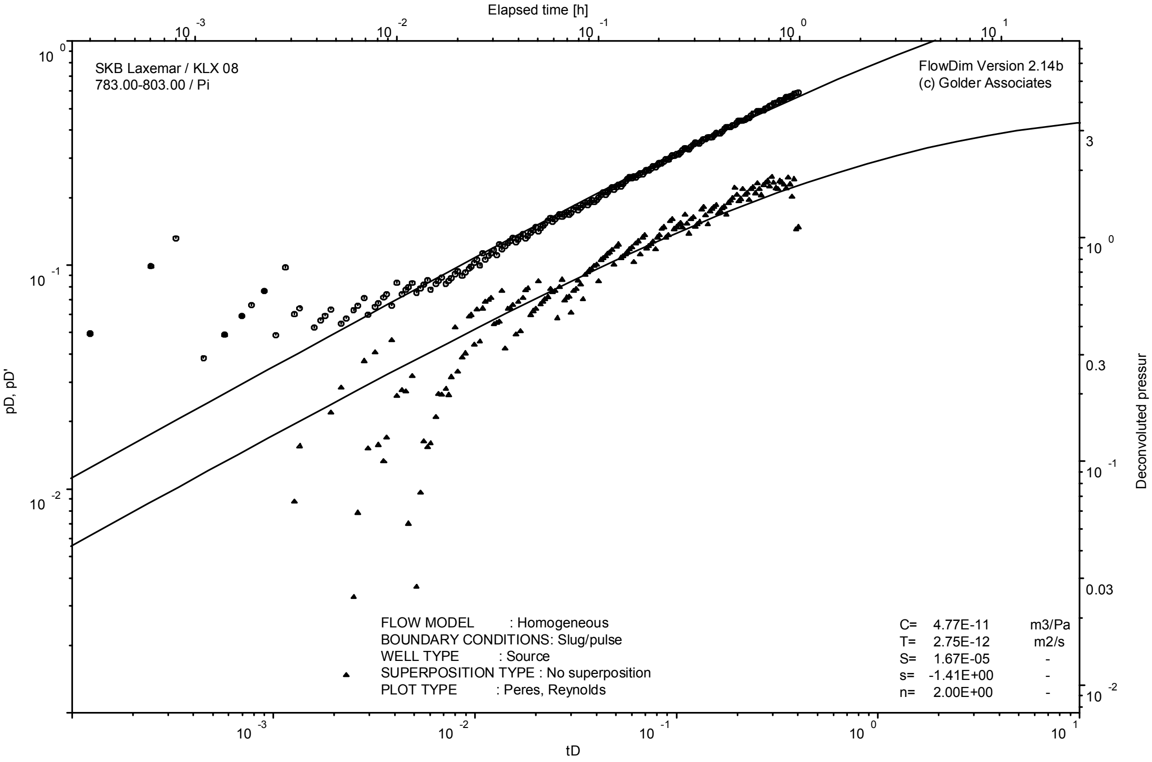
Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot

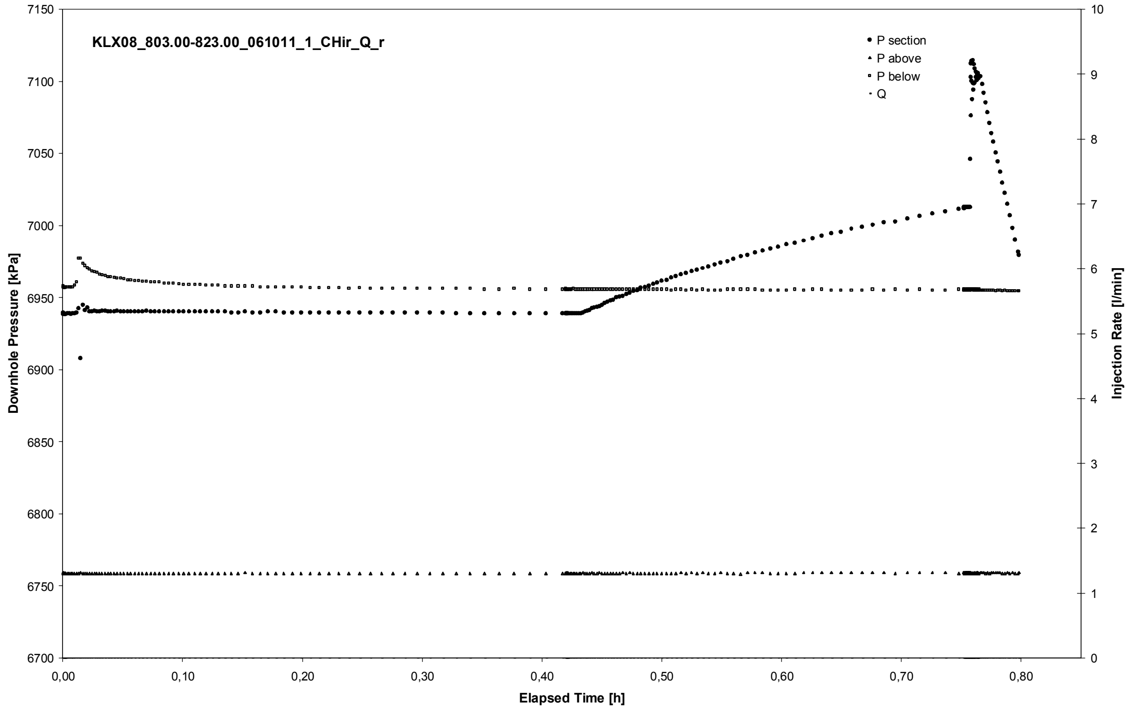


Pulse injection; deconvolution match

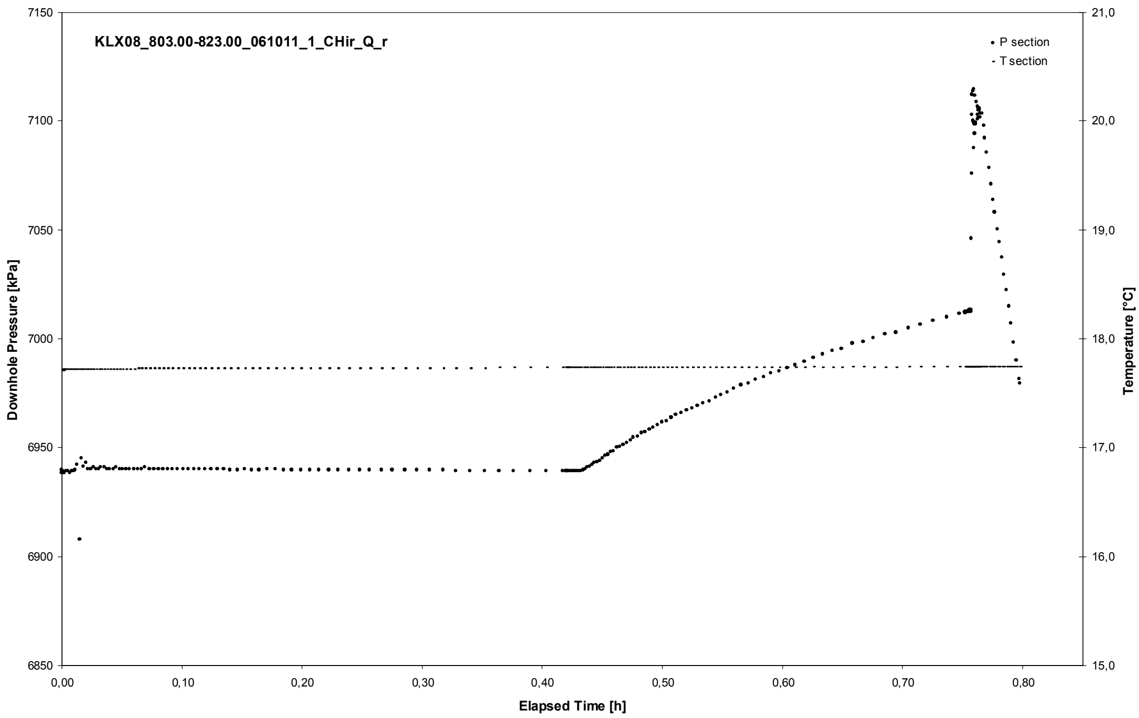
APPENDIX 2-45

Test 803.00 – 823.00 m

Analysis diagrams



Pressure and flow rate vs. time; cartesian plot



Interval pressure and temperature vs. time; cartesian plot

Not Analysed

CHI phase; log-log match

Not Analysed

CHIR phase; log-log match

Not Analysed

CHIR phase; HORNER match

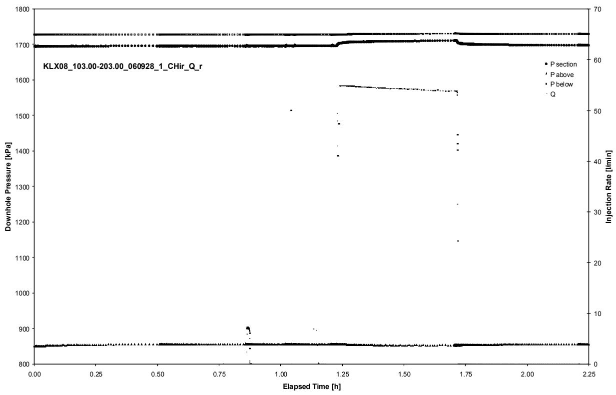
APPENDIX 3

Test Summary Sheets

Test Summary Sheet

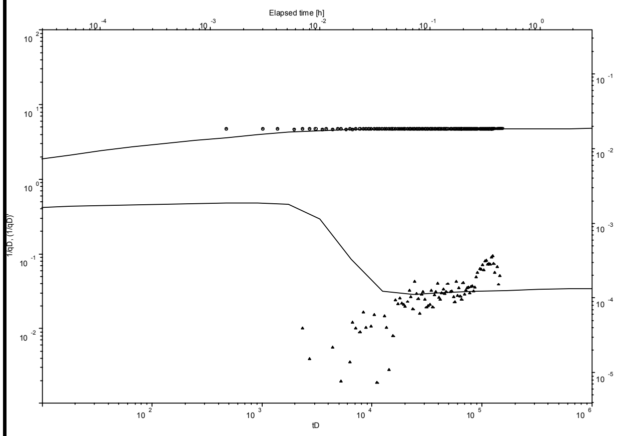
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	060928 07:55
Test section from - to (m):	103.00-203.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

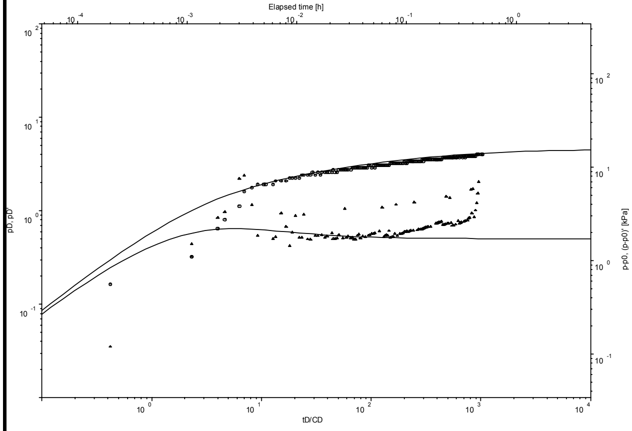


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	1695		
p_i (kPa) =	1696		
p_p(kPa) =	1707	p_F (kPa) =	1697
Q_p (m^3/s)=	8.92E-04		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	9.2		
Derivative fact.=	0.07	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	8.0E-04		
T_M (m^2/s)=	1.0E-03		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3.35	dt_1 (min) =	0.43
dt_2 (min) =	15.26	dt_2 (min) =	0.53
T (m^2/s) =	8.7E-03	T (m^2/s) =	4.2E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	8.7E-05	K_s (m/s) =	4.2E-06
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.6E-07
C_D (-) =	NA	C_D (-) =	5.1E+01
ξ (-) =	-4.2	ξ (-) =	-6.0
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	0.43	C (m^3/Pa) =	4.6E-07
dt_2 (min) =	0.53	C_D (-) =	5.1E+01
T_T (m^2/s) =	4.2E-04	ξ (-) =	-6.0
S (-) =	1.0E-06		
K_s (m/s) =	4.2E-06		
S_s (1/m) =	1.0E-08		

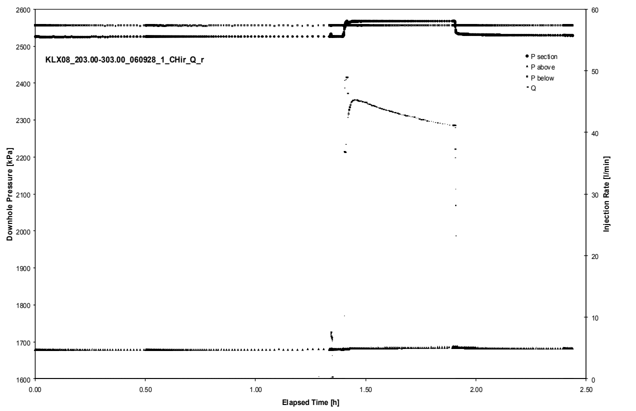
Comments:

The recommended transmissivity of 4.2E-4 m2/s was derived from the analysis of the CHir phase, which shows the better derivative. The confidence range for the interval transmissivity is estimated to be 1E-4 m2/s to 8E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,696.5 kPa.

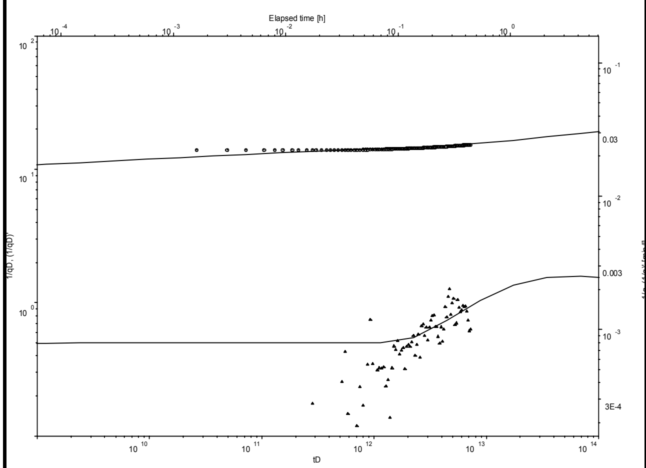
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	060928 11:37
Test section from - to (m):	203.00-303.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

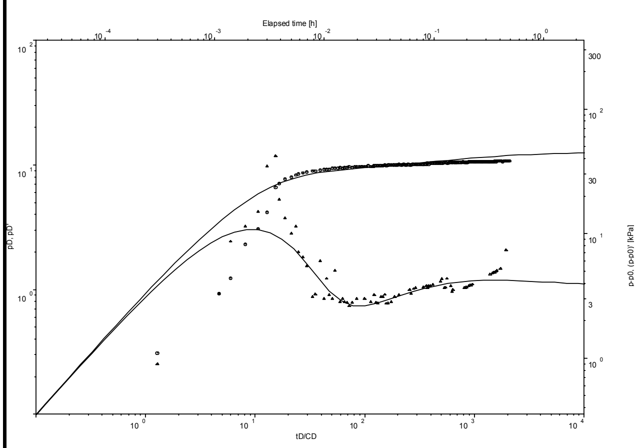
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	2526		
p_i (kPa) =	2526		
p_p(kPa) =	2568	p_F (kPa) =	2529
Q_p (m^3/s)=	6.86E-04		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10.6		
Derivative fact.=	0.02	Derivative fact.=	0.03
Results		**Results**	
Q/s (m^2/s)=	1.6E-04		
T_M (m^2/s)=	2.1E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	0.83
dt_2 (min) =	NA	dt_2 (min) =	2.32
T (m^2/s) =	3.9E-04	T (m^2/s) =	3.2E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	3.9E-06	K_s (m/s) =	3.2E-06
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.7E-07
C_D (-) =	NA	C_D (-) =	1.9E+01
ξ (-) =	4.9	ξ (-) =	0.8
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.83	C (m^3/Pa) =	1.7E-07
dt_2 (min) =	2.32	C_D (-) =	1.9E+01
T_T (m^2/s) =	3.2E-04	ξ (-) =	0.8
S (-) =	1.0E-06		
K_s (m/s) =	3.2E-06		
S_s (1/m) =	1.0E-08		

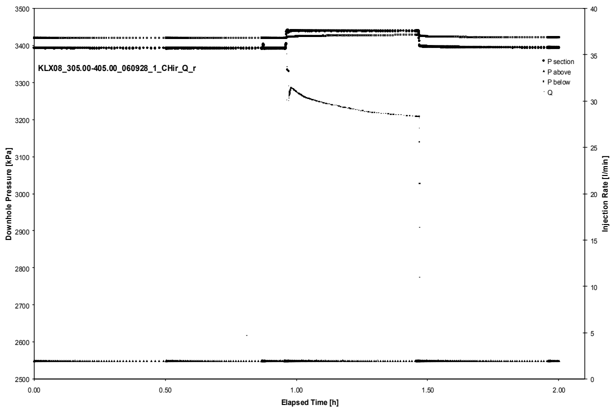
Comments:

The recommended transmissivity of 3.2E-4 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 9E-5 m2/s to 7E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,528.2 kPa.

Test Summary Sheet

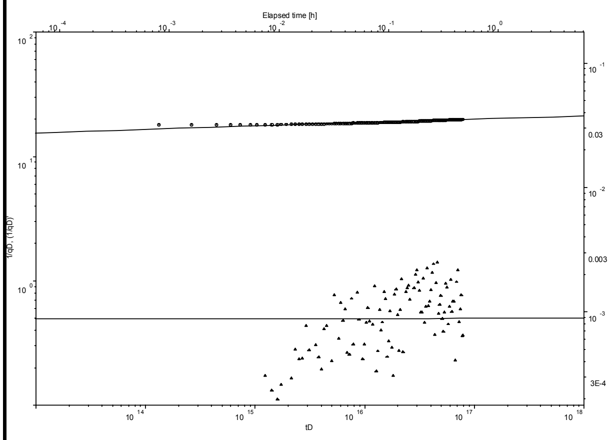
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	060928 15:27
Test section from - to (m):	305.00-405.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3393		
p_i (kPa) =	3393		
p_p(kPa) =	3439	p_F (kPa) =	3394
Q_p (m^3/s)=	4.70E-04		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11.3		
Derivative fact.=	0.00	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	1.0E-04		
T_M (m^2/s)=	1.3E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.06	dt_1 (min) =	0.76
dt_2 (min) =	26.17	dt_2 (min) =	4.64
T (m^2/s) =	3.2E-04	T (m^2/s) =	1.7E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	3.2E-06	K_s (m/s) =	1.7E-06
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.0E-08
C_D (-) =	NA	C_D (-) =	4.4E+00
ξ (-) =	9.6	ξ (-) =	1.6
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

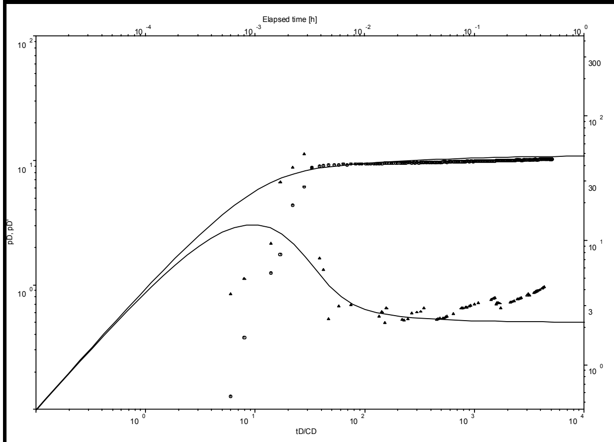
Log-Log plot incl. derivates- flow period



Selected representative parameters.

dt_1 (min) =	0.76	C (m^3/Pa) =	4.0E-08
dt_2 (min) =	4.64	C_D (-) =	4.4E+00
T_T (m^2/s) =	1.7E-04	ξ (-) =	1.6
S (-) =	1.0E-06		
K_s (m/s) =	1.7E-06		
S_s (1/m) =	1.0E-08		

Log-Log plot incl. derivatives- recovery period



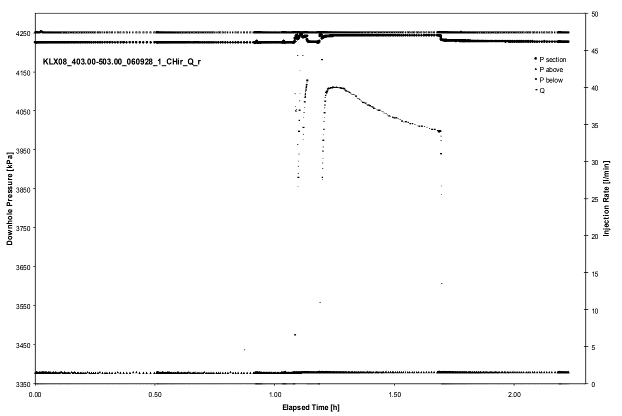
Comments:

The recommended transmissivity of 1.7E-4 m2/s was derived from the analysis of the CHir phase, which shows the better derivative stabilization. The confidence range for the interval transmissivity is estimated to be 7E-5 m2/s to 4E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,394.0 kPa.

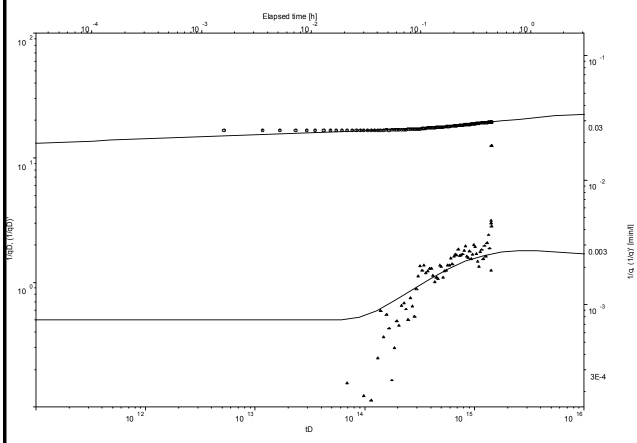
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	0
Borehole ID:	KLX08	Test start:	060928 19:13
Test section from - to (m):	403.00-503.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

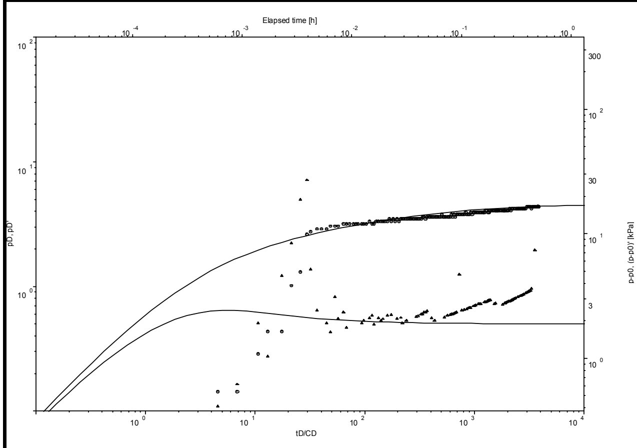
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4225		
p_i (kPa) =	4226		
p_p(kPa) =	4251	p_F (kPa) =	4227
Q_p (m^3/s)=	5.69E-04		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13.5		
Derivative fact.=	0.05	Derivative fact.=	0.05
Results		**Results**	
Q/s (m^2/s)=	2.2E-04		
T_M (m^2/s)=	2.9E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	#NV	dt_1 (min) =	0.35
dt_2 (min) =	#NV	dt_2 (min) =	4.34
T (m^2/s) =	2.3E-04	T (m^2/s) =	2.5E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.3E-06	K_s (m/s) =	2.5E-06
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	7.7E-08
C_D (-) =	NA	C_D (-) =	8.5E+00
ξ (-) =	7.2	ξ (-) =	-5.1
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.35	C (m^3/Pa) =	7.7E-08
dt_2 (min) =	4.34	C_D (-) =	8.5E+00
T_T (m^2/s) =	2.5E-04	ξ (-) =	-5.1
S (-) =	1.0E-06		
K_s (m/s) =	2.5E-06		
S_s (1/m) =	1.0E-08		

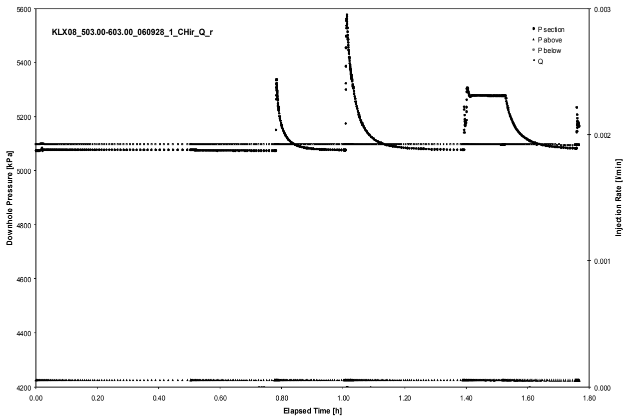
Comments:

The recommended transmissivity of 2.5E-4 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 9E-5 m2/s to 5E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,226.5 kPa.

Test Summary Sheet

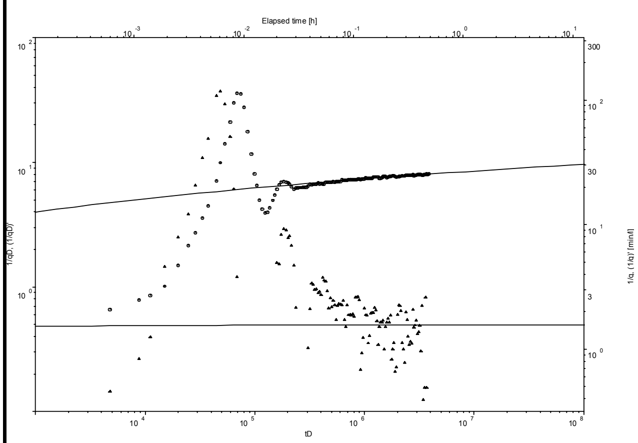
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061006 09:32
Test section from - to (m):	503.00-603.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

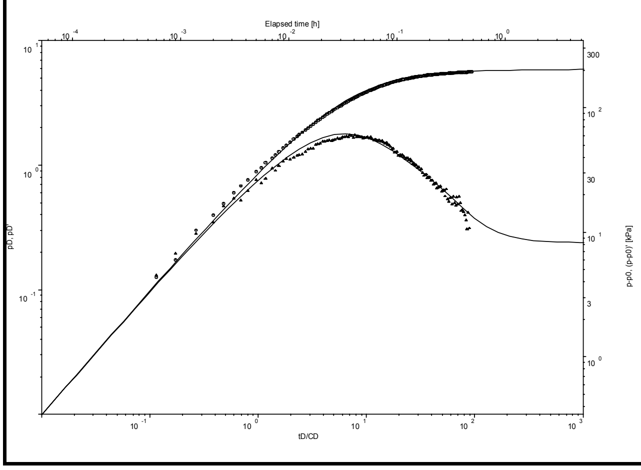


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5074		
p_i (kPa) =	5077		
p_p(kPa) =	5278	p_F (kPa) =	5082
Q_p (m^3/s)=	6.53E-07		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14.8		
Derivative fact.=	0.17	Derivative fact.=	0.07
Results		**Results**	
Q/s (m^2/s)=	3.2E-08		
T_M (m^2/s)=	4.2E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4.15	dt_1 (min) =	1.49
dt_2 (min) =	24.11	dt_2 (min) =	3.23
T (m^2/s) =	4.1E-08	T (m^2/s) =	3.3E-08
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	4.1E-10	K_s (m/s) =	3.3E-10
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.0E-10
C_D (-) =	NA	C_D (-) =	4.4E-02
ξ (-) =	2.2	ξ (-) =	0.4
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	4.15	C (m^3/Pa) =	4.0E-10
dt_2 (min) =	24.11	C_D (-) =	4.4E-02
T_T (m^2/s) =	4.1E-08	ξ (-) =	2.2
S (-) =	1.0E-06		
K_s (m/s) =	4.1E-10		
S_s (1/m) =	1.0E-08		

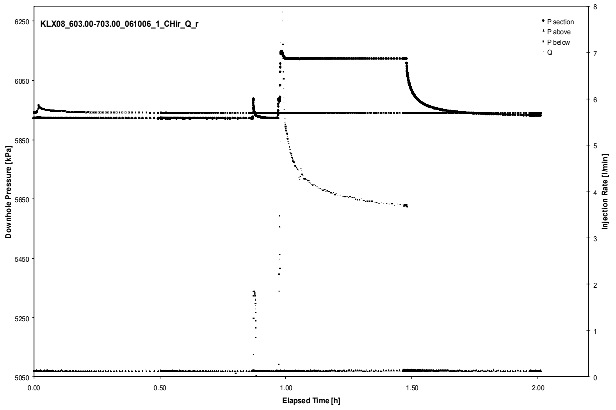
Comments:

The recommended transmissivity of 4.1E-8 m2/s was derived from the analysis of the CHi phase, which shows a horizontal stabilization. The confidence range for the interval transmissivity is estimated to be 2E-8 m2/s to 7E-8 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,070.9 kPa.

Test Summary Sheet

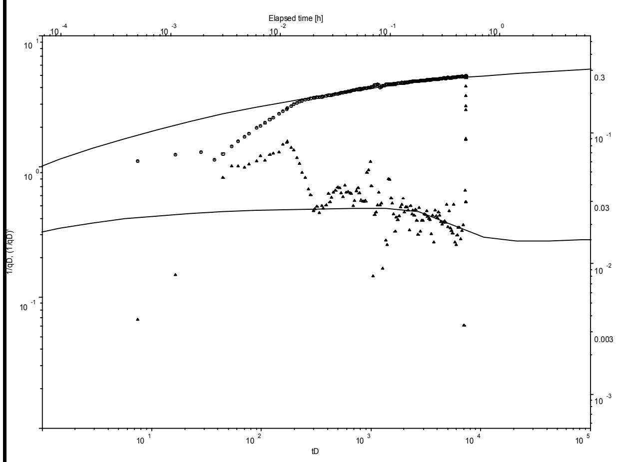
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061006 14:05
Test section from - to (m):	603.00-703.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

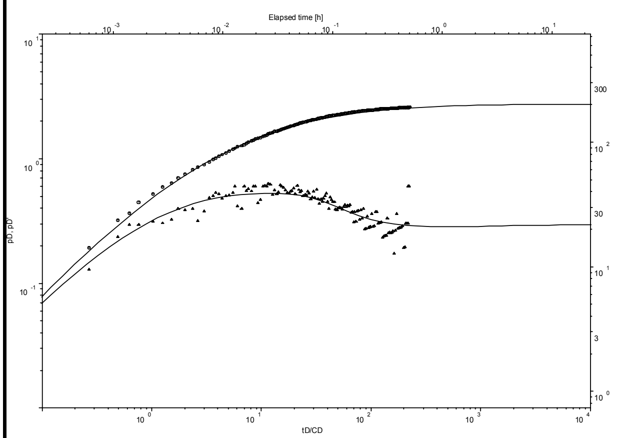


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5923		
p_i (kPa) =	5923		
p_p(kPa) =	6123	p_F (kPa) =	5938
Q_p (m^3/s)=	6.08E-05		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	16.1		
Derivative fact.=	0.06	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	3.0E-06		
T_M (m^2/s)=	3.9E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.84	dt_1 (min) =	0.62
dt_2 (min) =	14.49	dt_2 (min) =	2.84
T (m^2/s) =	2.4E-06	T (m^2/s) =	1.5E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.4E-08	K_s (m/s) =	1.5E-08
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	7.6E-09
C_D (-) =	NA	C_D (-) =	8.4E-01
ξ (-) =	-3.0	ξ (-) =	-4.5
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0.62	C (m^3/Pa) =	7.6E-09
dt_2 (min) =	2.84	C_D (-) =	8.4E-01
T_T (m^2/s) =	1.5E-06	ξ (-) =	-4.5
S (-) =	1.0E-06		
K_s (m/s) =	1.5E-08		
S_s (1/m) =	1.0E-08		

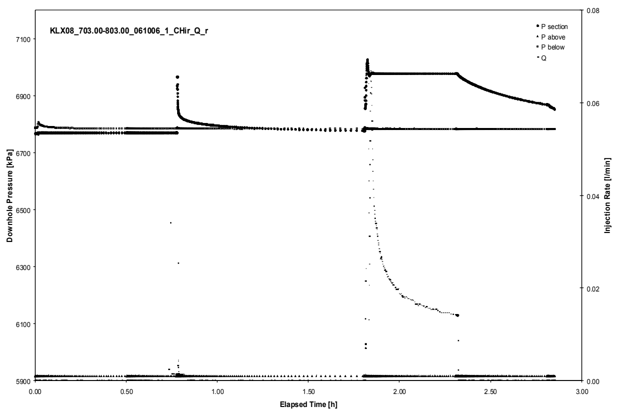
Comments:

The recommended transmissivity of 1.5E-6 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 8E-7 m2/s to 4E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,914.3 kPa.

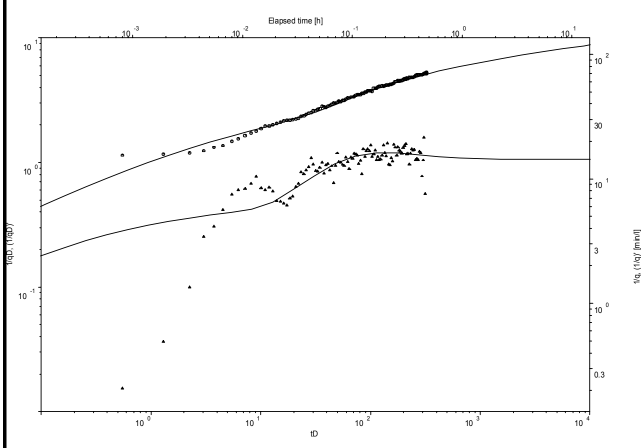
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061006 17:48
Test section from - to (m):	703.00-803.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

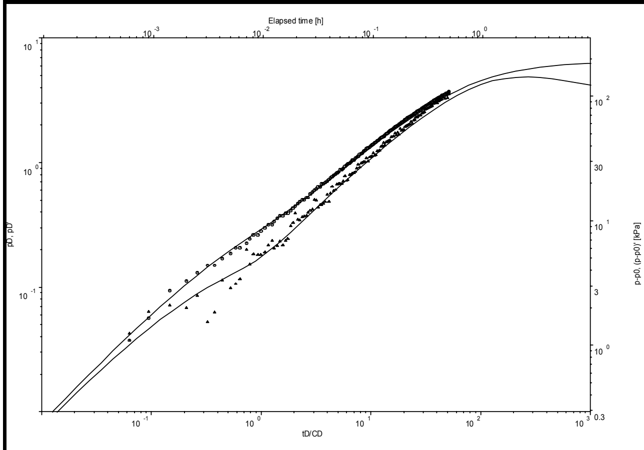
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	6766		
p_i (kPa) =	6775		
p_p(kPa) =	6970	p_F (kPa) =	6864
Q_p (m^3/s)=	2.33E-07		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17.5		
Derivative fact.=	0.09	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	1.2E-08		
T_M (m^2/s)=	1.5E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4.53	dt_1 (min) =	#NV
dt_2 (min) =	25.22	dt_2 (min) =	#NV
T (m^2/s) =	4.5E-09	T (m^2/s) =	2.5E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	4.5E-11	K_s (m/s) =	2.5E-11
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3.9E-10
C_D (-) =	NA	C_D (-) =	4.3E-02
ξ (-) =	-1.8	ξ (-) =	-3.6
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	4.53	C (m^3/Pa) =	3.9E-10
dt_2 (min) =	25.22	C_D (-) =	4.3E-02
T_T (m^2/s) =	4.5E-09	ξ (-) =	-1.8
S (-) =	1.0E-06		
K_s (m/s) =	4.5E-11		
S_s (1/m) =	1.0E-08		

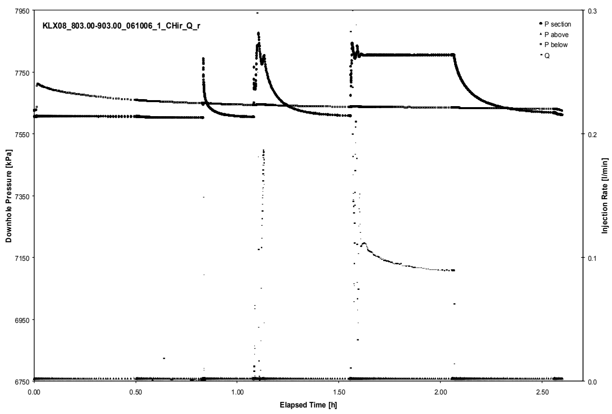
Comments:

The recommended transmissivity of 4.5E-9 m2/s was derived from the analysis of the CHi phase (outer zone), which shows a clear horizontal stabilization. The confidence range for the interval transmissivity is estimated to be 1E-9 m2/s to 6E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

Test Summary Sheet

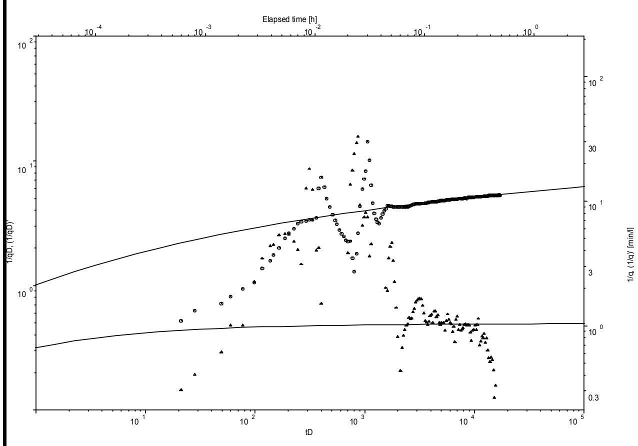
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061006 22:17
Test section from - to (m):	803.00-903.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

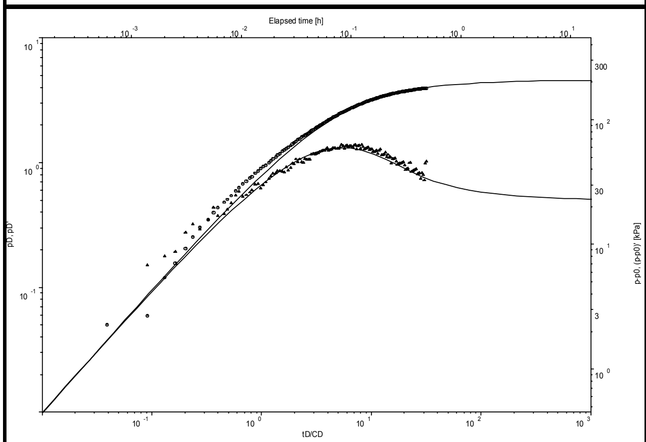


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	7605		
p_i (kPa) =	7607		
p_p(kPa) =	7804	p_F (kPa) =	7616
Q_p (m^3/s)=	1.48E-06		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	18.9		
Derivative fact.=	0.1	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	7.4E-08		
T_M (m^2/s)=	9.6E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	6.02	dt_1 (min) =	#NV
dt_2 (min) =	17.19	dt_2 (min) =	#NV
T (m^2/s) =	6.3E-08	T (m^2/s) =	6.0E-08
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	6.3E-10	K_s (m/s) =	6.0E-10
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	2.1E-09
C_D (-) =	NA	C_D (-) =	2.3E-01
ξ (-) =	-0.8	ξ (-) =	-1.6
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	#NV	C (m^3/Pa) =	2.1E-09
dt_2 (min) =	#NV	C_D (-) =	2.3E-01
T_T (m^2/s) =	6.0E-08	ξ (-) =	-1.6
S (-) =	1.0E-06		
K_s (m/s) =	6.0E-10		
S_s (1/m) =	1.0E-08		

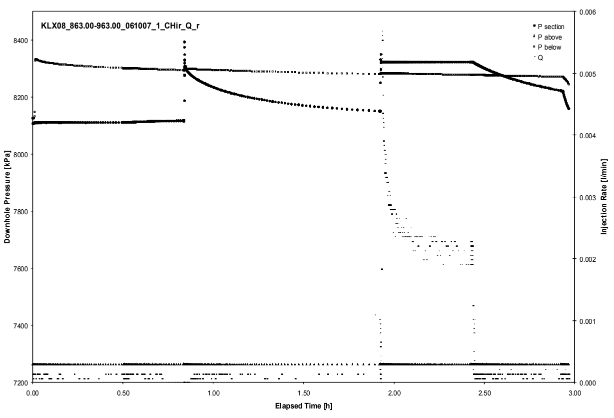
Comments:

The recommended transmissivity of 6.0E-8 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 2.0E-8 m2/s to 9E-8 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 7,591.3 kPa.

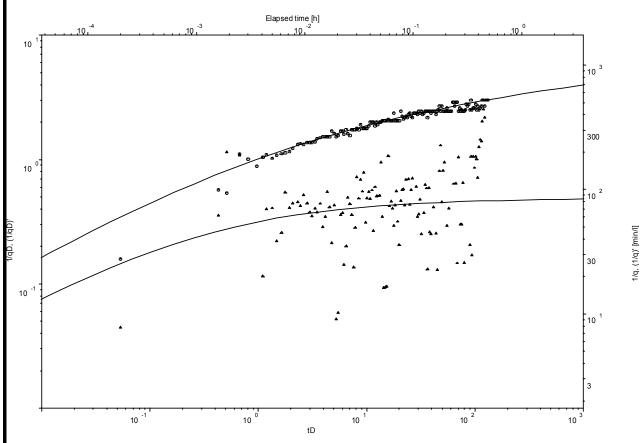
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061007 06:04
Test section from - to (m):	863.00-963.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

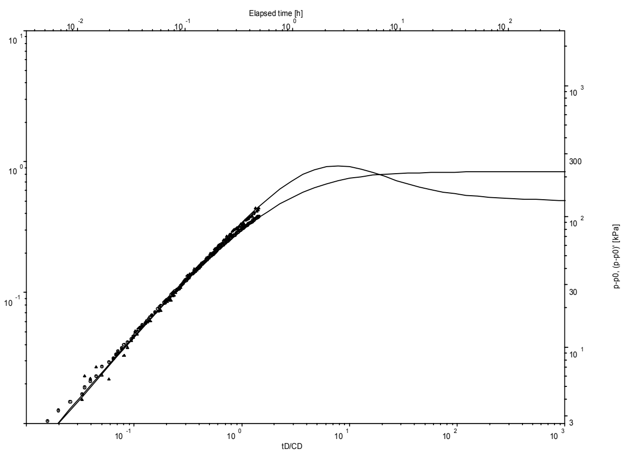
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	8110		
p_i (kPa) =	8116		
p_p(kPa) =	8322	p_F (kPa) =	8221
Q_p (m^3/s)=	3.17E-08		
tp (s) =	1800	t_F (s) =	1800
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	19.7		
Derivative fact.=	0.11	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	1.5E-09		
T_M (m^2/s)=	2.0E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.78	dt_1 (min) =	#NV
dt_2 (min) =	13.12	dt_2 (min) =	#NV
T (m^2/s) =	7.3E-10	T (m^2/s) =	2.5E-10
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	7.3E-12	K_s (m/s) =	2.5E-12
S_s (1/m) =	1.0E-08	S_s (1/m) =	1.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.9E-10
C_D (-) =	NA	C_D (-) =	2.1E-02
ξ (-) =	-1.0	ξ (-) =	-3.3
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.78	C (m^3/Pa) =	1.9E-10
dt_2 (min) =	13.12	C_D (-) =	2.1E-02
T_T (m^2/s) =	7.3E-10	ξ (-) =	-1.0
S (-) =	1.0E-06		
K_s (m/s) =	7.3E-12		
S_s (1/m) =	1.0E-08		

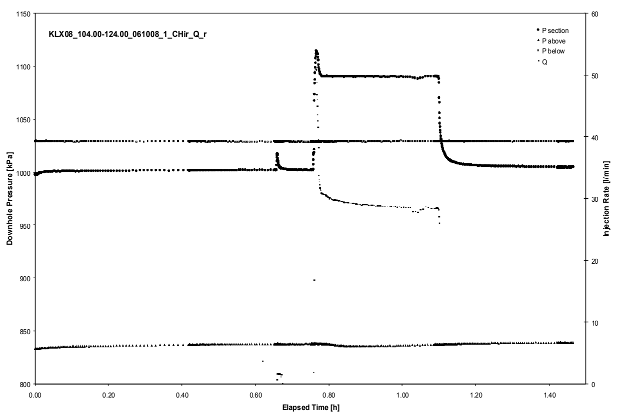
Comments:

The recommended transmissivity of 7.3E-10 m2/s was derived from the analysis of the CHi phase. The confidence range for the interval transmissivity is estimated to be 2E-10 m2/s to 3E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

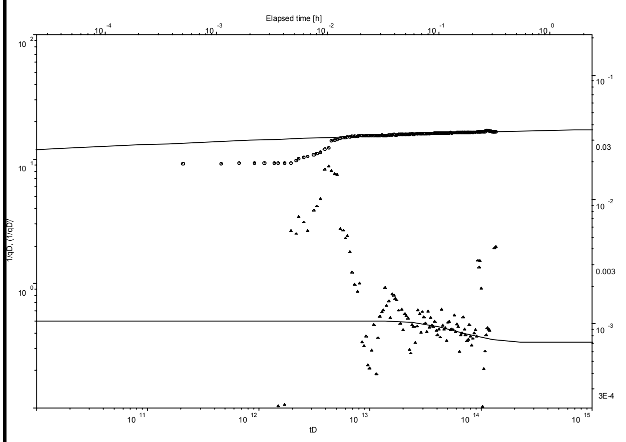
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 07:04
Test section from - to (m):	104.00-124.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

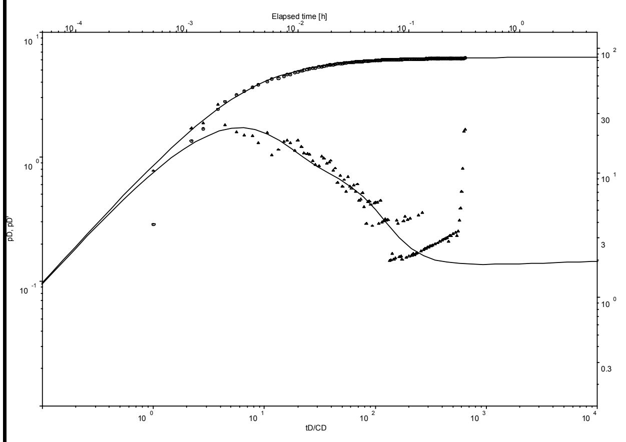
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	999		
p_i (kPa) =	1003		
p_p(kPa) =	1091	p_F (kPa) =	1005
Q_p (m^3/s)=	4.73E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	8.4		
Derivative fact.=	0.07	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	5.3E-05		
T_M (m^2/s)=	5.5E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	#NV	dt_1 (min) =	#NV
dt_2 (min) =	#NV	dt_2 (min) =	#NV
T (m^2/s) =	2.0E-04	T (m^2/s) =	1.9E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.0E-05	K_s (m/s) =	9.5E-06
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	6.6E-08
C_D (-) =	NA	C_D (-) =	7.3E+00
ξ (-) =	7.0	ξ (-) =	-2.1
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	6.6E-08
dt_2 (min) =	NA	C_D (-) =	7.3E+00
T_T (m^2/s) =	2.0E-04	ξ (-) =	7.0
S (-) =	1.0E-06		
K_s (m/s) =	1.0E-05		
S_s (1/m) =	5.0E-08		

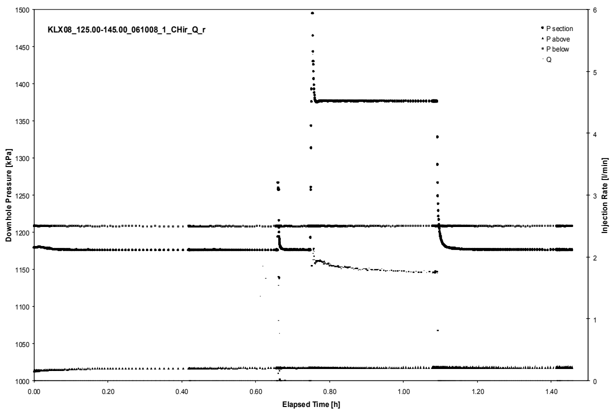
Comments:

The recommended transmissivity of 2.0E-4 m2/s was derived from the analysis of the CHir phase, which shows the better derivative quality. The confidence range for the interval transmissivity is estimated to be 9E-5 m2/s to 7E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,003.6 kPa.

Test Summary Sheet

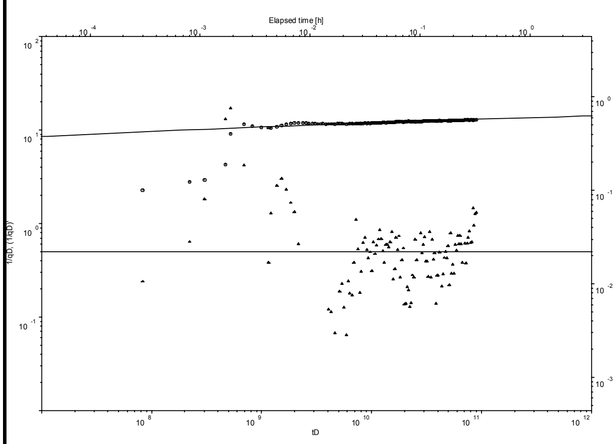
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 09:13
Test section from - to (m):	125.00-145.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

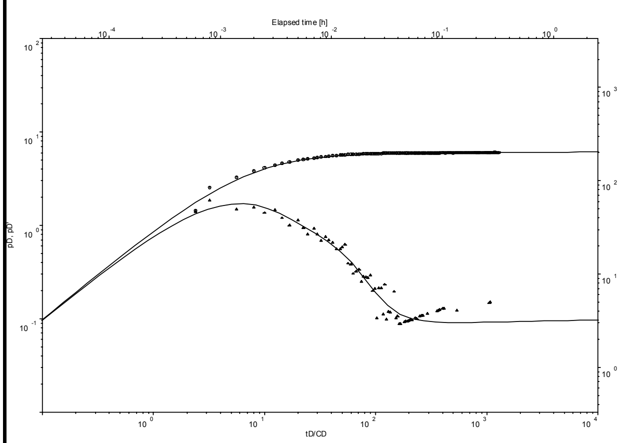


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	1179		
p_i (kPa) =	1176		
p_p(kPa) =	1377	p_F (kPa) =	1176
Q_p (m^3/s)=	2.96E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	8.9		
Derivative fact.=	0.08	Derivative fact.=	0.03
Results		**Results**	
Q/s (m^2/s)=	1.4E-06		
T_M (m^2/s)=	1.5E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1.63	dt_1 (min) =	2.34
dt_2 (min) =	12.86	dt_2 (min) =	6.47
T (m^2/s) =	2.9E-06	T (m^2/s) =	7.3E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.5E-07	K_s (m/s) =	3.7E-07
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8.3E-10
C_D (-) =	NA	C_D (-) =	9.1E-02
ξ (-) =	5.3	ξ (-) =	0.0
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	2.34	C (m^3/Pa) =	8.3E-10
dt_2 (min) =	6.47	C_D (-) =	9.1E-02
T_T (m^2/s) =	7.3E-06	ξ (-) =	0.0
S (-) =	1.0E-06		
K_s (m/s) =	3.7E-07		
S_s (1/m) =	5.0E-08		

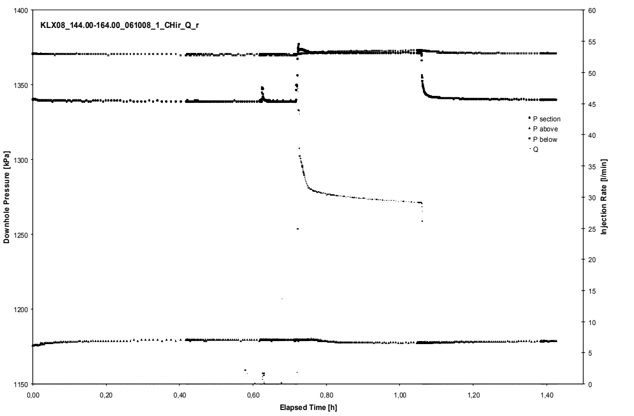
Comments:

The recommended transmissivity of 7.3E-6 m2/s was derived from the analysis of the CHir phase (outer zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 5E-6 m2/s to 5E-5 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,176.6 kPa.

Test Summary Sheet

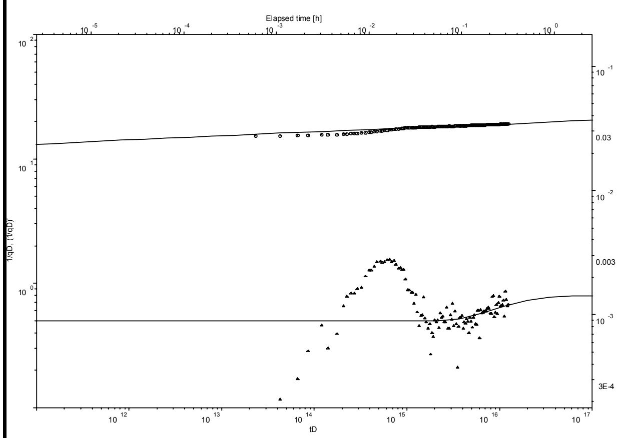
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 11:12
Test section from - to (m):	144.00-164.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

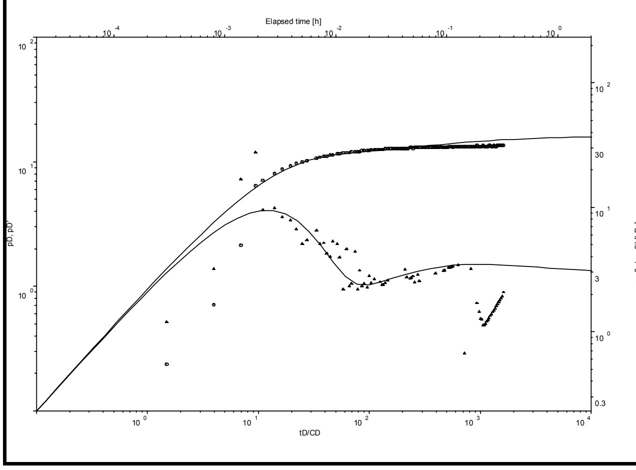


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	1341		
p_i (kPa) =	1339		
p_p(kPa) =	1373	p_F (kPa) =	1340
Q_p (m^3/s)=	4.86E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	8.8		
Derivative fact.=	0.08	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	1.4E-04		
T_M (m^2/s)=	1.5E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.18	dt_1 (min) =	0.80
dt_2 (min) =	6.07	dt_2 (min) =	1.52
T (m^2/s) =	4.3E-04	T (m^2/s) =	3.4E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.1E-05	K_s (m/s) =	1.7E-05
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.6E-07
C_D (-) =	NA	C_D (-) =	1.8E+01
ξ (-) =	8.7	ξ (-) =	3.5
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	2.18	C (m^3/Pa) =	1.6E-07
dt_2 (min) =	6.07	C_D (-) =	1.8E+01
T_T (m^2/s) =	4.3E-04	ξ (-) =	8.7
S (-) =	1.0E-06		
K_s (m/s) =	2.1E-05		
S_s (1/m) =	5.0E-08		

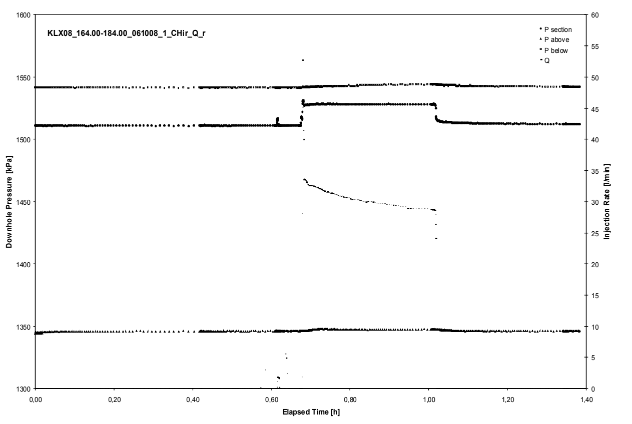
Comments:

The recommended transmissivity of 4.3E-4 m2/s was derived from the analysis of the CHi phase (inner zone), which shows the clearest horizontal stabilization. The confidence range for the interval transmissivity is estimated to be 1E-4 m2/s to 8E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,339.6 kPa.

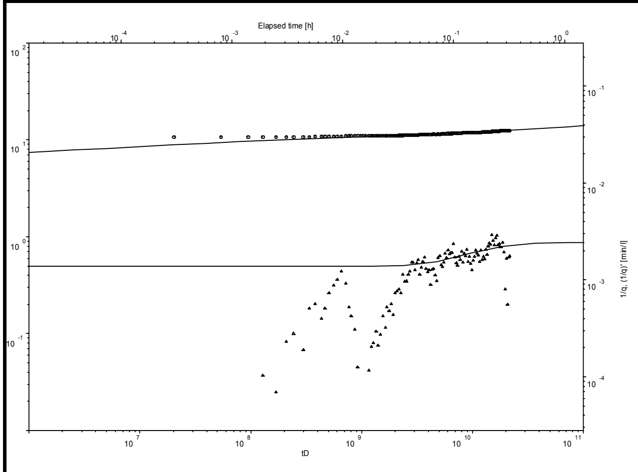
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 13:19
Test section from - to (m):	164.00-184.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

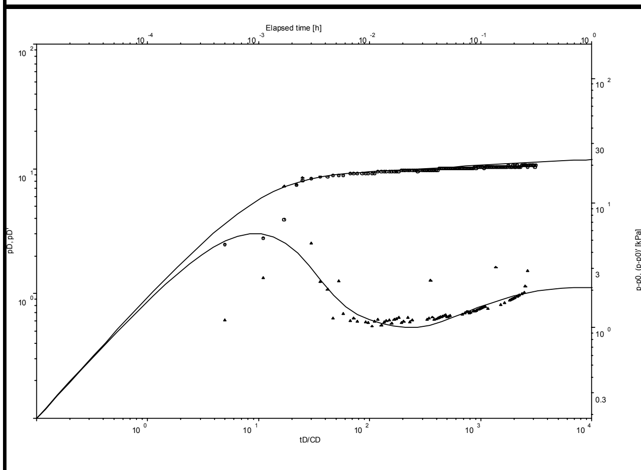
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	1511		
p_i (kPa) =	1511		
p_p(kPa) =	1528	p_F (kPa) =	1512
Q_p (m^3/s)=	4.79E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	9.1		
Derivative fact.=	0.07	Derivative fact.=	0.1
Results		**Results**	
Q/s (m^2/s)=	2.8E-04		
T_M (m^2/s)=	2.9E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	0.43
dt_2 (min) =	NA	dt_2 (min) =	3.20
T (m^2/s) =	5.5E-04	T (m^2/s) =	4.2E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.7E-05	K_s (m/s) =	2.1E-05
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	9.7E-08
C_D (-) =	NA	C_D (-) =	1.1E+01
ξ (-) =	0.2	ξ (-) =	1.1
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.43	C (m^3/Pa) =	9.7E-08
dt_2 (min) =	3.20	C_D (-) =	1.1E+01
T_T (m^2/s) =	4.2E-04	ξ (-) =	1.1
S (-) =	1.0E-06		
K_s (m/s) =	2.1E-05		
S_s (1/m) =	5.0E-08		

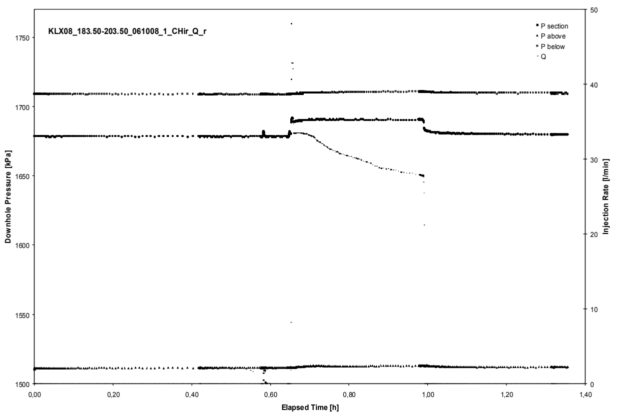
Comments:

The recommended transmissivity of 4.2E-4 m2/s was derived from the analysis of the CHir phase (inner zone), which shows a horizontal stabilization. The confidence range for the interval transmissivity is estimated to be 1E-4 m2/s to 8E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,511.6 kPa.

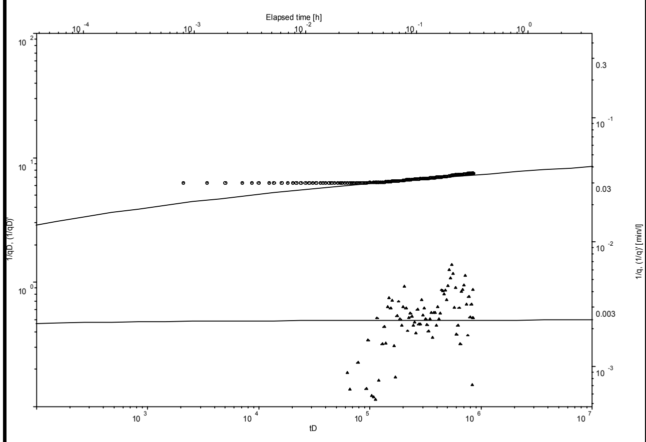
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 15:14
Test section from - to (m):	183.50-203.50 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

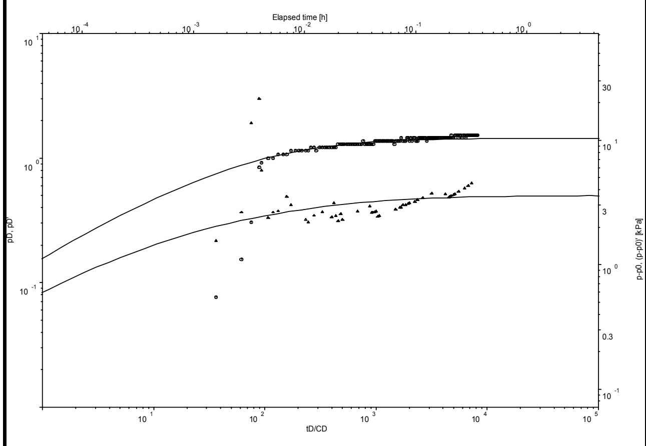
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	1679		
p_i (kPa) =	1679		
p_p(kPa) =	1690	p_F (kPa) =	1679
Q_p (m^3/s)=	4.61E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	9.2		
Derivative fact.=	0.01	Derivative fact.=	0.07
Results		**Results**	
Q/s (m^2/s)=	4.1E-04		
T_M (m^2/s)=	4.3E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.65	dt_1 (min) =	0.37
dt_2 (min) =	19.97	dt_2 (min) =	98.57
T (m^2/s) =	5.0E-04	T (m^2/s) =	1.1E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.5E-05	K_s (m/s) =	5.5E-06
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.1E-08
C_D (-) =	NA	C_D (-) =	1.2E+00
ξ (-) =	-3.1	ξ (-) =	-6.5
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	2.65	C (m^3/Pa) =	1.1E-08
dt_2 (min) =	19.97	C_D (-) =	1.2E+00
T_T (m^2/s) =	5.0E-04	ξ (-) =	-3.1
S (-) =	1.0E-06		
K_s (m/s) =	2.5E-05		
S_s (1/m) =	5.0E-08		

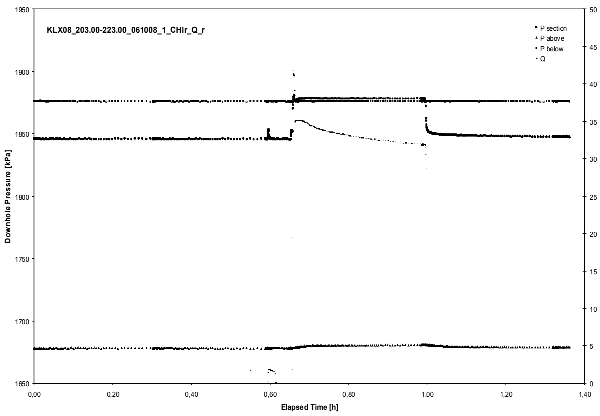
Comments:

The recommended transmissivity of 5E-4 m2/s was derived from the analysis of the CHi phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 9E-5 m2/s to 9E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,679.3 kPa.

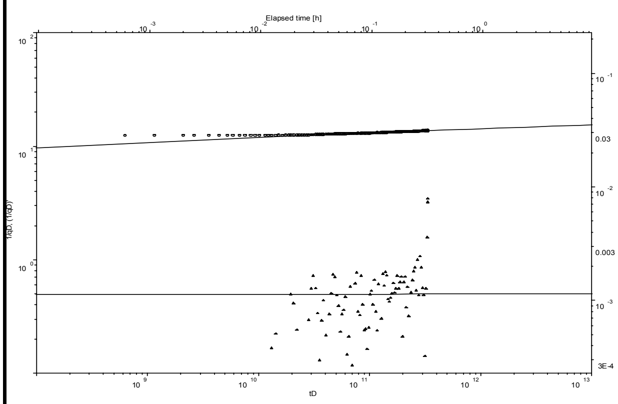
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 17:07
Test section from - to (m):	203.00-223.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

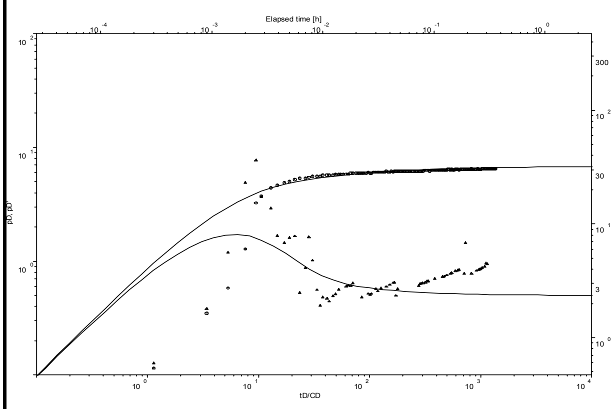
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	1846		
p_i (kPa) =	1847		
p_p(kPa) =	1879	p_F (kPa) =	1847
Q_p (m^3/s)=	5.30E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	9.5		
Derivative fact.=	0.01	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	1.6E-04		
T_M (m^2/s)=	1.7E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1.85	dt_1 (min) =	0.82
dt_2 (min) =	17.98	dt_2 (min) =	3.73
T (m^2/s) =	3.6E-04	T (m^2/s) =	1.8E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.8E-05	K_s (m/s) =	9.0E-06
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.1E-07
C_D (-) =	NA	C_D (-) =	1.2E+01
ξ (-) =	3.5	ξ (-) =	-2.4
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	0.82	C (m^3/Pa) =	1.1E-07
dt_2 (min) =	3.73	C_D (-) =	1.2E+01
T_T (m^2/s) =	1.8E-04	ξ (-) =	-2.4
S (-) =	1.0E-06		
K_s (m/s) =	9.0E-06		
S_s (1/m) =	5.0E-08		

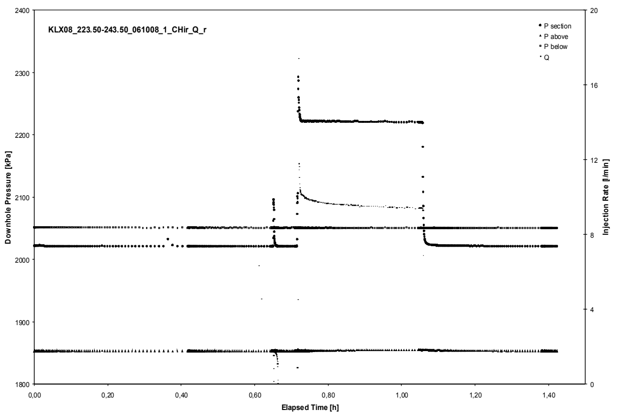
Comments:

The recommended transmissivity of 1.8•10-4 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 7E-5 m2/s to 5E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 1,846.7 kPa.

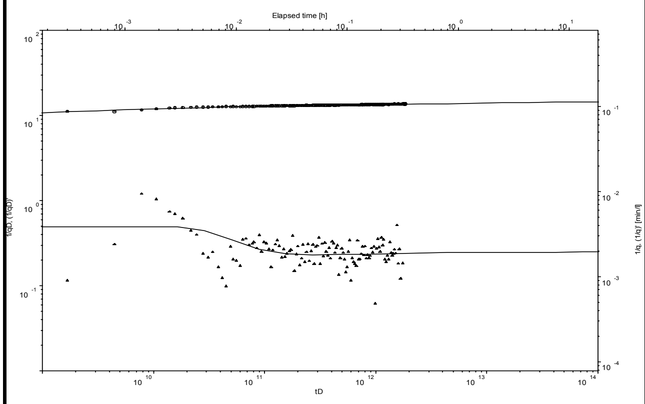
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 19:00
Test section from - to (m):	223.50-243.50 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

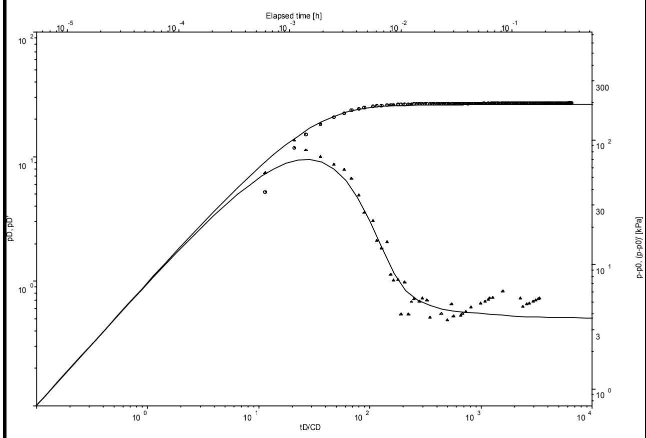
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	2021		
p_i (kPa) =	2021		
p_p(kPa) =	2220	p_F (kPa) =	2021
Q_p (m^3/s)=	1.55E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	9.9		
Derivative fact.=	0.11	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	7.6E-06		
T_M (m^2/s)=	8.0E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1.54	dt_1 (min) =	0.63
dt_2 (min) =	16.37	dt_2 (min) =	3.21
T (m^2/s) =	3.4E-05	T (m^2/s) =	3.4E-05
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.7E-06	K_s (m/s) =	1.7E-06
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.1E-09
C_D (-) =	NA	C_D (-) =	4.5E-01
ξ (-) =	5.9	ξ (-) =	18.8
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	1.54	C (m^3/Pa) =	4.1E-09
dt_2 (min) =	16.37	C_D (-) =	4.5E-01
T_T (m^2/s) =	3.4E-05	ξ (-) =	5.9
S (-) =	1.0E-06		
K_s (m/s) =	1.7E-06		
S_s (1/m) =	5.0E-08		

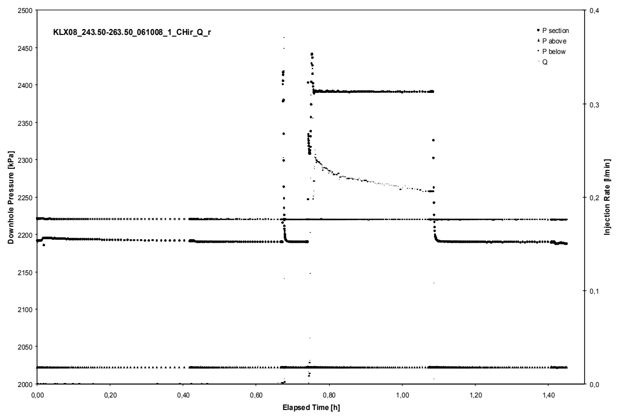
Comments:

The recommended transmissivity of 3.4E-5 m2/s was derived from the analysis of the CHi phase (outer zone), which shows the clearest derivative stabilization. The confidence range for the interval transmissivity is estimated to be 1E-5 m2/s to 6E-5 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,020.3 kPa.

Test Summary Sheet

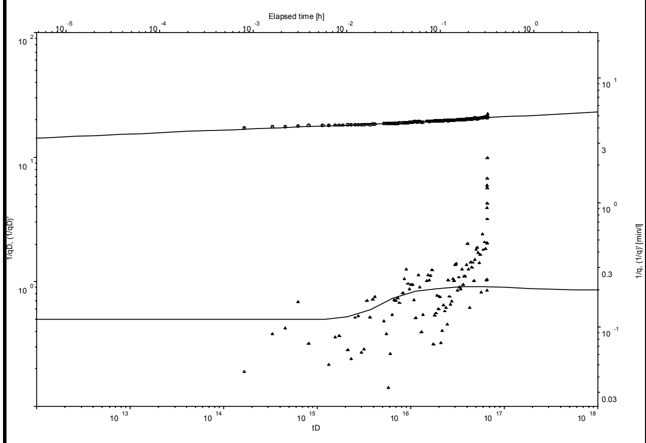
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 21:09
Test section from - to (m):	243.50-264.50 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, 2·r_w (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

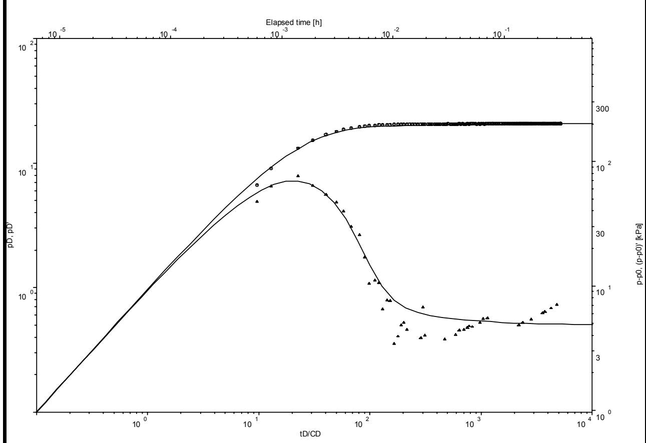


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2191		
p_i (kPa) =	2191		
p_p(kPa) =	2391	p_F (kPa) =	2190
Q_p (m^3/s)=	3.43E-06		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10.2		
Derivative fact.=	0.07	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	1.7E-07		
T_M (m^2/s)=	1.8E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	47.93	dt_1 (min) =	1.17
dt_2 (min) =	64.58	dt_2 (min) =	16.40
T (m^2/s) =	3.3E-07	T (m^2/s) =	5.8E-07
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.7E-08	K_s (m/s) =	2.9E-08
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8.3E-11
C_D (-) =	NA	C_D (-) =	9.1E-03
ξ (-) =	12.9	ξ (-) =	15.0
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	1.17	C (m^3/Pa) =	8.3E-11
dt_2 (min) =	16.40	C_D (-) =	9.1E-03
T_T (m^2/s) =	5.8E-07	ξ (-) =	15.0
S (-) =	1.0E-06		
K_s (m/s) =	2.9E-08		
S_s (1/m) =	5.0E-08		

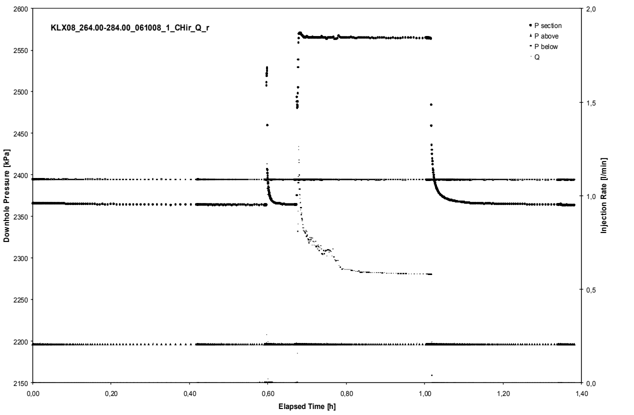
Comments:

The recommended transmissivity of 5.8E-7 m2/s was derived from the analysis of the CHir phase, which shows a derivative stabilization at late times. The confidence range for the interval transmissivity is estimated to be 1E-7 m2/s to 1E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,189.7 kPa.

Test Summary Sheet

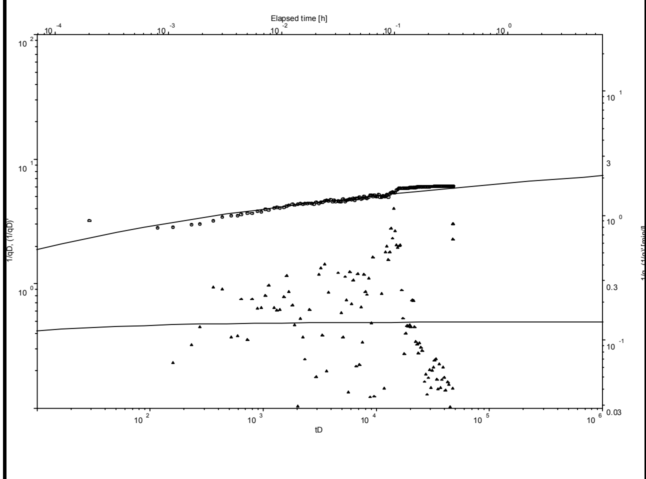
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061008 23:10
Test section from - to (m):	264.00-284.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

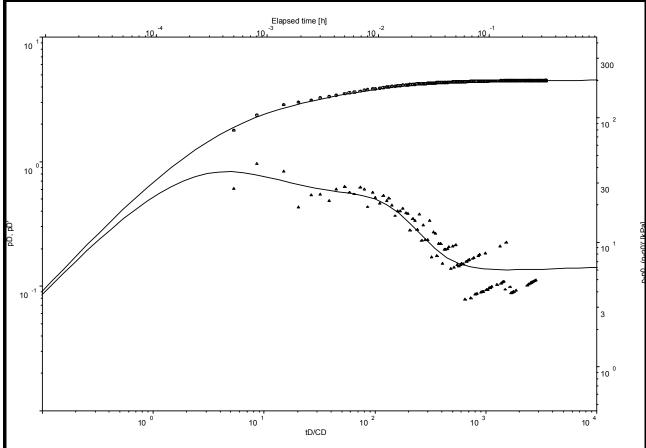


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2365		
p_i (kPa) =	2364		
p_p(kPa) =	2564	p_F (kPa) =	2364
Q_p (m^3/s)=	9.65E-06		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10.5		
Derivative fact.=	0.04	Derivative fact.=	0.03
Results		**Results**	
Q/s (m^2/s)=	4.7E-07		
T_M (m^2/s)=	5.0E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.41	dt_1 (min) =	0.14
dt_2 (min) =	8.69	dt_2 (min) =	0.62
T (m^2/s) =	4.6E-07	T (m^2/s) =	3.8E-07
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.3E-08	K_s (m/s) =	1.9E-08
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8.1E-11
C_D (-) =	NA	C_D (-) =	8.9E-03
ξ (-) =	-1.0	ξ (-) =	-1.1
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0.14	C (m^3/Pa) =	8.1E-11
dt_2 (min) =	0.62	C_D (-) =	8.9E-03
T_T (m^2/s) =	3.8E-07	ξ (-) =	-1.1
S (-) =	1.0E-06		
K_s (m/s) =	1.9E-08		
S_s (1/m) =	5.0E-08		

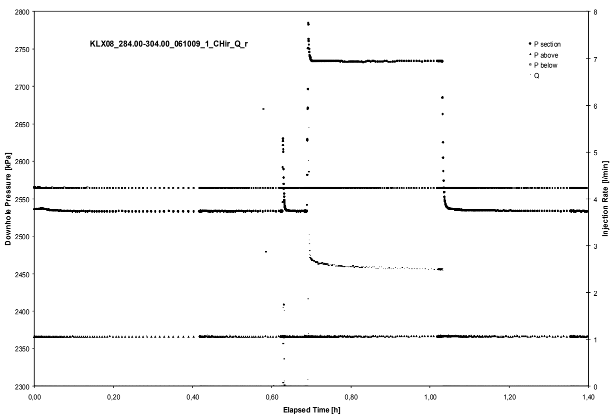
Comments:

The recommended transmissivity of 3.8E-7 m2/s was derived from the analysis of the CHir phase (inner zone), which shows a derivative stabilization. The confidence range for the interval transmissivity is estimated to be 1E-7 m2/s to 1E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,361.3 kPa.

Test Summary Sheet

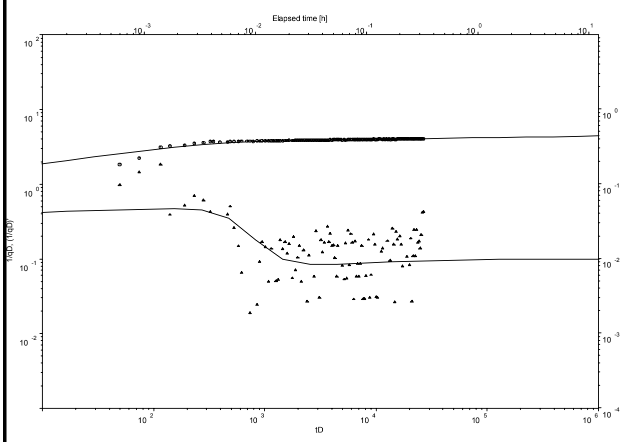
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 01:07
Test section from - to (m):	284.00-304.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

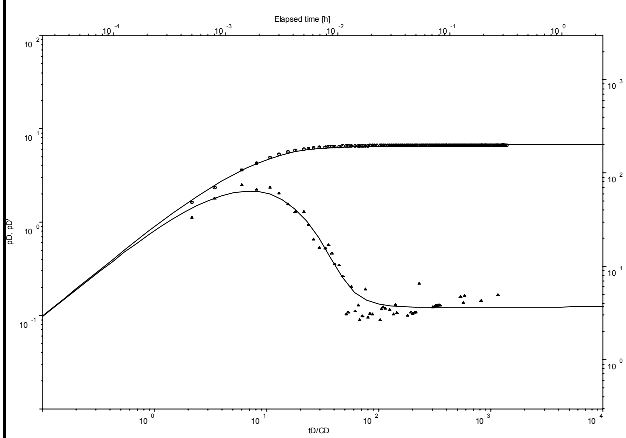


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	2536		
p_i (kPa) =	2534		
p_p(kPa) =	2734	p_F (kPa) =	2534
Q_p (m^3/s)=	4.16E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	10.7		
Derivative fact.=	0.04	Derivative fact.=	0.03
Results		**Results**	
Q/s (m^2/s)=	2.0E-06		
T_M (m^2/s)=	2.1E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1.00	dt_1 (min) =	0.94
dt_2 (min) =	17.14	dt_2 (min) =	11.02
T (m^2/s) =	6.6E-06	T (m^2/s) =	6.6E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	3.3E-07	K_s (m/s) =	3.3E-07
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.2E-09
C_D (-) =	NA	C_D (-) =	1.3E-01
ξ (-) =	-1.8	ξ (-) =	1.0
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0.94	C (m^3/Pa) =	1.2E-09
dt_2 (min) =	11.02	C_D (-) =	1.3E-01
T_T (m^2/s) =	6.6E-06	ξ (-) =	1.0
S (-) =	1.0E-06		
K_s (m/s) =	3.3E-07		
S_s (1/m) =	5.0E-08		

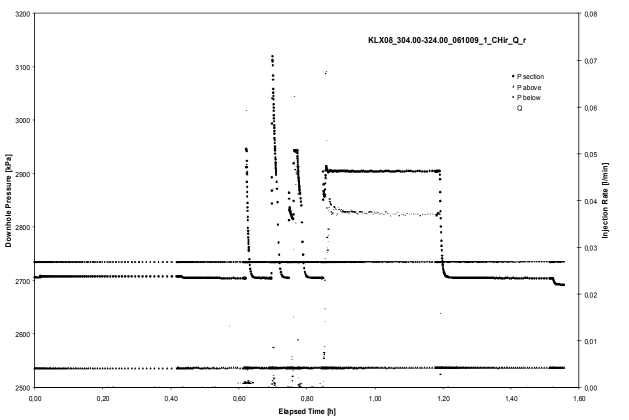
Comments:

The recommended transmissivity of 6.6E-6 m2/s was derived from the analysis of the CHir phase (outer zone), which shows a better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 2E-6 m2/s to 9E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,533.2 kPa.

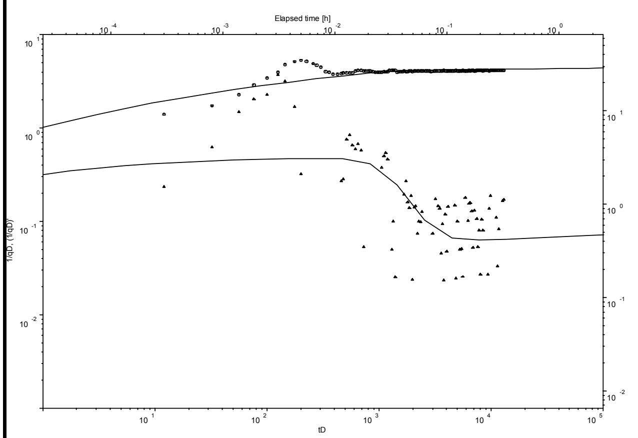
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 06:17
Test section from - to (m):	304.00-324.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

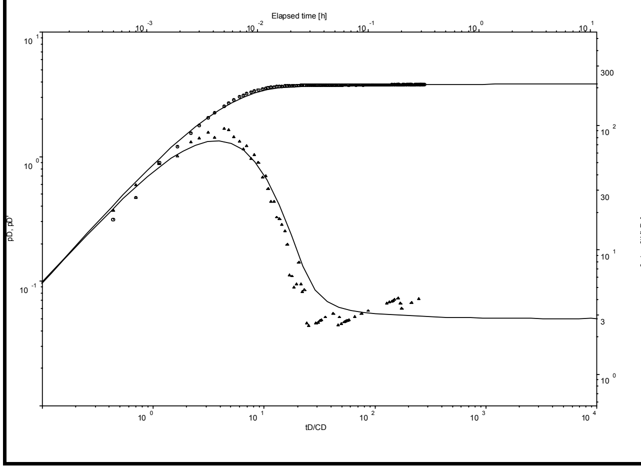
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	2706		
p_i (kPa) =	2705		
p_p(kPa) =	2905	p_F (kPa) =	2704
Q_p (m^3/s)=	6.17E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11.0 €		
Derivative fact.=	0.06	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	3.0E-08		
T_M (m^2/s)=	3.2E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4.80	dt_1 (min) =	2.98
dt_2 (min) =	17.92	dt_2 (min) =	13.90
T (m^2/s) =	1.3E-07	T (m^2/s) =	1.8E-07
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	6.5E-09	K_s (m/s) =	9.0E-09
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.6E-11
C_D (-) =	NA	C_D (-) =	5.1E-03
ξ (-) =	-0.1	ξ (-) =	2.7
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA
Selected representative parameters.			
dt_1 (min) =	4.80	C (m^3/Pa) =	4.6E-11
dt_2 (min) =	17.92	C_D (-) =	5.1E-03
T_T (m^2/s) =	1.3E-07	ξ (-) =	-0.1
S (-) =	1.0E-06		
K_s (m/s) =	6.5E-09		
S_s (1/m) =	5.0E-08		

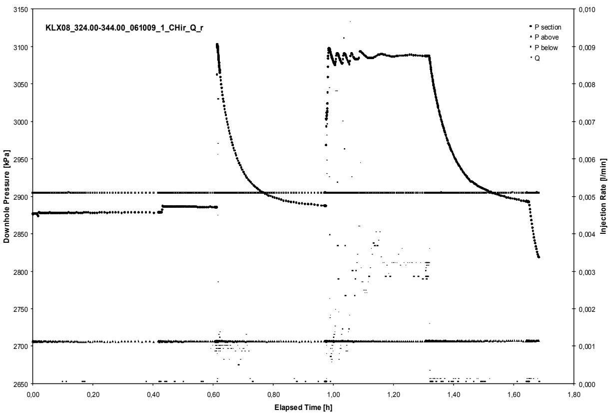
Comments:

The recommended transmissivity of 1.3E-7 m2/s was derived from the analysis of the CHi phase (outer zone), which shows a better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 2E-8 m2/s to 3E-7 m2/s (this range includes the inner zone transmissivity). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 2,703.6 kPa.

Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 08:23
Test section from - to (m):	324.00-344.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

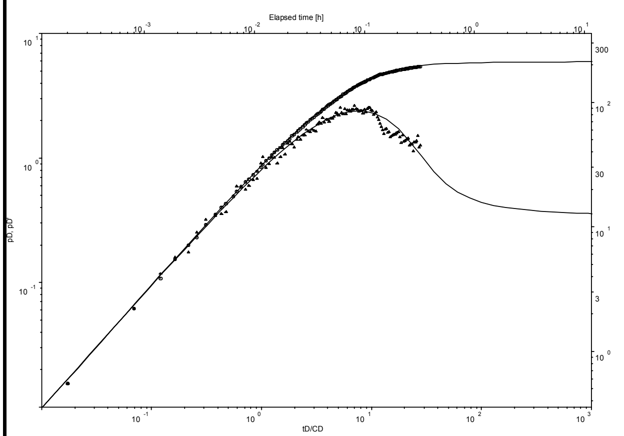
Linear plot Q and p



Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	2877		
p_i (kPa) =	2887		
p_p(kPa) =	3087	p_F (kPa) =	2893
Q_p (m^3/s)=	5.17E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11.2		
Derivative fact.=	NA	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	2.5E-09		
T_M (m^2/s)=	2.7E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	#NV	dt_1 (min) =	#NV
dt_2 (min) =	#NV	dt_2 (min) =	#NV
T (m^2/s) =	NA	T (m^2/s) =	2.7E-09
S (-) =	NA	S (-) =	1.0E-06
K_s (m/s) =	NA	K_s (m/s) =	1.4E-10
S_s (1/m) =	NA	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	7.1E-11
C_D (-) =	NA	C_D (-) =	7.8E-03
ξ (-) =	NA	ξ (-) =	2.4
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	7.1E-11
dt_2 (min) =	NA	C_D (-) =	7.8E-03
T_T (m^2/s) =	2.7E-09	ξ (-) =	2.4
S (-) =	1.0E-06		
K_s (m/s) =	1.4E-10		
S_s (1/m) =	5.0E-08		

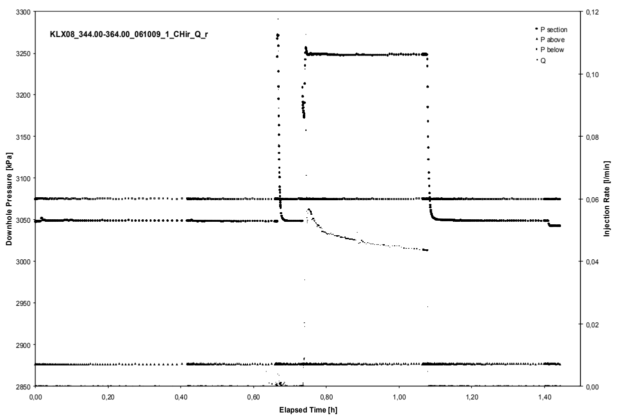
Comments:

The recommended transmissivity of 2.7E-9 m2/s was derived from the analysis of the CHir phase (inner zone). The confidence range for the interval transmissivity is estimated to be 9E-10 m2/s to 5E-9 m2/s. The static pressure could not be extrapolated due to the low transmissivity.

Test Summary Sheet

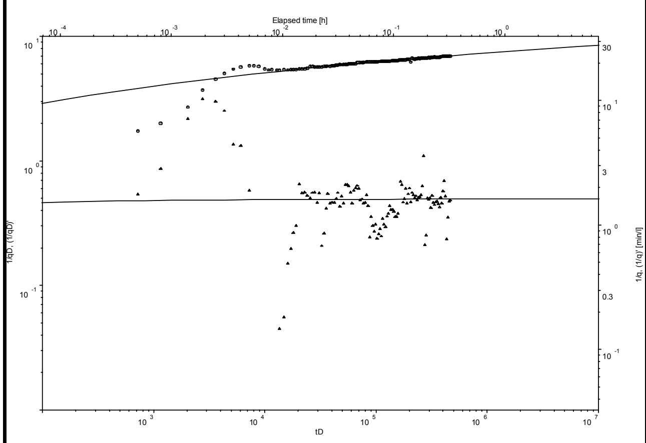
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 10:41
Test section from - to (m):	344.00-364.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

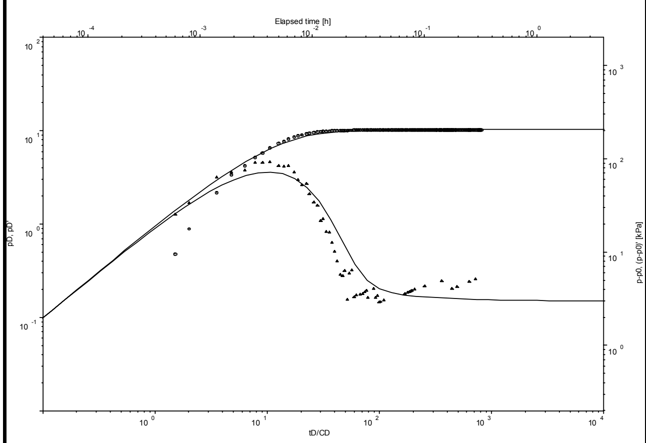


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3048		
p_i (kPa) =	3048		
p_p(kPa) =	3248	p_F (kPa) =	3048
Q_p (m^3/s)=	7.27E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11.5		
Derivative fact.=	0.10	Derivative fact.=	0.03
Results		**Results**	
Q/s (m^2/s)=	3.6E-08		
T_M (m^2/s)=	3.7E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.82	dt_1 (min) =	#NV
dt_2 (min) =	19.54	dt_2 (min) =	#NV
T (m^2/s) =	4.0E-08	T (m^2/s) =	6.2E-08
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.0E-09	K_s (m/s) =	3.1E-09
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5.7E-11
C_D (-) =	NA	C_D (-) =	6.3E-03
ξ (-) =	-1.0	ξ (-) =	7.5
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0.82	C (m^3/Pa) =	5.7E-11
dt_2 (min) =	19.54	C_D (-) =	6.3E-03
T_T (m^2/s) =	4.0E-08	ξ (-) =	-1.0
S (-) =	1.0E-06		
K_s (m/s) =	2.0E-09		
S_s (1/m) =	5.0E-08		

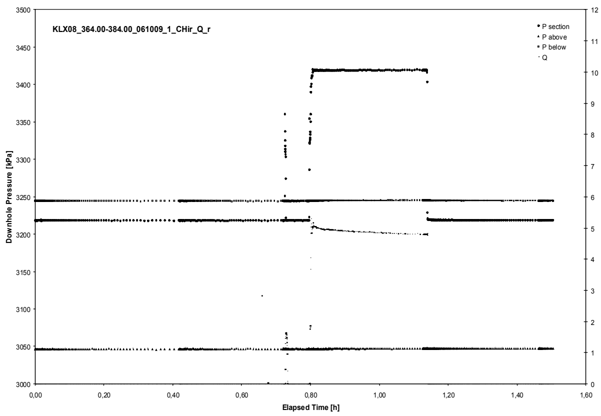
Comments:

The recommended transmissivity of 4.0E-8 m2/s was derived from the analysis of the CHi phase, which shows a horizontal stabilization of the derivative. The confidence range for the interval transmissivity is estimated to be 1E-8 m2/s to 7E-8 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,048.7 kPa.

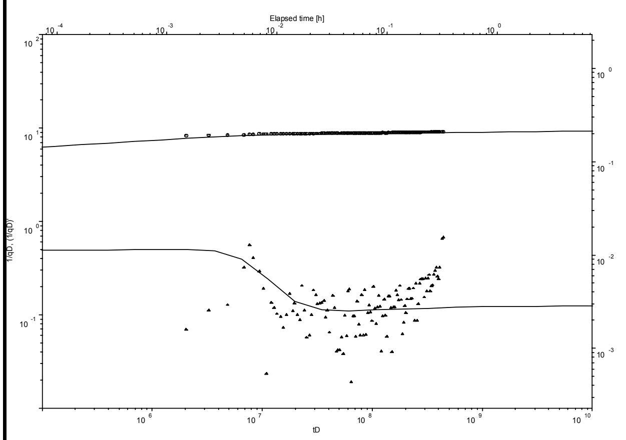
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 12:57
Test section from - to (m):	364.00-384.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

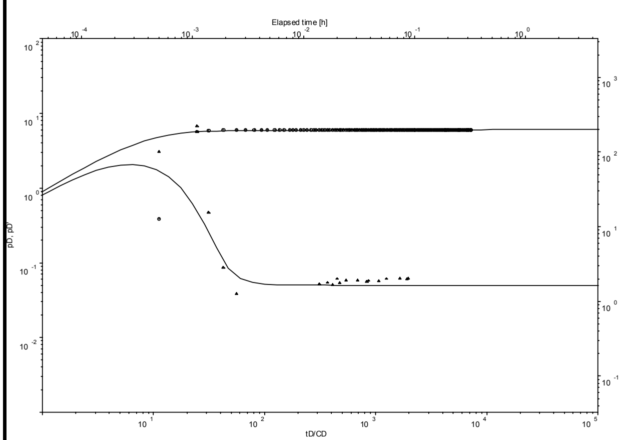
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3218		
p_i (kPa) =	3218		
p_p(kPa) =	3419	p_F (kPa) =	3219
Q_p (m^3/s)=	7.96E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11.6		
Derivative fact.=	0.07	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	3.9E-06		
T_M (m^2/s)=	4.1E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.79	dt_1 (min) =	0.80
dt_2 (min) =	11.86	dt_2 (min) =	5.27
T (m^2/s) =	2.3E-05	T (m^2/s) =	3.9E-05
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.2E-06	K_s (m/s) =	2.0E-06
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.0E-10
C_D (-) =	NA	C_D (-) =	4.4E-02
ξ (-) =	2.3	ξ (-) =	1.6
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.79	C (m^3/Pa) =	4.0E-10
dt_2 (min) =	11.86	C_D (-) =	4.4E-02
T_T (m^2/s) =	2.3E-05	ξ (-) =	2.3
S (-) =	1.0E-06		
K_s (m/s) =	1.2E-06		
S_s (1/m) =	5.0E-08		

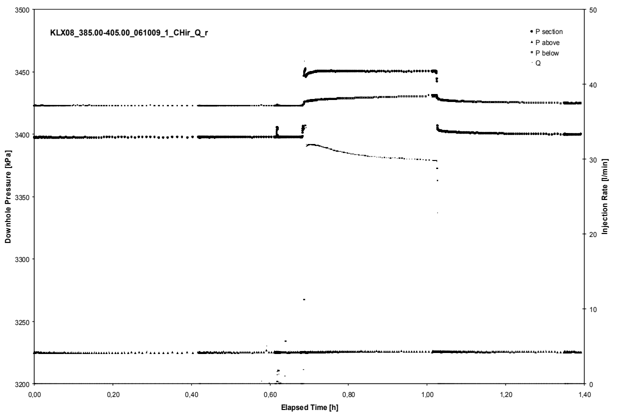
Comments:

The recommended transmissivity of 2.3E-5 m2/s was derived from the analysis of the CHi phase (outer zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 5E-6 m2/s to 6E-5 m2/s (this range includes the inner zone transmissivity). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,218.8 kPa.

Test Summary Sheet

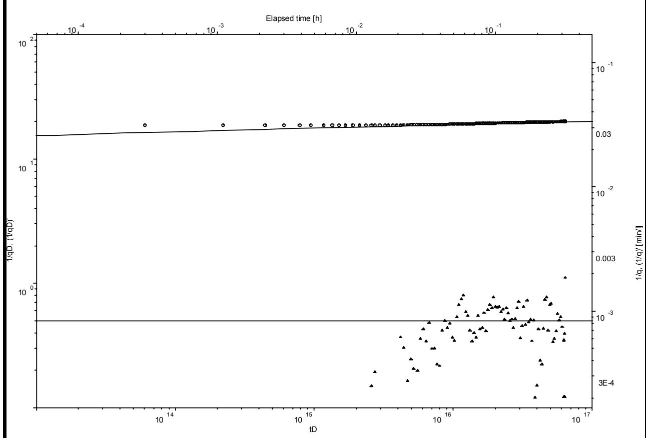
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 15:01
Test section from - to (m):	385.00-405.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, 2·r_w (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

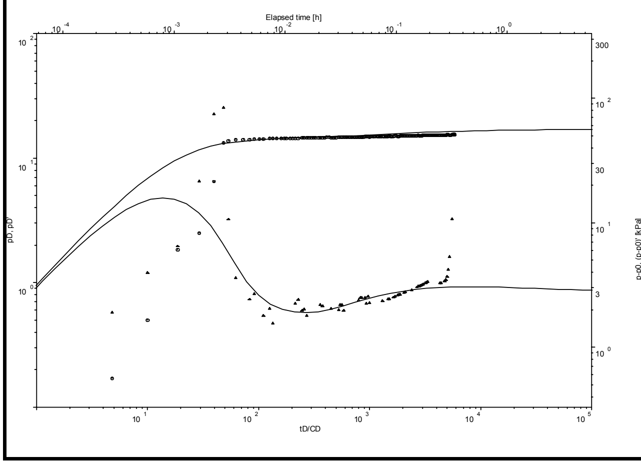


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3397		
p_i (kPa) =	3398		
p_p(kPa) =	3450	p_F (kPa) =	3399
Q_p (m^3/s)=	4.97E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	11.4		
Derivative fact.=	0.02	Derivative fact.=	0.05
Results		**Results**	
Q/s (m^2/s)=	9.4E-05		
T_M (m^2/s)=	9.8E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.00	dt_1 (min) =	0.38
dt_2 (min) =	18.06	dt_2 (min) =	2.27
T (m^2/s) =	3.0E-04	T (m^2/s) =	2.4E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.5E-05	K_s (m/s) =	1.2E-05
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3.2E-08
C_D (-) =	NA	C_D (-) =	3.5E+00
ξ (-) =	9.7	ξ (-) =	6.3
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0.38	C (m^3/Pa) =	3.2E-08
dt_2 (min) =	2.27	C_D (-) =	3.5E+00
T_T (m^2/s) =	2.4E-04	ξ (-) =	6.3
S (-) =	1.0E-06		
K_s (m/s) =	1.2E-05		
S_s (1/m) =	5.0E-08		

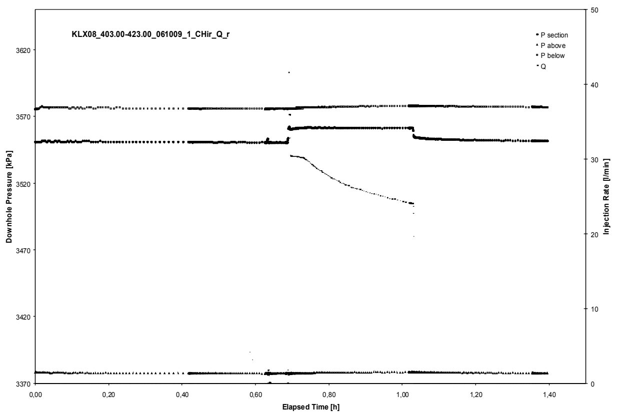
Comments:

The recommended transmissivity of 2.4E-4 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 8E-5 m2/s to 6E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,398.8 kPa.

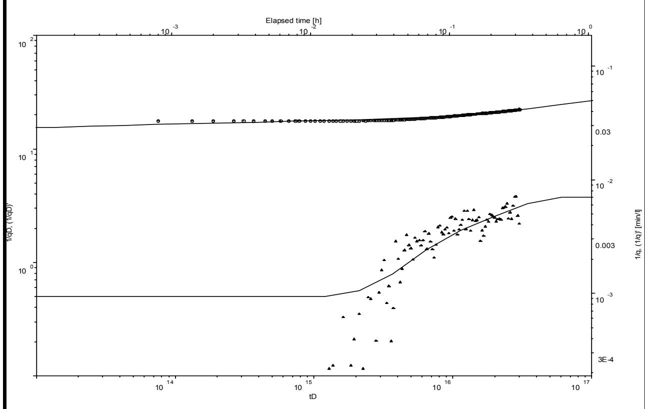
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 16:55
Test section from - to (m):	403.00-423.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

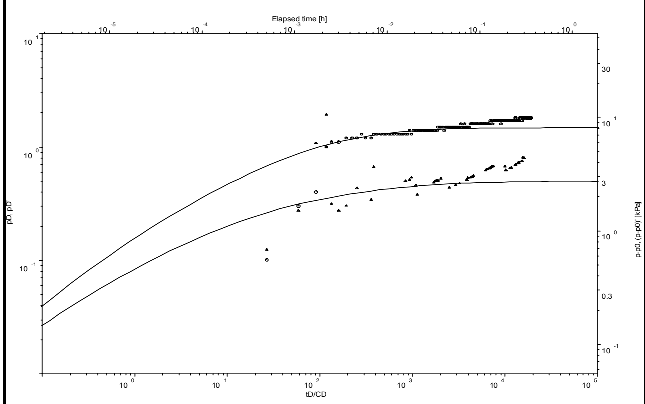
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3550		
p_i (kPa) =	3550		
p_p(kPa) =	3561	p_F (kPa) =	3551
Q_p (m^3/s)=	4.01E-04		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12.3		
Derivative fact.=	0.01	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	3.6E-04		
T_M (m^2/s)=	3.7E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	#NV	dt_1 (min) =	0.69
dt_2 (min) =	#NV	dt_2 (min) =	6.59
T (m^2/s) =	2.3E-04	T (m^2/s) =	1.3E-04
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.2E-05	K_s (m/s) =	6.5E-06
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5.5E-09
C_D (-) =	NA	C_D (-) =	6.1E-01
ξ (-) =	8.6	ξ (-) =	-6.1
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.69	C (m^3/Pa) =	5.5E-09
dt_2 (min) =	6.59	C_D (-) =	6.1E-01
T_T (m^2/s) =	1.3E-04	ξ (-) =	-6.1
S (-) =	1.0E-06		
K_s (m/s) =	6.5E-06		
S_s (1/m) =	5.0E-08		

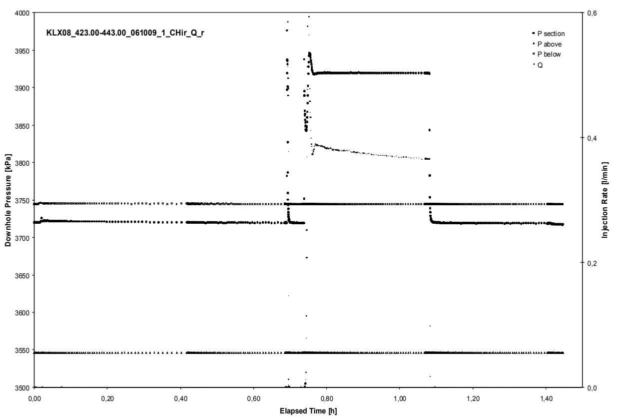
Comments:

The recommended transmissivity of 1.3E-4 m2/s was derived from the analysis of the CHir phase. The confidence range for the interval transmissivity is estimated to be 7E-5 m2/s to 5E-4 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,550.9 kPa.

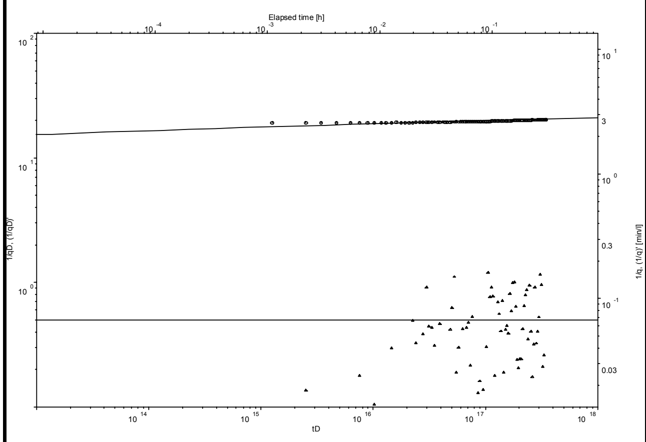
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 18:50
Test section from - to (m):	423.00-443.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

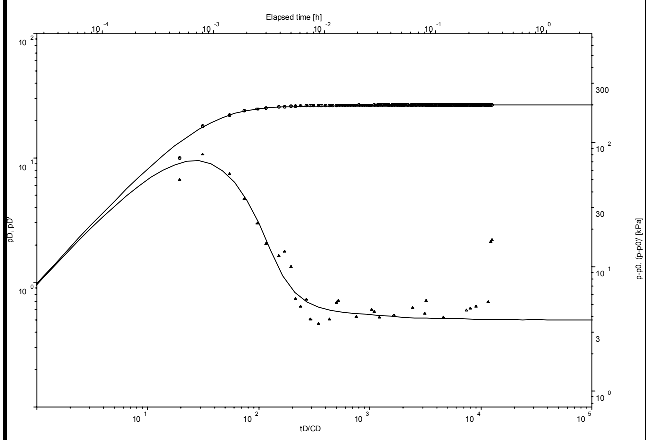
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	3719		
p_i (kPa) =	3719		
p_p(kPa) =	3919	p_F (kPa) =	3719
Q_p (m^3/s)=	6.08E-06		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12.6		
Derivative fact.=	0.02	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	3.0E-07		
T_M (m^2/s)=	3.1E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	1.18	dt_1 (min) =	0.33
dt_2 (min) =	15.75	dt_2 (min) =	12.94
T (m^2/s) =	9.7E-07	T (m^2/s) =	1.3E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	4.9E-08	K_s (m/s) =	6.5E-08
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	7.7E-11
C_D (-) =	NA	C_D (-) =	8.5E-03
ξ (-) =	13.4	ξ (-) =	20.8
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	0.33	C (m^3/Pa) =	7.7E-11
dt_2 (min) =	12.94	C_D (-) =	8.5E-03
T_T (m^2/s) =	1.3E-06	ξ (-) =	20.8
S (-) =	1.0E-06		
K_s (m/s) =	6.5E-08		
S_s (1/m) =	5.0E-08		

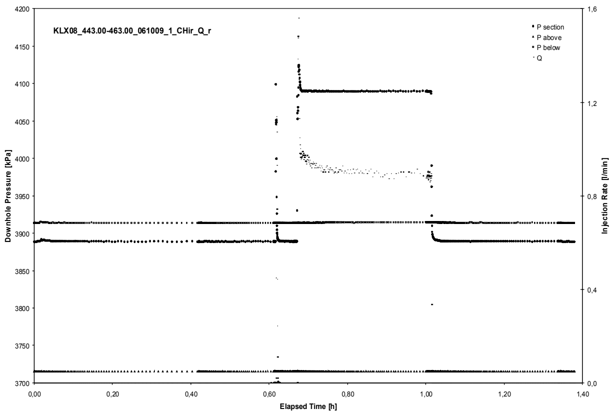
Comments:

The recommended transmissivity of 1.3E-6 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 7E-7 m2/s to 4E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,718.9 kPa.

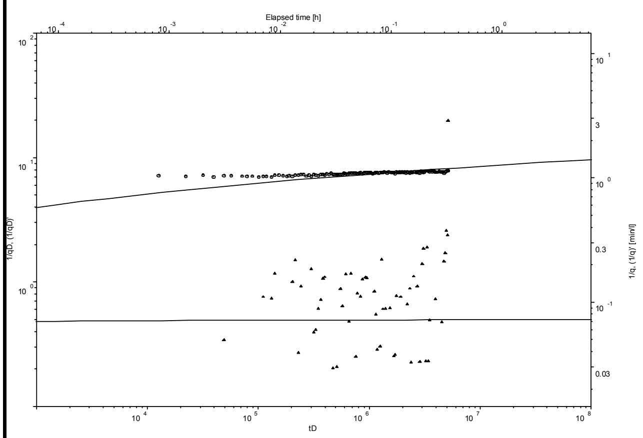
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061009 21:00
Test section from - to (m):	443.00-463.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

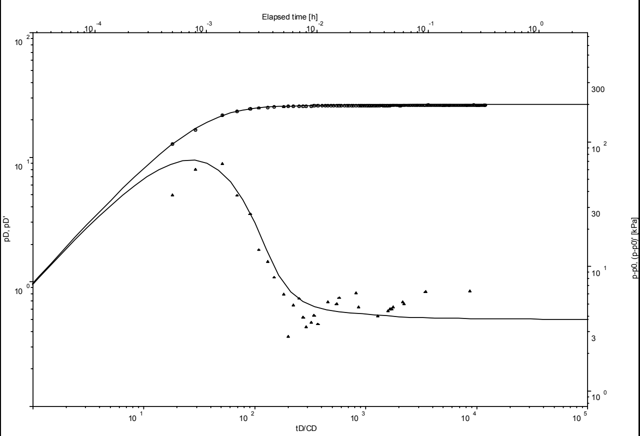
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	3889		
p_i (kPa) =	3889		
p_p(kPa) =	4089	p_F (kPa) =	3888
Q_p (m^3/s)=	1.48E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	12.9		
Derivative fact.=	0.02	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	7.2E-07		
T_M (m^2/s)=	7.6E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.73	dt_1 (min) =	0.58
dt_2 (min) =	17.05	dt_2 (min) =	3.71
T (m^2/s) =	9.0E-07	T (m^2/s) =	3.1E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	4.5E-08	K_s (m/s) =	1.6E-07
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	2.0E-10
C_D (-) =	NA	C_D (-) =	2.2E-02
ξ (-) =	1.0	ξ (-) =	20.3
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	0.58	C (m^3/Pa) =	2.0E-10
dt_2 (min) =	3.71	C_D (-) =	2.2E-02
T_T (m^2/s) =	3.1E-06	ξ (-) =	20.3
S (-) =	1.0E-06		
K_s (m/s) =	1.6E-07		
S_s (1/m) =	5.0E-08		

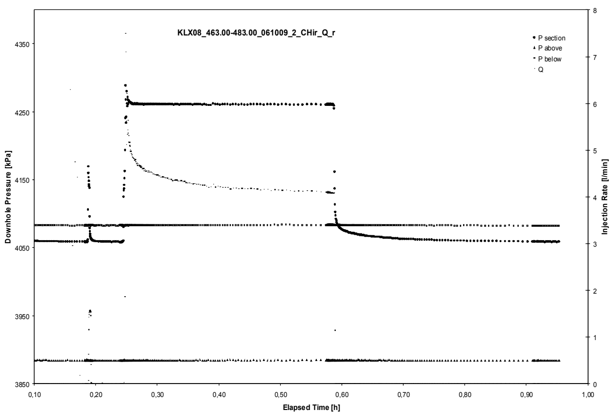
Comments:

The recommended transmissivity of 3.3E-6 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 8E-7 m2/s to 5E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 3,888.9 kPa.

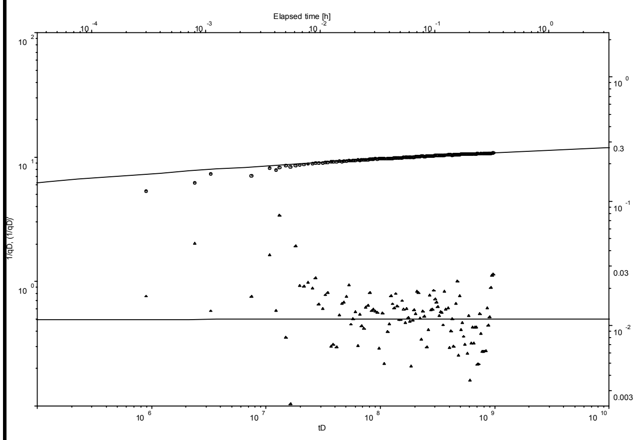
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	2
Borehole ID:	KLX08	Test start:	061009 23:36
Test section from - to (m):	463.00-483.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

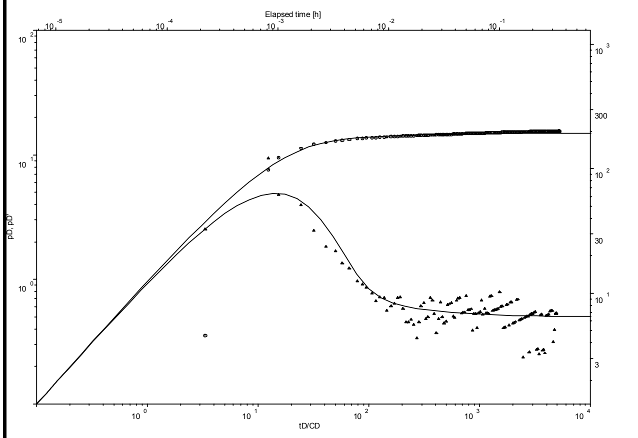
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4060		
p_i (kPa) =	4060		
p_p(kPa) =	4260	p_F (kPa) =	4059
Q_p (m^3/s)=	6.82E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13.2		
Derivative fact.=	0.03	Derivative fact.=	0.05
Results		**Results**	
Q/s (m^2/s)=	3.3E-06		
T_M (m^2/s)=	3.5E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.70	dt_1 (min) =	0.71
dt_2 (min) =	18.95	dt_2 (min) =	18.67
T (m^2/s) =	5.8E-06	T (m^2/s) =	8.7E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.9E-07	K_s (m/s) =	4.4E-07
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.3E-09
C_D (-) =	NA	C_D (-) =	1.4E-01
ξ (-) =	-0.8	ξ (-) =	7.9
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	0.71	C (m^3/Pa) =	1.3E-09
dt_2 (min) =	18.67	C_D (-) =	1.4E-01
T_T (m^2/s) =	8.7E-06	ξ (-) =	7.9
S (-) =	1.0E-06		
K_s (m/s) =	4.4E-07		
S_s (1/m) =	5.0E-08		

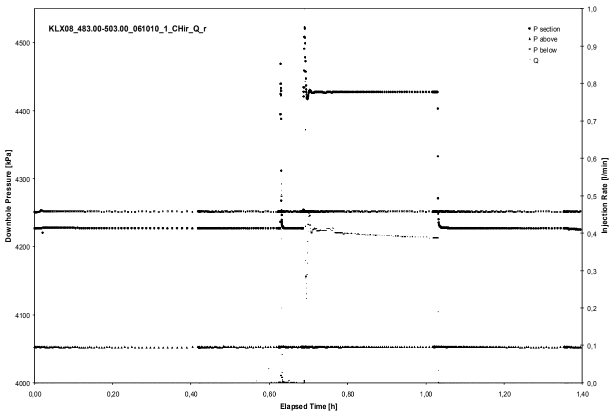
Comments:

The recommended transmissivity of 8.7E-6 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 5E-6 m2/s to 1E-5 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,054.0 kPa.

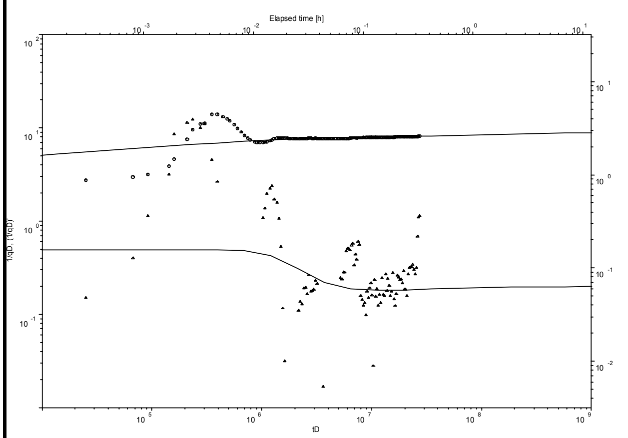
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 01:14
Test section from - to (m):	483.00-503.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

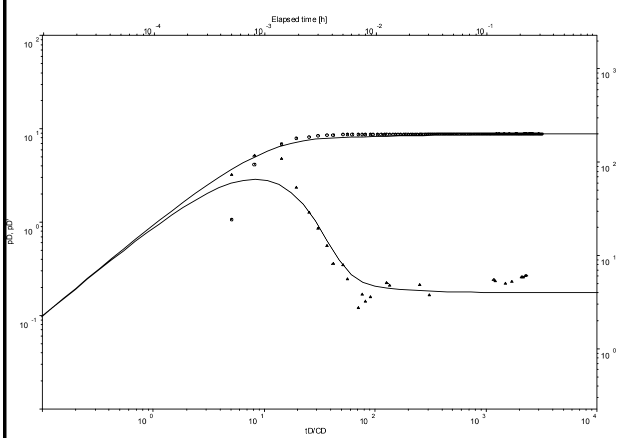
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4227		
p_i (kPa) =	4227		
p_p(kPa) =	4427	p_F (kPa) =	4227
Q_p (m^3/s)=	6.45E-06		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13.4		
Derivative fact.=	0.08	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	3.2E-07		
T_M (m^2/s)=	3.3E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	5.78	dt_1 (min) =	1.07
dt_2 (min) =	16.13	dt_2 (min) =	8.81
T (m^2/s) =	1.0E-06	T (m^2/s) =	1.3E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	5.0E-08	K_s (m/s) =	6.5E-08
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.0E-10
C_D (-) =	NA	C_D (-) =	1.1E-02
ξ (-) =	2.2	ξ (-) =	4.6
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	5.78	C (m^3/Pa) =	1.0E-10
dt_2 (min) =	16.13	C_D (-) =	1.1E-02
T_T (m^2/s) =	1.0E-06	ξ (-) =	2.2
S (-) =	1.0E-06		
K_s (m/s) =	6.5E-08		
S_s (1/m) =	5.0E-08		

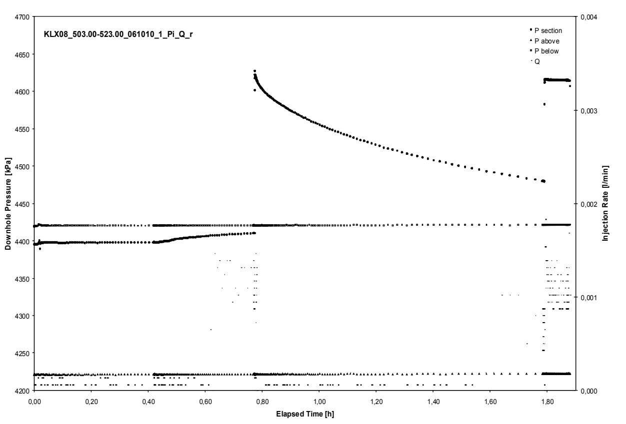
Comments:

The recommended transmissivity of 1.0E-6 m2/s was derived from the analysis of the CHi phase (outer zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 7E-7 m2/s to 4E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 4,226.9 kPa.

Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	Pi
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 06:13
Test section from - to (m):	503.00-523.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

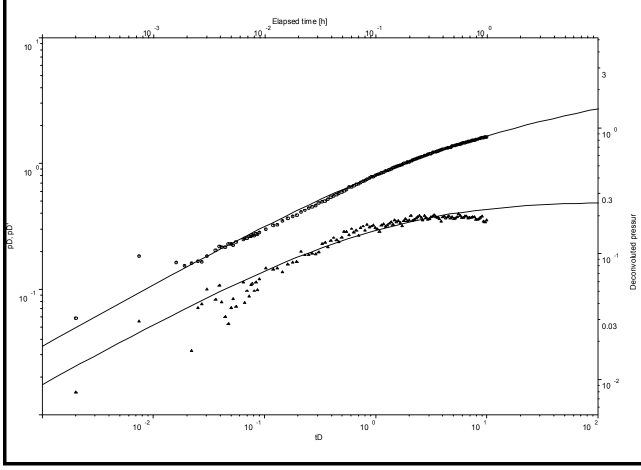
Linear plot Q and p



Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4396		
p_i (kPa) =	4410		
p_p(kPa) =	4627	p_F (kPa) =	4479
Q_p (m^3/s)=	#NV		
tp (s) =	10	t_F (s) =	3660
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	13.7		
Derivative fact.=	NA	Derivative fact.=	0.07
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	#NV
dt_2 (min) =	NA	dt_2 (min) =	#NV
T (m^2/s) =	NA	T (m^2/s) =	4.9E-11
S (-) =	NA	S (-) =	1.0E-06
K_s (m/s) =	NA	K_s (m/s) =	2.5E-12
S_s (1/m) =	NA	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5.9E-11
C_D (-) =	NA	C_D (-) =	6.5E-03
ξ (-) =	NA	ξ (-) =	-1.3
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	5.9E-11
dt_2 (min) =	NA	C_D (-) =	6.5E-03
T_T (m^2/s) =	4.9E-11	ξ (-) =	-1.3
S (-) =	1.0E-06		
K_s (m/s) =	2.5E-12		
S_s (1/m) =	5.0E-08		

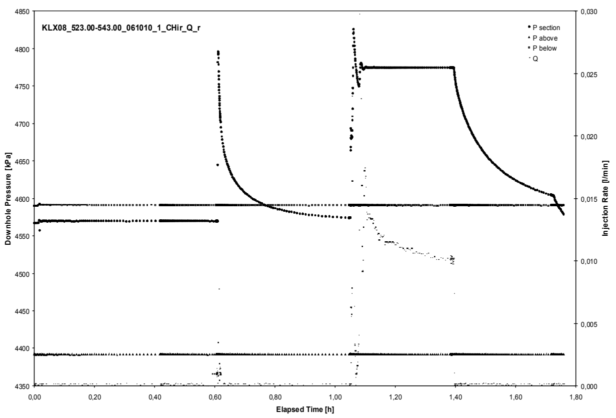
Comments:

The recommended transmissivity of 4.9E11 m2/s was derived from the analysis of the Pi phase. The confidence range for the interval transmissivity is estimated to be 1E-11 to 9E-11 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

Test Summary Sheet

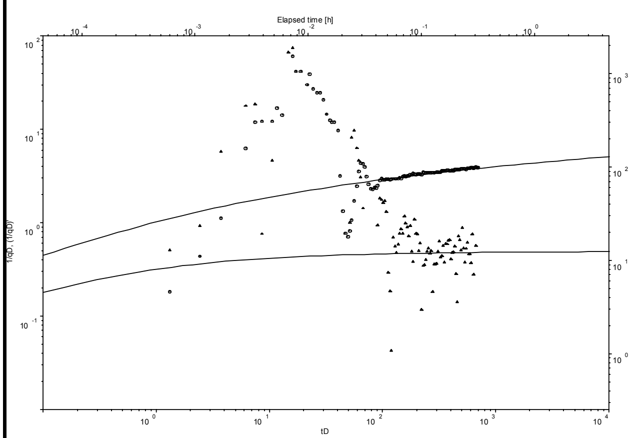
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 08:37
Test section from - to (m):	523.00-543.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

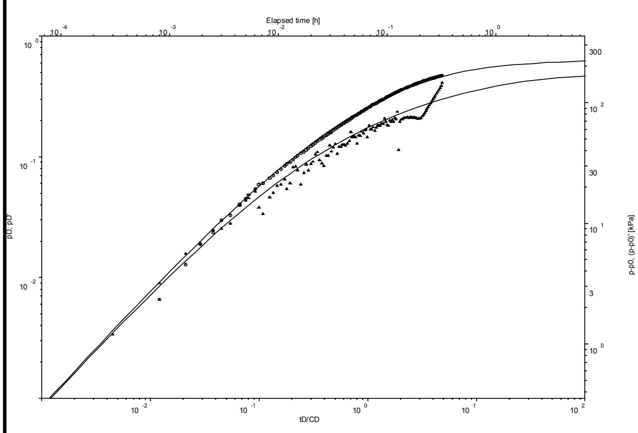


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4567		
p_i (kPa) =	4574		
p_p(kPa) =	4775	p_F (kPa) =	4604
Q_p (m^3/s)=	1.70E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14.0		
Derivative fact.=	0.07	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	8.3E-09		
T_M (m^2/s)=	8.7E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3.52	dt_1 (min) =	#NV
dt_2 (min) =	17.54	dt_2 (min) =	#NV
T (m^2/s) =	5.1E-09	T (m^2/s) =	8.8E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.6E-10	K_s (m/s) =	4.4E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.4E-10
C_D (-) =	NA	C_D (-) =	1.5E-02
ξ (-) =	-0.9	ξ (-) =	-3.1
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	3.52	C (m^3/Pa) =	1.4E-10
dt_2 (min) =	17.54	C_D (-) =	1.5E-02
T_T (m^2/s) =	5.1E-09	ξ (-) =	-0.9
S (-) =	1.0E-06		
K_s (m/s) =	2.6E-10		
S_s (1/m) =	5.0E-08		

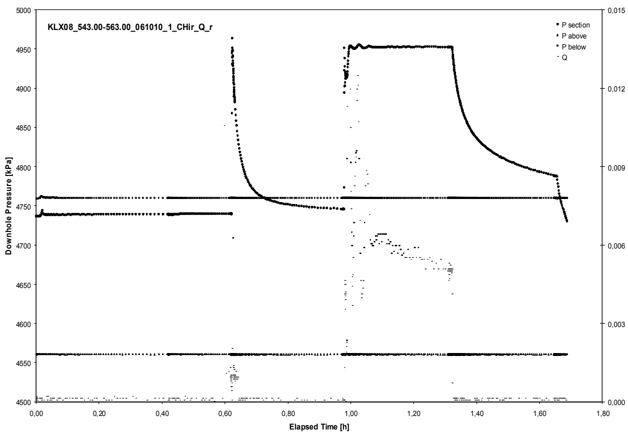
Comments:

The recommended transmissivity of 5.1E-9 m2/s was derived from the analysis of the CHi phase, which shows a horizontal stabilisation. The confidence range for the interval transmissivity is estimated to be 1E-9 m2/s to 9E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

Test Summary Sheet

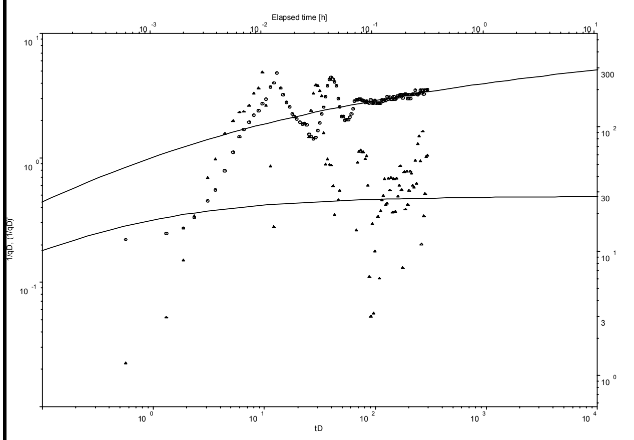
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 10:59
Test section from - to (m):	543.00-563.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

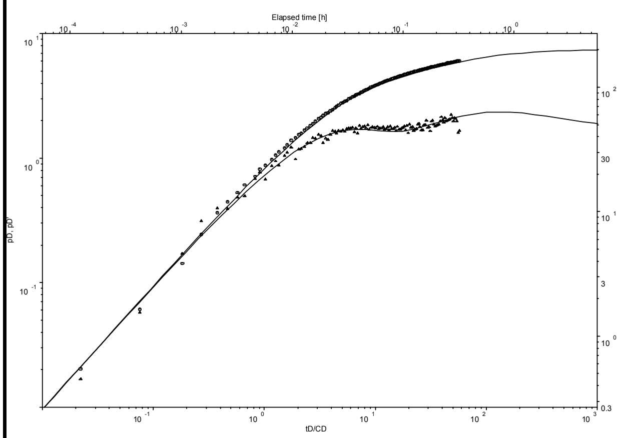


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	4737		
p_i (kPa) =	4746		
p_p(kPa) =	4952	p_F (kPa) =	4788
Q_p (m^3/s)=	8.33E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14.2		
Derivative fact.=	0.13	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	4.0E-09		
T_M (m^2/s)=	4.2E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	5.93	dt_1 (min) =	1.57
dt_2 (min) =	18.51	dt_2 (min) =	6.34
T (m^2/s) =	2.2E-09	T (m^2/s) =	6.6E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.1E-10	K_s (m/s) =	3.3E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8.6E-11
C_D (-) =	NA	C_D (-) =	9.5E-03
ξ (-) =	-0.9	ξ (-) =	1.2
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	1.57	C (m^3/Pa) =	8.6E-11
dt_2 (min) =	6.34	C_D (-) =	9.5E-03
T_T (m^2/s) =	6.6E-09	ξ (-) =	1.2
S (-) =	1.0E-06		
K_s (m/s) =	3.3E-10		
S_s (1/m) =	5.0E-08		

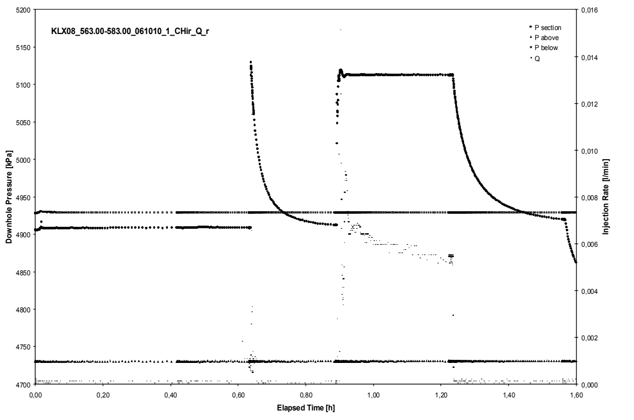
Comments:

The recommended transmissivity of 6.6E-9 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the best data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1E-9 m2/s to 9E-9 m2/s. The static pressure could not be extrapolated due to the low transmissivity.

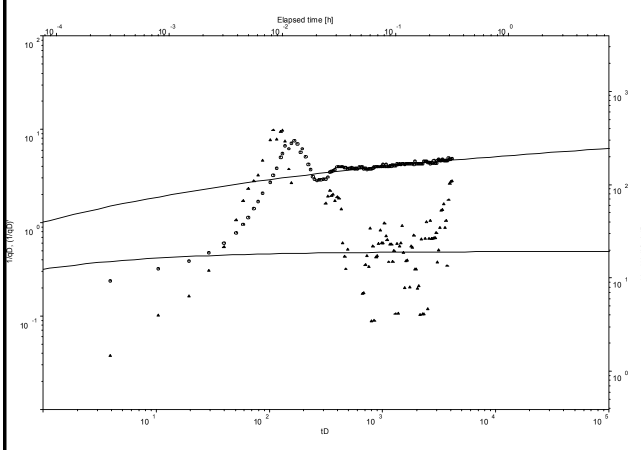
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 13:25
Test section from - to (m):	563.00-583.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

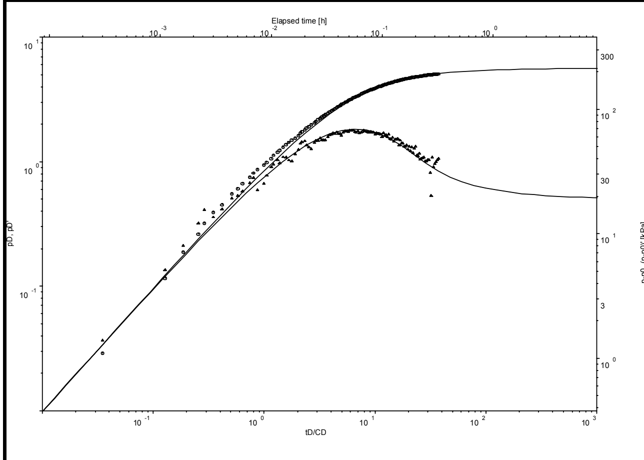
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	4906		
p_i (kPa) =	4912		
p_p(kPa) =	5113	p_F (kPa) =	4920
Q_p (m^3/s)=	9.00E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14.5		
Derivative fact.=	0.1	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	4.4E-09		
T_M (m^2/s)=	4.6E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.03	dt_1 (min) =	#NV
dt_2 (min) =	16.24	dt_2 (min) =	#NV
T (m^2/s) =	3.3E-09	T (m^2/s) =	4.7E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.7E-10	K_s (m/s) =	2.4E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	9.3E-11
C_D (-) =	NA	C_D (-) =	1.0E-02
ξ (-) =	0.2	ξ (-) =	1.2
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	9.3E-11
dt_2 (min) =	NA	C_D (-) =	1.0E-02
T_T (m^2/s) =	4.7E-09	ξ (-) =	1.2
S (-) =	1.0E-06		
K_s (m/s) =	2.4E-10		
S_s (1/m) =	5.0E-08		

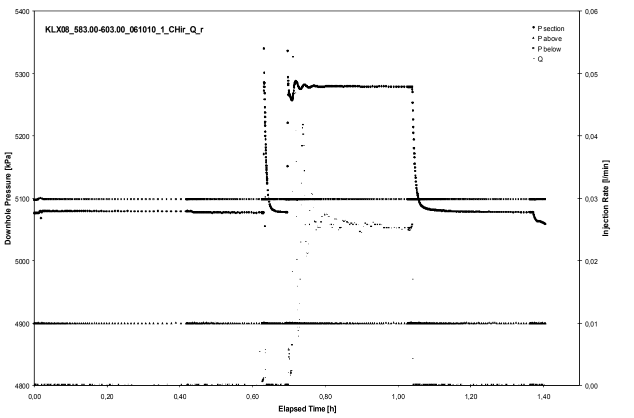
Comments:

The recommended transmissivity of 4.7E-9 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1E-9 m2/s to 9E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

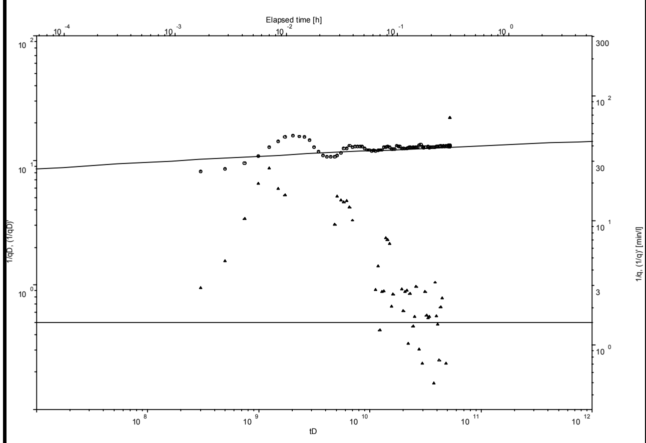
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 15:33
Test section from - to (m):	583.00-603.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

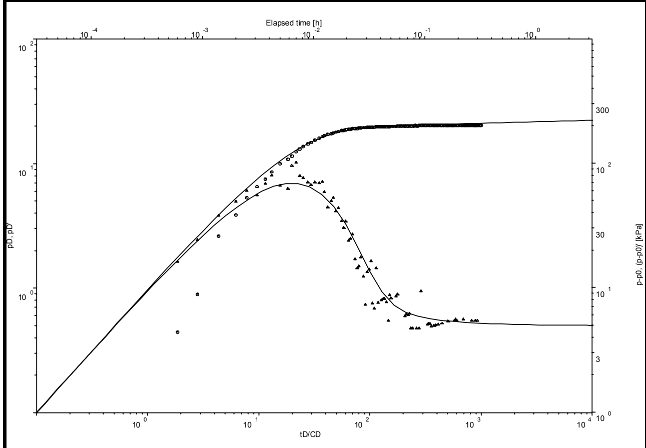
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5076		
p_i (kPa) =	5077		
p_p(kPa) =	5278	p_F (kPa) =	5077
Q_p (m^3/s)=	4.17E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	14.7		
Derivative fact.=	0.09	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	2.0E-08		
T_M (m^2/s)=	2.1E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4.26	dt_1 (min) =	3.32
dt_2 (min) =	14.53	dt_2 (min) =	13.85
T (m^2/s) =	4.3E-08	T (m^2/s) =	6.9E-08
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.1E-09	K_s (m/s) =	3.4E-09
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5.1E-11
C_D (-) =	NA	C_D (-) =	5.6E-03
ξ (-) =	7.2	ξ (-) =	15.3
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	3.32	C (m^3/Pa) =	5.1E-11
dt_2 (min) =	13.85	C_D (-) =	5.6E-03
T_T (m^2/s) =	6.9E-08	ξ (-) =	15.3
S (-) =	1.0E-06		
K_s (m/s) =	1.4E-08		
S_s (1/m) =	2.0E-07		

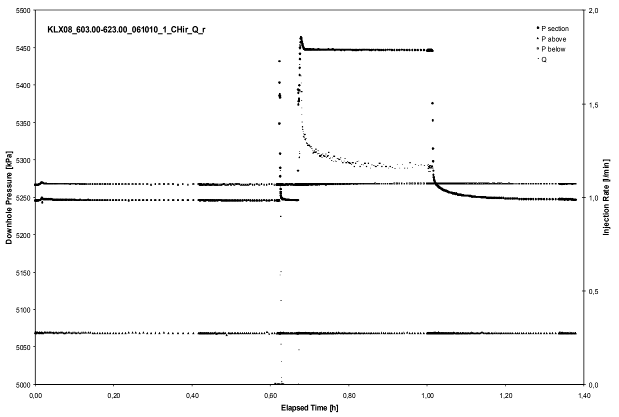
Comments:

The recommended transmissivity of 6.9E-8 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1E-8 m2/s to 1E-7 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,074.5 kPa.

Test Summary Sheet

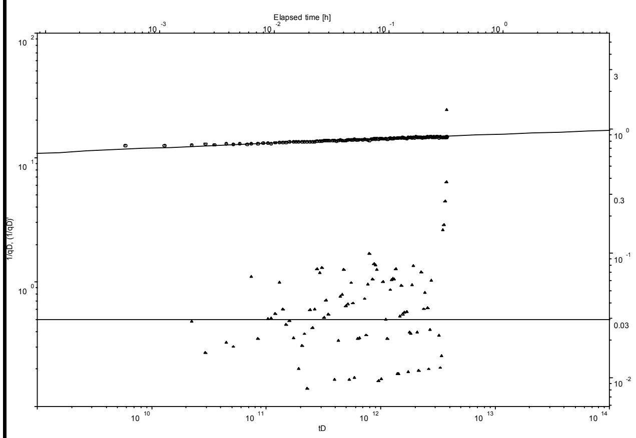
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 17:32
Test section from - to (m):	603.00-623.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

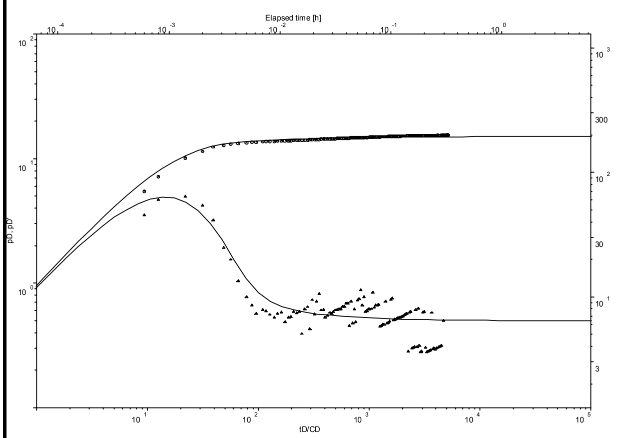


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5245		
p_i (kPa) =	5246		
p_p(kPa) =	5446	p_F (kPa) =	5247
Q_p (m^3/s)=	1.93E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	15.0		
Derivative fact.=	0.05	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	9.5E-07		
T_M (m^2/s)=	9.9E-07		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.53	dt_1 (min) =	0.62
dt_2 (min) =	13.15	dt_2 (min) =	17.95
T (m^2/s) =	2.2E-06	T (m^2/s) =	2.4E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.1E-07	K_s (m/s) =	1.2E-07
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	3.5E-10
C_D (-) =	NA	C_D (-) =	3.9E-02
ξ (-) =	7.3	ξ (-) =	8.5
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	0.62	C (m^3/Pa) =	3.5E-10
dt_2 (min) =	17.95	C_D (-) =	3.9E-02
T_T (m^2/s) =	2.4E-06	ξ (-) =	8.5
S (-) =	1.0E-06		
K_s (m/s) =	4.8E-07		
S_s (1/m) =	2.0E-07		

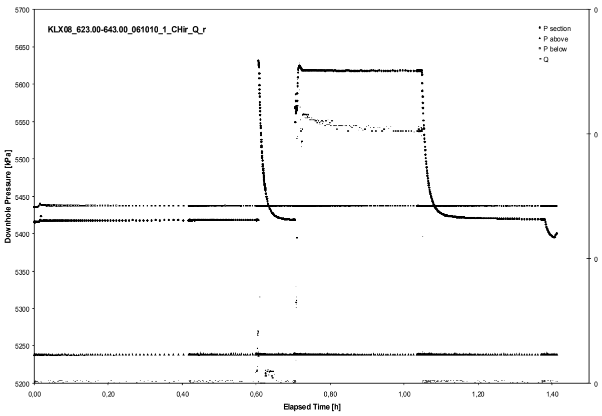
Comments:

The recommended transmissivity of 2.4E-6 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 7E-7 m2/s to 5E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,241.9 kPa.

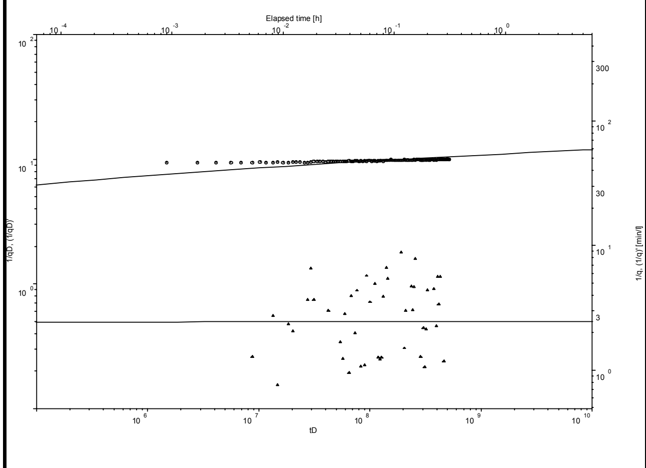
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 19:25
Test section from - to (m):	623.00-643.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

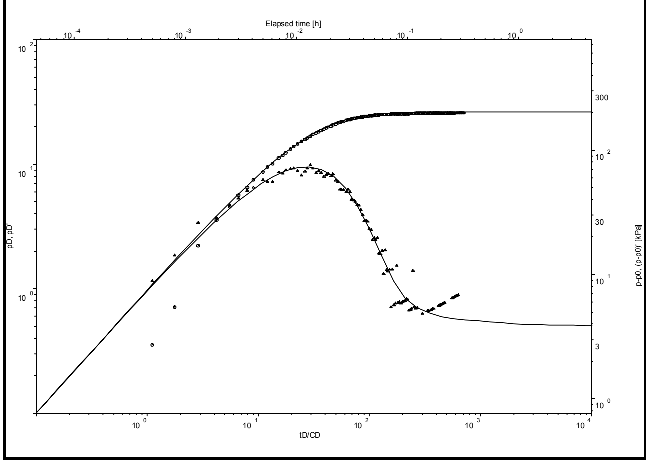
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5415		
p_i (kPa) =	5418		
p_p(kPa) =	5618	p_F (kPa) =	5418
Q_p (m^3/s)=	3.33E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	15.3		
Derivative fact.=	0.02	Derivative fact.=	0.03
Results		**Results**	
Q/s (m^2/s)=	1.6E-08		
T_M (m^2/s)=	1.7E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.67	dt_1 (min) =	6.39
dt_2 (min) =	14.57	dt_2 (min) =	16.69
T (m^2/s) =	2.6E-08	T (m^2/s) =	7.1E-08
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.3E-09	K_s (m/s) =	3.6E-09
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	7.4E-11
C_D (-) =	NA	C_D (-) =	8.2E-03
ξ (-) =	5.1	ξ (-) =	20.8
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.

dt_1 (min) =	6.39	C (m^3/Pa) =	7.4E-11
dt_2 (min) =	16.69	C_D (-) =	8.2E-03
T_T (m^2/s) =	7.1E-08	ξ (-) =	20.8
S (-) =	1.0E-06		
K_s (m/s) =	3.6E-09		
S_s (1/m) =	5.0E-08		

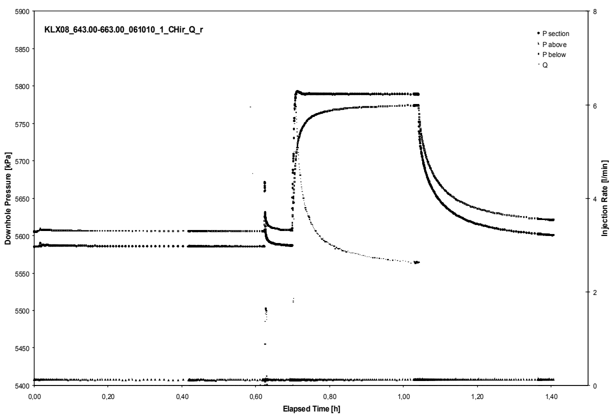
Comments:

The recommended transmissivity of 7.1E-8 m2/s was derived from the analysis of the CHir phase, which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1E-8 m2/s to 1E-7 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,413.0 kPa.

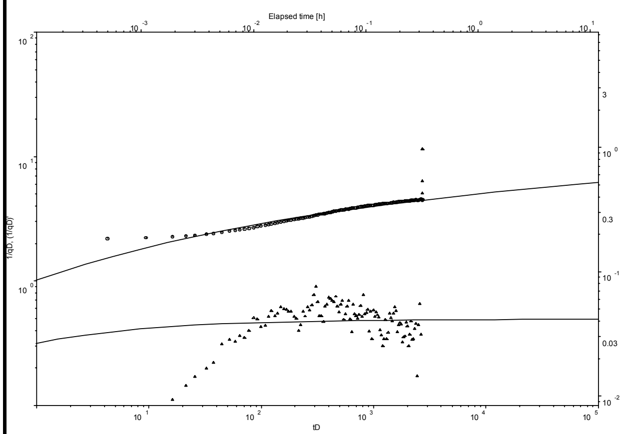
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 21:30
Test section from - to (m):	643.00-663.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

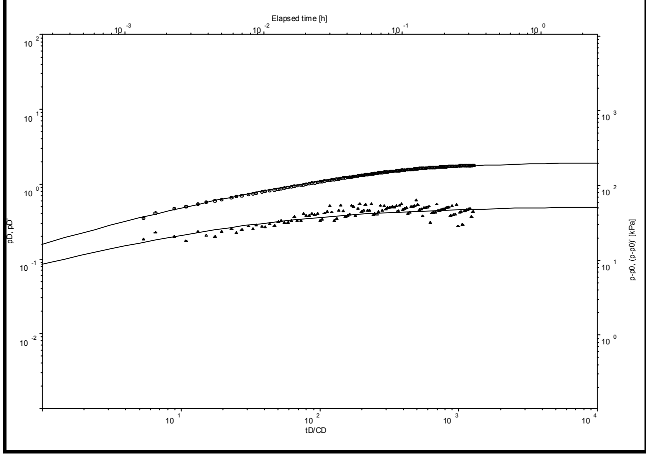
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	5585		
p_i (kPa) =	5587		
p_p(kPa) =	5789	p_F (kPa) =	5600
Q_p (m^3/s)=	4.37E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	15.5		
Derivative fact.=	0.03	Derivative fact.=	0.01
Results		**Results**	
Q/s (m^2/s)=	2.1E-06		
T_M (m^2/s)=	2.2E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.83	dt_1 (min) =	1.67
dt_2 (min) =	17.71	dt_2 (min) =	18.44
T (m^2/s) =	1.5E-06	T (m^2/s) =	7.4E-07
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	7.5E-08	K_s (m/s) =	3.7E-08
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.4E-10
C_D (-) =	NA	C_D (-) =	4.8E-02
ξ (-) =	-3.1	ξ (-) =	-4.8
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	0.83	C (m^3/Pa) =	4.4E-10
dt_2 (min) =	17.71	C_D (-) =	4.8E-02
T_T (m^2/s) =	1.5E-06	ξ (-) =	-3.1
S (-) =	1.0E-06		
K_s (m/s) =	7.5E-08		
S_s (1/m) =	5.0E-08		

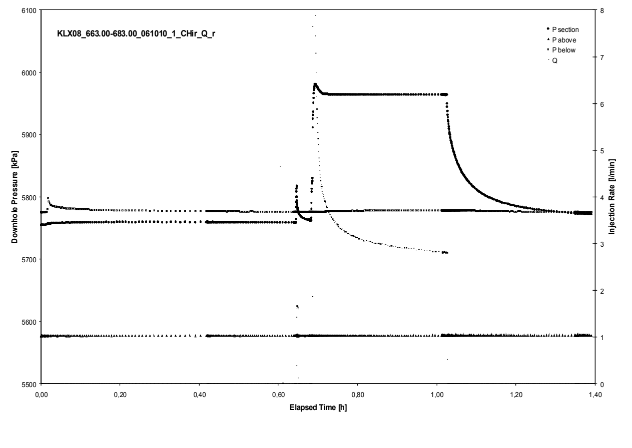
Comments:

The recommended transmissivity of 1.5E-6 m2/s was derived from the analysis of the CHi phase, which shows the slight better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 7E-7 m2/s to 3E-6 m2/s (This range includes the derived transmissivity from the CHir phase). The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,583.9 kPa.

Test Summary Sheet

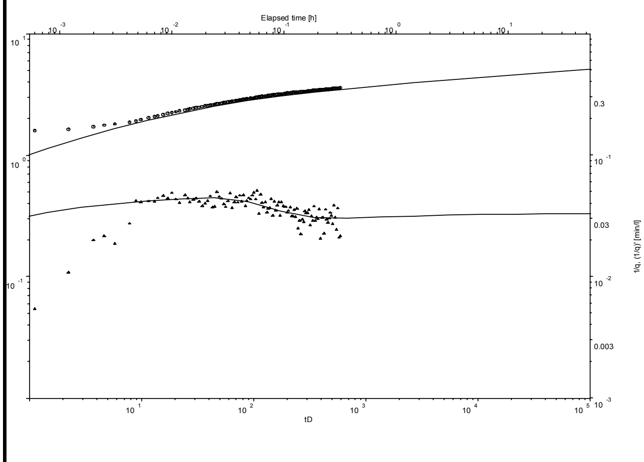
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061010 23:25
Test section from - to (m):	663.00-683.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

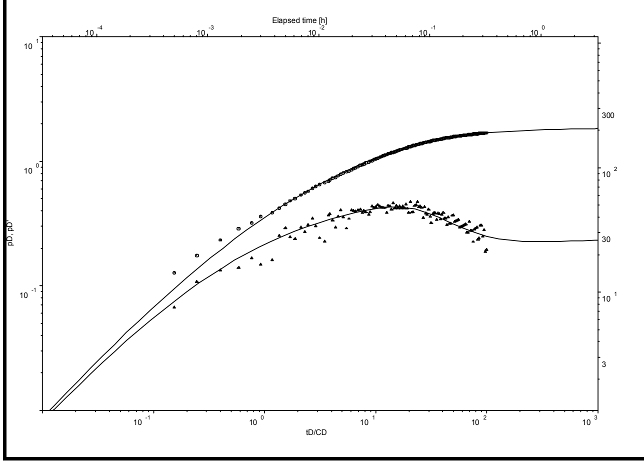


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5755		
p_i (kPa) =	5764		
p_p(kPa) =	5964	p_F (kPa) =	5774
Q_p (m^3/s)=	4.68E-05		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	15.8		
Derivative fact.=	0.06	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	2.3E-06		
T_M (m^2/s)=	2.4E-06		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.31	dt_1 (min) =	#NV
dt_2 (min) =	2.80	dt_2 (min) =	#NV
T (m^2/s) =	1.3E-06	T (m^2/s) =	1.5E-06
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	6.6E-08	K_s (m/s) =	7.5E-08
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	5.5E-09
C_D (-) =	NA	C_D (-) =	6.1E-01
ξ (-) =	-3.7	ξ (-) =	-5.0
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	0.31	C (m^3/Pa) =	5.5E-09
dt_2 (min) =	2.80	C_D (-) =	6.1E-01
T_T (m^2/s) =	1.3E-06	ξ (-) =	-3.7
S (-) =	1.0E-06		
K_s (m/s) =	6.6E-08		
S_s (1/m) =	5.0E-08		

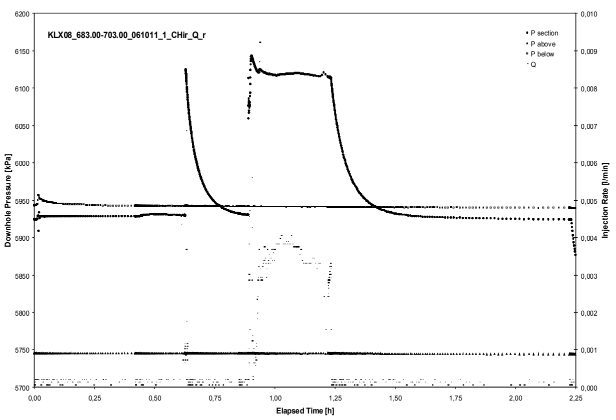
Comments:

The recommended transmissivity of 1.3E-6 m2/s was derived from the analysis of the CHi phase (inner zone), which shows the clearest horizontal stabilization. The confidence range for the interval transmissivity is estimated to be 7E-7 m2/s to 3E-6 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,747.7 kPa.

Test Summary Sheet

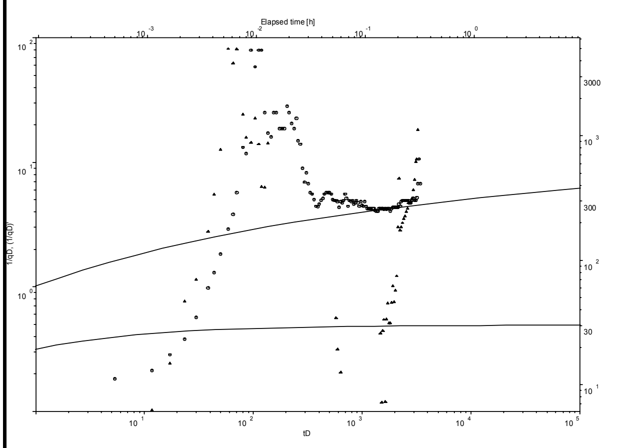
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 01:25
Test section from - to (m):	683.00-703.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

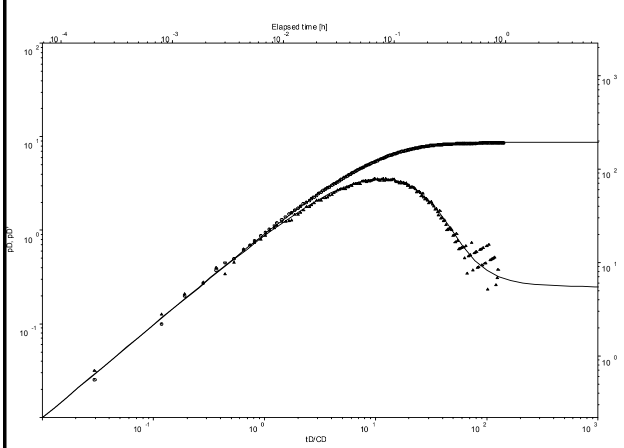


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	5925		
p_i (kPa) =	5931		
p_p(kPa) =	6114	p_F (kPa) =	5925
Q_p (m^3/s)=	5.50E-08		
tp (s) =	1200	t_F (s) =	3600
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	16.0		
Derivative fact.=	0.19	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	2.9E-09		
T_M (m^2/s)=	3.1E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	#NV	dt_1 (min) =	3.07
dt_2 (min) =	#NV	dt_2 (min) =	6.86
T (m^2/s) =	2.3E-09	T (m^2/s) =	4.6E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.2E-10	K_s (m/s) =	2.3E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	7.2E-11
C_D (-) =	NA	C_D (-) =	7.9E-03
ξ (-) =	0.3	ξ (-) =	4.7
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	3.07	C (m^3/Pa) =	7.2E-11
dt_2 (min) =	6.86	C_D (-) =	7.9E-03
T_T (m^2/s) =	4.6E-09	ξ (-) =	4.7
S (-) =	1.0E-06		
K_s (m/s) =	2.3E-10		
S_s (1/m) =	5.0E-08		

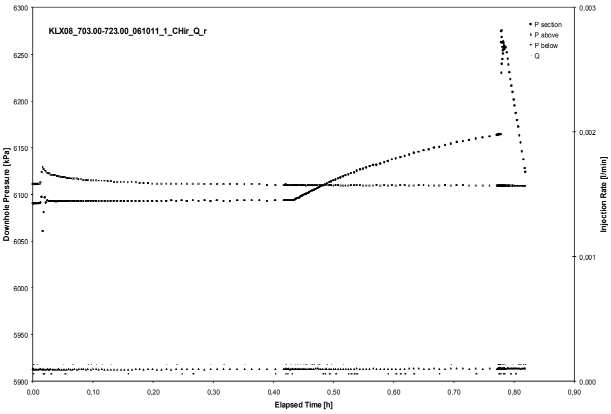
Comments:

The recommended transmissivity of 4.6E-9 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 1E-9 m2/s to 9E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth, was derived from the CHir phase using straight line extrapolation in the Horner plot to a value of 5,921.1 kPa.

Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 05:22
Test section from - to (m):	703.00-723.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6091		
p_i (kPa) =	NA		
p_p(kPa) =	NA	p_F (kPa) =	NA
Q_p (m^3/s)=	NA		
tp (s) =	NA	t_F (s) =	NA
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	16.4		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	1.00E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period

Not Analysed

Selected representative parameters.

dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	1.00E-11	ξ (-) =	NA
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

Log-Log plot incl. derivatives- recovery period

Not Analysed

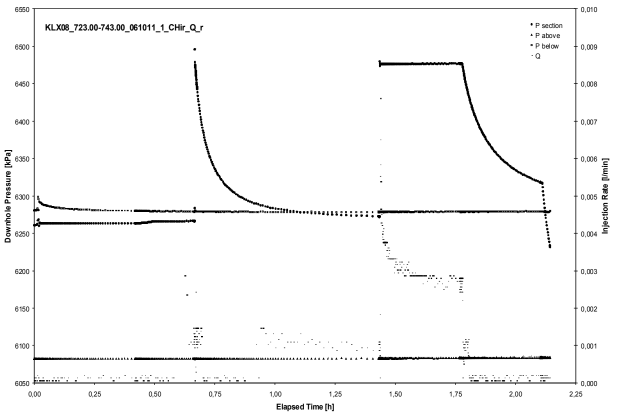
Comments:

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1.0•10-11 m2/s.

Test Summary Sheet

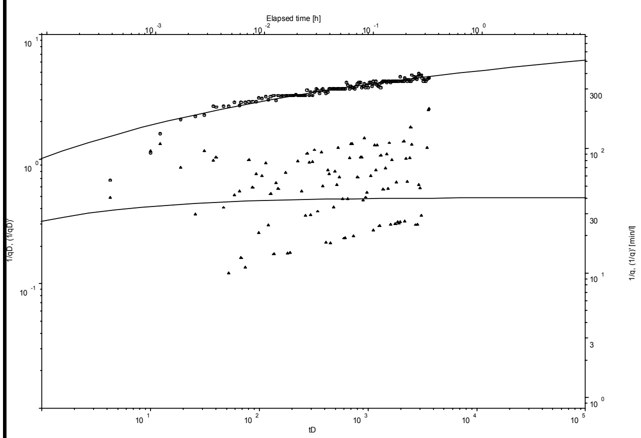
Project:	Oskarshamn site investigation	Test type:[1]	Chir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 06:43
Test section from - to (m):	723.00-743.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

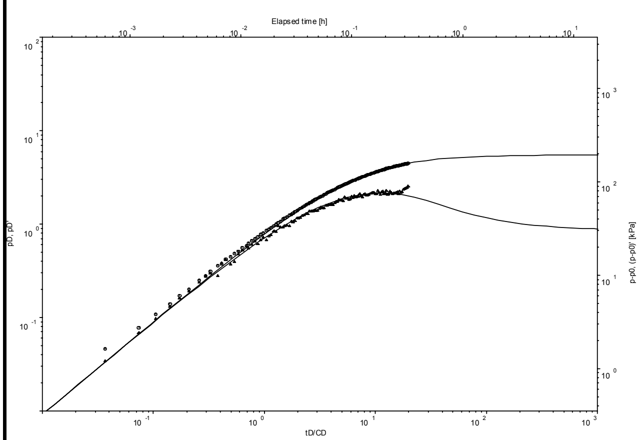


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6261		
p_i (kPa) =	6272		
p_p(kPa) =	6477	p_F (kPa) =	6317
Q_p (m^3/s)=	4.50E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	16.6		
Derivative fact.=	0.07	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	2.2E-09		
T_M (m^2/s)=	2.3E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	0.46	dt_1 (min) =	6.32
dt_2 (min) =	15.13	dt_2 (min) =	16.62
T (m^2/s) =	1.6E-09	T (m^2/s) =	2.2E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	8.0E-11	K_s (m/s) =	1.1E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	8.4E-11
C_D (-) =	NA	C_D (-) =	9.3E-03
ξ (-) =	0.5	ξ (-) =	1.2
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	6.32	C (m^3/Pa) =	8.4E-11
dt_2 (min) =	16.62	C_D (-) =	9.3E-03
T_T (m^2/s) =	2.2E-09	ξ (-) =	1.2
S (-) =	1.0E-06		
K_s (m/s) =	1.1E-10		
S_s (1/m) =	5.0E-08		

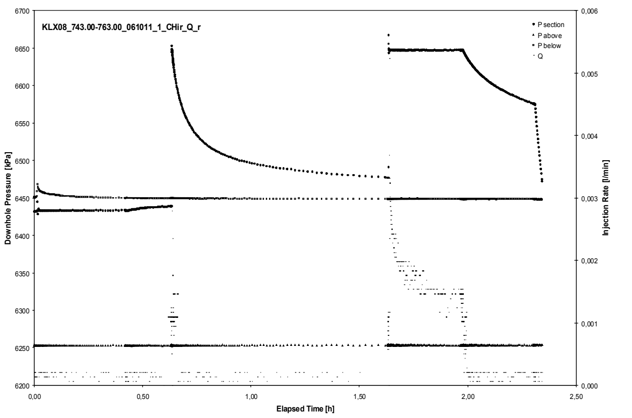
Comments:

The recommended transmissivity of 2.2E-9 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 8E-10 m2/s to 5E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

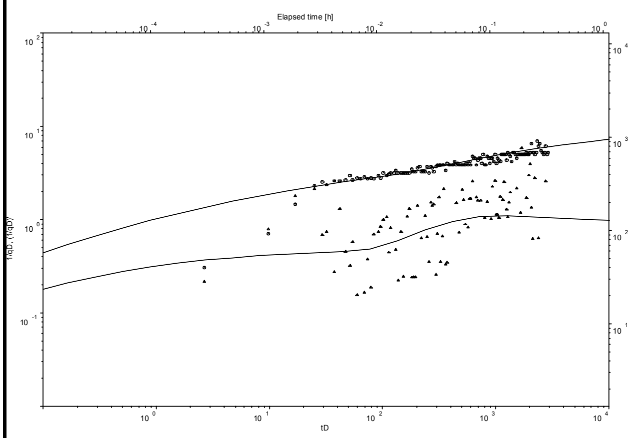
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 09:27
Test section from - to (m):	743.00-763.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

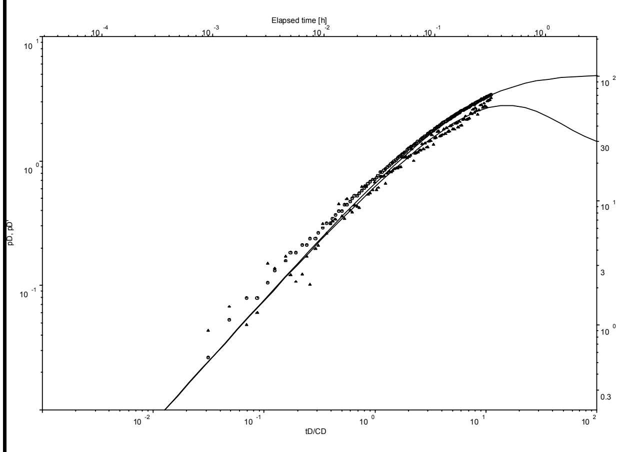
Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6432		
p_i (kPa) =	6439		
p_p(kPa) =	6646	p_F (kPa) =	6575
Q_p (m^3/s)=	2.33E-08		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	16.9		
Derivative fact.=	0.08	Derivative fact.=	0.04
Results		**Results**	
Q/s (m^2/s)=	1.1E-09		
T_M (m^2/s)=	1.2E-09		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	4.64	dt_1 (min) =	#NV
dt_2 (min) =	14.15	dt_2 (min) =	#NV
T (m^2/s) =	4.8E-10	T (m^2/s) =	2.2E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	2.4E-11	K_s (m/s) =	1.1E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	1.5E-10
C_D (-) =	NA	C_D (-) =	1.7E-02
ξ (-) =	0.7	ξ (-) =	0.9
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Selected representative parameters.			
dt_1 (min) =	#NV	C (m^3/Pa) =	1.5E-10
dt_2 (min) =	#NV	C_D (-) =	1.7E-02
T_T (m^2/s) =	2.2E-09	ξ (-) =	0.9
S (-) =	1.0E-06		
K_s (m/s) =	1.1E-10		
S_s (1/m) =	5.0E-08		

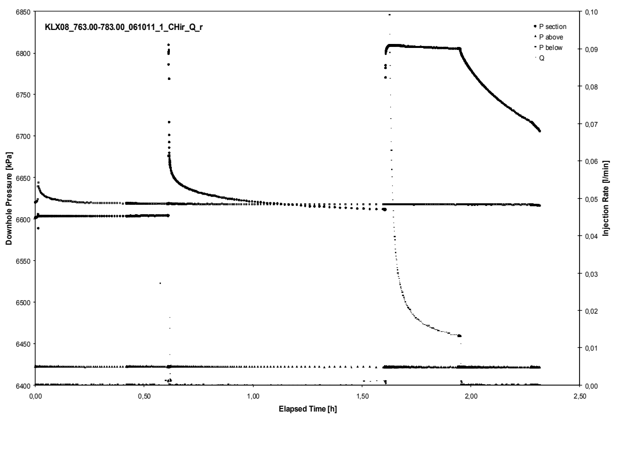
Comments:

The recommended transmissivity of 2.2E-9 m2/s was derived from the analysis of the CHir phase (inner zone), which shows the better data and derivative quality. The confidence range for the interval transmissivity is estimated to be 8E-10 m2/s to 5E-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

Test Summary Sheet

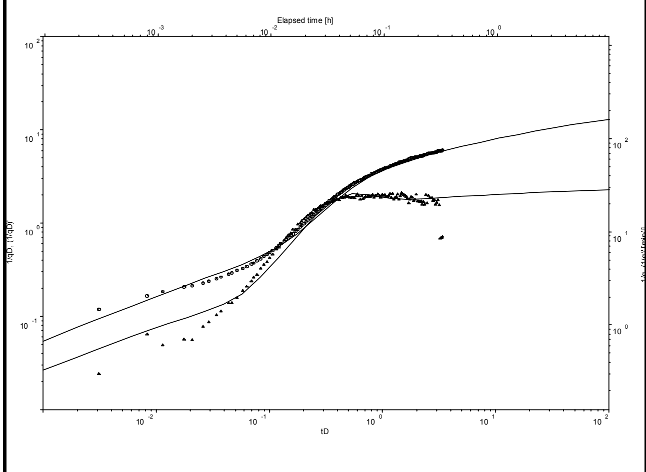
Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 12:33
Test section from - to (m):	763.00-783.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

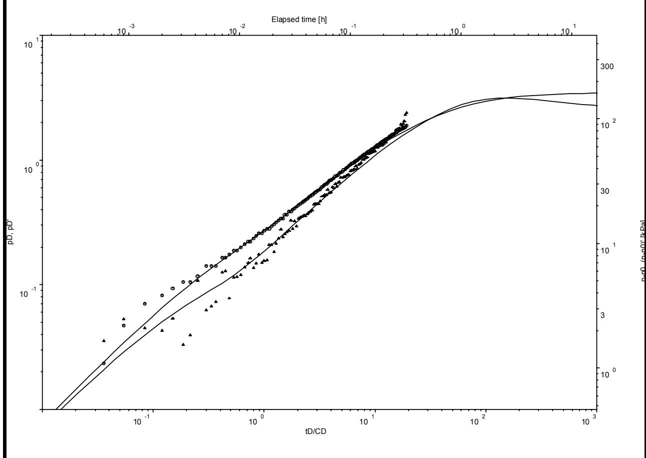


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6603		
p_i (kPa) =	6604		
p_p(kPa) =	6805	p_F (kPa) =	6713
Q_p (m^3/s)=	2.17E-07		
tp (s) =	1200	t_F (s) =	1200
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17.2		
Derivative fact.=	0.07	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	1.1E-08		
T_M (m^2/s)=	1.1E-08		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	2.82	dt_1 (min) =	#NV
dt_2 (min) =	17.44	dt_2 (min) =	#NV
T (m^2/s) =	2.1E-09	T (m^2/s) =	3.5E-09
S (-) =	1.0E-06	S (-) =	1.0E-06
K_s (m/s) =	1.1E-10	K_s (m/s) =	1.8E-10
S_s (1/m) =	5.0E-08	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	6.8E-10
C_D (-) =	NA	C_D (-) =	7.5E-02
ξ (-) =	-3.9	ξ (-) =	-3.9
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	2.82	C (m^3/Pa) =	6.8E-10
dt_2 (min) =	17.44	C_D (-) =	7.5E-02
T_T (m^2/s) =	2.1E-09	ξ (-) =	-3.9
S (-) =	1.0E-06		
K_s (m/s) =	4.2E-10		
S_s (1/m) =	2.0E-07		

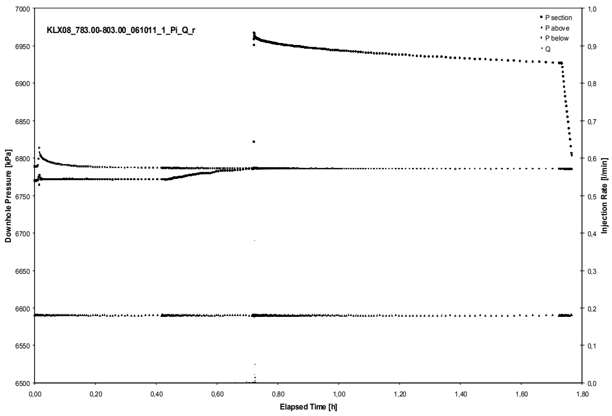
Comments:

The recommended transmissivity of 2.1•10-9 m2/s was derived from the analysis of the CHi phase, which shows the clearest horizontal stabilization. The confidence range for the interval transmissivity is estimated to be 9.0•10-10 m2/s to 9.0•10-9 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the low transmissivity.

Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	Pi
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 15:28
Test section from - to (m):	783.00-803.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

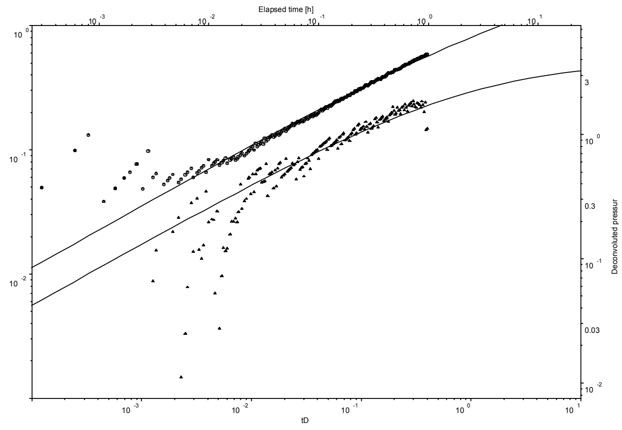


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	6770		
p_i (kPa) =	6786		
p_p(kPa) =	6959	p_F (kPa) =	6927
Q_p (m^3/s)=	#NV		
tp (s) =	10	t_F (s) =	3630
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17.5		
Derivative fact.=	NA	Derivative fact.=	0.06
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	#NV
dt_2 (min) =	NA	dt_2 (min) =	#NV
T (m^2/s) =	NA	T (m^2/s) =	2.8E-12
S (-) =	NA	S (-) =	1.0E-06
K_s (m/s) =	NA	K_s (m/s) =	1.4E-13
S_s (1/m) =	NA	S_s (1/m) =	5.0E-08
C (m^3/Pa) =	NA	C (m^3/Pa) =	4.8E-11
C_D (-) =	NA	C_D (-) =	5.3E-03
ξ (-) =	NA	ξ (-) =	-1.4
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA

Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period



Selected representative parameters.

dt_1 (min) =	#NV	C (m^3/Pa) =	4.8E-11
dt_2 (min) =	#NV	C_D (-) =	5.3E-03
T_T (m^2/s) =	2.8E-12	ξ (-) =	-1.4
S (-) =	1.0E-06		
K_s (m/s) =	1.4E-13		
S_s (1/m) =	5.0E-08		

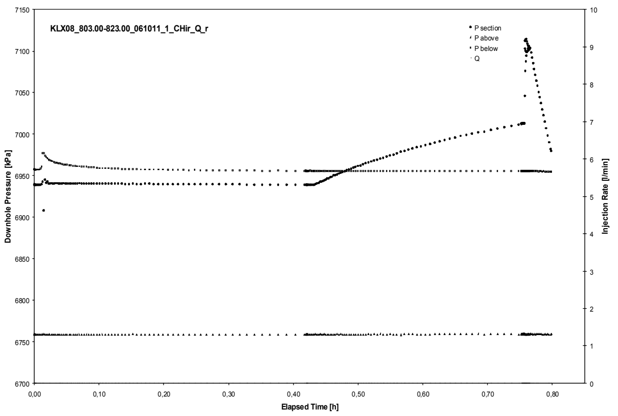
Comments:

The recommended transmissivity of 2.3E-12 m2/s was derived from the analysis of the Pi phase. The confidence range for the interval transmissivity is estimated to be 9E-13 to 5E-12 m2/s. The flow dimension displayed during the test is 2. The static pressure could not be extrapolated due to the very low transmissivity.

Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CHir
Area:	Laxemar	Test no:	1
Borehole ID:	KLX08	Test start:	061011 17:47
Test section from - to (m):	803.00-823.00 m	Responsible for test execution:	Reinder van der Wall Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.076	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period

Not Analysed

Log-Log plot incl. derivatives- recovery period

Not Analysed

Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	6939		
p_i (kPa) =	NA		
p_p(kPa) =	NA	p_F (kPa) =	NA
Q_p (m^3/s)=	NA		
tp (s) =	NA	t_F (s) =	NA
S el S^* (-)=	1.00E-06	S el S^* (-)=	1.00E-06
EC_w (mS/m)=			
$Temp_w$(gr C)=	17.7		
Derivative fact.=	NA	Derivative fact.=	NA
Results		**Results**	
Q/s (m^2/s)=	NA		
T_M (m^2/s)=	NA		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	NA	dt_1 (min) =	NA
dt_2 (min) =	NA	dt_2 (min) =	NA
T (m^2/s) =	1.0E-11	T (m^2/s) =	NA
S (-) =	NA	S (-) =	NA
K_s (m/s) =	NA	K_s (m/s) =	NA
S_s (1/m) =	NA	S_s (1/m) =	NA
C (m^3/Pa) =	NA	C (m^3/Pa) =	NA
C_D (-) =	NA	C_D (-) =	NA
ξ (-) =	NA	ξ (-) =	NA
T_{GRF}(m^2/s) =	NA	T_{GRF}(m^2/s) =	NA
S_{GRF}(-) =	NA	S_{GRF}(-) =	NA
D_{GRF} (-) =	NA	D_{GRF} (-) =	NA
Selected representative parameters.			
dt_1 (min) =	NA	C (m^3/Pa) =	NA
dt_2 (min) =	NA	C_D (-) =	NA
T_T (m^2/s) =	1.0E-11	ξ (-) =	
S (-) =	NA		
K_s (m/s) =	NA		
S_s (1/m) =	NA		

Comments:

Based on the test response (prolonged packer compliance) the interval transmissivity is lower than 1.0•10-11 m2/s.

APPENDIX 4

Nomenclature

Character	SICADA designation	Explanation	Dimension	Unit
Variables, constants				
A_w		Horizontal area of water surface in open borehole, not including area of signal cables, etc.	$[L^2]$	m^2
b		Aquifer thickness (Thickness of 2D formation)	[L]	m
B		Width of channel	[L]	m
L		Corrected borehole length	[L]	m
L_0		Uncorrected borehole length	[L]	m
L_p		Point of application for a measuring section based on its centre point or centre of gravity for distribution of transmissivity in the measuring section.	[L]	m
L_w		Test section length.	[L]	m
dL		Step length, Positive Flow Log - overlapping flow logging. (step length, PFL)	[L]	m
r		Radius	[L]	m
r_w		Borehole, well or soil pipe radius in test section.	[L]	m
r_{we}		Effective borehole, well or soil pipe radius in test section. (Consideration taken to skin factor)	[L]	m
r_s		Distance from test section to observation section, the shortest distance.	[L]	m
r_t		Distance from test section to observation section, the **interpreted** shortest distance via conductive structures.	[L]	m
r_D		Dimensionless radius, $r_D=r/r_w$	-	-
z		Level above reference point	[L]	m
z_r		Level for reference point on borehole	[L]	m
z_{wu}		Level for test section (section that is being flowed), upper limitation	[L]	m
z_{wl}		Level for test section (section that is being flowed), lower limitation	[L]	m
z_{ws}		Level for sensor that measures response in test section (section that is flowed)	[L]	m
z_{ou}		Level for observation section, upper limitation	[L]	m
z_{ol}		Level for observation section, lower limitation	[L]	m
z_{os}		Level for sensor that measures response in observation section	[L]	m
E		Evaporation: hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
ET		Evapotranspiration hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
P		Precipitation hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
R		Groundwater recharge hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
D		Groundwater discharge hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
Q_R		Run-off rate	$[L^3/T]$	m^3/s
Q_p		Pumping rate	$[L^3/T]$	m^3/s
Q_I		Infiltration rate	$[L^3/T]$	m^3/s
Q		Volumetric flow. Corrected flow in flow logging ($Q_1 - Q_0$) (Flow rate)	$[L^3/T]$	m^3/s
Q_0		Flow in test section during undisturbed conditions (flow logging).	$[L^3/T]$	m^3/s
Q_p		Flow in test section immediately before stop of flow. Stabilised pump flow in flow logging.	$[L^3/T]$	m^3/s

Character	SICADA designation	Explanation	Dimension	Unit
Q_m		Arithmetical mean flow during perturbation phase.	[L^3/T]	m^3/s
Q_1		Flow in test section during pumping with pump flow Q_{p1}, (flow logging).	[L^3/T]	m^3/s
Q_2		Flow in test section during pumping with pump flow Q_{p1}, (flow logging).	[L^3/T]	m^3/s
ΣQ	SumQ	Cumulative volumetric flow along borehole	[L^3/T]	m^3/s
ΣQ_0	SumQ0	Cumulative volumetric flow along borehole, undisturbed conditions (ie, not pumped)	[L^3/T]	m^3/s
ΣQ_1	SumQ1	Cumulative volumetric flow along borehole, with pump flow Q_{p1}	[L^3/T]	m^3/s
ΣQ_2	SumQ2	Cumulative volumetric flow along borehole, with pump flow Q_{p2}	[L^3/T]	m^3/s
ΣQ_{C1}	SumQC1	Corrected cumulative volumetric flow along borehole, ΣQ_1-ΣQ_0	[L^3/T]	m^3/s
ΣQ_{C2}	SumQC2	Corrected cumulative volumetric flow along borehole, ΣQ_2-ΣQ_0	[L^3/T]	m^3/s
q		Volumetric flow per flow passage area (Specific discharge (Darcy velocity, Darcy flux, Filtration velocity)).	([L^3/T*L^2]	m/s
V		Volume	[L^3]	m^3
V_w		Water volume in test section.	[L^3]	m^3
V_p		Total water volume injected/pumped during perturbation phase.	[L^3]	m^3
v		Velocity	([L^3/T*L^2]	m/s
v_a		Mean transport velocity (Average linear velocity (Average linear groundwater velocity, Mean microscopic velocity));. $v_a=q/n_e$	([L^3/T*L^2]	m/s
t		Time	[T]	hour,min,s
t_0		Duration of rest phase before perturbation phase.	[T]	s
t_p		Duration of perturbation phase. (from flow start as far as p_p).	[T]	s
t_F		Duration of recovery phase (from p_p to p_F).	[T]	s
t_1, t_2 etc		Times for various phases during a hydro test.	[T]	hour,min,s
dt		Running time from start of flow phase and recovery phase respectively.	[T]	s
dt_e		$dt_e = (dt \cdot tp) / (dt + tp)$ Agarwal equivalent time with dt as running time for recovery phase.	[T]	s
t_D		$t_D = T{\cdot}t / (S{\cdot} r_w^2)$. Dimensionless time	-	-
p		Static pressure; including non-dynamic pressure which depends on water velocity. Dynamic pressure is normally ignored in estimating the potential in groundwater flow relations.	[M/$(LT)^2$]	kPa
p_a		Atmospheric pressure	[M/$(LT)^2$]	kPa
p_t		Absolute pressure; $p_t=p_a+p_g$	[M/$(LT)^2$]	kPa
p_g		Gauge pressure; Difference between absolute pressure and atmospheric pressure.	[M/$(LT)^2$]	kPa
p_0		Initial pressure before test begins, prior to packer expansion.	[M/$(LT)^2$]	kPa
p_i		Pressure in measuring section before start of flow.	[M/$(LT)^2$]	kPa
p_f		Pressure during perturbation phase.	[M/$(LT)^2$]	kPa
p_s		Pressure during recovery.	[M/$(LT)^2$]	kPa
p_p		Pressure in measuring section before flow stop.	[M/$(LT)^2$]	kPa
p_F		Pressure in measuring section at end of recovery.	[M/$(LT)^2$]	kPa
p_D		$p_D=2\pi{\cdot}T{\cdot}p/(Q{\cdot}\rho_w g)$, Dimensionless pressure	-	-
dp		Pressure difference, drawdown of pressure surface between two points of time.	[M/$(LT)^2$]	kPa

Character	SICADA designation	Explanation	Dimension	Unit
dp_f		$dp_f = p_i - p_f$ or $= p_f - p_i$, drawdown/pressure increase of pressure surface between two points of time during perturbation phase. dp_f usually expressed positive.	$[M/(LT)^2]$	kPa
dp_s		$dp_s = p_s - p_p$ or $= p_p - p_s$, pressure increase/drawdown of pressure surface between two points of time during recovery phase. dp_s usually expressed positive.	$[M/(LT)^2]$	kPa
dp_p		$dp_p = p_i - p_p$ or $= p_p - p_i$, **maximal** pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dp_p expressed positive.	$[M/(LT)^2]$	kPa
dp_F		$dp_F = p_p - p_F$ or $= p_F - p_p$, **maximal** pressure increase/drawdown of pressure surface between two points of time during recovery phase. dp_F expressed positive.	$[M/(LT)^2]$	kPa
H		Total head; (potential relative a reference level) (indication of h for phase as for p). $H=h_e+h_p+h_v$	[L]	m
h		Groundwater pressure level (hydraulic head (piezometric head; possible to use for level observations in boreholes, static head)); (indication of h for phase as for p). $h=h_e+h_p$	[L]	m
h_e		Height of measuring point (Elevation head); Level above reference level for measuring point.	[L]	m
h_p		Pressure head; Level above reference level for height of measuring point of stationary column of water giving corresponding static pressure at measuring point	[L]	m
h_v		Velocity head; height corresponding to the lifting for which the kinetic energy is capable (usually neglected in hydrogeology)	[L]	m
s		Drawdown; Drawdown from undisturbed level (same as dh_p, positive)	[L]	m
s_p		Drawdown in measuring section before flow stop.	[L]	m
			[L]	
h_0		Initial above reference level before test begins, prior to packer expansion.	[L]	m
h_i		Level above reference level in measuring section before start of flow.	[L]	m
h_f		Level above reference level during perturbation phase.	[L]	m
h_s		Level above reference level during recovery phase.	[L]	m
h_p		Level above reference level in measuring section before flow stop.	[L]	m
h_F		Level above reference level in measuring section at end of recovery.	[L]	m
dh		Level difference, drawdown of water level between two points of time.	[L]	m
dh_f		$dh_f = h_i - h_f$ or $= h_f - h_i$, drawdown/pressure increase of pressure surface between two points of time during perturbation phase. dh_f usually expressed positive.	[L]	m
dh_s		$dh_s = h_s - h_p$ or $= h_p - h_s$, pressure increase/drawdown of pressure surface between two points of time during recovery phase. dh_s usually expressed positive.	[L]	m
dh_p		$dh_p = h_i - h_p$ or $= h_p - h_i$, maximal pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dh_p expressed positive.	[L]	m
dh_F		$dh_F = h_p - h_F$ or $= h_F - h_p$, maximal pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dh_F expressed positive.	[L]	m
Te_w		Temperature in the test section (taken from temperature logging). Temperature		^oC
Te_{w0}		Temperature in the test section during undisturbed conditions (taken from temperature logging).		^oC

Character	SICADA designation	Explanation	Dimension	Unit
Te_o		Temperature in the observation section (taken from temperature logging). Temperature		^oC
EC_w		Electrical conductivity of water in test section.		mS/m
EC_{w0}		Electrical conductivity of water in test section during undisturbed conditions.		mS/m
EC_o		Electrical conductivity of water in observation section		mS/m
TDS_w		Total salinity of water in the test section.	$[M/L^3]$	mg/L
TDS_{w0}		Total salinity of water in the test section during undisturbed conditions.	$[M/L^3]$	mg/L
TDS_o		Total salinity of water in the observation section.	$[M/L^3]$	mg/L
g		Constant of gravitation (9.81 $m*s^{-2}$) (Acceleration due to gravity)	$[L/T^2]$	m/s^2
π	pi	Constant (approx 3.1416).	[-]	
r		Residual. r= p_c-p_m , r= h_c-h_m, etc. Difference between measured data (p_m, h_m, etc) and estimated data (p_c, h_c, etc)		
ME		Mean error in residuals. $ME = \frac{1}{n}\sum_{i=1}^{n} r_i$		
NME		Normalized ME. NME=ME/(x_{MAX}-x_{MIN}), x: measured variable considered.		
MAE		Mean absolute error. $MAE = \frac{1}{n}\sum_{i=1}^{n} \lvert r_i \rvert$		
NMAE		Normalized MAE. NMAE=MAE/(x_{MAX}-x_{MIN}), x: measured variable considered.		
RMS		Root mean squared error. $RMS = \left(\frac{1}{n}\sum_{i=1}^{n} r_i^2\right)^{0.5}$		
NRMS		Normalized RMR. NRMR=RMR/(x_{MAX}-x_{MIN}), x: measured variable considered.		
SDR		Standard deviation of residual. $SDR = \left(\frac{1}{n-1}\sum_{i=1}^{n} (r_i - ME)^2\right)^{0.5}$		
SEMR		Standard error of mean residual. $SEMR = \left(\frac{1}{n(n-1)}\sum_{i=1}^{n} (r_i - ME)^2\right)^{0.5}$		
Parameters				
Q/s		Specific capacity s=dp_p or s=s_p=h_0-h_p (open borehole)	$[L^2/T]$	m^2/s
D		Interpreted flow dimension according to Barker, 1988.	[-]	-
dt_1		Time of starting for semi-log or log-log evaluated characteristic counted from start of flow phase and recovery phase respectively.	[T]	s
dt_2		End of time for semi-log or log-log evaluated characteristic counted from start of flow phase and recovery phase respectively.	[T]	s
dt_L		Response time to obtain 0.1 m (or 1 kPa) drawdown in observation section counted from start of recovery phase.	[T]	s
TB		Flow capacity in a one-dimensional structure of width B and transmissivity T. Transient evaluation of one-dimensional structure	$[L^3/T]$	m^3/s
T		Transmissivity	$[L^2/T]$	m^2/s
T_M		Transmissivity according to Moye (1967)	$[L^2/T]$	m^2/s
T_Q		Evaluation based on Q/s and regression curve between Q/s and T, as example see Rhén et al (1997) p. 190.	$[L^2/T]$	m^2/s
T_S		Transmissivity evaluated from slug test	$[L^2/T]$	m^2/s

Character	SICADA designation	Explanation	Dimension	Unit
T_D		Transmissivity evaluated from PFL-Difference Flow Meter	[L^2/T]	m^2/s
T_I		Transmissivity evaluated from Impeller flow log	[L^2/T]	m^2/s
T_{Sf}, T_{Lf}		Transient evaluation based on semi-log or log-log diagram for perturbation phase in injection or pumping.	[L^2/T]	m^2/s
T_{Ss}, T_{Ls}		Transient evaluation based on semi-log or log-log diagram for recovery phase in injection or pumping.	[L^2/T]	m^2/s
T_T		Transient evaluation (log-log or lin-log). Judged best evaluation of T_{Sf}, T_{Lf}, T_{Ss}, T_{Ls}	[L^2/T]	m^2/s
T_{NLR}		Evaluation based on non-linear regression.	[L^2/T]	m^2/s
T_{Tot}		Judged most representative transmissivity for particular test section and (in certain cases) evaluation time with respect to available data (made by SKB at a later stage).	[L^2/T]	m^2/s
K		Hydraulic conductivity	[L/T]	m/s
K_s		Hydraulic conductivity based on spherical flow model	[L/T]	m/s
K_m		Hydraulic conductivity matrix, intact rock	[L/T]	m/s
k		Intrinsic permeability	[L^2]	m^2
kb		Permeability-thickness product: kb=k·b	[L^3]	m^3
SB		Storage capacity in a one-dimensional structure of width B and storage coefficient S. Transient evaluation of one-dimensional structure	[L]	m
SB*		Assumed storage capacity in a one-dimensional structure of width B and storage coefficient S. Transient evaluation of one-dimensional structure	[L]	m
S		Storage coefficient, (Storativity)	[-]	-
S*		Assumed storage coefficient	[-]	-
S_y		Theoretical specific yield of water (Specific yield; unconfined storage. Defined as total porosity (n) minus retention capacity (S_r)	[-]	-
S_{ya}		Specific yield of water (Apparent specific yield); unconfined storage, field measuring. Corresponds to volume of water achieved on draining saturated soil or rock in free draining of a volumetric unit. $S_{ya}= S_y$ (often called S_y in literature)	[-]	-
S_r		Specific retention capacity, (specific retention of water, field capacity) (Specific retention); unconfined storage. Corresponds to water volume that the soil or rock has left after free draining of saturated soil or rock.	[-]	-
S_f		Fracture storage coefficient	[-]	-
S_m		Matrix storage coefficient	[-]	-
S_{NLR}		Storage coefficient, evaluation based on non-linear regression	[-]	-
S_{Tot}		Judged most representative storage coefficient for particular test section and (in certain cases) evaluation time with respect to available data (made by SKB at a later stage).	[-]	-
S_s		Specific storage coefficient; confined storage.	[1/L]	1/m
S_s*		Assumed specific storage coefficient; confined storage.	[1/L]	1/m
c_f		Hydraulic resistance: The hydraulic resistance is an aquitard with a flow vertical to a two-dimensional formation. The inverse of c is also called Leakage coefficient. c_f=b´/K´ where b´ is thickness of the aquitard and K´ its hydraulic conductivity across the aquitard.	[T]	s
L_f		Leakage factor: $L_f =(K\cdot b\cdot c_f)^{0.5}$ where K represents characteristics of the aquifer.	[L]	m
ξ	Skin	Skin factor	[-]	-

Character	SICADA designation	Explanation	Dimension	Unit
ξ^*	Skin	Assumed skin factor	[-]	-
C		Wellbore storage coefficient	$[(LT^2)\cdot M^2]$	m^3/Pa
C_D		$C_D = C\cdot\rho_w g/(2\pi\cdot S\cdot r_w^2)$, Dimensionless wellbore storage coefficient	[-]	-
ω	Stor-ratio	$\omega = S_f/(S_f + S_m)$, storage ratio (Storativity ratio); the ratio of storage coefficient between that of the fracture and total storage.	[-]	-
λ	Interflow-coeff	$\lambda = \alpha\cdot(K_m/K_f)\cdot r_w^2$ interporosity flow coefficient.	[-]	-
T_{GRF}		Transmissivity interpreted using the GRF method	$[L^2/T]$	m^2/s
S_{GRF}		Storage coefficient interpreted using the GRF method	[1/L]	1/m
D_{GRF}		Flow dimension interpreted using the GRF method	[-]	-
c_w		Water compressibility; corresponding to β in hydrogeological literature.	$[(LT^2)/M]$	1/Pa
c_r		Pore-volume compressibility, (rock compressibility); Corresponding to α/n in hydrogeological literature.	$[(LT^2)/M]$	1/Pa
c_t		$c_t = c_r + c_w$, total compressibility; compressibility per volumetric unit of rock obtained through multiplying by the total porosity, n. (Presence of gas or other fluids can be included in c_t if the degree of saturation (volume of respective fluid divided by n) of the pore system of respective fluid is also included)	$[(LT^2)/M]$	1/Pa
nc_t		Porosity-compressibility factor: $nc_t = n\cdot c_t$	$[(LT^2)/M]$	1/Pa
nc_tb		Porosity-compressibility-thickness product: $nc_tb = n\cdot c_t\cdot b$	$[(L^2T^2)/M]$	m/Pa
n		Total porosity	-	-
n_e		Kinematic porosity, (Effective porosity)	-	-
e		Transport aperture. $e = n_e\cdot b$	[L]	m
ρ	Density	Density	$[M/L^3]$	$kg/(m^3)$
ρ_w	Density-w	Fluid density in measurement section during pumping/injection	$[M/L^3]$	$kg/(m^3)$
ρ_o	Density-o	Fluid density in observation section	$[M/L^3]$	$kg/(m^3)$
ρ_{sp}	Density-sp	Fluid density in standpipes from measurement section	$[M/L^3]$	$kg/(m^3)$
μ	my	Dynamic viscosity	[M/LT]	Pa s
μ_w	my	Dynamic viscosity (Fluid density in measurement section during pumping/injection)	[M/LT]	Pa s
FC_T		Fluid coefficient for intrinsic permeability, transference of k to K; $K = FC_T\cdot k$; $FC_T = \rho_w\cdot g/\mu_w$	[1/LT]	1/(ms)
FC_S		Fluid coefficient for porosity-compressibility, transference of c_t to S_s ; $S_s = FC_S\cdot n\cdot c_t$; $FC_S = \rho_w\cdot g$	$[M/T^2L^2]$	Pa/m
Index on K, T and S				
S		S: semi-log		
L		L: log-log		
f		Pump phase or injection phase, designation following S or L (withdrawal)		
s		Recovery phase, designation following S or L (recovery)		
NLR		NLR: Non-linear regression. Performed on the entire test sequence, perturbation and recovery		
M		Moye		
GRF		Generalised Radial Flow according to Barker (1988)		
m		Matrix		
f		Fracture		
T		Judged best evaluation based on transient evaluation.		

Character	SICADA designation	Explanation	Dimension	Unit
Tot		Judged most representative parameter for particular test section and (in certain cases) evaluation time with respect to available data (made by SKB at a later stage).		
b		Bloch property in a numerical groundwater flow model		
e		Effective property (constant) within a domain in a numerical groundwater flow model.		
Index on p and Q				
0		Initial condition, undisturbed condition in open holes		
i		Natural, "undisturbed" condition of formation parameter		
f		Pump phase or injection phase (withdrawal, flowing phase)		
s		Recovery, shut-in phase		
p		Pressure or flow in measuring section at end of perturbation period		
F		Pressure in measuring section at end of recovery period.		
m		Arithmetical mean value		
c		Estimated value. The index is placed last if index for “where” and “what” are used. Simulated value		
m		Measured value. The index is placed last if index for “where” and “what” are used. Measured value		
Some miscellaneous indexes on p and h				
w		Test section (final difference pressure during flow phase in test section can be expressed dp_{wp}; First index shows “where” and second index shows “what”)		
o		Observation section (final difference pressure during flow phase in observation section can be expressed dp_{op}; First index shows “where” and second index shows “what”)		
f		Fresh-water head. Water is normally pumped up from section to measuring hoses where pressure and level are observed. Density of the water is therefore approximately the same as that of the measuring section. Measured groundwater level is therefore normally represented by what is defined as point-water head. If pressure at the measuring level is recalculated to a level for a column of water with density of fresh water above the measuring point it is referred to as fresh-water head and h is indicated last by an f. Observation section (final level during flow phase in observation section can be expressed h_{opf}; the first index shows “where” and the second index shows “what” and the last one “recalculation”)		

APPENDIX 5

SICADA data tables

(Simplified version v1.4)

SICADA/Data Import Template

File Identity	
Created By	Stephan Rohs
Created	2006-09-22

Compiled By	
Quality Check For Delivery	
Delivery Approval	

Activity Type	KLX 08 KLX 08 - Injection test

Project	AP PS 400-06-001

Activity Information						**Additional Activity Data**				
						C10	P20	P200	P220	R25
Idcode	**Start Date**	**Stop Date**	**Secup (m)**	**Seclow (m)**	**Section No**	**Company**	**Field crew manager**	**Field crew**	**evaluating data**	**Report**
KLX 08	2006-09-28 07:55	2006-09-28 21:27	103.00	503.00		Golder Associates	Reinder van der Wall	Reinder van der Wall, Philipp Wolf, Mesgena Gebrezghi, Nikolaj Sokrut	Reinder van der Wall, Philipp Wolf, Stephan Rohs	Stephan Rohs
KLX 08	2006-10-06 09:32	2006-10-11 18:34	104.00	963.00		Golder Associates	Reinder van der Wall	Reinder van der Wall, Philipp Wolf, Mesgena Gebrezghi, Nikolaj Sokrut	Reinder van der Wall, Philipp Wolf, Stephan Rohs	Stephan Rohs

Table	plu_s_hole_test_d PLU Injection and pumping, General information

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
project	CHAR		project code
idcode	CHAR		Object or borehole identification code
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
section_no	INTEGER	number	Section number
test_type	CHAR		Test type code (1-7), see table description
formation_type	CHAR		1: Rock, 2: Soil (superficial deposits)
start_flow_period	DATE	yyyymmdd	Date & time of pumping/injection start (YYYY-MM-DD hh:mm:ss)
stop_flow_period	DATE	yyyymmdd	Date & time of pumping/injection stop (YYYY-MM-DD hh:mm:ss)
flow_rate_end_qp	FLOAT	m**3/s	Flow rate at the end of the flowing period
value_type_qp	CHAR		0:true value,-1<lower meas.limit1:>upper meas.limit
mean_flow_rate_qm	FLOAT	m**3/s	Arithmetic mean flow rate during flow period
q_measl__l	FLOAT	m**3/s	Estimated lower measurement limit of flow rate
q_measl__u	FLOAT	m**3/s	Estimated upper measurement limit of flow rate
tot_volume_vp	FLOAT	m**3	Total volume of pumped or injected water
dur_flow_phase_tp	FLOAT	s	Duration of the flowing period of the test
dur_rec_phase_tf	FLOAT	s	Duration of the recovery period of the test
initial_head_hi	FLOAT	m	Hydraulic head in test section at start of the flow period
head_at_flow_end_hp	FLOAT	m	Hydraulic head in test section at stop of the flow period.
final_head_hf	FLOAT	m	Hydraulic head in test section at stop of recovery period.
initial_press_pi	FLOAT	kPa	Groundwater pressure in test section at start of flow period
press_at_flow_end_pp	FLOAT	kPa	Groundwater pressure in test section at stop of flow period.
final_press_pf	FLOAT	kPa	Ground water pressure at the end of the recovery period.
fluid_temp_tew	FLOAT	oC	Measured section fluid temperature, see table description
fluid_elcond_ecw	FLOAT	mS/m	Measured section fluid el. conductivity,see table descr.
fluid_salinity_tdsw	FLOAT	mg/l	Total salinity of section fluid based on EC,see table descr.
fluid_salinity_tdswm	FLOAT	mg/l	Tot. section fluid salinity based on water sampling,see...
reference	CHAR		SKB report No for reports describing data and evaluation
comments	VARCHAR		Short comment to data
error_flag	CHAR		If error_flag = "*" then an error occured and an error
in_use	CHAR		If in_use = "*" then the activity has been selected as
sign	CHAR		Signature for QA data accknowledge (QA - OK)
lp	FLOAT	m	Hydraulic point of application

idcode	start_date	stop_date	secup	seclow	section_no	test_type	formation_type	start_flow_period	stop_flow_period	flow_rate_end_qp	value_type_qp	mean_flow_rate_qm	q_measl__l	q_measl__u	tot_volume_vp
KLX 08	2006-09-28 07:55:00	2006-09-28 10:12:00	103.00	203.00		3	1	2006-09-28 09:09:54	2006-09-28 09:40:04	8.92E-04	0	9.05E-04	1.67E-08	8.33E-04	1.63E+00
KLX 08	2006-09-28 11:37:00	2006-09-28 14:04:00	203.00	303.00		3	1	2006-09-28 13:02:15	2006-09-28 13:32:25	6.86E-04	0	7.19E-04	1.67E-08	8.33E-04	1.29E+00
KLX 08	2006-09-28 15:27:00	2006-09-28 17:28:00	305.00	405.00		3	1	2006-09-28 16:25:53	2006-09-28 16:56:03	4.70E-04	0	4.89E-04	1.67E-08	8.33E-04	8.79E-01
KLX 08	2006-09-28 19:13:00	2006-09-28 21:27:00	403.00	503.00		3	1	2006-09-28 20:25:46	2006-09-28 20:55:56	5.69E-04	0	6.13E-04	1.67E-08	8.33E-04	1.10E+00
KLX 08	2006-10-06 09:32:00	2006-10-06 12:05:00	503.00	603.00		3	1	2006-10-06 11:03:11	2006-10-06 11:33:21	6.53E-07	0	7.32E-07	1.67E-08	8.33E-04	1.32E-03
KLX 08	2006-10-06 14:05:00	2006-10-06 16:06:00	603.00	703.00		3	1	2006-10-06 15:04:09	2006-10-06 15:34:19	6.08E-05	0	6.98E-05	1.67E-08	8.33E-04	6.98E-05
KLX 08	2006-10-06 17:48:00	2006-10-06 20:40:00	703.00	803.00		3	1	2006-10-06 19:38:49	2006-10-06 20:08:59	2.33E-07	0	3.28E-07	1.67E-08	8.33E-04	5.91E-04
KLX 08	2006-10-06 22:17:00	2006-10-07 00:54:00	803.00	903.00		3	1	2006-10-06 23:52:28	2006-10-07 00:22:38	1.48E-06	0	1.72E-06	1.67E-08	8.33E-04	3.10E-03
KLX 08	2006-10-07 06:04:00	2006-10-07 09:02:00	863.00	963.00		3	1	2006-10-07 08:00:40	2006-10-07 08:30:50	3.17E-08	0	4.11E-08	1.67E-08	8.33E-04	7.40E-05
KLX 08	2006-10-08 07:04:00	2006-10-08 08:32:00	104.00	124.00		3	1	2006-10-08 07:50:25	2006-10-08 08:10:35	4.73E-04	0	4.94E-04	1.67E-08	8.33E-04	5.93E-01
KLX 08	2006-10-08 09:13:00	2006-10-08 10:41:00	125.00	145.00		3	1	2006-10-08 09:59:04	2006-10-08 10:19:14	2.96E-05	0	3.08E-05	1.67E-08	8.33E-04	3.70E-02
KLX 08	2006-10-08 11:12:00	2006-10-08 12:38:00	144.00	164.00		3	1	2006-10-08 11:56:19	2006-10-08 12:16:29	4.86E-04	0	5.03E-04	1.67E-08	8.33E-04	6.04E-01
KLX 08	2006-10-08 13:19:00	2006-10-08 14:42:00	164.00	184.00		3	1	2006-10-08 14:00:33	2006-10-08 14:20:43	4.79E-04	0	5.05E-04	1.67E-08	8.33E-04	6.06E-01
KLX 08	2006-10-08 15:14:00	2006-10-08 16:36:00	183.50	203.50		3	1	2006-10-08 15:54:25	2006-10-08 16:14:35	4.61E-04	0	5.06E-04	1.67E-08	8.33E-04	6.07E-01
KLX 08	2006-10-08 17:07:00	2006-10-08 18:30:00	203.00	223.00		3	1	2006-10-08 17:48:01	2006-10-08 18:08:11	5.30E-04	0	5.51E-04	1.67E-08	8.33E-04	6.62E-01
KLX 08	2006-10-08 19:00:00	2006-10-08 20:26:00	223.50	243.50		3	1	2006-10-08 19:44:15	2006-10-08 20:04:25	1.55E-04	0	1.60E-04	1.67E-08	8.33E-04	1.92E-01
KLX 08	2006-10-08 21:09:00	2006-10-08 22:36:00	243.50	263.50		3	1	2006-10-08 21:54:54	2006-10-08 22:15:04	3.43E-06	0	3.62E-06	1.67E-08	8.33E-04	4.34E-03
KLX 08	2006-10-08 23:10:00	2006-10-09 00:33:00	264.00	284.00		3	1	2006-10-08 23:51:26	2006-10-09 00:11:36	9.65E-06	0	1.07E-05	1.67E-08	8.33E-04	1.28E-02
KLX 08	2006-10-09 01:07:00	2006-10-09 02:31:00	284.00	304.00		3	1	2006-10-09 01:49:38	2006-10-09 02:09:48	4.16E-05	0	4.26E-05	1.67E-08	8.33E-04	5.11E-02
KLX 08	2006-10-09 06:17:00	2006-10-09 07:50:00	304.00	324.00		3	1	2006-10-09 07:08:22	2006-10-09 07:28:32	6.17E-07	0	6.25E-07	1.67E-08	8.33E-04	7.50E-04
KLX 08	2006-10-09 08:23:00	2006-10-09 10:04:00	324.00	344.00		3	1	2006-10-09 09:22:21	2006-10-09 09:42:31	5.17E-08	0	6.06E-08	1.67E-08	8.33E-04	7.27E-05
KLX 08	2006-10-09 10:41:00	2006-10-09 12:08:00	344.00	364.00		3	1	2006-10-09 11:26:13	2006-10-09 11:46:23	7.27E-07	0	7.94E-07	1.67E-08	8.33E-04	9.53E-04
KLX 08	2006-10-09 12:57:00	2006-10-09 14:27:00	364.00	384.00		3	1	2006-10-09 13:45:22	2006-10-09 14:05:32	7.96E-05	0	8.13E-05	1.67E-08	8.33E-04	9.76E-02
KLX 08	2006-10-09 15:01:00	2006-10-09 16:25:00	385.00	405.00		3	1	2006-10-09 15:43:03	2006-10-09 16:03:13	4.97E-04	0	5.10E-04	1.67E-08	8.33E-04	6.11E-01
KLX 08	2006-10-09 16:55:00	2006-10-09 18:19:00	403.00	423.00		3	1	2006-10-09 17:37:42	2006-10-09 17:57:52	4.01E-04	0	4.47E-04	1.67E-08	8.33E-04	5.36E-01
KLX 08	2006-10-09 18:50:00	2006-10-09 20:17:00	423.00	443.00		3	1	2006-10-09 19:35:12	2006-10-09 19:55:22	6.08E-06	0	6.25E-06	1.67E-08	8.33E-04	7.50E-03
KLX 08	2006-10-09 21:00:00	2006-10-09 22:23:00	443.00	463.00		3	1	2006-10-09 21:41:28	2006-10-09 22:01:38	1.48E-05	0	1.51E-05	1.67E-08	8.33E-04	1.81E-02
KLX 08	2006-10-09 23:36:00	2006-10-10 00:35:00	463.00	483.00		3	1	2006-10-09 23:53:44	2006-10-10 00:13:54	6.82E-05	0	7.17E-05	1.67E-08	8.33E-04	8.60E-02
KLX 08	2006-10-10 01:14:00	2006-10-10 02:38:00	483.00	503.00		3	1	2006-10-10 01:56:17	2006-10-10 02:16:27	6.45E-06	0	6.66E-06	1.67E-08	8.33E-04	7.99E-03
KLX 08	2006-10-10 06:13:00	2006-10-10 08:07:00	503.00	523.00		4B	1	2006-10-10 07:00:31	2006-10-10 07:00:41	#NV	0	#NV	1.67E-08	8.33E-04	#NV
KLX 08	2006-10-10 08:37:00	2006-10-10 10:22:00	523.00	543.00		3	1	2006-10-10 09:40:38	2006-10-10 10:00:48	1.70E-07	0	2.04E-07	1.67E-08	8.33E-04	2.45E-04
KLX 08	2006-10-10 10:59:00	2006-10-10 12:41:00	543.00	563.00		3	1	2006-10-10 11:58:53	2006-10-10 12:19:03	8.33E-08	0	1.14E-07	1.67E-08	8.33E-04	1.37E-04
KLX 08	2006-10-10 13:25:00	2006-10-10 15:01:00	563.00	583.00		3	1	2006-10-10 14:19:13	2006-10-10 14:39:23	9.00E-08	0	1.13E-07	1.67E-08	8.33E-04	1.36E-04
KLX 08	2006-10-10 15:33:00	2006-10-10 16:58:00	583.00	603.00		3	1	2006-10-10 16:15:54	2006-10-10 16:36:04	4.17E-07	-1	4.33E-07	1.67E-08	8.33E-04	5.20E-04
KLX 08	2006-10-10 17:32:00	2006-10-10 18:55:00	603.00	623.00		3	1	2006-10-10 18:13:19	2006-10-10 18:33:29	1.93E-05	0	1.98E-05	1.67E-08	8.33E-04	2.38E-02
KLX 08	2006-10-10 19:25:00	2006-10-10 20:50:00	623.00	643.00		3	1	2006-10-10 20:08:43	2006-10-10 20:28:53	3.33E-07	-1	3.50E-07	1.67E-08	8.33E-04	4.20E-04
KLX 08	2006-10-10 21:30:00	2006-10-10 22:54:00	643.00	663.00		3	1	2006-10-10 22:12:45	2006-10-10 22:32:55	4.37E-05	0	4.98E-05	1.67E-08	8.33E-04	5.98E-02
KLX 08	2006-10-10 23:25:00	2006-10-11 00:49:00	663.00	683.00		3	1	2006-10-11 00:06:59	2006-10-11 00:27:09	4.68E-05	0	5.28E-05	1.67E-08	8.33E-04	6.34E-02
KLX 08	2006-10-11 01:25:00	2006-10-11 03:01:00	683.00	703.00		3	1	2006-10-11 02:19:17	2006-10-11 02:39:27	5.50E-08	0	6.48E-08	1.67E-08	8.33E-04	7.78E-05
KLX 08	2006-10-11 05:22:00	2006-10-11 06:11:00	703.00	723.00		3	1	#NV	#NV	#NV	0	#NV	1.67E-08	8.33E-04	#NV
KLX 08	2006-10-11 06:43:00	2006-10-11 08:51:00	723.00	743.00		3	1	2006-10-11 08:09:42	2006-10-11 08:29:52	4.50E-08	0	5.07E-08	1.67E-08	8.33E-04	6.08E-05
KLX 08	2006-10-11 09:27:00	2006-10-11 11:47:00	743.00	763.00		3	1	2006-10-11 11:05:49	2006-10-11 11:25:59	2.33E-08	0	2.92E-08	1.67E-08	8.33E-04	3.50E-05
KLX 08	2006-10-11 12:33:00	2006-10-11 14:52:00	763.00	783.00		3	1	2006-10-11 14:10:45	2006-10-11 14:30:55	2.17E-07	0	5.28E-07	1.67E-08	8.33E-04	6.34E-04
KLX 08	2006-10-11 15:28:00	2006-10-11 17:14:00	783.00	803.00		4B	1	2006-10-11 16:12:36	2006-10-11 16:12:46	#NV	0	#NV	1.67E-08	8.33E-04	#NV
KLX 08	2006-10-11 17:47:00	2006-10-11 18:34:00	803.00	823.00		3	1	#NV	#NV	#NV	0	#NV	1.67E-08	8.33E-04	#NV

idcode	secup	seclow	dur_flow_phase_tp	dur_rec_phase_tf	initial_head_hi	low_end_hp	final_head_hf	initial_press_pi	press_at_flow_end_pp	final_press_pf	fluid_temp_tew	fluid_elcond_ecw	fluid_salinity_tdsw	fluid_salinity_tdswm	reference	comments	lp
KLX 08	103.00	203.00	1800	1800				1696	1707	1697	9.2						153.00
KLX 08	203.00	303.00	1800	1800				2526	2568	2529	10.6						253.00
KLX 08	305.00	405.00	1800	1800				3393	3439	3394	11.3						355.00
KLX 08	403.00	503.00	1800	1800				4226	4251	4227	13.5						453.00
KLX 08	503.00	603.00	1800	1800				5077	5278	5082	14.8						553.00
KLX 08	603.00	703.00	1800	1800				5923	6123	5938	16.1						653.00
KLX 08	703.00	803.00	1800	1800				6775	6970	6864	17.5						753.00
KLX 08	803.00	903.00	1800	1800				7607	7804	7616	18.9						853.00
KLX 08	863.00	963.00	1800	1800				8116	8322	8221	19.7						913.00
KLX 08	104.00	124.00	1200	1200				1003	1091	1005	8.4						114.00
KLX 08	125.00	145.00	1200	1200				1176	1377	1176	8.9						135.00
KLX 08	144.00	164.00	1200	1200				1339	1373	1340	8.8						154.00
KLX 08	164.00	184.00	1200	1200				1511	1528	1512	9.1						174.00
KLX 08	183.50	203.50	1200	1200				1679	1690	1679	9.2						193.50
KLX 08	203.00	223.00	1200	1200				1847	1879	1847	9.5						213.00
KLX 08	223.50	243.50	1200	1200				2021	2220	2021	9.9						233.50
KLX 08	243.50	263.50	1200	1200				2191	2391	2190	10.2						253.50
KLX 08	264.00	284.00	1200	1200				2364	2564	2364	10.5						274.00
KLX 08	284.00	304.00	1200	1200				2534	2734	2534	10.7						294.00
KLX 08	304.00	324.00	1200	1200				2705	2905	2704	11.0						314.00
KLX 08	324.00	344.00	1200	1200				2887	3087	2893	11.2						334.00
KLX 08	344.00	364.00	1200	1200				3048	3248	3048	11.5						354.00
KLX 08	364.00	384.00	1200	1200				3218	3419	3219	11.6						374.00
KLX 08	385.00	405.00	1200	1200				3398	3450	3399	11.4						395.00
KLX 08	403.00	423.00	1200	1200				3550	3561	3551	12.3						413.00
KLX 08	423.00	443.00	1200	1200				3719	3919	3719	12.6						433.00
KLX 08	443.00	463.00	1200	1200				3889	4089	3888	12.9						453.00
KLX 08	463.00	483.00	1200	1200				4060	4260	4059	13.2						473.00
KLX 08	483.00	503.00	1200	1200				4227	4427	4227	13.4						493.00
KLX 08	503.00	523.00	10	3659				4410	4627	4479	13.7						513.00
KLX 08	523.00	543.00	1200	1200				4574	4775	4604	14.0						533.00
KLX 08	543.00	563.00	1200	1200				4746	4952	4788	14.2						553.00
KLX 08	563.00	583.00	1200	1200				4912	5113	4920	14.5						573.00
KLX 08	583.00	603.00	1200	1200				5077	5278	5077	14.7						593.00
KLX 08	603.00	623.00	1200	1200				5246	5446	5247	15.0						613.00
KLX 08	623.00	643.00	1200	1200				5418	5618	5418	15.3						633.00
KLX 08	643.00	663.00	1200	1200				5587	5789	5600	15.5						653.00
KLX 08	663.00	683.00	1200	1200				5764	5964	5774	15.8						673.00
KLX 08	683.00	703.00	1200	3600				5931	6114	5925	16.0						693.00
KLX 08	703.00	723.00	#NV	#NV				#NV	#NV	#NV	16.4						713.00
KLX 08	723.00	743.00	1200	1200				6272	6477	6317	16.6						733.00
KLX 08	743.00	763.00	1200	1200				6439	6646	6575	16.9						753.00
KLX 08	763.00	783.00	1200	1200				6604	6805	6713	17.2						773.00
KLX 08	783.00	803.00	10	3630				6786	6959	6927	17.5						793.00
KLX 08	803.00	823.00	#NV	#NV				#NV	#NV	#NV	17.7						813.00

Table	plu_s_hole_test_ed1
	PLU Single hole tests, pumping/injection. Basic evaluation

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
project	CHAR		project code
idcode	CHAR		Object or borehole identification code
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
section_no	INTEGER	number	Section number
test_type	CHAR		Test type code (1-7), see table description!
formation_type	CHAR		Formation type code. 1: Rock, 2: Soil (superficial deposits)
lp	FLOAT	m	Hydraulic point of application for test section, see descr.
seclen_class	FLOAT	m	Planned ordinary test interval during test campaign.
spec_capacity_q_s	FLOAT	m**2/s	Specific capacity (Q/s) of test section, see table descript.
value_type_q_s	CHAR		0:true value,-1:Q/s<lower meas.limit,1:Q/s>upper meas.limit
transmissivity_tq	FLOAT	m**2/s	Tranmissivity based on Q/s, see table description
value_type_tq	CHAR		0:true value,-1:TQ<lower meas.limit,1:TQ>upper meas.limit.
bc_tq	CHAR		Best choice code. 1 means TQ is best choice of T, else 0
transmissivity_moye	FLOAT	m**2/s	Transmissivity,TM, based on Moye (1967)
bc_tm	CHAR		Best choice code. 1 means Tmoye is best choice of T, else 0
value_type_tm	CHAR		0:true value,-1:TM<lower meas.limit,1:TM>upper meas.limit.
hydr_cond_moye	FLOAT	m/s	K_M: Hydraulic conductivity based on Moye (1967)
formation_width_b	FLOAT	m	b:Aquifer thickness repr. for T(generally b=Lw) ,see descr.
width_of_channel_b	FLOAT	m	B:Inferred width of formation for evaluated TB
tb	FLOAT	m**3/s	TB:Flow capacity in 1D formation of T & width B, see descr.
l_measl_tb	FLOAT	m**3/s	Estimated lower meas. limit for evaluated TB,see description
u_measl_tb	FLOAT	m**3/s	Estimated upper meas. limit of evaluated TB,see description
sb	FLOAT	m	SB:S=storativity,B=width of formation,1D model,see descript.
assumed_sb	FLOAT	m	SB* : Assumed SB,S=storativity,B=width of formation,see...
leakage_factor_lf	FLOAT	m	Lf:1D model for evaluation of Leakage factor
transmissivity_tt	FLOAT	m**2/s	TT:Transmissivity of formation, 2D radial flow model,see...
value_type_tt	CHAR		0:true value,-1:TT<lower meas.limit,1:TT>upper meas.limit,
bc_tt	CHAR		Best choice code. 1 means TT is best choice of T, else 0
l_measl_q_s	FLOAT	m**2/s	Estimated lower meas. limit for evaluated TT,see table descr
u_measl_q_s	FLOAT	m**2/s	Estimated upper meas. limit for evaluated TT,see description
storativity_s	FLOAT		S:Storativity of formation based on 2D rad flow,see descr.
assumed_s	FLOAT		Assumed Storativity,2D model evaluation,see table descr.
bc_s	FLOAT		Best choice of S (Storativity) ,see descr.
ri	FLOAT	m	Radius of influence
ri_index	CHAR		ri index=index of radius of influence :-1,0 or 1, see descr.
leakage_coeff	FLOAT	1/s	K'/b':2D rad flow model evaluation of leakage coeff,see desc
hydr_cond_ksf	FLOAT	m/s	Ksf:3D model evaluation of hydraulic conductivity,see desc.
value_type_ksf	CHAR		0:true value,-1:Ksf<lower meas.limit,1:Ksf>upper meas.limit,
l_measl_ksf	FLOAT	m/s	Estimated lower meas.limit for evaluated Ksf,see table desc.
u_measl_ksf	FLOAT	m/s	Estimated upper meas.limit for evaluated Ksf,see table descr
spec_storage_ssf	FLOAT	1/m	Ssf:Specific storage,3D model evaluation,see table descr.
assumed_ssf	FLOAT	1/m	Ssf*:Assumed Spec.storage,3D model evaluation,see table des.
c	FLOAT	m**3/pa	C: Wellbore storage coefficient; flow or recovery period
cd	FLOAT		CD: Dimensionless wellbore storage coefficient
skin	FLOAT		Skin factor;best estimate of flow/recovery period,see descr.
dt1	FLOAT	s	Estimated start time of evaluation, see table description
dt2	FLOAT	s	Estimated stop time of evaluation. see table description
t1	FLOAT	s	Start time for evaluated parameter from start flow period
t2	FLOAT	s	Stop time for evaluated parameter from start of flow period
dte1	FLOAT	s	Start time for evaluated parameter from start of recovery
dte2	FLOAT	s	Stop time for evaluated parameter from start of recovery
p_horner	FLOAT	kPa	p*:Horner extrapolated pressure, see table description
transmissivity_t_nlr	FLOAT	m**2/s	T_NLR Transmissivity based on None Linear Regression...
storativity_s_nlr	FLOAT		S_NLR=storativity based on None Linear Regression,see..
value_type_t_nlr	CHAR		0:true value,-1:T_NLR<lower meas.limit,1:>upper meas.limit
bc_t_nlr	CHAR		Best choice code. 1 means T_NLR is best choice of T, else 0
c_nlr	FLOAT	m**3/pa	Wellbore storage coefficient, based on NLR, see descr.
cd_nlr	FLOAT		Dimensionless wellbore storage constant, see table descrip.
skin_nlr	FLOAT		Skin factor based on Non Linear Regression,see desc.
transmissivity_t_grf	FLOAT	m**2/s	T_GRF:Transmissivity based on Genelized Radial Flow,see...
value_type_t_grf	CHAR		0:true value,-1:T_GRF<lower meas.limit,1:>upper meas.limit
bc_t_grf	CHAR		Best choice code. 1 means T_GRF is best choice of T, else 0
storativity_s_grf	FLOAT		S_GRF:Storativity based on Generalized Radial Flow, see des.
flow_dim_grf	FLOAT		Inferred flow dimesion based on Generalized Rad. Flow model
comment	VARCHAR	no_unit	Short comment to the evaluated parameters
error_flag	CHAR		If error_flag = "*" then an error occured and an error
in_use	CHAR		If in_use = "*" then the activity has been selected as
sign	CHAR		Signature for QA data accknowledge (QA - OK)

idcode	start_date	stop_date	secup	seclow	section_no	test_type	formation_type	lp	seclen_class	spec_capacity_q_s	value_type_q_s	transmissivity_tq	value_type_tq	bc_tq	transmissivity_moye	bc_tm	value_type_tm	hydr_cond_moye	formation_width_b	width_of_channel_b
KLX 08	2006-09-28 07:55:00	2006-09-28 10:12:00	103.00	203.00		3	1	153.00	100	7.96E-04	0				1.04E-03	0	0	1.04E-05		
KLX 08	2006-09-28 11:37:00	2006-09-28 14:04:00	203.00	303.00		3	1	253.00	100	1.60E-04	0				2.09E-04	0	0	2.09E-06		
KLX 08	2006-09-28 15:27:00	2006-09-28 17:28:00	305.00	405.00		3	1	355.00	100	1.00E-04	0				1.31E-04	0	0	1.31E-06		
KLX 08	2006-09-28 19:13:00	2006-09-28 21:27:00	403.00	503.00		3	1	453.00	100	2.23E-04	0				2.91E-04	0	0	2.91E-06		
KLX 08	2006-10-06 09:32:00	2006-10-06 12:05:00	503.00	603.00		3	1	553.00	100	3.19E-08	0				4.15E-08	0	0	4.15E-10		
KLX 08	2006-10-06 14:05:00	2006-10-06 16:06:00	603.00	703.00		3	1	653.00	100	2.98E-06	0				3.89E-06	0	0	3.89E-08		
KLX 08	2006-10-06 17:48:00	2006-10-06 20:40:00	703.00	803.00		3	1	753.00	100	1.17E-08	0				1.53E-08	0	0	1.53E-10		
KLX 08	2006-10-06 22:17:00	2006-10-07 00:54:00	803.00	903.00		3	1	853.00	100	7.39E-08	0				9.62E-08	0	0	9.62E-10		
KLX 08	2006-10-07 06:04:00	2006-10-07 09:02:00	863.00	963.00		3	1	913.00	100	1.51E-09	0				1.96E-09	0	0	1.96E-11		
KLX 08	2006-10-08 07:04:00	2006-10-08 08:32:00	104.00	124.00		3	1	114.00	20	5.27E-05	0				5.52E-05	0	0	2.76E-06		
KLX 08	2006-10-08 09:13:00	2006-10-08 10:41:00	125.00	145.00		3	1	135.00	20	1.45E-06	0				1.51E-06	0	0	7.55E-08		
KLX 08	2006-10-08 11:12:00	2006-10-08 12:38:00	144.00	164.00		3	1	154.00	20	1.40E-04	0				1.47E-04	0	0	7.35E-06		
KLX 08	2006-10-08 13:19:00	2006-10-08 14:42:00	164.00	184.00		3	1	174.00	20	2.76E-04	0				2.89E-04	0	0	1.45E-05		
KLX 08	2006-10-08 15:14:00	2006-10-08 16:36:00	183.50	203.50		3	1	193.50	20	4.11E-04	0				4.30E-04	0	0	2.15E-05		
KLX 08	2006-10-08 17:07:00	2006-10-08 18:30:00	203.00	223.00		3	1	213.00	20	1.62E-04	0				1.70E-04	0	0	8.50E-06		
KLX 08	2006-10-08 19:00:00	2006-10-08 20:26:00	223.50	243.50		3	1	233.50	20	7.63E-06	0				7.98E-06	0	0	3.99E-07		
KLX 08	2006-10-08 21:09:00	2006-10-08 22:36:00	243.50	263.50		3	1	253.50	20	1.68E-07	0				1.76E-07	0	0	8.80E-09		
KLX 08	2006-10-08 23:10:00	2006-10-09 00:33:00	264.00	284.00		3	1	274.00	20	4.73E-07	0				4.95E-07	0	0	2.48E-08		
KLX 08	2006-10-09 01:07:00	2006-10-09 02:31:00	284.00	304.00		3	1	294.00	20	2.04E-06	0				2.13E-06	0	0	1.07E-07		
KLX 08	2006-10-09 06:17:00	2006-10-09 07:50:00	304.00	324.00		3	1	314.00	20	3.02E-08	0				3.16E-08	0	0	1.58E-09		
KLX 08	2006-10-09 08:23:00	2006-10-09 10:04:00	324.00	344.00		3	1	334.00	20	2.53E-09	0				2.65E-09	0	0	1.33E-10		
KLX 08	2006-10-09 10:41:00	2006-10-09 12:08:00	344.00	364.00		3	1	354.00	20	3.56E-08	0				3.73E-08	0	0	1.87E-09		
KLX 08	2006-10-09 12:57:00	2006-10-09 14:27:00	364.00	384.00		3	1	374.00	20	3.88E-06	0				4.06E-06	0	0	2.03E-07		
KLX 08	2006-10-09 15:01:00	2006-10-09 16:25:00	385.00	405.00		3	1	395.00	20	9.38E-05	0				9.81E-05	0	0	4.91E-06		
KLX 08	2006-10-09 16:55:00	2006-10-09 18:19:00	403.00	423.00		3	1	413.00	20	3.57E-04	0				3.74E-04	0	0	1.87E-05		
KLX 08	2006-10-09 18:50:00	2006-10-09 20:17:00	423.00	443.00		3	1	433.00	20	2.98E-07	0				3.12E-07	0	0	1.56E-08		
KLX 08	2006-10-09 21:00:00	2006-10-09 22:23:00	443.00	463.00		3	1	453.00	20	7.23E-07	0				7.57E-07	0	0	3.79E-08		
KLX 08	2006-10-09 23:36:00	2006-10-10 00:35:00	463.00	483.00		3	1	473.00	20	3.34E-06	0				3.50E-06	0	0	1.75E-07		
KLX 08	2006-10-10 01:14:00	2006-10-10 02:38:00	483.00	503.00		3	1	493.00	20	3.16E-07	0				3.31E-07	0	0	1.66E-08		
KLX 08	2006-10-10 06:13:00	2006-10-10 08:07:00	503.00	523.00		4B	1	513.00	20	#NV	-1				#NV	0	-1	#NV		
KLX 08	2006-10-10 08:37:00	2006-10-10 10:22:00	523.00	543.00		3	1	533.00	20	8.30E-09	0				8.68E-09	0	0	4.34E-10		
KLX 08	2006-10-10 10:59:00	2006-10-10 12:41:00	543.00	563.00		3	1	553.00	20	3.97E-09	0				4.15E-09	0	0	2.08E-10		
KLX 08	2006-10-10 13:25:00	2006-10-10 15:01:00	563.00	583.00		3	1	573.00	20	4.39E-09	0				4.59E-09	0	0	2.30E-10		
KLX 08	2006-10-10 15:33:00	2006-10-10 16:58:00	583.00	603.00		3	1	593.00	20	2.03E-08	0				2.13E-08	0	0	1.07E-09		
KLX 08	2006-10-10 17:32:00	2006-10-10 18:55:00	603.00	623.00		3	1	613.00	20	9.48E-07	0				9.92E-07	0	0	4.96E-08		
KLX 08	2006-10-10 19:25:00	2006-10-10 20:50:00	623.00	643.00		3	1	633.00	20	1.64E-08	0				1.71E-08	0	0	8.55E-10		
KLX 08	2006-10-10 21:30:00	2006-10-10 22:54:00	643.00	663.00		3	1	653.00	20	2.12E-06	0				2.22E-06	0	0	1.11E-07		
KLX 08	2006-10-10 23:25:00	2006-10-11 00:49:00	663.00	683.00		3	1	673.00	20	2.30E-06	0				2.40E-06	0	0	1.20E-07		
KLX 08	2006-10-11 01:25:00	2006-10-11 03:01:00	683.00	703.00		3	1	693.00	20	2.95E-09	0				3.08E-09	0	0	1.54E-10		
KLX 08	2006-10-11 05:22:00	2006-10-11 06:11:00	703.00	723.00		3	1	713.00	20	#NV	-1				#NV	0	-1	#NV		
KLX 08	2006-10-11 06:43:00	2006-10-11 08:51:00	723.00	743.00		3	1	733.00	20	2.15E-09	0				2.25E-09	0	0	1.13E-10		
KLX 08	2006-10-11 09:27:00	2006-10-11 11:47:00	743.00	763.00		3	1	753.00	20	1.11E-09	0				1.16E-09	0	0	5.80E-11		
KLX 08	2006-10-11 12:33:00	2006-10-11 14:52:00	763.00	783.00		3	1	773.00	20	1.06E-08	0				1.11E-08	0	0	5.55E-10		
KLX 08	2006-10-11 15:28:00	2006-10-11 17:14:00	783.00	803.00		4B	1	793.00	20	#NV	-1				#NV	0	-1	#NV		
KLX 08	2006-10-11 17:47:00	2006-10-11 18:34:00	803.00	823.00		3	1	813.00	20	#NV	-1				#NV	0	-1	#NV		

idcode	secup	seclow	tb	l_measl_tb	u_measl_tb	sb	assumed_sb	leakage_factor_lf	transmissivity_tt	value_type_tt	bc_tt	l_measl_q_s	u_measl_q_s	storativity_s	assumed_s	bc_s	ri	ri_index	leakage_coeff	hydr_cond_ksf	value_type_ksf	l_measl_ksf	u_measl_ksf	spec_storage_ssf	assumed_ssf
KLX 08	103.00	203.00							4.15E-04	0	1	1.00E-04	8.00E-04	1.00E-06	1.00E-06		432.57	0							
KLX 08	203.00	303.00							3.16E-04	0	1	9.00E-05	7.00E-04	1.00E-06	1.00E-06		112.37	1							
KLX 08	305.00	405.00							1.74E-04	0	1	7.00E-05	4.00E-04	1.00E-06	1.00E-06		348.09	0							
KLX 08	403.00	503.00							2.54E-04	0	1	9.00E-05	5.00E-04	1.00E-06	1.00E-06		382.61	0							
KLX 08	503.00	603.00							4.10E-08	0	1	2.00E-08	7.00E-08	1.00E-06	1.00E-06		43.13	0							
KLX 08	603.00	703.00							1.48E-06	0	1	8.00E-07	4.00E-06	1.00E-06	1.00E-06		32.52	-1							
KLX 08	703.00	803.00							4.50E-09	0	1	1.00E-09	6.00E-09	1.00E-06	1.00E-06		9.65	1							
KLX 08	803.00	903.00							5.95E-08	0	1	2.00E-08	9.00E-08	1.00E-06	1.00E-06		47.33	0							
KLX 08	863.00	963.00							7.30E-10	0	1	2.00E-10	3.00E-09	1.00E-06	1.00E-06		15.75	0							
KLX 08	104.00	124.00							2.00E-04	0	1	9.00E-05	7.00E-04	1.00E-06	1.00E-06		294.28	-1							
KLX 08	125.00	145.00							7.30E-06	0	1	5.00E-06	5.00E-05	1.00E-06	1.00E-06		128.63	-1							
KLX 08	144.00	164.00							4.28E-04	0	1	1.00E-04	8.00E-04	1.00E-06	1.00E-06		196.08	1							
KLX 08	164.00	184.00							4.20E-04	0	1	1.00E-04	8.00E-04	1.00E-06	1.00E-06		141.70	1							
KLX 08	183.50	203.50							4.98E-04	0	1	9.00E-05	9.00E-04	1.00E-06	1.00E-06		369.67	0							
KLX 08	203.00	223.00							1.83E-04	0	1	7.00E-05	5.00E-04	1.00E-06	1.00E-06		287.82	0							
KLX 08	223.50	243.50							3.36E-05	0	1	1.00E-05	6.00E-05	1.00E-06	1.00E-06		188.40	-1							
KLX 08	243.50	263.50							5.83E-07	0	1	1.00E-07	1.00E-06	1.00E-06	1.00E-06		68.38	0							
KLX 08	264.00	284.00							3.76E-07	0	1	1.00E-07	1.00E-06	1.00E-06	1.00E-06		10.79	-1							
KLX 08	284.00	304.00							6.60E-06	0	1	2.00E-06	9.00E-06	1.00E-06	1.00E-06		125.43	-1							
KLX 08	304.00	324.00							1.30E-07	0	1	2.00E-08	3.00E-07	1.00E-06	1.00E-06		28.46	-1							
KLX 08	324.00	344.00							2.70E-09	0	1	9.00E-10	5.00E-09	1.00E-06	1.00E-06		17.84	-1							
KLX 08	344.00	364.00							3.98E-08	0	1	1.00E-08	7.00E-08	1.00E-06	1.00E-06		34.95	0							
KLX 08	364.00	384.00							2.30E-05	0	1	5.00E-06	6.00E-05	1.00E-06	1.00E-06		171.37	-1							
KLX 08	385.00	405.00							2.41E-04	0	1	8.00E-05	6.00E-04	1.00E-06	1.00E-06		103.87	1							
KLX 08	403.00	423.00							1.27E-04	0	1	7.00E-05	5.00E-04	1.00E-06	1.00E-06		262.70	0							
KLX 08	423.00	443.00							1.30E-06	0	1	7.00E-07	4.00E-06	1.00E-06	1.00E-06		83.56	0							
KLX 08	443.00	463.00							3.13E-06	0	1	8.00E-07	5.00E-06	1.00E-06	1.00E-06		104.09	0							
KLX 08	463.00	483.00							8.67E-06	0	1	5.00E-06	1.00E-05	1.00E-06	1.00E-06		134.28	0							
KLX 08	483.00	503.00							1.00E-06	0	1	7.00E-07	4.00E-06	1.00E-06	1.00E-06		78.25	-1							
KLX 08	503.00	523.00							4.90E-11	1	1	1.00E-11	9.00E-11	1.00E-06	1.00E-06		11.43	0							
KLX 08	523.00	543.00							5.10E-09	0	1	1.00E-09	9.00E-09	1.00E-06	1.00E-06		20.93	0							
KLX 08	543.00	563.00							6.60E-09	0	1	1.00E-09	9.00E-09	1.00E-06	1.00E-06		12.56	1							
KLX 08	563.00	583.00							4.70E-09	0	1	1.00E-09	9.00E-09	1.00E-06	1.00E-06		20.49	-1							
KLX 08	583.00	603.00							6.85E-08	0	1	1.00E-08	1.00E-07	1.00E-06	1.00E-06		40.03	0							
KLX 08	603.00	623.00							2.41E-06	0	1	7.00E-07	5.00E-06	1.00E-06	1.00E-06		97.50	0							
KLX 08	623.00	643.00							7.11E-08	0	1	1.00E-08	1.00E-07	1.00E-06	1.00E-06		40.41	0							
KLX 08	643.00	663.00							1.53E-06	0	1	7.00E-07	3.00E-06	1.00E-06	1.00E-06		87.03	0							
KLX 08	663.00	683.00							1.31E-06	0	1	7.00E-07	3.00E-06	1.00E-06	1.00E-06		31.32	-1							
KLX 08	683.00	703.00							4.60E-09	0	1	1.00E-09	9.00E-09	1.00E-06	1.00E-06		11.94	-1							
KLX 08	703.00	723.00							1.00E-11	-1	1	1.00E-13	1.00E-11	1.00E-06	1.00E-06		#NV	#NV							
KLX 08	723.00	743.00							2.20E-09	0	1	8.00E-10	5.00E-09	1.00E-06	1.00E-06		15.45	1							
KLX 08	743.00	763.00							2.19E-09	0	1	8.00E-10	5.00E-09	1.00E-06	1.00E-06		#NV	1							
KLX 08	763.00	783.00							2.08E-09	0	1	9.00E-10	9.00E-09	1.00E-06	1.00E-06		16.71	1							
KLX 08	783.00	803.00							2.75E-12	-1	1	9.00E-13	5.00E-12	1.00E-06	1.00E-06		5.54	1							
KLX 08	803.00	823.00							1.00E-11	-1	1	1.00E-13	1.00E-11	1.00E-06	1.00E-06		#NV	#NV							

idcode	secup	seclow	c	cd	skin	dt1	dt2	t1	t2	dte1	dte2	p_horner	transmissivity_t_nlr	storativity_s_nlr	value_type_t_nlr	bc_t_nlr	c_nlr	cd_nlr	skin_nlr	transmissivity_t_grf	value_type_t_grf	bc_t_grf	storativity_s_grf	flow_dim_grf	comment
KLX 08	103.00	203.00	4.55E-07	5.01E+01	-6.00	25.8	31.8					1696.5													
KLX 08	203.00	303.00	1.71E-07	1.88E+01	0.84	49.8	139.2					2528.2													
KLX 08	305.00	405.00	4.03E-08	4.44E+00	1.57	45.6	278.4					3394.0													
KLX 08	403.00	503.00	7.68E-08	8.46E+00	-5.11	21.0	260.4					4226.5													
KLX 08	503.00	603.00	3.97E-10	4.38E-02	2.18	249.0	1446.6					5070.9													
KLX 08	603.00	703.00	7.64E-09	8.42E-01	-4.50	37.2	170.4					5914.3													
KLX 08	703.00	803.00	3.85E-10	4.24E-02	-1.79	271.8	1513.2					#NV													
KLX 08	803.00	903.00	2.10E-09	2.31E-01	-1.56	#NV	#NV					7591.3													
KLX 08	863.00	963.00	1.91E-10	2.11E-02	-0.95	46.8	787.2					#NV													
KLX 08	104.00	124.00	6.62E-08	7.30E+00	7.00	#NV	#NV					1003.6													
KLX 08	125.00	145.00	8.33E-10	9.18E-02	0.05	140.4	388.2					1176.3													
KLX 08	144.00	164.00	1.57E-07	1.73E+01	8.71	130.8	364.2					1339.6													
KLX 08	164.00	184.00	9.69E-08	1.07E+01	1.13	25.8	192.0					1511.6													
KLX 08	183.50	203.50	1.11E-08	1.22E+00	-3.08	159.0	1198.2					1679.3													
KLX 08	203.00	223.00	1.11E-07	1.22E+01	-2.39	49.2	223.8					1846.7													
KLX 08	223.50	243.50	4.13E-09	4.55E-01	5.90	92.4	982.2					2020.3													
KLX 08	243.50	263.50	8.34E-11	9.19E-03	15.02	70.2	984.0					2198.7													
KLX 08	264.00	284.00	8.11E-11	8.94E-03	-1.09	8.4	37.2					2361.3													
KLX 08	284.00	304.00	1.21E-09	1.33E-01	1.00	56.4	661.2					2553.2													
KLX 08	304.00	324.00	4.64E-11	5.11E-03	-0.11	288.0	1075.2					2703.6													
KLX 08	324.00	344.00	7.09E-11	7.81E-03	2.44	#NV	#NV					#NV													
KLX 08	344.00	364.00	5.69E-11	6.27E-03	-0.96	49.2	1172.4					3048.7													
KLX 08	364.00	384.00	3.97E-10	4.38E-02	2.28	47.4	711.6					3218.8													
KLX 08	385.00	405.00	3.19E-08	3.52E+00	6.29	22.8	136.2					3398.8													
KLX 08	403.00	423.00	5.51E-09	6.07E-01	-6.10	41.4	395.4					3550.9													
KLX 08	423.00	443.00	7.69E-11	8.48E-03	20.82	19.8	776.4					3718.9													
KLX 08	443.00	463.00	1.98E-10	2.18E-02	20.30	34.8	222.6					3888.9													
KLX 08	463.00	483.00	1.33E-09	1.47E-01	7.88	42.6	1120.2					4054.0													
KLX 08	483.00	503.00	1.03E-10	1.14E-02	2.20	346.8	967.8					4226.9													
KLX 08	503.00	523.00	5.89E-11	6.49E-03	-1.25	#NV	#NV					#NV													
KLX 08	523.00	543.00	1.37E-10	1.51E-02	-0.88	211.2	1052.4					#NV													
KLX 08	543.00	563.00	8.59E-11	9.47E-03	1.19	94.2	380.4					#NV													
KLX 08	563.00	583.00	9.31E-11	1.03E-02	1.15	#NV	#NV					#NV													
KLX 08	583.00	603.00	5.07E-11	5.59E-03	15.27	199.2	831.0					5074.5													
KLX 08	603.00	623.00	3.53E-10	3.89E-02	8.54	37.2	1077.0					5241.9													
KLX 08	623.00	643.00	7.42E-11	8.18E-03	20.80	383.4	1001.4					5413.0													
KLX 08	643.00	663.00	4.36E-10	4.81E-02	-3.05	49.8	1062.6					5583.9													
KLX 08	663.00	683.00	5.50E-09	6.06E-01	-3.73	18.6	168.0					5747.7													
KLX 08	683.00	703.00	7.18E-11	7.91E-03	4.73	184.2	411.6					5921.1													
KLX 08	703.00	723.00	#NV	#NV	#NV	#NV	#NV					#NV													
KLX 08	723.00	743.00	8.41E-11	9.27E-03	1.20	379.2	997.2					#NV													
KLX 08	743.00	763.00	1.46E-10	1.61E-02	0.92	#NV	#NV					#NV													
KLX 08	763.00	783.00	6.79E-10	7.48E-02	-3.91	169.2	1046.4					#NV													
KLX 08	783.00	803.00	4.77E-11	5.26E-03	-1.41	#NV	#NV					#NV													
KLX 08	803.00	823.00	#NV	#NV	#NV	#NV	#NV					#NV													

Table	plu_s_hole_test_obs Data of observation sections of single hole test		
Column	**Datatype**	**Unit**	**Column Description**
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
idcode	CHAR		Object or borehole identification code
start_date	DATE		Date (yymmdd hh:mm:ss)
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
obs_secup	FLOAT	m	Upper limit of observation section
obs_seclow	FLOAT	m	Lower limit of observation section
pi_above	FLOAT	kPa	Groundwater pressure above test section,start of flow period
pp_above	FLOAT	kPa	Groundwater pressure above test section,at stop flow period
pf_above	FLOAT	kPa	Groundwater pressure above test section at stop recovery per
pi_below	FLOAT	kPa	Groundwater pressure below test section at start flow period
pp_below	FLOAT	kPa	Groundwater pressure below test section at stop flow period
pf_below	FLOAT	kPa	Groundwater pressure below test section at stop recovery per
comments	VARCHAR		Comment text row (unformatted text)

idcode	start_date	stop_date	secup	seclow	section_no	obs_secup	obs_seclow	pi_above	pp_above	pf_above	pi_below	pp_below	pf_below	comments
KLX 08	060928 07:55:00	060928 10:12:00	103.00	203.00		204.00	1000.41	854	852	856	1727	1730	1728	
KLX 08	060928 11:37:00	060928 14:04:00	203.00	303.00		304.00	1000.41	1682	1684	1681	2556	2556	2556	
KLX 08	060928 15:27:00	060928 17:28:00	305.00	405.00		406.00	1000.41	2550	2549	2549	3420	3428	3422	
KLX 08	060928 19:13:00	060928 21:27:00	403.00	503.00		504.00	1000.41	3380	3380	3379	4250	4251	4251	
KLX 08	061006 09:32:00	061006 12:05:00	503.00	603.00		604.00	1000.41	4224	4224	4224	5096	5096	5096	
KLX 08	061006 14:05:00	061006 16:06:00	603.00	703.00		704.00	1000.41	5071	5071	5071	5939	5939	5939	
KLX 08	061006 17:48:00	061006 20:40:00	703.00	803.00		804.00	1000.41	5916	5916	5916	6783	6783	6783	
KLX 08	061006 22:17:00	061007 00:54:00	803.00	903.00		904.00	1000.41	6758	6758	6758	7637	7633	7631	
KLX 08	061007 06:04:00	061007 09:02:00	863.00	963.00		964.00	1000.41	7263	7263	7263	8279	8277	8270	
KLX 08	061008 07:04:00	061008 08:32:00	104.00	124.00		125.00	1000.41	837	837	839	1028	1029	1029	
KLX 08	061008 09:13:00	061008 10:41:00	125.00	145.00		146.00	1000.41	1017	1017	1017	1207	1207	1208	
KLX 08	061008 11:12:00	061008 12:38:00	144.00	164.00		165.00	1000.41	1179	1177	1177	1370	1373	1371	
KLX 08	061008 13:19:00	061008 14:42:00	164.00	184.00		185.00	1000.41	1345	1346	1345	1541	1544	1542	
KLX 08	061008 15:14:00	061008 16:36:00	183.50	203.50		204.50	1000.41	1511	1513	1511	1708	1711	1709	
KLX 08	061008 17:07:00	061008 18:30:00	203.00	223.00		224.00	1000.41	1678	1680	1678	1876	1876	1876	
KLX 08	061008 19:00:00	061008 20:26:00	223.50	243.50		244.50	1000.41	1853	1854	1853	2050	2050	2050	
KLX 08	061008 21:09:00	061008 22:36:00	243.50	263.50		264.50	1000.41	2022	2022	2022	2220	2220	2220	
KLX 08	061008 23:10:00	061009 00:33:00	264.00	284.00		285.00	1000.41	2196	2196	2196	2394	2394	2394	
KLX 08	061009 01:07:00	061009 02:31:00	284.00	304.00		305.00	1000.41	2366	2366	2366	2564	2564	2564	
KLX 08	061009 06:17:00	061009 07:50:00	304.00	324.00		325.00	1000.41	2537	2537	2537	2735	2735	2735	
KLX 08	061009 08:23:00	061009 10:04:00	324.00	344.00		345.00	1000.41	2706	2706	2706	2905	2905	2905	
KLX 08	061009 10:41:00	061009 12:08:00	344.00	364.00		365.00	1000.41	2877	2877	2877	3075	3075	3075	
KLX 08	061009 12:57:00	061009 14:27:00	364.00	384.00		385.00	1000.41	3046	3047	3047	3245	3245	3245	
KLX 08	061009 15:01:00	061009 16:25:00	385.00	405.00		406.00	1000.41	3225	3226	3225	3423	3431	3425	
KLX 08	061009 16:55:00	061009 18:19:00	403.00	423.00		424.00	1000.41	3378	3378	3378	3576	3577	3577	
KLX 08	061009 18:50:00	000100 20:17:00	423.00	443.00		444.00	1000.41	3546	3546	3546	3745	3745	3745	
KLX 08	061009 21:00:00	061009 22:23:00	443.00	463.00		464.00	1000.41	3716	3716	3716	3914	3914	3914	
KLX 08	061009 23:36:00	061010 00:35:00	463.00	483.00		484.00	1000.41	3884	3884	3884	4083	4083	4083	
KLX 08	061010 01:14:00	061010 02:38:00	483.00	503.00		504.00	1000.41	4053	4053	4053	4252	4252	4252	
KLX 08	061010 06:13:00	061010 08:07:00	503.00	523.00		524.00	1000.41	4221	4221	4221	4421	4421	4421	
KLX 08	061010 08:37:00	061010 10:22:00	523.00	543.00		544.00	1000.41	4392	4392	4392	4591	4591	4591	
KLX 08	061010 10:59:00	061010 12:41:00	543.00	563.00		564.00	1000.41	4561	4561	4561	4760	4760	4760	
KLX 08	061010 13:25:00	061010 15:01:00	563.00	583.00		584.00	1000.41	4730	4730	4730	4929	4929	4929	
KLX 08	061010 15:33:00	061010 16:58:00	583.00	603.00		604.00	1000.41	4900	4900	4900	5098	5098	5098	
KLX 08	061010 17:32:00	061010 18:55:00	603.00	623.00		624.00	1000.41	5068	5068	5068	5267	5267	5267	
KLX 08	061010 19:25:00	061010 20:50:00	623.00	643.00		644.00	1000.41	5238	5238	5238	5437	5437	5437	
KLX 08	061010 21:30:00	061010 22:54:00	643.00	663.00		664.00	1000.41	5407	5407	5407	5607	5774	5621	
KLX 08	061010 23:25:00	061011 00:49:00	663.00	683.00		684.00	1000.41	5577	5577	5577	5776	5778	5776	
KLX 08	061011 01:25:00	061011 03:01:00	683.00	703.00		704.00	1000.41	5745	5745	5745	5942	5942	5942	
KLX 08	061011 05:22:00	061011 06:11:00	703.00	723.00		724.00	1000.41	5912	5912	5912	6110	6110	6110	
KLX 08	061011 06:43:00	061011 08:51:00	723.00	743.00		744.00	1000.41	6083	6083	6083	6279	6279	6279	
KLX 08	061011 09:27:00	061011 11:47:00	743.00	763.00		764.00	1000.41	6254	6254	6254	6449	6449	6449	
KLX 08	061011 12:33:00	061011 14:52:00	763.00	783.00		784.00	1000.41	6422	6422	6422	6617	6617	6617	
KLX 08	061011 15:28:00	061011 17:14:00	783.00	803.00		804.00	1000.41	6591	6591	6591	6787	6787	6787	
KLX 08	061011 17:47:00	061011 18:34:00	803.00	823.00		824.00	1000.41	6759	6759	6759	6955	6955	6955	