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Forsmark site investigation

Large-scale interference test with borehole HFM14 used as pumping borehole, 2007

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Abstract

Two interference tests were performed at Forsmark with borehole HFM14 used as pumping borehole. HFM14 is situated by drill site 5 in the north-western part of the candidate area. It is approximately 150 m long and inclined c. 60° north by north-west. The tests were performed in order to increase the understanding of the hydraulic conditions in the northern part of the candidate area at Forsmark. The main purpose of the interference tests was to document different fracture zones, to quantify their hydraulic properties and to clarify whether there are any hydraulic boundaries in the area.

The interference tests were performed by pumping in HFM14 and at the same time monitoring pressure responses in different observation sections in surrounding boreholes. All boreholes monitored for potential responses are part of the HMS, the Hydro Monitoring System. In total, 185 observation sections in 49 observation boreholes were included in the interference test. 21 of the 49 boreholes are core-drilled and have 118 sections included in the interference test. 28 boreholes are percussion-drilled with a total of 67 sections. Only two observation boreholes, KFM08A and KFM08D, containing 9 and 7 sections, were included in the second interference test.

The flow period in the first, main interference test lasted for almost 15 weeks and the subsequent recovery was measured for about 7 days. Activities in the area influenced the pressure in many observations sections which made a longer recovery time impossible. The pumping flow rate in HFM14 was relatively constant at c. 349 L/min during the flow period, resulting in a final drawdown in the pumping borehole of about 12 m. These values indicate a specific capacity (~ transmissivity) of $5 \cdot 10^{-4}$ m^2/s which is a high value. The capacity of the well was, in conjunction with drilling, estimated at about 36,000 L/h, which is c. 60 times more than a Swedish standard well in fractured rock.

The second interference test was much shorter with a flow period of approximately 16 days and where recovery was measured for c. 1 week. The pumping flow rate was similar to that used in the first test and the final drawdown slightly less than that reached during the first longer pumping. The second interference test was performed in order to get information about boreholes KFM08A and KFM08D which were not yet fitted with monitoring equipment for the HMS in time for the first interference test. At a very late stage also KFM02B and KFM11A were included in this test.

Out of the 185 observation sections included in the interference tests, 76 did not respond at all to pumping in HFM14 or responded very weakly. Of the remaining 109 sections, approximately 50% responded with a drawdown of more than 0.5 m. Four observation sections stand out as responding most strongly. These sections, HFM15: 0–84 m, HFM15: 85–95 m, HFM19: 168–182 m and KFM10A: 430–440 m, together with at least three other sections; HFM19: 104–167 m, HFM13: 159–173 m and KFM10A: 441–500 m, demonstrate responses that are distinct enough to be characterized as potential zone responses between HFM14 and the actual sections.

In KFM08D, section 0–160 m is clearly affected by the pumping in HFM14. Neither any of the other sections in KFM08D nor any of the sections in KFM08A can be said to respond clearly to the pumping in HFM14.

Six observation sections, HFM01: 33.5–45.5 m, HFM13: 159–173 m, HFM15: 85–95 m, HFM19: 168–182 m, HFM32: 26–31 m and KFM10A: 430–440 m, as well as the pumping borehole were evaluated quantitatively using methods for transient evaluation. The evaluated observation sections were chosen since they were used in a tracer dilution test that was running at the same time as the first hydraulic interference test. For the pumping borehole, HFM14, the transmissivity from the transient evaluation was $3.7 \cdot 10^{-4}$ m^2/s which is in good agreement with previously performed investigations. The estimated transmissivities from observation

sections HFM01: 33.5–45.5 m and KFM10A: 430–440 m are significantly higher than the T-values obtained from single-hole tests from previous investigations (/2/ and /34/), cf. Table 3-4. Thus, the results from the interference test may not be quite representative of the formation close to the observation section but rather to an adjacent fracture zone, suggesting that the response may possibly be a strong secondary response rather than a primary response. The estimated T-values from the other observation sections correspond well to those from previous single-hole investigations.

The results of the interference tests show a fairly good agreement between the estimated hydraulic diffusivity of the sections based on the response time lags and from the results of the transient evaluation, respectively.

During the tests, several observation sections were influenced by so called tidal effects, and probably to some extent also by changes of the sea level. Primarily due to the tidal effects the pressure data from certain observation sections exhibit an oscillating behaviour. Also, it is suspected that precipitation and shifting sea water levels to some extent may have been influencing the results from the response evaluation.

Sammanfattning

Två interferenstester har genomförts i Forsmark med borrhål HFM14 som pumphål. HFM14 är beläget vid borrplats 5 i den nordvästra delen av kandidatområdet. Det är ca 150 m långt och lutar ca 60° mot NNW. Huvudsyftet med de utförda interferenstesterna är att dokumentera hur spricksystemen i berget hänger ihop hydrauliskt, kvantifiera deras hydrauliska egenskaper, samt att klargöra om det finns några hydrauliska gränser inom området.

Interferenstesterna utfördes genom att en tryckavsänkning skapades i HFM14 samtidigt som tryckresponser registrerades i olika observationssektioner i ett flertal omgivande borrhål. Alla borrhål som övervakades ingår i SKB:s hydromoniteringssystem, HMS. Totalt övervakades 49 borrhål och sammanlagt 185 observationssektioner ingick i interfenstestet. 21 av de 49 hålen är kärnborrhål med sammanlagt 118 observationssektioner, medan 28 är hammarborrhål med sammanlagt 67 observationssektioner. Endast två observationsborrhål, KFM08A och KFM08D, med vardera 9 och 7 observationssektioner ingick i det andra interferenstestet.

Pumpfasen för det första, huvudsakliga interferenstestet pågick under nästan 15 veckor och den påföljande återhämtningen registrerades i ungefär 7 dagar. Aktiviteter i området påverkade trycket i ett flertal observationssektioner, vilket omöjliggjorde en längre återhämtningsperiod. Pumpflödet från HFM14 låg relativt konstant runt 349 L/min under pumpfasen och resulterade i en slutlig avsänkning i pumpborrhålet av ca 12 m. Dessa värden indikerar en specifik kapacitet (~ transmissivitet) av $5 \cdot 10^{-4}$ m^2/s, vilket är ett högt värde. Brunnskapaciteten i samband med borrning uppskattades till ca 36 000 L/h, vilket är ca 60 ggr mer än hos en svensk normalbrunn i sprickigt berg.

Det andra interferenstestet pågick under mycket kortare tid med en pumpfas som pågick i ca 16 dygn och med en efterföljande återhämtningsperiod på ungefär en vecka. Pumpflödet motsvarade flödet från det första testet men den slutliga avsänkningen var något mindre än den som blev resultatet av den första, längre pumpningen. Det andra interferenstestet utfördes för att få information om borrhålen KFM08A och KFM08D som inte var färdiginstrumenterade med HMS-utrustning i tid för det första interferenstestet. I ett mycket sent skede inkluderades även KFM02B och KFM11Ai detta test.

Av de 185 observationssektioner som ingick i interferenstestet reagerade 76 sektioner inte alls eller bara mycket svagt på avsänkningen i HFM14. Av de återstående 109 sektionerna responderade ca 50 % med en avsänkning som översteg 0.5 m. Fyra observationssektioner uppvisar de allra starkaste tryckresponserna. Dessa sektioner, HFM15: 0–84 m, HFM15: 85–95 m, HFM19: 168–182 m och KFM10A: 430–440 m, tillsammans med åtminstone tre andra sektioner, HFM19: 104–167 m, HFM13: 159–173 och KFM10A: 441–500 m, uppvisar responser som är distinkta nog att kunna karaktäriseras som potentiella hög-transmissiva zonresponser mellan HFM14 och respektive borrhålssektion.

I KFM08D är sektion 0–160 m tydligt påverkad av pumpningen i HFM14. Inga av de andra sektionerna i KFM08D och heller inte någon sektion i KFM08A kan sägas uppvisa något tydlig svar från pumpningen i HFM14.

Sex observationssektioner, HFM01: 33.5–45.5 m, HFM13: 159–173 m, HFM15: 85–95 m, HFM19: 168–182 m, HFM32: 26–31 m och KFM10A: 430–440 m, samt pumpborrhålet utvärderades kvantitativt med metoder för transient utvärdering. De utvärderade observationssektionerna valdes ut för närmare analys då de användes i ett spårförsök som pågick parallellt med det första hydrauliska interferenstestet. För pumpborrhålet, HFM14, gav den transienta utvärderingen ett värde för transmissiviteten på $5.1 \cdot 10^{-4}$ m^2/s, vilket ligger helt i linje med resultat från tidigare utförda undersökningar. De utvärderade transmissiviteterna för observationssektionerna HFM01: 33.5–45.5 m och KFM10A: 430–440 m är signifikant högre än de T-värden som erhållits från tidigare utförda enhålstester (/2/ och /34/). Således representerar

möjligen resultaten från interferenstesten inte helt formationen i närheten av observationssektionen utan snarare en närliggande sprickzon. Detta antyder att responsen händelsevis skulle kunna vara en stark sekundär respons snarare än en primär respons. De utvärderade T-värdena för de andra sektionerna korresponderar väl med de värden som erhållits från tidigare enhålsförsök.

Resultaten från interferenstesterna visar på en relativt god överensstämmelse mellan den uppskattade hydrauliska diffusiviteten för sektionerna baserade dels på responstiderna och dels på värden från den transienta utvärderingen.

Under testernas gång påverkades många observationssektioner av så kallade tidaleffekter, samt troligen även effekter orsakade av ett föränderligt havsvattenstånd. Framförallt på grund av tidaleffekterna uppvisar vissa berörda sektioner ett oscillerande beteende. Dessutom misstänks att nederbörd och föränderligt havsvattenstånd i viss mån kan ha påverkat resultaten av responsutvärderingen.

Contents

1	**Introduction**	13
2	**Objectives**	15
3	**Scope**	17
3.1	Boreholes tested	17
3.2	Tests performed	25
3.3	Equipment check	39
4	**Description of equipment**	41
4.1	Overview	41
4.2	Measurement sensors	41
5	**Execution**	47
5.1	Preparations	47
5.2	Procedure	47
5.3	Data handling	48
5.4	Analyses and interpretation	48
5.5	Nonconformities	49
6	**Results**	51
6.1	Nomenclature and symbols	51
6.2	Interference test 1 in HFM14	51
6.2.1	Pumping borehole HFM14: 0–150 m	52
6.2.2	Observation section HFM15: 0–84 m	55
6.2.3	Observation section HFM15: 85–95 m	56
6.2.4	Observation section KFM05A: 0–114 m	56
6.2.5	Observation section KFM05A: 115–253 m	57
6.2.6	Observation section KFM05A: 254–272 m	58
6.2.7	Observation section KFM05A: 273–489 m	58
6.2.8	Observation section KFM05A: 490–698 m	58
6.2.9	Observation section KFM05A: 699–1,002 m	59
6.2.10	Observation section HFM19: 0–103 m	59
6.2.11	Observation section HFM19: 104–167 m	60
6.2.12	Observation section HFM19: 168–182 m	61
6.2.13	Observation section HFM13: 0–100 m	61
6.2.14	Observation section HFM13: 101–158 m	62
6.2.15	Observation section HFM13: 159–173 m	63
6.2.16	Observation section KFM01C: 0–58 m	63
6.2.17	Observation section KFM01C: 59–237 m	64
6.2.18	Observation section KFM01C: 238–450 m	65
6.2.19	Observation section HFM01: 0–32.5 m	65
6.2.20	Observation section HFM01:33.5–45.5 m	66
6.2.21	Observation section HFM01:46.5–200 m	67
6.2.22	Observation section KFM01A: 0–108 m	67
6.2.23	Observation section KFM01A: 109–130 m	68
6.2.24	Observation section KFM01A: 131–204 m	69
6.2.25	Observation section KFM01A: 205–373 m	69
6.2.26	Observation section KFM01A: 374–430 m	69
6.2.27	Observation section KFM01A: 431–1,002 m	70
6.2.28	Observation section KFM01D: 0–153 m	70
6.2.29	Observation section KFM01D: 154–252 m	71

6.2.30 Observation section KFM01D: 253–310 m 71
6.2.31 Observation section KFM01D: 311–321 m 72
6.2.32 Observation section KFM01D: 322–428 m 72
6.2.33 Observation section KFM01D: 429–438 m 73
6.2.34 Observation section KFM01D: 439–800 m 73
6.2.35 Observation section KFM01B: 0–100 m 73
6.2.36 Observation section KFM01B: 101–141 m 74
6.2.37 Observation section KFM01B: 142–500 m 75
6.2.38 Observation section KFM10A: 0–152 m 75
6.2.39 Observation section KFM10A: 153–352 m 76
6.2.40 Observation section KFM10A: 353–429 m 77
6.2.41 Observation section KFM10A: 430–440 m 77
6.2.42 Observation section KFM10A: 441–500 m 77
6.2.43 Observation section HFM32: 0–25 m 78
6.2.44 Observation section HFM32: 26–31 m 79
6.2.45 Observation section HFM32: 32–97 m 79
6.2.46 Observation section HFM32: 98–203 m 80
6.2.47 Observation section HFM03: 0–18 m 80
6.2.48 Observation section HFM03: 19–26 m 81
6.2.49 Observation section HFM02: 0–37 m 81
6.2.50 Observation section HFM02: 38–48 m 82
6.2.51 Observation section HFM02: 49–100 m 83
6.2.52 Observation section HFM27: 0–24 m 83
6.2.53 Observation section HFM27: 25–45 m 84
6.2.54 Observation section HFM27: 46–58 m 85
6.2.55 Observation section HFM27: 59–128 m 85
6.2.56 Observation section HFM24: 0–35 m 85
6.2.57 Observation section HFM24: 36–65 m 86
6.2.58 Observation section HFM24: 66–151 m 87
6.2.59 Observation section KFM04A: 0–163 m 87
6.2.60 Observation section KFM04A: 164–185 m 88
6.2.61 Observation section KFM04A: 186–229 m 89
6.2.62 Observation section KFM04A: 230–245 m 89
6.2.63 Observation section KFM04A: 246–390 m 90
6.2.64 Observation section KFM04A: 391–495 m 90
6.2.65 Observation section KFM04A: 496–1,001 m 90
6.2.66 Observation section KFM06A: 0–150 m 91
6.2.67 Observation section KFM06A: 151–246 m 92
6.2.68 Observation section KFM06A: 247–340 m 93
6.2.69 Observation section KFM06A: 341–362 m 93
6.2.70 Observation section KFM06A: 363–737 m 94
6.2.71 Observation section KFM06A: 738–748 m 94
6.2.72 Observation section KFM06A: 749–826 m 95
6.2.73 Observation section KFM06A: 827–1,001 m 95
6.2.74 Observation section KFM06C: 0–186 m 95
6.2.75 Observation section KFM06C: 187–280 m 96
6.2.76 Observation section KFM06C: 281–350 m 97
6.2.77 Observation section KFM06C: 351–401 m 97
6.2.78 Observation section KFM06C: 402–530 m 98
6.2.79 Observation section KFM06C: 531–540 m 98
6.2.80 Observation section KFM06C: 541–646 m 99
6.2.81 Observation section KFM06C: 647–666 m 99
6.2.82 Observation section KFM06C: 667–872 m 99
6.2.83 Observation section KFM06C: 873–1,001 m 100
6.2.84 Observation section KFM06B: 0–26 m 100
6.2.85 Observation section KFM06B: 27–50 m 101

6.2.86 Observation section KFM06B: 51–100 m 102
6.2.87 Observation section HFM10: 0–99 m 102
6.2.88 Observation section HFM10: 100–150 m 103
6.2.89 Observation section HFM16: 0–53 m 104
6.2.90 Observation section HFM16: 54–67 m 105
6.2.91 Observation section HFM16: 68–132 m 105
6.2.92 Observation section HFM09: 0–50 m 106
6.2.93 Observation section KFM07B: 0–74 m 107
6.2.94 Observation section KFM07B: 75–202 m 108
6.2.95 Observation section KFM07B: 203–300 m 108
6.2.96 Observation section HFM21: 0–21 m 108
6.2.97 Observation section HFM21: 22–32 m 109
6.2.98 Observation section HFM21: 33–106 m 110
6.2.99 Observation section HFM21: 107–202 m 110
6.2.100 Observation section KFM07C: 0–110 m 111
6.2.101 Observation section KFM07C: 111–160 m 112
6.2.102 Observation section KFM07C: 161–301 m 112
6.2.103 Observation section KFM07C: 302–500 m 113
6.2.104 Observation section KFM07A: 0–148 m 113
6.2.105 Observation section KFM07A: 149–190 m 113
6.2.106 Observation section KFM07A: 191–225 m 114
6.2.107 Observation section KFM07A: 226–961 m 115
6.2.108 Observation section KFM07A: 962–972 m 115
6.2.109 Observation section KFM07A: 973–1,001 m 116
6.2.110 Observation section KFM09B: 0–200 m 116
6.2.111 Observation section KFM09B: 201–450 m 117
6.2.112 Observation section KFM09B: 451–616 m 118
6.2.113 Observation section HFM22: 0–222 m 118
6.2.114 Observation section HFM20: 0–48 m 119
6.2.115 Observation section HFM20: 49–100 m 120
6.2.116 Observation section HFM20: 101–130 m 120
6.2.117 Observation section HFM20: 131–301 m 121
6.2.118 Observation section KFM08A: 0–1,001 m 121
6.2.119 Observation section KFM08B: 0–70 m 122
6.2.120 Observation section KFM08B: 71–112 m 123
6.2.121 Observation section KFM08B: 113–200 m 124
6.2.122 Observation section HFM30: 0–60 m 124
6.2.123 Observation section HFM30: 61–73 m 124
6.2.124 Observation section HFM30: 74–176 m 125
6.2.125 Observation section HFM30: 177–201 m 126
6.2.126 Observation section HFM25: 0–188 m 126
6.2.127 Observation section KFM09A: 0–300 m 127
6.2.128 Observation section KFM09A: 301–550 m 128
6.2.129 Observation section KFM09A: 551–800 m 129
6.2.130 Observation section HFM28: 0–151 m 129
6.2.131 Observation section HFM23: 0–212 m 130
6.2.132 Observation section HFM38: 0–23 m 131
6.2.133 Observation section HFM38: 24–41 m 132
6.2.134 Observation section HFM38: 42–201 m 133
6.2.135 Observation section HFM29: 0–200 m 133
6.2.136 Observation section HFM17: 0–211 m 134
6.2.137 Observation section KFM02B: 0–130 m 135
6.2.138 Observation section KFM02B: 131–245 m 136
6.2.139 Observation section KFM02B: 246–409 m 137
6.2.140 Observation section KFM02B: 410–431 m 137
6.2.141 Observation section KFM02B: 432–490 m 138

6.2.142 Observation section KFM02B: 491–506 m 138
6.2.143 Observation section KFM02B: 507–570 m 139
6.2.144 Observation section KFM02A: 0–132 m 139
6.2.145 Observation section KFM02A: 133–240 m 139
6.2.146 Observation section KFM02A: 241–410 m 140
6.2.147 Observation section KFM02A: 411–442 m 141
6.2.148 Observation section KFM02A: 443–489 m 141
6.2.149 Observation section KFM02A: 490–518 m 142
6.2.150 Observation section KFM02A: 519–888 m 142
6.2.151 Observation section KFM02A: 889–1,002 m 143
6.2.152 Observation section HFM05: 0–138 m 143
6.2.153 Observation section HFM05: 139–200 m 143
6.2.154 Observation section HFM33: 0–140 m 144
6.2.155 Observation section HFM04: 0–57 m 145
6.2.156 Observation section HFM04: 58–66 m 146
6.2.157 Observation section HFM04: 67–222 m 147
6.2.158 Observation section HFM12: 0–56.5 m 147
6.2.159 Observation section HFM12: 57.5–210 m 148
6.2.160 Observation section KFM11A: 0–130 m 149
6.2.161 Observation section KFM11A: 131–360 m 150
6.2.162 Observation section KFM11A: 361–445 m 150
6.2.163 Observation section KFM11A: 446–456 m 151
6.2.164 Observation section KFM11A: 457–689 m 151
6.2.165 Observation section KFM11A: 690–710 m 152
6.2.166 Observation section KFM11A: 711–850 m 152
6.2.167 Observation section HFM11: 0–53 m 153
6.2.168 Observation section HFM11: 54–182 m 154
6.2.169 Observation section HFM18: 0–27 m 154
6.2.170 Observation section HFM18: 28–41 m 155
6.2.171 Observation section HFM18: 42–180 m 155
6.3 Interference test 2 in HFM14 156
6.3.1 Pumping borehole HFM14: 0–150 m, second pumping 157
6.3.2 Observation section KFM08D: 0–160 m 158
6.3.3 Observation section KFM08D: 161–330 m 159
6.3.4 Observation section KFM08D: 331–659 m 160
6.3.5 Observation section KFM08D: 660–680 m 160
6.3.6 Observation section KFM08D: 681–824 m 161
6.3.7 Observation section KFM08D: 825–835 m 161
6.3.8 Observation section KFM08D: 836–950 m 161
6.3.9 Observation section KFM08A: 0–161 m 162
6.3.10 Observation section KFM08A: 162–215 m 163
6.3.11 Observation section KFM08A: 216–264 m 163
6.3.12 Observation section KFM08A: 265–280 m 164
6.3.13 Observation section KFM08A: 281–473 m 164
6.3.14 Observation section KFM08A: 474–503 m 164
6.3.15 Observation section KFM08A: 504–683 m 165
6.3.16 Observation section KFM08A: 684–694 m 165
6.3.17 Observation section KFM08A: 695–1,001 m 166
6.3.18 Observation section KFM02B: 0–130 m 166
6.3.19 Observation section KFM02B: 131–245 m 167
6.3.20 Observation section KFM02B: 246–409 m 168
6.3.21 Observation section KFM02B: 410–431 m 168
6.3.22 Observation section KFM02B: 432–490 m 168
6.3.23 Observation section KFM02B: 491–506 m 169
6.3.24 Observation section KFM02B: 507–570 m 169
6.3.25 Observation section KFM11A: 0–130 m 170

6.3.26 Observation section KFM11A: 131–360 m 171
6.3.27 Observation section KFM11A: 361–445 m 171
6.3.28 Observation section KFM11A: 446–456 m 172
6.3.29 Observation section KFM11A: 457–689 m 172
6.3.30 Observation section KFM11A: 690–710 m 172
6.3.31 Observation section KFM11A: 711–850 m 173
6.4 Response analysis for interference tests 1 and 2 173
6.5 Transient evaluation of responses in selected sections 184
6.5.1 Observation section HFM01: 33.5–45.5 m 186
6.5.2 Observation section HFM13: 159–173 m 186
6.5.3 Observation section HFM15: 85–95 m 187
6.5.4 Observation section HFM19: 168–182 m 187
6.5.5 Observation section HFM32: 26–31 m 188
6.5.6 Observation section KFM10A: 430–440 m 188
6.5.7 Estimation of the hydraulic diffusivity of the sections 188
6.6 Summary of the results of the interference tests 190

7 References 199

Appendix 1 List of data files 203

Appendix 2 Test diagrams and meteorological data 205

Appendices on CD

Appendix 3 Result tables to Sicada – Test 1

Appendix 4 Result tables to Sicada – Test 2

1 Introduction

This report documents the results from a hydraulic interference test performed within the site investigation at Forsmark. It was carried out in order to study how different fracture zones are connected hydraulically in the northern part of the candidate area at Forsmark, to quantify their hydraulic properties and to clarify whether there are any major hydraulic boundaries in the area. The locations of the boreholes involved in the interference tests are shown in Figure 1-1. The test started in July and was running until October of 2007. The test was carried out by Geosigma AB.

The open percussion drilled borehole HFM14 was used as pumping borehole for the tests and 49 surrounding boreholes served as observation wells.

The interference tests were conducted in accordance with activity plan AP PF 400-07-030. In Table 1-1, controlling documents for the performance of this activity are listed. Both the activity plan and method descriptions are internal controlling documents of SKB. A third interference test is described in the activity plan, where HFM33 is used as a pumping borehole. This activity is reported separately.

From pumping tests and flow logging, /1/, performed prior to the interference tests, the total transmissivity of the pumping borehole, HFM14, was estimated at c. $5.7 \cdot 10^{-4}$ m^2/s. In addition, another interference test had been performed in HFM14 in 2006 and the drawdown characteristics were already rather well known.

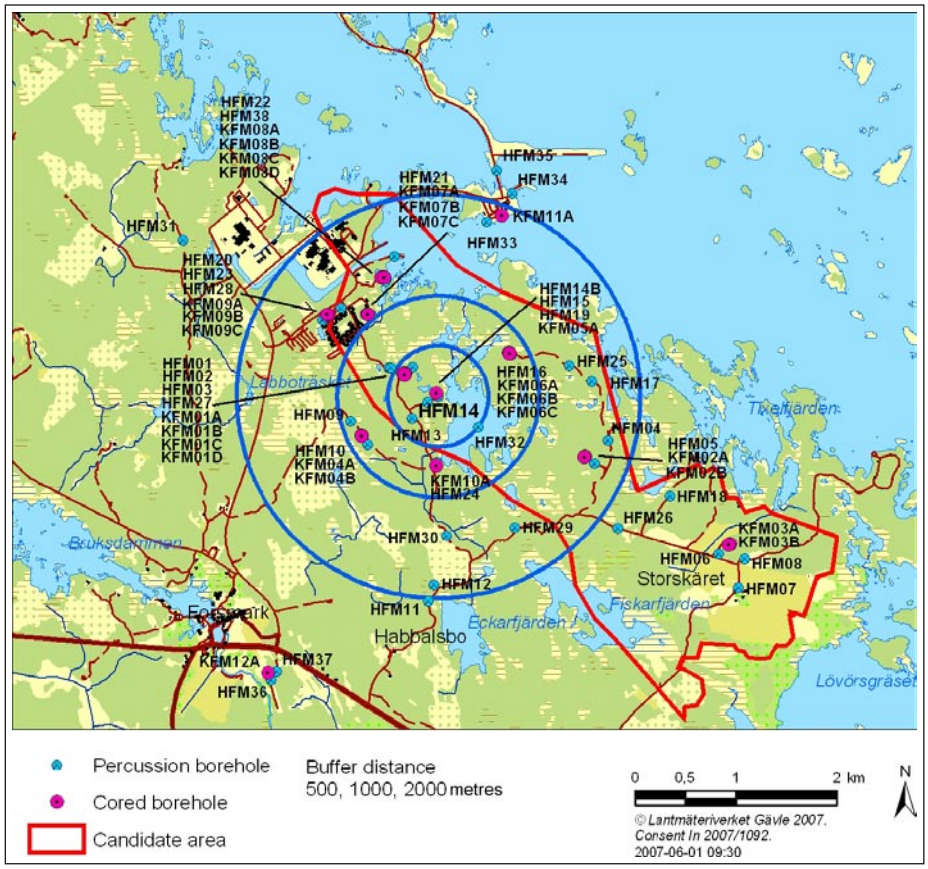


Figure 1-1. *The investigation area at Forsmark including part of the candidate area selected for more detailed investigations. The positions of the boreholes included in the interference tests are displayed as well as the areas corresponding to radii of 500 m, 1,000 m and 2,000 m from HFM14, respectively.*

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

Activity plan	Number	Version
Hydrauliskt interferenstest med hammarborrhål HFM14 och HFM33 som pumphål.	AP PF 400-07-030	1.0
Method documents	**Number**	**Version**
Instruktion för analys av injektions- och enhålspumptester.	SKB MD 320.004	1.0
Metodbeskrivning för interferenstester.	SKB MD 330.003	1.0

Original data from the reported activity are stored in the primary database Sicada, where they are traceable by the Activity Plan number (AP PF 400-07-030). Only data in SKB's databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. Such revisions will not necessarily result in a revision of the P-report, although the normal procedure is that major data revisions entail a revision of the P-report. Minor data revisions are normally presented as supplements, available at www.skb.se.

2 Objectives

The main aim of hydraulic interference tests is to get support for interpretations of geologic structures in regard to their hydraulic and geometric properties deduced from single-hole tests. Furthermore, an interference test may provide information about the hydraulic connectivity and hydraulic boundary conditions within the tested area. Finally, interference tests make up the basis for calibration of numerical models of the area.

The interference test, with borehole HFM14 as pumping borehole, was performed in order to increase the understanding of the hydraulic conditions in the north-western part of the candidate area at Forsmark. The primary aim was to document how different fracture zones are connected hydraulically, to quantify their hydraulic properties and to find any major hydraulic boundaries in the area of influence.

The interference test was performed by pumping in the open percussion drilled borehole HFM14 and monitoring pressure responses in different observation sections in surrounding boreholes. All boreholes monitored for responses are part of the Forsmark HMS, the Hydro Monitoring System. Besides the pumping borehole a total of 185 observation sections in 49 observation boreholes were included in the interference test. Also, the pumping in HFM14 was evaluated as a single-hole pumping test.

3 Scope

3.1 Boreholes tested

Technical data of the boreholes tested are presented in Table 3-1. In this report boreholes are presented in order of distance from the pumping borehole, i.e. the borehole closest to HFM14 is presented first and the borehole furthest away from HFM14 is presented last. The reference point in the boreholes is always top of casing (ToC). The Swedish National coordinate system (RT90 2.5 gon V 0:–15) is used in the x-y-direction together with RHB70 in the z-direction. The coordinates of the boreholes at ground surface are shown in Table 3-2. All section positions are given as length along the borehole (not vertical distance from ToC).

Table 3-1. Pertinent technical data of the tested boreholes. (From Sicada).

Borehole data							
Bh ID	**Elevation of top of casing (ToC) (m.a.s.l.)**	**Borehole interval from ToC (m)**	**Casing/ Bh-diam. (m)**	**Remarks**	**Leaning-top of borehole (from local N) [1] (°)**	**Inclination-top of bh (from horizontal plane) [1] (°)**	**Drilling finished Date (YYYY-MM-DD)**
HFM14	3.912	0.00–3.10	0.235	Borehole	331.748	–59.810	2003-10-09
		3.10–6.00	0.189	Borehole			
		6.00–101.30	0.138	Borehole			
		101.30–150.50	0.136	Borehole			
		0.10–3.10	0.209	Casing ID			
		0.00–6.00	0.160	Casing ID			
HFM15	3.878	0.00–6.00	0.176	Borehole	314.305	–43.700	2003-10-15
		6.00–99.50	0.139	Borehole			
		0.00–6.00	0.160	Casing ID			
KFM05A	5.528	0.00–12.25	0.340	Borehole	80.897	–59.804	2004-05-05
		12.25–100.30	0.244	Borehole			
		100.30–100.35	0.164	Borehole			
		100.35–110.10	0.086	Borehole			
		110.10–1,002.71	0.077	Borehole			
		0.00–100.02	0.200	Casing ID			
		0.00–12.25	0.310	Casing ID			
		0.19–12.25	0.309	Casing ID			
		100.02–100.07	0.170	Casing ID			
HFM19	3.656	0.00–12.04	0.180	Borehole	280.915	–58.103	2003-12-18
		12.04–185.20	0.137	Borehole			
		0.00–12.04	0.160	Casing ID			
HFM13	5.687	0.00–4.40	0.235	Borehole	51.194	–58.845	2003-10-02
		4.40–14.90	0.189	Borehole			
		14.90–101.00	0.138	Borehole			
		101.00–152.35	0.137	Borehole			
		152.35–175.60	0.135	Borehole			
		0.00–14.90	0.160	Casing ID			
KFM01C	2.91	0.00–6.15	0.151	Borehole	165.35	–49.61	2005-11-29
		6.15–11.96	0.113	Borehole			
		11.96–450.02	0.076	Borehole			

Borehole data Bh ID	Elevation of top of casing (ToC) (m.a.s.l.)	Borehole interval from ToC (m)	Casing/ Bh-diam. (m)	Remarks	Leaning-top of borehole (from local N) [1] (°)	Inclination-top of bh (from horizontal plane) [1] (°)	Drilling finished Date (YYYY-MM-DD)
		0.00–11.96	0.077	Casing ID			
HFM01	1.731	0.00–31.93	0.204	Borehole	34.061	–77.513	2002-05-03
		31.93–200.20	0.140	Borehole			
		0.00–31.93	0.160	Casing ID			
KFM01A	3.125	0.00–12.00	0.440	Borehole	318.350	–84.730	2002-10-28
		12.00–29.40	0.358	Borehole			
		29.40–100.48	0.251	Borehole			
		100.48–100.52	0.164	Borehole			
		100.52–102.13	0.086	Borehole			
		102.13–1,001.49	0.076	Borehole			
		0.00–100.40	0.200	Casing ID			
		0.00–29.40	0.265	Casing ID			
		97.33–97.33	0.195	Casing ID			
		101.99–101.99	0.080	Casing ID			
KFM01D	2.947	0.23–11.61	0.339	Borehole	35.035	–54.896	2006-02-18
		11.61–89.72	0.245	Borehole			
		89.77–91.48	0.086	Borehole			
		91.48–800.24	0.076	Borehole			
		0.00–83.26	0.200	Casing ID			
		0.23–11.53	0.310	Casing ID			
		83.26–89.46	0.200	Casing ID			
		89.46–89.51	0.170	Casing ID			
KFM01B	3.093	0.15–9.17	0.150	Borehole	267.594	–79.040	2004-01-15
		9.17–15.56	0.101	Borehole			
		15.56–500.52	0.076	Borehole			
		0.00–15.53	0.078	Casing ID			
		0.05–9.05	0.130	Casing ID			
		8.99–9.09	0.115	Casing ID			
KFM10A	4.507	0.23–12.31	0.339	Borehole	10.420	–50.049	2006-06-01
		12.31–60.68	0.244	Borehole			
		60.68–500.16	0.076	Borehole			
		0.00–60.34	0.200	Casing ID			
		0.23–12.23	0.310	Casing ID			
		12.23–12.31	0.281	Casing ID			
		60.34–60.39	0.170	Casing ID			
HFM32	0.974	0.00–6.03	0.175	Borehole	116.146	–86.057	2006-01-14
		6.03–106.60	0.139	Borehole			
		106.60–169.65	0.136	Borehole			
		169.65–202.65	0.132	Borehole			
		0.00–5.94	0.160	Casing ID			
		5.94–6.03	0.143	Casing ID			
HFM03	3.148	0.00–13.10	0.204	Borehole	264.528	–87.284	2002-05-28
		13.10–26.00	0.136	Borehole			
		0.00–13.10	0.160	Casing ID			
HFM02	3.053	0.00–25.40	0.204	Borehole	6.516	–87.787	2002-05-21

Borehole data Bh ID	Elevation of top of casing (ToC) (m.a.s.l.)	Borehole interval from ToC (m)	Casing/ Bh-diam. (m)	Remarks	Leaning-top of borehole (from local N) [1] (°)	Inclination-top of bh (from horizontal plane) [1] (°)	Drilling finished Date (YYYY-MM-DD)
		25.40–100.00	0.137	Borehole			
		0.00–25.40	0.160	Casing ID			
HFM27	2.445	0.00–12.03	0.180	Borehole	337.257	–67.827	2005-11-10
		12.03–110.00	0.140	Borehole			
		110.00–127.50	0.139	Borehole			
		0.00–11.94	0.160	Casing ID			
		11.94–12.03	0.143	Casing ID			
HFM24	3.683	0.00–18.03	0.180	Borehole	47.291	–59.564	2005-11-22
		18.03–100.35	0.139	Borehole			
		100.35–151.35	0.138	Borehole			
		0.00–17.94	0.160	Casing ID			
		17.94–18.03	0.143	Casing ID			
KFM04A	8.771	0.00–12.03	0.350	Borehole	45.240	–60.080	2003-11-19
		12.03–107.33	0.247	Borehole			
		107.33–107.42	0.161	Borehole			
		107.42–108.69	0.086	Borehole			
		108.69–1,001.42	0.077	Borehole			
		0.00–106.91	0.200	Casing ID			
		0.00–12.03	0.265	Casing ID			
		0.00–106.91	0.200	Casing ID			
		106.91–106.95	0.170	Casing ID			
KFM06A	4.100	0.00–2.12	0.415	Borehole	300.920	–60.250	2004-09-21
		2.12–12.30	0.333	Borehole			
		12.30–100.59	0.243	Borehole			
		100.59–100.64	0.164	Borehole			
		100.64–102.19	0.086	Borehole			
		102.19–1,000.64	0.077	Borehole			
		0.00–100.35	0.200	Casing ID			
		0.19–2.12	0.392	Casing ID			
		0.19–12.30	0.309	Casing ID			
		100.35–100.40	0.170	Casing ID			
KFM06C	4.085	0.00–12.14	0.339	Borehole	26.067	–60.124	2005-06-30
		12.14–18.00	0.260	Borehole			
		18.00–100.35	0.339	Borehole			
		100.35–100.40	0.162	Borehole			
		100.40–102.08	0.086	Borehole			
		102.08–1,000.43	0.077	Borehole			
		0.00–100.07	0.200	Casing ID			
		0.20–12.00	0.280	Casing ID			
		100.07–100.12	0.170	Casing ID			
KFM06B	4.130	0.00–3.88	0.116	Borehole	296.960	–83.520	2003-06-08
		3.88–4.61	0.101	Borehole			
		4.61–6.33	0.086	Borehole			
		6.33–100.33	0.077	Borehole			
		0.00–4.61	0.078	Casing ID			

Borehole data Bh ID	Elevation of top of casing (ToC) (m.a.s.l.)	Borehole interval from ToC (m)	Casing/ Bh-diam. (m)	Remarks	Leaning-top of borehole (from local N) [1] (°)	Inclination-top of bh (from horizontal plane) [1] (°)	Drilling finished Date (YYYY-MM-DD)
HFM10	4.986	0.00–4.50	0.219	Borehole	92.934	–68.700	2003-08-19
		0.00–11.80	0.190	Borehole			
		11.80–110.00	0.140	Borehole			
		110.00–150.00	0.139	Borehole			
		0.00–11.80	0.160	Casing ID			
HFM16	3.210	0.00–12.02	0.195	Borehole	327.957	–84.218	2003-11-11
		12.02–82.00	0.140	Borehole			
		82.00–132.50	0.139	Borehole			
		0.00–12.02	0.160	Casing ID			
HFM09	5.150	0.00–5.30	0.190	Borehole	139.359	–68.899	2003-06-30
		5.30–17.00	0.190	Borehole			
		17.00–50.25	0.141	Borehole			
		0.00–17.02	0.160	Casing ID			
KFM07B	3.363	0.00–5.18	0.116	Borehole	134.346	–53.713	2005-10-18
		5.18–65.69	0.096	Borehole			
		65.69–298.93	0.076	Borehole			
		0.00–65.29	0.077	Casing ID			
HFM21	3.979	0.00–12.03	0.185	Borehole	88.810	–58.480	2004-06-07
		12.03–148.00	0.139	Borehole			
		148.00–202.00	0.137	Borehole			
		0.00–11.94	0.160	Casing ID			
		11.94–12.03	0.147	Casing ID			
KFM07C	3.35	0.15–6.23	0.339	Borehole	142.71	–85.40	2006-08-08
		6.23–85.15	0.157	Borehole			
		85.15–98.42	0.086	Borehole			
		98.42–500.34	0.076	Borehole			
		428.20–430.40	0.084	Borehole			
		0.00–84.79	0.200	Casing ID			
KFM07A	3.330	0.00–9.14	0.346	Borehole	261.470	–59.220	2004-12-09
		9.14–100.35	0.251	Borehole			
		9.14–100.40	0.252	Borehole			
		100.35–100.40	0.164	Borehole			
		100.40–101.95	0.086	Borehole			
		101.95–1,001.55	0.077	Borehole			
		0.00–100.05	0.200	Casing ID			
		0.00–8.94	0.311	Casing ID			
		0.20–8.94	0.310	Casing ID			
		100.05–100.10	0.170	Casing ID			
KFM09B	4.303	0.00–9.12	0.151	Borehole	140.834	–55.081	2005-12-19
		9.12–616.45	0.0773	Borehole			
		0.00–9.12	0.0773	Casing ID			
HFM22	1.539	0.00–12.03	0.180	Borehole	90.081	–58.854	2004-09-10
		12.03–222.00	0.136	Borehole			
		0.00–11.94	0.160	Casing ID			

Borehole data Bh ID	Elevation of top of casing (ToC) (m.a.s.l.)	Borehole interval from ToC (m)	Casing/ Bh-diam. (m)	Remarks	Leaning-top of borehole (from local N) [1] (°)	Inclination-top of bh (from horizontal plane) [1] (°)	Drilling finished Date (YYYY-MM-DD)
		11.94–12.03	0.147	Casing ID			
KFM08D	2.61	0.30–5.60	0.343	Borehole	99.98	–55.00	2007-02-10
		5.60–58.99	0.253	Borehole			
		58.99–59.04	0.157	Borehole			
		59.04–60.80	0.086	Borehole			
		60.80–942.30	0.077	Borehole			
		0.30–5.52	0.310	Casing ID			
		5.52–5.60	0.281	Casing ID			
		5.60–58.77	0.200	Casing ID			
		58.77–58.80	0.170	Casing ID			
HFM20	2.966	0.00–12.30	0.185	Borehole	354.415	–85.448	2004-06-01
		12.30–112.70	0.139	Borehole			
		112.70–250.00	0.138	Borehole			
		250.00–301.00	0.135	Borehole			
		0.00–11.94	0.160	Casing ID			
		11.94–12.03	0.147	Casing ID			
KFM08A	2.487	0.00–9.14	0.343	Borehole	321.000	–60.887	2005-03-31
		9.14–97.14	0.249	Borehole			
		97.14–102.40	0.086	Borehole			
		102.40–1,001.19	0.077	Borehole			
		0.00–100.15	0.200	Casing ID			
		0.23–9.14	0.310	Casing ID			
		100.15–100.20	0.170	Casing ID			
KFM08B	2.250	0.00–5.58	0.093	Borehole	270.450	–58.850	2005-01-26
		5.58–200.54	0.076	Borehole			
		0.00–5.58	0.077	Casing ID			
HFM30	3.13	0.30–18.03	0.180	Borehole	28.81	–55.50	2006-05-11
		18.03–122.25	0.140	Borehole			
		122.25–200.75	0.139	Borehole			
		0.00–17.94	0.160	Casing ID			
		17.94–18.03	0.143	Casing ID			
HFM25	3.858	0.00–9.10	0.178	Borehole	140.842	–57.814	2005-09-08
		9.10–187.50	0.139	Borehole			
		0.00–8.94	0.168	Casing ID			
		8.94–9.04	0.168	Casing ID			
KFM09A	4.29	0.00–7.23	0.116	Borehole	200.077	–59.46	2005-10-27
		7.23–7.79	0.096	Borehole			
		7.79–799.67	0.077	Borehole			
		0.00–7.79	0.077	Casing ID			
HFM28	4.266	12.10–117.90	0.137	Borehole	146.783	–84.761	2005-09-14
		117.90–151.20	0.135	Borehole			
		0.00–11.94	0.160	Casing ID			
		11.94–12.03	0.142	Casing ID			
HFM23	4.250	0.00–20.80	0.182	Borehole	324.348	–58.477	2005-09-01

Borehole data							
Bh ID	**Elevation of top of casing (ToC) (m.a.s.l.)**	**Borehole interval from ToC (m)**	**Casing/ Bh-diam. (m)**	**Remarks**	**Leaning-top of borehole (from local N) [1] (°)**	**Inclination-top of bh (from horizontal plane) [1] (°)**	**Drilling finished Date (YYYY-MM-DD)**
		20.80–115.00	0.136	Borehole			
		115.00–211.50	0.134	Borehole			
		0.00–20.71	0.168	Casing ID			
		20.71–20.80	0.168	Casing ID			
HFM38	2.21	0.35–9.05	0.180	Borehole	93.62	–54.45	2006-06-22
		9.05–122.25	0.139	Borehole			
		122.25–200.75	0.136	Borehole			
		0.00–8.96	0.160	Casing ID			
		8.96–9.05	0.143	Casing ID			
HFM29	4.467	0.00–9.03	0.180	Borehole	29.952	–58.572	2005-12-19
		9.03–85.70	0.140	Borehole			
		85.70–199.70	0.138	Borehole			
		0.00–8.94	0.160	Casing ID			
		8.94–9.03	0.143	Casing ID			
HFM17	3.750	0.00–8.00	0.180	Borehole	318.576	–84.186	2003-12-08
		8.00–120.50	0.137	Borehole			
		120.50–210.65	0.136	Borehole			
		0.00–8.00	0.160	Casing ID			
KFM02B	7.62	0.15–3.23	0.339	Borehole	313.06	–80.27	2007-02-13
		3.23–87.10	0.242	Borehole			
		87.10–87.15	0.156	Borehole			
		87.15–88.61	0.086	Borehole			
		88.61–573.87	0.076	Borehole			
		0.00–80.55	0.200	Casing ID			
		80.55–86.55	0.200	Casing ID			
		86.55–86.60	0.170	Casing ID			
KFM02A	7.353	0.00–2.39	0.440	Borehole	275.764	–85.385	2003-03-12
		2.39–11.80	0.358	Borehole			
		11.80–100.35	0.251	Borehole			
		100.35–100.42	0.164	Borehole			
		100.42–102.00	0.086	Borehole			
		102.00–1,002.44	0.077	Borehole			
		0.00–100.14	0.200	Casing ID			
		0.10–11.80	0.265	Casing ID			
HFM05	7.672	0.00–4.60	0.215	Borehole	335.589	–84.961	2002-12-16
		4.60–11.87	0.215	Borehole			
		11.87–101.30	0.136	Borehole			
		101.30–200.10	0.134	Borehole			
		0.00–11.85	0.160	Casing ID			
		11.85–11.87	0.146	Casing ID			
HFM33	2.62	0.30–12.35	0.18	Borehole	220.03	–58.97	2006-05-03
		12.35–122.20	0.14	Borehole			
		122.20–140.20	0.139	Borehole			
		0.00–11.95	0.16	Casing ID			
		11.95–12.04	0.143	Casing ID			

Borehole data							
Bh ID	**Elevation of top of casing (ToC) (m.a.s.l.)**	**Borehole interval from ToC (m)**	**Casing/ Bh-diam. (m)**	**Remarks**	**Leaning-top of borehole (from local N) [1] (°)**	**Inclination-top of bh (from horizontal plane) [1] (°)**	**Drilling finished Date (YYYY-MM-DD)**
HFM04	3.873	0.00–3.00	0.215	Borehole	336.875	–84.257	2002-12-03
		3.00–12.10	0.215	Borehole			
		12.10–221.70	0.138	Borehole			
		–0.22–2.72	0.244	Casing ID			
		0.00–12.10	0.160	Casing ID			
		12.10–12.12	0.146	Casing ID			
HFM12	7.025	0.00–4.30	0.235	Borehole	245.163	–49.052	2003-09-16
		4.30–14.90	0.189	Borehole			
		14.90–110.00	0.138	Borehole			
		110.00–170.35	0.137	Borehole			
		170.35–209.55	0.135	Borehole			
		0.00–14.90	0.160	Casing ID			
KFM11A	2.95	0.30–12.30	0.34	Borehole	40.25	–60.86	2007-04-02
		12.30–71.00	0.242	Borehole			
		71.00–71.06	0.16	Borehole			
		71.06–72.81	0.086	Borehole			
		72.81–851.21	0.077	Borehole			
		497.30–501.00	0.084	Borehole			
		521.45–523.65	0.084	Borehole			
		0.00–64.77	0.200	Casing ID			
		64.77–70.77	0.200	Casing ID			
HFM11	7.559	0.00–3.10	0.235	Borehole	63.506	–49.317	2003-09-01
		3.10–11.90	0.190	Borehole			
		11.90–110.20	0.140	Borehole			
		110.20–158.35	0.139	Borehole			
		158.35–182.35	0.139	Borehole			
		0.00–11.90	0.160	Casing ID			
HFM18	5.039	9.00–180.65	0.140	Borehole	313.29	–59.35	2003-12-16
		0.00–9.00	0.160	Casing ID			

[1] The borehole inclination and leaning at ToC are stored in Sicada as “Borehole direction surveying” (activity type EG151) and are based upon an independent measurement at ToC. However, minor deviations between these values and the corresponding values at ToC in the “Object_location” file in Sicada may occur. These deviations are caused by the fact that the values in “Object_location” are affected also by other borehole deviation measurements according to specifications in the EG154-file. The definition of algorithm is presented in SKB P-07-28.

Table 3-2. Coordinates of the tested boreholes. (From Sicada).

Borehole data		
Bh ID	**Northing (m)**	**Easting (m)**
HFM14	6699313.139	1631734.586
HFM15	6699312.444	1631733.081
KFM05A	6699344.850	1631710.804
HFM19	6699257.585	1631626.925
HFM13	6699093.678	1631474.404
KFM01C	6699546.14	1631403.75
HFM01	6699605.181	1631484.552
KFM01A	6699529.813	1631397.160
KFM01D	6699542.066	1631404.521
KFM01B	6699539.396	1631387.672
KFM10A	6698629.174	1631715.900
HFM32	6699015.036	1632137.068
HFM03	6699592.812	1631272.626
HFM02	6699593.212	1631268.674
HFM27	6699595.263	1631245.935
HFM24	6698662.373	1631719.641
KFM04A	6698921.744	1630978.964
KFM06A	6699732.880	1632442.510
KFM06C	6699740.961	1632437.029
KFM06B	6699732.240	1632446.410
HFM10	6698834.785	1631037.188
HFM16	6699721.098	1632466.182
HFM09	6699064.648	1630869.120
KFM07B	6700123.622	1631036.833
HFM21	6700125.566	1631074.054
KFM07C	6700125.61	1631034.45
KFM07A	6700127.080	1631031.570
KFM09B	6700119.887	1630638.784
HFM22	6700456.184	1631217.635
KFM08D	6700491.67	1631199.16
HFM20	6700187.496	1630776.681
KFM08A	6700494.492	1631197.060
KFM08B	6700492.750	1631173.270
HFM30	6697932.95	1631819.57
HFM25	6699616.177	1633039.368
KFM09A	6700115.04	1630648.50
HFM28	6700068.840	1630597.240
HFM23	6700067.686	1630595.433
HFM38	6700701.28	1631301.71
HFM29	6698018.647	1632502.813
HFM17	6699461.952	1633261.310
KFM02B	6698719.19	1633186.29
KFM02A	6698712.501	1633182.863
HFM05	6698647.275	1633289.721
HFM33	6701042.57	1632222.99
HFM04	6698878.968	1633420.733
HFM12	6697446.459	1631695.671
KFM11A	6701103.82	1632366.75
HFM11	6697283.402	1631636.333
HFM18	6698326.858	1634037.374

3.2 Tests performed

The borehole sections involved in the interference test in HFM14 are listed in Table 3-3. The times referred to in Table 3-3 are the chosen start and stop times of the compiled HMS or Sicada data files used for evaluation. Alternatively, for the pumping borehole, the times referred to are the relevant times included in the original file produced by the data logger. The amount of data extracted from Sicada and/or HMS, the Hydro Monitoring System, from the observation boreholes was chosen so as to receive an appropriate amount of data that would correspond to available data from the pumping borehole, HFM14, as well as giving adequate information about the pressure conditions prior to as well as after the performed interference test. HMS is registering pressure continuously.

The column "Test section" In Table 3-3 reports the nominal section length. It should be noted, however, that the upper part of the upper section in most boreholes are cased to some depth. The casing length of each borehole can be found in Table 3-1. The hydraulically active section, used for instance when calculating the point of application, is, as a consequence of this, shorter than the nominal length which would explain the apparent discrepancy between reported section length and "Test section" mentioned in different parts of this report.

The test performance was according to the Geosigma quality plan ("Kvalitetsplan för SKB uppdrag – Hydrauliskt interferenstest med hammarborrhål HFM14 och HFM33 som pumphål, K/587071, Kristoffer Gokall-Norman, 2007-06-08", Geosigma and SKB internal controlling document) and according to the methodology description for interference tests, SKB MD 330.003. However, no response matrix was prepared since only one interference test was performed.

Table 3-3. Borehole sections involved in the interference test in HFM14, see Figure 1-1.

Bh ID	Test section (m)	Test type[1]	Test config.	Test start date and time (YYYY-MM-DD tt:mm)	Test stop date and time (YYYY-MM-DD tt:mm)
HFM14	0–150	1B	Open borehole	2007-06-25 14:58	2007-10-15 12:00
HFM15	0–84	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	85–95	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM05A	0–114	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	115–253	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	254–272	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	273–489	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	490–698	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	699–1,002	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM19	0–103	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	104–167	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	168–182	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM13	0–100	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	101–158	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	159–173	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM01C	0–58	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	59–237	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	238–450	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM01	0–32.5	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	33.5–45.5	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	46.5–200	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM01A	0–108	2	Above packer	2007-06-01 01:00	2007-10-20 00:00

Bh ID	Test section (m)	Test type[1]	Test config.	Test start date and time (YYYY-MM-DD tt:mm)	Test stop date and time (YYYY-MM-DD tt:mm)
	109–130	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	131–204	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	205–373	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	374–430	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	431–1,002	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM01D	0–153	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	154–252	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	253–310	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	311–321	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	322–428	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	429–438	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	439–800	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM01B	0–100	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	101–141	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	142–500	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM10A	0–152	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	153–352	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	353–429	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	430–440	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	441–500	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM32	0–25	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	26–31	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	32–97	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	98–203	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM03	0–18	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	19–26	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM02	0–37	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	38–48	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	49–100	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM27	0–24	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	25–45	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	46–58	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	59–128	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM24	0–35	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	36–65	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	66–151	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM04A	0–163	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	164–185	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	186–229	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	230–245	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	246–390	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	391–495	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	496–1,001	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM06A	0–150	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	151–246	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	247–340	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	341–362	2	Between packers	2007-06-01 01:00	2007-10-20 00:00

Bh ID	Test section (m)	Test type[1]	Test config.	Test start date and time (YYYY-MM-DD tt:mm)	Test stop date and time (YYYY-MM-DD tt:mm)
	363–737	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	738–748	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	749–826	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	827–1,001	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM06C	0–186	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	187–280	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	281–350	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	351–401	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	402–530	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	531–540	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	541–646	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	647–666	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	667–872	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	873–1,001	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM06B	0–26	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	27–50	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	51–100	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM10	0–99	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	100–150	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM16	0–53	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	54–67	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	68–132	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM09	0–50	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
KFM07B	0–74	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	75–202	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	203–300	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM21	0–21	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	22–32	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	33–106	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	107–202	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM07C	0–110	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	111–160	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	161–301	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	302–500	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM07A	0–148	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	149–190	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	191–225	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	226–961	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	962–972	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	973–1,001.55	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM09B	0–200	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	201–450	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	451–616	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM22	0–222	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
HFM20	0–48	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	49–100	2	Between packers	2007-06-01 01:00	2007-10-20 00:00

Bh ID	Test section (m)	Test type[1]	Test config.	Test start date and time (YYYY-MM-DD tt:mm)	Test stop date and time (YYYY-MM-DD tt:mm)
	101–130	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	131–301	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM08B	0–70	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	71–112	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	113–200	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM30	0–60	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	61–73	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	74–176	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	177–201	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM25	0–188	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
KFM09A	0–300	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	301–550	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	551–800	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM28	0–151	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
HFM23	0–212	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
HFM38	0–23	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	24–41	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	42–201	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM29	0–200	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
HFM17	0–211	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
KFM02B	0–130	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	131–245	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	246–409	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	410–431	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	432–490	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	491–506	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	507–570	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM02A	0–132	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	133–240	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	241–410	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	411–442	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	443–489	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	490–518	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	519–888	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	889–1,002	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM05	0–138	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	139–200	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM33	0–140	2	Open borehole	2007-06-01 01:00	2007-10-20 00:00
HFM04	0–57	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	58–66	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	67–222	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM12	0–56.5	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	57.5–210	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM11A	0–130	2	Above packer	2007-11-01 00:00	2007-12-20 06:00

Bh ID	Test section (m)	Test type[1]	Test config.	Test start date and time (YYYY-MM-DD tt:mm)	Test stop date and time (YYYY-MM-DD tt:mm)
	131–360	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	361–445	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	446–456	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	457–689	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	690–710	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	711–850	2	Below packer	2007-11-01 00:00	2007-12-20 06:00
HFM11	0–53	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	54–182	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
HFM18	0–27	2	Above packer	2007-06-01 01:00	2007-10-20 00:00
	28–41	2	Between packers	2007-06-01 01:00	2007-10-20 00:00
	42–180	2	Below packer	2007-06-01 01:00	2007-10-20 00:00
KFM08D [2)]	0–160	2	Above packer	2007-11-01 00:00	2007-12-20 06:00
	161–330	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	331–659	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	660–680	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	681–824	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	825–835	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	836–950	2	Below packer	2007-11-01 00:00	2007-12-20 06:00
KFM08A [2)]	0–161	2	Above packer	2007-11-01 00:00	2007-12-20 06:00
	162–215	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	216–264	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	265–280	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	281–473	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	474–503	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	504–683	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	684–694	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	695–1,001	2	Below packer	2007-11-01 00:00	2007-12-20 06:00
KFM02B [2)]	0–130	2	Above packer	2007-11-01 00:00	2007-12-20 06:00
	131–245	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	246–409	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	410–431	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	432–490	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	491–506	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	507–570	2	Below packer	2007-11-01 00:00	2007-12-20 06:00
KFM11A [2)]	0–130	2	Above packer	2007-11-01 00:00	2007-12-20 06:00
	131–360	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	361–445	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	446–456	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	457–689	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	690–710	2	Between packers	2007-11-01 00:00	2007-12-20 06:00
	711–850	2	Below packer	2007-11-01 00:00	2007-12-20 06:00

[1)] 1B: Pumping test-submersible pump, 2: Interference test.

[2)] Sections measured during the second shorter interference test. Not inserted in table by order of distance from HFM14. Some of these boreholes may also have been involved in the first interference test.

The interpreted points of application, see explanation below, and lengths of the borehole sections involved in the interference test together with their estimated transmissivities from previous investigations, if available, (/1/ – /33/) are presented in Table 3-4. The distances between the pumping borehole and the observation borehole sections are shown in Table 3-5. The distances between the hydraulic points of application in the boreholes were calculated. For boreholes KFM02A and KFM11A, pressure data were not available until after the pumping started. No response analysis could therefore be performed and distance calculations have thus not been considered necessary.

The estimations of the points of application in the pumping borehole and in the different observation borehole sections respectively were made in one of two ways. If it was obvious that a certain flow anomaly, identified from e.g. flow logging, contributed to the major part of the transmissivity in one section, the position of that anomaly was chosen as the point of application. Alternatively, if no evident part of the section could be chosen with regard to transmissivity, either the midpoint of the section was selected or, if several parts of the section have comparable values of transmissivity, a point of balance calculation was made to estimate the point of application. In the case of the sections in boreholes KFM08A and KFM08D the midpoints were used since values of transmissivity were not available.

Table 3-4. Points of application and lengths of the test sections in the interference test in HFM14 as well as their estimated transmissivities from previous investigations /1/ – /33/.

Bh ID	Test section (m)	Point of application (m below TOC)	Section length (m)	Transmissivity (m^2/s)
HFM14	0–150	20	144	$4.7 \cdot 10^{-4}$
HFM15	0–84	50	84	$2.2 \cdot 10^{-4}$
	85–95	89	10	$1.0 \cdot 10^{-4}$
KFM05A	0–114	109	14	$1.2 \cdot 10^{-3}$
	115–253	145	138	$5.3 \cdot 10^{-6}$
	254–272	256	18	$2.2 \cdot 10^{-8}$
	273–489	292	216	$5.1 \cdot 10^{-9}$
	490–698	594	208	$1.2 \cdot 10^{-9}$
	699–1,002	850	303	$1.2 \cdot 10^{-10}$
HFM19	0–103	101	91	$4.0 \cdot 10^{-5}$
	104–167	150	63	$2.2 \cdot 10^{-5}$
	168–182	176	14	$2.7 \cdot 10^{-4}$
HFM13	0–100	50	85	–
	101–158	106	57	$2.1 \cdot 10^{-5}$
	159–173	162	14	$2.9 \cdot 10^{-4}$
KFM01C	0–58	38	46	$7.1 \cdot 10^{-4}$
	59–237	85	178	$2.4 \cdot 10^{-4}$
	238–450	436	212	$1.8 \cdot 10^{-8}$
HFM01	0–32.5	16 [1)]	0.5	–
	33.5–45.5	39	12	$4.5 \cdot 10^{-5}$
	46.5–200	64	154	$1.8 \cdot 10^{-5}$
KFM01A	0–108	105	6	–
	109–130	118	21	$1.1 \cdot 10^{-7}$
	131–204	148	73	$1.6 \cdot 10^{-7}$
	205–373	285	168	$1.9 \cdot 10^{-8}$
	374–430	402	56	$9.5 \cdot 10^{-10}$

Bh ID	Test section (m)	Point of application (m below TOC)	Section length (m)	Transmissivity (m^2/s)
	431–1,002	715	571	$5.5 \cdot 10^{-9}$
KFM01D	0–153	123	63	$2.8 \cdot 10^{-5}$
	154–252	163	98	$1.6 \cdot 10^{-7}$
	253–310	303	57	$7.3 \cdot 10^{-6}$
	311–321	316	10	$1.8 \cdot 10^{-5}$
	322–428	370	106	$2.2 \cdot 10^{-6}$
	429–438	434	9	$1.0 \cdot 10^{-7}$
	439–800	564	361	$3.3 \cdot 10^{-8}$
KFM01B	0–100	54	91	–
	101–141	121	40	–
	142–500	321	358	–
KFM10A	0–152	98	92	$2.7 \cdot 10^{-6}$
	153–352	314	199	$7.0 \cdot 10^{-8}$
	353–429	391	76	–
	430–440	432	10	$7.7 \cdot 10^{-6}$
	441–500	484	59	$5.3 \cdot 10^{-8}$
HFM32	0–25	19	19	$7.2 \cdot 10^{-4}$
	26–31	29	5	$2.3 \cdot 10^{-4}$
	32–97	64	65	$1.7 \cdot 10^{-5}$
	98–203	150	105	$1.7 \cdot 10^{-5}$
HFM03	0–18	15	5	–
	19–26	21	7	$4.2 \cdot 10^{-4}$
HFM02	0–37	31	12	–
	38–48	43	10	$5.9 \cdot 10^{-4}$
	49–100	74	51	–
HFM27	0–24	20	12	$1.3 \cdot 10^{-5}$
	25–45	28	20	$2.3 \cdot 10^{-5}$
	46–58	54	12	$4.0 \cdot 10^{-5}$
	59–128	119	69	$6.7 \cdot 10^{-6}$
HFM24	0–35	24	17	$3.0 \cdot 10^{-5}$
	36–65	47	29	$8.0 \cdot 10^{-5}$
	66–151	108	85	–
KFM04A	0–163	114	56	$6.4 \cdot 10^{-5}$
	164–185	165	21	$2.2 \cdot 10^{-6}$
	186–229	206	43	$4.2 \cdot 10^{-5}$
	230–245	233	15	$4.6 \cdot 10^{-5}$
	246–390	360	144	$1.5 \cdot 10^{-6}$
	391–495	419	104	$1.4 \cdot 10^{-8}$
	496–1,001	749	505	$2.7 \cdot 10^{-9}$
KFM06A	0–150	130	50	$6.0 \cdot 10^{-5}$
	151–246	215	95	$2.7 \cdot 10^{-5}$
	247–340	267	93	$7.5 \cdot 10^{-5}$
	341–362	357	21	$6.8 \cdot 10^{-6}$
	363–737	392	374	$3.1 \cdot 10^{-7}$
	738–748	743	10	$1.2 \cdot 10^{-7}$

Bh ID	Test section (m)	Point of application (m below TOC)	Section length (m)	Transmissivity (m^2/s)
	749–826	775	77	$1.9 \cdot 10^{-8}$
	827–1,000	913	173	$1.3 \cdot 10^{-9}$
KFM06C	0–186	144	86	$6.6 \cdot 10^{-5}$
	187–280	214	93	$1.8 \cdot 10^{-6}$
	281–350	316	69	$1.4 \cdot 10^{-6}$
	351–401	395	50	$8.3 \cdot 10^{-6}$
	402–530	422	128	$8.2 \cdot 10^{-8}$
	531–540	536	9	$1.1 \cdot 10^{-6}$
	541–646	593	105	$1.0 \cdot 10^{-9}$
	647–666	658	19	$9.5 \cdot 10^{-8}$
	667–872	770	205	$1.0 \cdot 10^{-8}$
	873–1,001	927	128	$1.3 \cdot 10^{-8}$
KFM06B	0–26	11	21	$2.8 \cdot 10^{-6}$
	27–50	45	23	$2.9 \cdot 10^{-4}$
	51–100	56	49	$2.4 \cdot 10^{-4}$
HFM10	0–99	50	87	–
	100–150	118	50	$3.1 \cdot 10^{-4}$
HFM16	0–53	41	41	$1.2 \cdot 10^{-4}$
	54–67	58	13	$3.5 \cdot 10^{-4}$
	68–132	69	64	$5.7 \cdot 10^{-5}$
HFM09	0–50	26	33	$3.7 \cdot 10^{-4}$
KFM07B [2)]	0–74	70	9 (0)	
	75–202	138	127 (0)	
	203–300	236	91 (25)	$4.9 \cdot 10^{-8}$
HFM21	0–21	20	9	–
	22–32	27	10	$1.0 \cdot 10^{-4}$
	33–106	98	73	$3.7 \cdot 10^{-4}$
	107–202	160	95	$2.1 \cdot 10^{-4}$
KFM07C	0–110	98	25	$4.8 \cdot 10^{-5}$
	111–160	157	49	$4.7 \cdot 10^{-5}$
	161–301	194	140	$8.6 \cdot 10^{-8}$
	302–500	401	198	–
KFM07A	0–148	137	48	$1.2 \cdot 10^{-4}$
	149–190	178	41	$1.7 \cdot 10^{-5}$
	191–225	208	34	–
	226–961	261	770	$9.3 \cdot 10^{-8}$
	962–972	967	10	–
	973–1,001	987	28	–
KFM09B	0–200	46	191	$4.3 \cdot 10^{-5}$
	201–450	254	249	$9.2 \cdot 10^{-7}$
	451–616	564	165	$3.5 \cdot 10^{-8}$
HFM22	0–222	62	210	$1.6 \cdot 10^{-4}$
HFM20	0–48	25	36	$5.7 \cdot 10^{-5}$
	49–100	77	51	$1.8 \cdot 10^{-6}$

Bh ID	Test section (m)	Point of application (m below TOC)	Section length (m)	Transmissivity (m^2/s)
	101–130	118	29	$1.0 \cdot 10^{-5}$
	131–301	215	170	–
KFM08B	0–70	26	64	$3.9 \cdot 10^{-5}$
	71–112	92	41	$3.9 \cdot 10^{-7}$
	113–200	174	87	$6.0 \cdot 10^{-7}$
HFM30	0–60	30	42	–
	61–73	69	12	$6.9 \cdot 10^{-6}$
	74–176	138	102	$8.4 \cdot 10^{-5}$
	177–201	194	24	$4.4 \cdot 10^{-5}$
HFM25	0–188	99	179	$3.8 \cdot 10^{-7}$
KFM09A	0–300	160	292	$2.1 \cdot 10^{-6}$
	301–550	436	249	$9.1 \cdot 10^{-7}$
	551–800	685	249	$4.8 \cdot 10^{-8}$
HFM28	0–151	82	139	$9.0 \cdot 10^{-6}$
HFM23	0–212	30	191	$4.3 \cdot 10^{-6}$
HFM38	0–23	12	14	–
	24–41	29	17	$8.3 \cdot 10^{-5}$
	42–201	188	159	$4.8 \cdot 10^{-5}$
HFM29	0–200	105	191	$6.8 \cdot 10^{-8}$
HFM17	0–211	31	203	$3.9 \cdot 10^{-5}$
KFM02B	0–130	108	43	–
	131–245	188	114	–
	246–409	327.5	163	–
	410–431	420.5	21	–
	432–490	461	58	–
	491–506	498.5	15	–
	507–570	538.5	63	–
KFM02A	0–132	118	32	$3.0 \cdot 10^{-4}$
	133–240	173	107	$5.1 \cdot 10^{-6}$
	241–410	282	169	$1.3 \cdot 10^{-5}$
	411–442	428	31	$2.5 \cdot 10^{-6}$
	443–489	478	46	$3.9 \cdot 10^{-7}$
	490–518	513	46	$2.1 \cdot 10^{-6}$
	519–888	558	369	$6.0 \cdot 10^{-9}$
	889–1,002	945	113	–
HFM05	0–138	75	126	–
	139–200	153	61	$4.0 \cdot 10^{-4}$
HFM33	0–140	136	128	$4.7 \cdot 10^{-4}$
HFM04	0–57	35	45	–
	58–66	62	8	$7.9 \cdot 10^{-5}$
	67–222	145	155	–
HFM12	0–56.5	22	41.5	$9.0 \cdot 10^{-6}$
	57.5–210	117	152.5	$7.9 \cdot 10^{-6}$

Bh ID	Test section (m)	Point of application (m below TOC)	Section length (m)	Transmissivity (m^2/s)
KFM11A	0–130	100	59	–
	131–360	245.5	229	–
	361–445	403	84	–
	446–456	451	10	–
	457–689	573	232	–
	690–710	700	20	–
	711–850	780.5	139	–
HFM11	0–53	43	41	$2.2 \cdot 10^{-5}$
	54–182	125	128	$2.8 \cdot 10^{-5}$
HFM18	0–27	19	19	–
	28–41	35	13	$7.8 \cdot 10^{-5}$
	42–180	111	138	$8.4 \cdot 10^{-5}$
KFM08D [3)]	0–160	80	101	–
	161–330	246	169	–
	331–659	495	328	–
	660–680	670	20	–
	681–824	753	143	–
	825–835	830	10	–
	836–950	893	114	–
KFM08A [3)]	0–161	130	61	–
	162–215	189	53	–
	216–264	240	48	–
	265–280	273	15	–
	281–473	377	192	–
	474–503	489	29	–
	504–683	594	179	–
	684–694	689	10	–
	695–1,001	848	306	–

[1)] The Point of Application in this section was measured at 16 m even though the section interval is 31.93–32.5 m.

[2)] This borehole is grouted to 209 m.

[3)] Sections measured during the second shorter interference test. Not inserted in table by order of distance from HFM14.

Table 3-5. Calculated distances from the pumping borehole HFM14 to the observation borehole sections involved in the interference test in HFM14.

Pumping section in HFM14 (m)	Observation sections			Distance to HFM14@20 m (m)
	Borehole ID	Section (m)	Point of Application	
0–150	HFM15	0–84	50	32.6
		85–95	89	71.3
0–150	KFM05A	0–114	109	88.2
		115–253	145	123.1
		254–272	256	232.7
		273–489	292	268.5
		490–698	594	568.2
		699–1,002	850	821.4
0–150	HFM19	0–103	101	183
		104–167	150	224.8
		168–182	176	248.1
0–150	HFM13	0–100	50	319
		101–158	106	302.1
		159–173	162	296.6
0–150	KFM01C	0–58	38	367.5
		59–237	85	350
		238–450	436	403.9
0–150	HFM01	0–32.5	16	375.7
		33.5–45.5	39	377.6
		46.5–200	64	380.9
0–150	KFM01A	0–108	105	411.9
		109–130	118	416.1
		131–204	148	427.4
		205–373	285	500.3
		374–430	402	582.3
		431–1,002	715	849.6
0–150	KFM01D	0–153	123	406.7
		154–252	163	418.9
		253–310	303	486.7
		311–321	316	494.6
		322–428	370	529.6
		429–438	434	575.1
		439–800	564	676.7
0–150	KFM01B	0–100	54	415.9
		101–141	121	438.3
		142–500	321	555.6
0–150	KFM10A	0–152	98	632.0
		153–352	314	527.0
		353–429	391	502.6
		430–440	432	493.3
		441–500	484	485.2
0–150	HFM32	0–25	19	511.1
		26–31	29	512

Pumping section in HFM14 (m)	Observation sections			Distance to HFM14@20 m (m)
	Borehole ID	Section (m)	Point of Application	
		32–97	64	517.8
		98–203	150	546.2
0–150	HFM03	0–18	15	532.1
		19–26	21	532.4
0–150	HFM02	0–37	31	535.7
		38–48	43	536.3
		49–100	74	539
0–150	HFM27	0–24	20	561.8
		25–45	28	564.2
		46–58	54	573.4
		59–128	119	602.1
0–150	HFM24	0–35	24	651.0
		36–65	47	643.7
		66–151	108	630.7
0–150	KFM04A	0–163	114	803.8
		164–185	165	772.9
		186–229	206	776.3
		230–245	233	769.8
		246–390	360	748.5
		391–495	419	743.9
		496–1,001	749	778.3
0–150	KFM06A	0–150	130	797.5
		151–246	215	793.1
		247–340	267	795.5
		341–362	357	810.3
		363–737	392	816.1
		738–748	743	979.9
		749–826	775	1,001.4
		827–1,000	913	1,103.2
0–150	KFM06C	0–186	144	892.4
		187–280	214	935.5
		281–350	316	1,007.4
		351–401	395	1,069.1
		402–530	422	1,091.2
		531–540	536	1,188.3
		541–646	593	1,238.4
		647–666	658	1,296.7
		667–872	770	1,398.5
		873–1,001	927	1,543.5
0–150	KFM06B	0–26	11	825.1
		27–50	45	823.5
		51–100	56	823.3
0–150	HFM10	0–99	50	836.1
		100–150	118	830.8
0–150	HFM16	0–53	41	837.5

Pumping section in HFM14 (m)	Observation sections			Distance to HFM14@20 m (m)
	Borehole ID	Section (m)	Point of Application	
		54–67	58	838
		68–132	69	838.5
0–150	HFM09	0–50	26	894.8
0–150	KFM07B [1)]	0–74	70	1,020.3
		75–202	138	983.6
		203–300	236	937.1
0–150	HFM21	0–21	20	1,030.7
		22–32	27	1,028.3
		33–106	98	999.6
		107–202	160	967.4
0–150	KFM07C	0–110	98	1,056.6
		111–160	157	1,056.6
		161–301	194	1,058.3
		302–500	401	1,091.7
0–150	KFM07A	0–148	137	1,103.6
		149–190	178	1,124.2
		191–225	208	1,137.1
		226–961	261	1,162.3
		962–972	967	1,692.7
		973–1,001	987	1,711.4
0–150	KFM09B	0–200	46	1,326.5
		201–450	254	1,222.1
		451–616	564	1,101.2
0–150	HFM22	0–222	62	1,227.4
0–150	HFM20	0–48	25	1,289
		49–100	77	1,292.4
		101–130	118	1,295.9
		131–301	215	1,308.5
0–150	KFM08B	0–70	26	1,302.5
		71–112	92	1,320.5
		113–200	174	1,348.8
0–150	HFM30	0–60	30	1,380.1
		61–73	69	1,364.0
		74–176	138	1,341.1
		177–201	194	1,325.8
0–150	HFM25	0–188	99	1,371.9
0–150	KFM09A	0–300	160	1,341.5
		301–550	436	1,375.3
		551–800	685	1,493.9
0–150	HFM28	0–151	82	1,349
0–150	HFM23	0–212	30	1,373.1
0–150	HFM38	0–23	12	1,442.0
		24–41	29	1,438.9

Pumping section in HFM14 (m)	Observation sections			Distance to HFM14@20 m (m)
	Borehole ID	Section (m)	Point of Application	
		42–201	188	1,390.7
0–150	HFM29	0–200	105	1,499.5
0–150	HFM17	0–211	31	1,536.5
0–150	KFM02B	0–130	108	–
		131–245	188	1,556.1
		246–409	327.5	1,555.2
		410–431	420.5	1,561.5
		432–490	461	1,566.0
		491–506	498.5	1,570.8
		507–570	538.5	1,576.8
0–150	KFM02A	0–132	118	1,570.7
		133–240	173	1,571.1
		241–410	282	1,576.1
		411–442	428	1,593.7
		443–489	478	1,602.6
		490–518	513	1,609.5
		519–888	558	1,619.2
		889–1,002	945	1,739.8
0–150	HFM05	0–138	75	1,698.5
		139–200	153	1,712.1
0–150	HFM33	0–140	136	1,728.8
0–150	HFM04	0–57	35	1,746.5
		58–66	62	1,746.8
		67–222	145	1,758.6
0–150	HFM12	0–56.5	22	1,881.9
		57.5–210	117	1,911.8
0–150	KFM11A	0–130	100	–
		131–360	245.5	–
		361–445	403	–
		446–456	451	–
		457–689	573	–
		690–710	700	–
		711–850	780.5	–
0–150	HFM11	0–53	43	2,027.6
		54–182	125	2,007.8
0–150	HFM18	0–27	19	2,506.2
		28–41	35	2,495.5
		42–180	111	2,455.6
0–150	KFM08D [2)]	0–160	80	1,259.5
		161–330	246	1,219.7
		331–659	495	1,207.4
		660–680	670	1,228.1
		681–824	753	1,245.4
		825–835	830	1,265.4

Pumping section in HFM14 (m)	Observation sections			Distance to HFM14@20 m (m)
	Borehole ID	Section (m)	Point of Application	
		836–950	893	1,284.7
0–150	KFM08A [2]	0–161	130	1,328.3
		162–215	189	1,390.1
		216–264	240	1,422.3
		265–280	273	1,444.2
		281–473	377	1,517.5
		474–503	489	1,603
		504–683	594	1,689.3
		684–694	689	1,771.3
		695–1,001	848	1,914.3

[1] This borehole is grouted to 209 m.

[2] Borehole measured during the second, shorter interference test. Not inserted in table by order of distance from HFM14.

3.3 Equipment check

An equipment check was performed at the Geosigma engineering workshop in Uppsala as well as at the site as a simple and fast test to establish the operating status of sensors and other equipment. In addition, calibration constants were implemented and checked.

The borehole equipment, pump and pressure transducer, were already fitted in the borehole since a previous pumping had been performed in 2006. As a result, the pressure sensor could not be tested at air pressure. From a short capacity test the week prior to start of pumping the function of the transducer could however be verified.

4 Description of equipment

4.1 Overview

The temporary test system used for the interference test is described in Geosigma quality plan ("Kvalitetsplan för SKB uppdrag – Hydrauliskt interferenstest med hammarborrhål HFM14 och HFM33 som pumphål, K587071, Kristoffer Gokall-Norman, 2007-06-08", Geosigma and SKB internal controlling document). The equipment in the pumping borehole, HFM14, consisted primarily of the following parts:

- A dual 4" submersible pump with submarine contact and steel pipe to the ground surface.
- Plastic hose and pipe for transporting the pumped water into the sea.
- 1 pressure transducer in the borehole.
- Flow meter at the surface.
- Data logger to sample data from the flow meter and the pressure transducer.
- Flow rate control valve at the surface.
- PC to visualize the data.

All the observation sections included in the interference test are part of the SKB hydro monitoring system (HMS), where pressure is recorded continuously.

The estimated lower and upper practical measurement limits for the actual equipment used for the interference test, expressed in terms of specific flow (Q/s), are $Q/s–L = 2 \cdot 10^{-6}$ m^2/s and $Q/s–U = 2 \cdot 10^{-2}$ m^2/s, respectively.

4.2 Measurement sensors

Technical data of the sensors used together with estimated data specifications of the test system for pumping tests are given in Table 4-1.

Table 4-2 shows the type and position for each transducer used in the test. Positions are given in metre from reference point, i.e. top of casing (ToC).

Table 4-1. Technical data of measurement sensors used as well as estimated data specifications of the test system for pumping tests (based on current laboratory and field experiences).

Technical specification					
Parameter		**Unit**	**Sensor**	**Test system**	**Comments**
p-absolute	Output signal	mA	4–20		Depending on uncertainties of the sensor position
	Meas. range	kPa	0–1,500		
	Resolution	kPa	0.05		
	Accuracy	kPa	±1.5 *	± 10	
Flow rate (surface)	Output signal	mA	4–20		Passive
	Meas. range	L/min	1–500	1 – c. 500	Pumping tests
	Resolution	L/min	0.1	1	
	Accuracy	% o.r.**	± 0.5	± 0.5	

* Includes hysteresis, linearity and repeatability.

** Maximum error in % of actual reading (% o.r.).

Table 4-2. Type and position of pressure sensors (position from ToC) used in the interference test in HFM14.

Borehole information				Sensors	
ID	Test interval (m)	Test configuration	Test type[1)]	Type	Position (m b ToC)
HFM14	0–150	Open borehole	1B	P-absolute	23.5
HFM15	0–84	Above packer	2	HMS	29.8
	85–95	Below packer	2	HMS	29.8
KFM05A	0–114	Above packer	2	HMS	39.3
	115–253	Between packers	2	HMS	39.3
	254–272	Between packers	2	HMS	39.3
	273–489	Between packers	2	HMS	39.3
	490–698	Between packers	2	HMS	39.3
	699–1,002	Below packer	2	HMS	39.3
HFM19	0–103	Above packer	2	HMS	29.8
	104–167	Between packers	2	HMS	29.8
	168–182	Below packer	2	HMS	29.8
HFM13	0–100	Above packer	2	HMS	29.8
	101–158	Between packers	2	HMS	29.8
	159–173	Below packer	2	HMS	29.8
KFM01C	0–58	Above packer	2	HMS	29.8
	59–237	Between packers	2	HMS	29.8
	238–450	Below packer	2	HMS	29.8
HFM01	0–32.5	Above packer	2	HMS	29.8
	33.5–45.5	Between packers	2	HMS	29.8
	46.5–200	Below packer	2	HMS	29.8
KFM01A	0–108	Above packer	2	HMS	39.3
	109–130	Between packers	2	HMS	39.3
	131–204	Between packers	2	HMS	39.3
	205–373	Between packers	2	HMS	39.3
	374–430	Between packers	2	HMS	39.3
	431–1,002	Below packer	2	HMS	39.3
KFM01D	0–153	Above packer	2	HMS	39.3
	154–252	Between packers	2	HMS	39.3
	253–310	Between packers	2	HMS	39.3
	311–321	Between packers	2	HMS	39.3
	322–428	Between packers	2	HMS	39.3
	429–438	Between packers	2	HMS	39.3
	439–800	Below packer	2	HMS	39.3
KFM01B	0–100	Above packer	2	HMS	29.3
	101–141	Between packers	2	HMS	29.3
	142–500	Below packer	2	HMS	29.3
KFM10A	0–152	Above packer	2	HMS	39.3
	153–352	Between packers	2	HMS	39.3
	353–429	Between packers	2	HMS	39.3
	430–440	Between packers	2	HMS	39.3
	441–500	Below packer	2	HMS	39.3

Borehole information				Sensors	
ID	Test interval (m)	Test configuration	Test type[1)]	Type	Position (m b ToC)
HFM32	0–25	Above packer	2	HMS	39.3
	26–31	Between packers	2	HMS	39.3
	32–97	Between packers	2	HMS	39.3
	98–203	Below packer	2	HMS	39.3
HFM03	0–18	Above packer	2	HMS	29.3
	19–26	Below packer	2	HMS	29.3
HFM02	0–37	Above packer	2	HMS	29.3
	38–48	Between packers	2	HMS	29.3
	49–100	Below packer	2	HMS	29.3
HFM27	0–24	Above packer	2	HMS	21.8
	25–45	Between packers	2	HMS	21.8
	46–58	Between packers	2	HMS	21.8
	59–128	Below packer	2	HMS	21.8
HFM24	0–35	Above packer	2	HMS	29.8
	36–65	Between packers	2	HMS	29.8
	66–151	Below packer	2	HMS	29.8
KFM04A	0–163	Above packer	2	HMS	39.3
	164–185	Between packers	2	HMS	39.3
	186–229	Between packers	2	HMS	39.3
	230–245	Between packers	2	HMS	39.3
	246–390	Between packers	2	HMS	39.3
	391–495	Between packers	2	HMS	39.3
	496–1,001	Below packer	2	HMS	39.3
KFM06A	0–150	Above packer	2	HMS	39.3
	151–246	Between packers	2	HMS	39.3
	247–340	Between packers	2	HMS	39.3
	341–362	Between packers	2	HMS	39.3
	363–737	Between packers	2	HMS	39.3
	738–748	Between packers	2	HMS	39.3
	749–826	Between packers	2	HMS	39.3
	827–1,001	Below packer	2	HMS	39.3
KFM06C	0–186	Above packer	2	HMS	39.3
	187–280	Between packers	2	HMS	39.3
	281–350	Between packers	2	HMS	39.3
	351–401	Between packers	2	HMS	39.3
	402–530	Between packers	2	HMS	39.3
	531–540	Between packers	2	HMS	39.3
	541–646	Between packers	2	HMS	39.3
	647–666	Between packers	2	HMS	39.3
	667–872	Between packers	2	HMS	39.3
	873–1,001	Below packer	2	HMS	39.3
KFM06B	0–26	Above packer	2	HMS	23.8
	27–50	Between packers	2	HMS	23.8
	51–100	Below packer	2	HMS	23.8

Borehole information				Sensors	
ID	Test interval (m)	Test configuration	Test type[1)]	Type	Position (m b ToC)
HFM10	0–99	Above packer	2	HMS	29.3
	100–150	Below packer	2	HMS	29.3
HFM16	0–53	Above packer	2	HMS	39.3
	54–67	Between packers	2	HMS	39.3
	68–132	Below packer	2	HMS	39.3
HFM09	0–50	Open borehole	2	HMS	5
KFM07B	0–74	Above packer	2	HMS	39.3
	75–202	Between packers	2	HMS	39.3
	203–300	Below packer	2	HMS	39.3
HFM21	0–21	Above packer	2	HMS	18.8
	22–32	Between packers	2	HMS	18.8
	33–106	Between packers	2	HMS	18.8
	107–202	Below packer	2	HMS	18.8
KFM07C	0–110	Above packer	2	HMS	39.3
	111–160	Between packers	2	HMS	39.3
	161–301	Between packers	2	HMS	39.3
	302–500	Below packer	2	HMS	39.3
KFM07A	0–148	Above packer	2	HMS	39.3
	149–190	Between packers	2	HMS	39.3
	191–225	Between packers	2	HMS	39.3
	226–961	Between packers	2	HMS	39.3
	962–972	Between packers	2	HMS	39.3
	973–1,001	Below packer	2	HMS	39.3
KFM09B	0–200	Above packer	2	HMS	29.8
	201–450	Between packers	2	HMS	29.8
	451–616	Below packer	2	HMS	29.8
HFM22	0–222	Open borehole	2	HMS	15
HFM20	0–48	Above packer	2	HMS	39.3
	49–100	Between packers	2	HMS	39.3
	101–130	Between packers	2	HMS	39.3
	131–301	Below packer	2	HMS	39.3
KFM08B	0–70	Above packer	2	HMS	29.8
	71–112	Between packers	2	HMS	29.8
	113–200	Below packer	2	HMS	29.8
HFM30	0–60	Above packer	2	HMS	29.8
	61–73	Between packers	2	HMS	29.8
	74–176	Between packers	2	HMS	29.8
	177–201	Below packer	2	HMS	29.8
HFM25	0–188	Open borehole	–	–	–
KFM09A	0–300	Above packer	2	HMS	29.8
	301–550	Between packers	2	HMS	29.8
	551–800	Below packer	2	HMS	29.8
HFM28	0–151	Open borehole	2	HMS	10

Borehole information				Sensors	
ID	Test interval (m)	Test configuration	Test type[1)]	Type	Position (m b ToC)
HFM23	0–212	Open borehole	2	HMS	15
HFM38	0–23	Above packer	2	HMS	21.3
	24–41	Between packers	2	HMS	21.3
	42–201	Below packer	2	HMS	21.3
HFM29	0–200	Open borehole	2	HMS	10
HFM17	0–211	Open borehole	2	HMS	10
KFM02B	0–130	Above packer	2	HMS	39.3
	131–245	Between packers	2	HMS	39.3
	246–409	Between packers	2	HMS	39.3
	410–431	Between packers	2	HMS	39.3
	432–490	Between packers	2	HMS	39.3
	491–506	Between packers	2	HMS	39.3
	507–570	Below packer	2	HMS	39.3
KFM02A	0–132	Above packer	2	HMS	39.3
	133–240	Between packers	2	HMS	39.3
	241–410	Between packers	2	HMS	39.3
	411–442	Between packers	2	HMS	39.3
	443–489	Between packers	2	HMS	39.3
	490–518	Between packers	2	HMS	39.3
	519–888	Between packers	2	HMS	39.3
	889–1,002	Below packer	2	HMS	39.3
HFM05	0–138	Above packer	2	HMS	29.8
	139–200	Between packers	2	HMS	29.8
HFM33	0–140	Open borehole	2	HMS	10
HFM04	0–57	Above packer	2	HMS	29.3
	58–66	Between packers	2	HMS	29.3
	67–222	Below packer	2	HMS	29.3
HFM12	0–56.5	Above packer	2	HMS	39.3
	57.5–210	Below packer	2	HMS	39.3
KFM11A	0–130	Above packer	2	HMS	39.3
	131–360	Between packers	2	HMS	39.3
	361–445	Between packers	2	HMS	39.3
	446–456	Between packers	2	HMS	39.3
	457–689	Between packers	2	HMS	39.3
	690–710	Between packers	2	HMS	39.3
	711–850	Below packer	2	HMS	39.3
HFM11	0–53	Above packer	2	HMS	39.3
	54–182	Below packer	2	HMS	39.3
HFM18	0–27	Above packer	2	HMS	24.8
	28–41	Between packers	2	HMS	24.8
	42–180	Below packer	2	HMS	24.8
KFM08D [2)]	0–160	Above packer	2	HMS	39.3
	161–330	Between packers	2	HMS	39.3

Borehole information				Sensors	
ID	Test interval (m)	Test configuration	Test type[1)]	Type	Position (m b ToC)
	331–659	Between packers	2	HMS	39.3
	660–680	Between packers	2	HMS	39.3
	681–824	Between packers	2	HMS	39.3
	825–835	Between packers	2	HMS	39.3
	836–950	Below packer	2	HMS	39.3
KFM08A [2)]	0–161	Above packer	2	HMS	39.3
	162–215	Between packers	2	HMS	39.3
	216–264	Between packers	2	HMS	39.3
	265–280	Between packers	2	HMS	39.3
	281–473	Between packers	2	HMS	39.3
	474–503	Between packers	2	HMS	39.3
	504–683	Between packers	2	HMS	39.3
	684–694	Between packers	2	HMS	39.3
	695–1,001	Below packer	2	HMS	39.3

[1)] 1B: Pumping test-submersible pump, 2: Interference test (observation borehole during pumping in another borehole).

[2)] Borehole measured during the second, shorter interference test. Not inserted in table by order of distance from HFM14.

5 Execution

5.1 Preparations

A simple two point calibration of the pressure transducer that was used in the pumping borehole was conducted in June of 2006. The flow meter was calibrated in the Geosigma workshop just prior to the installation of the equipment. Also, since a similar test was performed in 2006 flow and drawdown data could be compared with data from the previously performed test. The data were very similar. Before the tests, function checks and cleaning of equipment were performed according to the Activity Plan.

5.2 Procedure

The interference test in HFM14 was carried out as a constant flow rate test followed by a subsequent pressure recovery period. The pressure interference was recorded in totally 185 sections in 49 observation boreholes, both cored and percussion drilled boreholes, all part of the HMS (Hydro Monitoring System). The flow rate in the pumping borehole was chosen based on the results from an interference test performed last year (2006) in HFM14, /35/. Approximately one week before the start of pumping, a capacity test lasting for c. 24 hours was performed in order to check the status of the equipment and to get even more information about the drawdown characteristics of the pumping borehole. It was desirable to achieve a slightly larger drawdown during the interference test than was reached last year. However, avoiding reaching the anomaly, cf /1/, at ca 20 m along the borehole was still important. The flow rate was manually adjusted by a control valve and monitored by an electromagnetic flow meter. The data logger sampled data at a suitable frequency determined by the operator, see Table 5-1. Pumping in HFM14 was carried out using two coupled 4” submersible pumps during a period of c. 102 days. The subsequent pressure recovery was measured for c. 7 days.

The discharged water from the pumping borehole was led into the sea approximately 80 m east of HFM14.

In HFM14, the absolute pressure transducer connected to the data-logger was attached to the pump pipe approximately 23.5 m below top of casing. The transducers were connected directly to the data logger via cables. In the observation boreholes the hydro monitoring system was utilized for pressure registration.

Approximate sampling intervals for flow rate and pressure in the pumping borehole HFM14 are presented in Table 5-1. During the first hours of pumping the sampling frequency was adjusted manually and Table 5-1 reflects only the character of the changes of frequency intervals. At the time of pumping stop, the sampling frequency was automatically changed in accordance with Table 5-1.

The observation boreholes are either fitted with removable miniTroll transducers equipped with an attached logger or with stationary equipment for measuring pressure in the different sections. The miniTroll transducers were logging a pressure value with the standard frequency of one reading every two hours. In addition, a value was logged in case there was a pressure change of at least 0.1 m since the last logging. The logging intervals of the stationary installations are given in Table 5-2. The standard condition for change induced logging is the same as for the miniTroll transducers.

Table 5-1. Approximate sampling intervals used for pressure registration in HFM14 during the interference test in HFM14.

Time interval (s) from start/stop of pumping	Sampling interval (s)
1–300	1
301–600	10
601–3,600	60
> 3,600	300
> 3,600 [1)]	600

[1)] The 600 s sampling interval was used during recovery instead of the 300 s interval.

Table 5-2. Logging schedule for the observation boreholes during the interference test in HFM14.

Time before or after start/stop of pumping	Scan interval	Log Interval
1 h. before	10 s.	10 s.
30 min. after	1 min.	1 min.
4 h. after	5 min.	5 min.
6 h. after	5 min.	10 min.
24 h. after	5 min.	30 min.

5.3 Data handling

Flow and pressure data from the pumping borehole, HFM14, were downloaded from the logger (Campbell CR 5000) to a laptop running the program PC9000 and are, already in the logger, transformed to engineering units. All files are comma-separated (*.DAT) when copied to a computer. A list of the data files from the data logger is shown in Appendix 1.

5.4 Analyses and interpretation

When performed, both qualitative and quantitative analyses have been carried out in accordance with the methodology descriptions for interference tests, SKB MD 330.003, and are reported in Chapter 6 below. Methods for constant-flow rate tests in an equivalent porous medium were used by the analyses and interpretation of the tests.

The main objective of the interference test was to document how different fracture zones are connected hydraulically, to quantify their hydraulic properties and to clarify whether there are any major hydraulic boundaries in the area. Quantitative evaluation of six selected observation sections was also included in the commission. One section in each of the boreholes HFM01: 33.5–45.5, HFM13: 159–173 m, HFM15: 85–95 m, HFM19: 168–182 m, HFM32: 26–31 m and KFM10A: 430–440 m was chosen for analyses with regard to transmissivity and storativity. Other borehole sections included in the interference tests were only qualitatively analysed, mainly by means of the response analysis reported in chapter 6 below.

Data from all available observation sections were used in the primary qualitative analyses. The qualitative analysis of the responses in interference test in HFM14 was primarily based on time versus pressure diagrams together with response diagrams. Linear diagrams of pressure versus time for all test sections are presented in Chapter 6 for each borehole included in the test.

For the six selected observation sections the dominating flow regimes (pseudo-linear, pseudo-radial and pseudo-spherical flow, respectively) and possible outer boundary conditions were

identified. In particular, pseudo-radial flow is reflected by a constant (horizontal) derivative in the diagrams, whereas no-flow- and constant head boundaries are characterized by rapid increase and decrease of the derivative, respectively.

Different values were applied on the filter coefficient (step length) by the calculation of the pressure derivative to investigate the effect of this coefficient on the derivative. It is desired to achieve maximum smoothing of the derivative without altering the original shape of the data.

Quantitative evaluation was only undertaken of the responses in the six above mentioned selected observation sections, HFM01: 33.5–45.5, HFM13: 159–173 m, HFM15: 85–95 m, HFM19: 168–182 m, HFM32: 26–31 m and KFM10A: 430–440 m. These sections were selected since they were used in the tracer dilution tests performed alongside the interference test. Results can then be used for comparison with and as a supplement to the results produced by the tracer dilution tests. In addition, the response in the pumping borehole HFM14 was evaluated as a single-hole pumping test according to the methods described in /30/.

The quantitative transient analysis was performed by using a special version of the test analysis software AQTESOLV that enables both visual and automatic type curve matching. The transient evaluation was carried out as an iterative process of type curve matching and automatic non-linear regression. The quantitative, transient interpretation of the hydraulic parameters (transmissivity and storativity) is normally based on the identified pseudo-radial flow regime during the tests in log-log and lin-log data diagrams.

For the single-hole pumping test in HFM14 the storativity was calculated using an empirical regression relationship between storativity and transmissivity, see Equation (5-1), Rhén et al. (1997) /31/. Firstly, the transmissivity and skin factor were obtained by type curve matching on the data curve using a fixed storativity value of 10^{-6} according to the instruction SKB MD 320.004. From the transmissivity value obtained, the storativity was then calculated according to Equation (5-1) and the type curve matching was repeated.

In most cases the change of storativity does not significantly alter the calculated transmissivity by the new type curve matching. Instead, the estimated skin factor, which is strongly correlated to the storativity using the effective borehole radius concept, is altered correspondingly.

$$S = 0.0007 \cdot T^{0.5} \qquad (5\text{-}1)$$

S = storativity (–).

T = transmissivity (m^2/s).

5.5 Nonconformities

From boreholes KFM02B and KFM11A there were no pressure data, bad pressure data or not enough pressure data available until after the start of pumping. This made the response analysis of these sections impossible.

An extra pumping in HFM14 was conducted between the 27th of November and the 13th of December to introduce pressure interference in boreholes KFM08A and KFM08D which were not ready for pressure measurement during the main interference test.

A simple analysis of the responses of KFM11A and KFM02B were also included in the second pumping. This was, however, not planned at the time of the actual test, and as a result the time resolution on data from HMS, concerning these boreholes was not as well adapted for evaluation.

Since the borehole equipment was already installed prior to the start of the test no manual groundwater level measurements could be performed before or during the test.

6 Results

6.1 Nomenclature and symbols

The nomenclature and symbols used for the results of the single-hole and interference test are according to the Instruction for analysis of single-hole injection- and pumping tests (SKB MD 320.004) and the methodology description for interference tests (SKB MD 330.003), respectively (both are SKB internal controlling documents). Additional symbols used are explained in the text.

6.2 Interference test 1 in HFM14

The start and stop of pumping occurred on June, 28 and October 8, 2007, respectively. The test stopped on the 15th of October. After this time, some minor intermittent pumping activities were performed within the area which affected the recovery in some of the boreholes. The overall data acquisition was continued until October, 20.

During the interference test the pressure was registered in a number of cored boreholes and percussion boreholes in rock. The pressure responses in all monitored observation sections are presented in Figures 6-3 through 6-50. All observation boreholes included in the test and their approximate distances to the pumping borehole HFM14 are marked in Figure 1-1. In two of the observation boreholes, KFM02B and KFM11A, there are no data, bad data or not sufficiently enough data until after the start of pumping. This made it impossible to make an ordinary response analysis from these sections.

The measured drawdown (s_p) at the end of the flow period and the estimated response time lag (dt_L) in all of the observation sections are shown in Tables 6-203 and 6-204, respectively. The response time is defined as the time lag after start of pumping until a drawdown response of 0.01 m was observed in the actual observation section.

All pressure data presented in this report have been corrected for atmospheric pressure changes by subtracting the latter pressure from the measured (absolute) pressure. This is also true for the data received from the HMS. It should be observed that no further corrections of the measured drawdown have been made, e.g. due to natural trends, precipitation, tidal effects etc, as discussed below. All times presented are Swedish summer times, i.e. adjustment for daylight saving time has been made for any reported times.

During the interference test, there was quite a large amount of dispersed precipitation reported from two stations in the vicinity of the boreholes included in the test, see Figure A2-20. In the figure the start and stop times of the interference test and flow period are marked. The rain was spread rather evenly during the summer except for a significant peak on the 20th of August. Since the precipitation is not concentrated in short periods of time it is difficult to tell for certain whether it has significantly influenced the pressure in the observation boreholes. The pressure curves from many of the sections do have characteristic and similar appearance though, and it is not unlikely that part of that can be explained by rainfall and/or air pressure conditions. The fact that some sections may be influenced by the meteorological conditions in the area during the test could make some of the interpretations somewhat erroneous. In the figure also the air pressure together with the sea-water level from one station in the vicinity of the investigation area during the interference test period are included. The seawater level is correlating to some extent with the characteristic shape in many of the pressure diagrams, indicating that many of the observation sections may be influenced by the seawater level.

The pressure in several of the observation sections included in the interference test was displaying an oscillating behaviour. This is believed to be naturally caused by so called tidal fluctuations or earth tides in combination with changes of the sea water level. These phenomena have, to some extent, been investigated previously in /35/. This effect can be observed, for instance, in many sections in borehole KFM06A, Figure 6-19a and 6-19b. This effect will not be further described in every section in which it appears. Only on some occasions where it is unusually strong or if it affects the analysis will it be commented on.

In some of the observation sections there was a sudden pressure increase registered in conjunction with the start of pumping. No explanation has been found for this. It is obvious that this makes the interpretation of the response times difficult and whenever such rising pressure has been observed it is mentioned in the report in the chapter covering that observation section.

Some of the models used in the transient evaluation of the responses in the pumping borehole and selected observation sections are described in /36/. Due to the variable flow rate during primarily the beginning of the pumping period, the tests were analysed as variable flow rate tests by the transient evaluation.

6.2.1 Pumping borehole HFM14: 0–150 m

General test data for the pumping test in HFM14 are presented in Table 6-1. According to Table 3-1, the borehole is cased to 6.0 m. The uncased interval of this section is thus c. 6–150 m.

Comments on the test

The test was performed as a constant-flow rate pumping test. The mean flow rate was c. 349 L/min and the duration of the flow period was c. 102 days. An approximately constant flow rate was reached within minutes after the start of pumping. On some occasions small adjustments were made to regulate the flow rate during the duration of the test, as can be seen more clearly in Figure 6-2. Small natural changes in pressure or flow rate can also be identified during the entire flow period. The final drawdown in HFM14 was approximately 12 m. The pressure recovery was measured for about 7 days. Overviews of the flow rate and pressure responses in HFM14 are presented in Figures 6-1 and 6-2. The pressure responses in log-log and lin-log diagrams during the flow period are presented in Figures A2-1 and A2-2 in Appendix 2. In Figures A2-3 and A2-4, log-log and lin-log diagrams of the recovery period are shown.

Interpreted flow regimes

During the flow period, WBS is indicated during the first c. 10 seconds followed by a transition period to pseudo-radial flow between c. 2,000–70,000 s. After this period throughout the flow period a pseudo-spherical flow regime is dominating approaching pseudo-stationary conditions by the end.

During the recovery period, a PRF is indicated between c. 2,000–50,000 s. A transition period, to a PSF, is following the period of pseudo-radial flow lasting until the end of the period.

Interpreted parameters

Transient, quantitative interpretation of the flow period is shown in log-log and lin-log diagrams in Figures A2-1 and A2-2 and of the recovery period in Figures A2-3 and A2-4, all in Appendix 2. The results from the flow period were selected as representative. The results from the transient evaluation of the single-hole pumping test in HFM14 are summarized in Table 6-209 and in the Test Summary Sheet.

Table 6-1. General test data for the pumping test in HFM14: 0–150 m.

General test data				
Pumping borehole		HFM14		
Test type[1)]		Constant Rate withdrawal and recovery test		
Test section (open borehole/packed-off section):		open borehole		
Test No		1		
Field crew		(GEOSIGMA AB)		
Test equipment system				
General comment		Interference test		
		Nomenclature	**Unit**	**Value**
Borehole length		L	m	150.50
Casing length		L_c	m	6.00
Test section- secup		Secup	m	6.00
Test section- seclow		Seclow	m	150.50
Test section length		L_w	m	144.50
Test section diameter[2)]		$2 \cdot r_w$	mm	136–138
Test start (start of pressure registration)			yymmdd hh:mm	070625 14:58:23
Packer expanded			yymmdd hh:mm:ss	
Start of flow period			yymmdd hh:mm:ss	070628 10:45:58
Stop of flow period			yymmdd hh:mm:ss	071008 10:30:03
Test stop (stop of pressure registration)			yymmdd hh:mm	071015 12:00:00
Total flow time		t_p	min	146,864
Total recovery time		t_F	min	10,170
Pressure data				
Relative pressure in test section before start of flow period		p_i	kPa	165.72
Relative pressure in test section before stop of flow period		p_p	kPa	47.87
Relative pressure in test section at stop of recovery period		p_F	kPa	162.43
Pressure change during flow period (p_i–p_p)		dp_p	kPa	117.85
Flow data				
Flow rate from test section just before stop of flow period		Q_p	m^3/s	0.00582
Mean (arithmetic) flow rate during flow period		Q_m	m^3/s	0.00581
Total volume discharged during flow period		V_p	m^3	51,220
Manual groundwater level measurements in HFM14 (6.0–150.5 m) [3)]		**GW level**		
Date YYYY-MM-DD	**Time tt:mm**	**Time (min)**	**(m b ToC)**	**(m.a.s.l.)**
2007-10-25	10:48	175,430	4.16	0.32
2007-11-26	12:27	221,609	3.75	0.67

[1)] Constant Head injection and recovery or Constant Rate withdrawal and recovery.

[2)] Nominal diameter.

[3)] Since the borehole equipment was already installed prior to the test, it was not possible to perform any manual ground water level measurements.

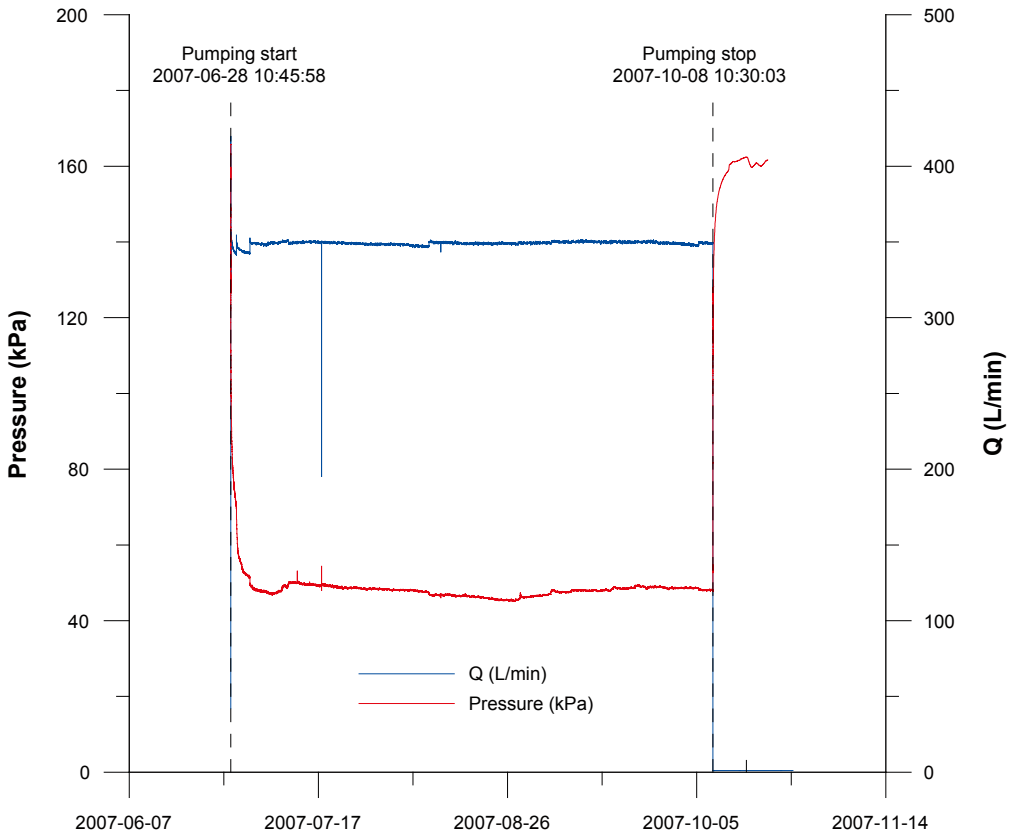


Figure 6-1. *Linear plot of flow rate and pressure versus time in the pumping borehole HFM14 during the interference test in HFM14.*

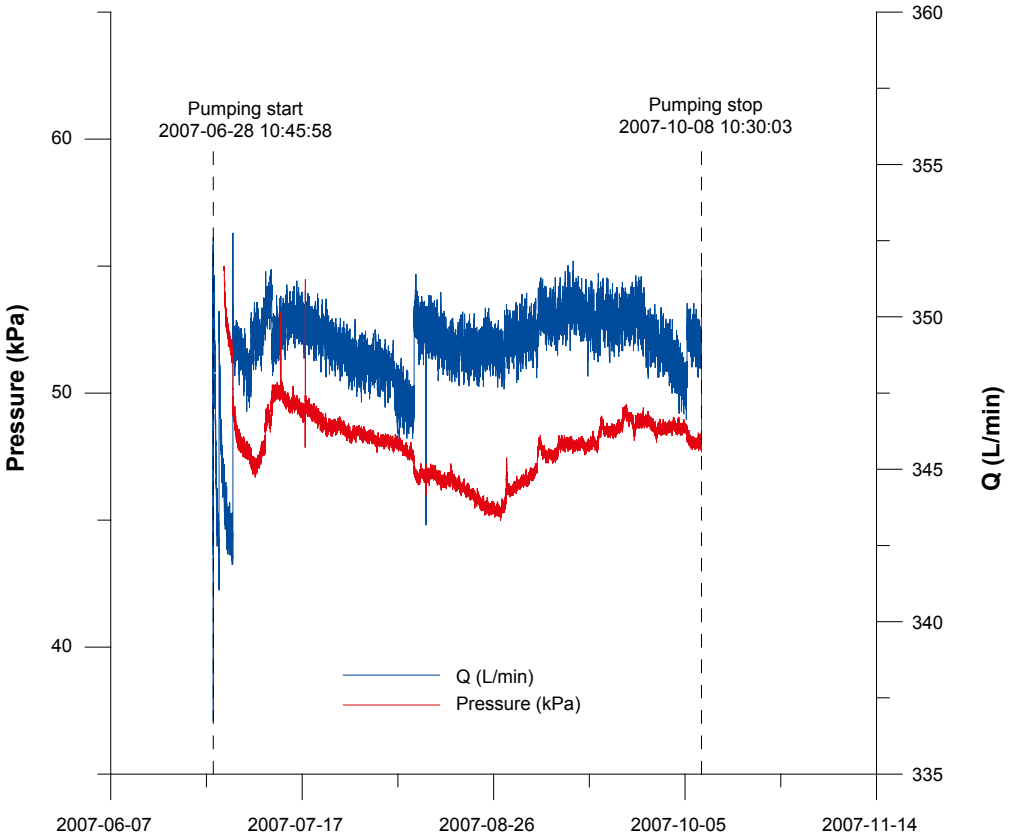


Figure 6-2. *Linear plot of flow rate and pressure versus time in the pumping borehole HFM14 during the interference test in HFM14. Zoomed in version.*

6.2.2 Observation section HFM15: 0–84 m

In Figure 6-3 an overview of the pressure responses in observation borehole HFM15 is shown. General test data from the observation section HFM15, 0–84 m, are presented in Table 6-2. According to Table 3-1, the borehole is cased to 6.0 m. The uncased interval of this section is thus c. 6–84 m.

Comments on the test

A very quick response to pumping is indicated in this section. The total drawdown during the flow period was c. 7.8 m. A drawdown of 0.01 m was reached approximately 2 seconds after start of pumping in HFM14. There was a total recovery of c. 7.5 m during the recovery period lasting for approximately 7 days.

Table 6-2. General test data from the observation section HFM15: 0–84 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.65
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–7.20
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.29
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	7.85

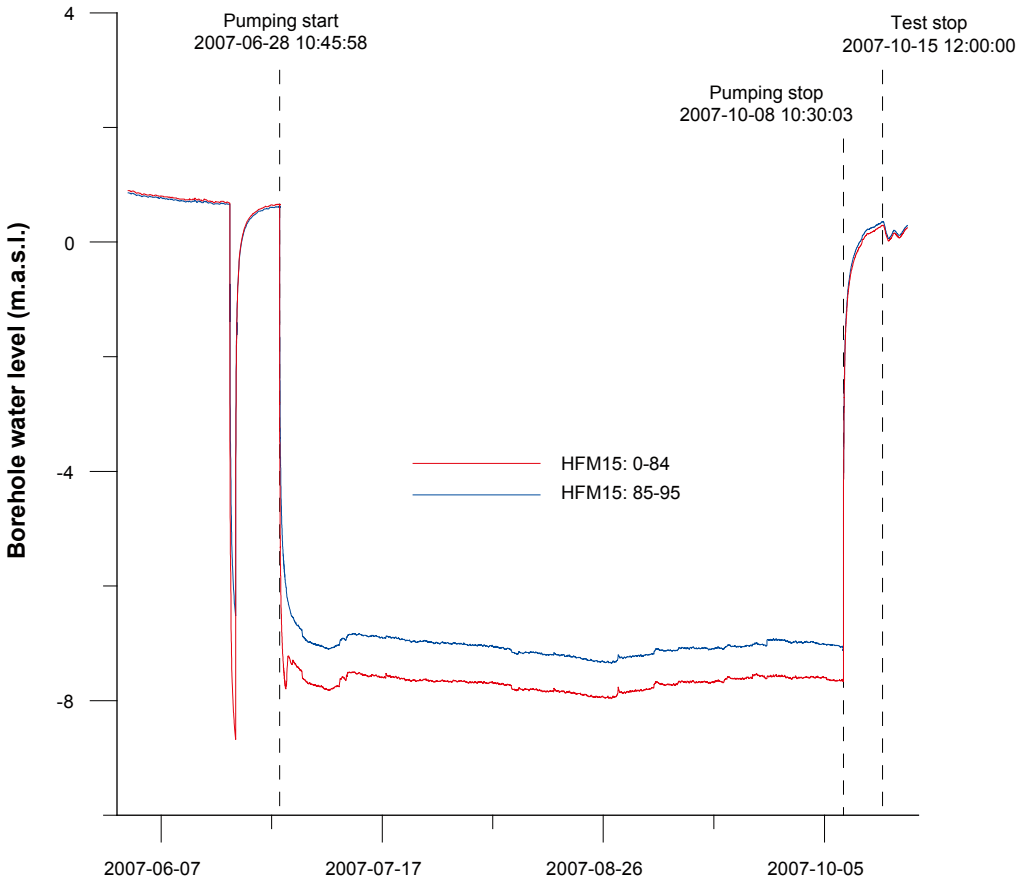


Figure 6-3. *Linear plot of pressure versus time in the observation sections in HFM15 during the interference test in HFM14.*

6.2.3 Observation section HFM15: 85–95 m

In Figure 6-3 an overview of the pressure responses in observation borehole HFM15 is shown. General test data from the observation section HFM15, 85–95 m, are presented in Table 6-3.

Comments on the test

A very quick response to pumping is indicated in this section. The total drawdown during the flow period was c. 7.6 m. A drawdown of 0.01 m was reached approximately 2 seconds after start of pumping in HFM14. There was a total recovery of c. 7.4 m during the recovery period lasting for approximately 7 days.

6.2.4 Observation section KFM05A: 0–114 m

In Figure 6-4 an overview of the pressure responses in observation borehole KFM05A is shown. General test data from the observation section KFM05A, 0–114 m, are presented in Table 6-4. According to Table 3-1, the borehole is cased to 100.07 m. The uncased interval of this section is thus c. 100–114 m. Part of the installation of the casing has been changed since the first installation of the casing and now reaches 110.1 m along the borehole, indicating that the hydrologically active section may be even shorter.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 5.4 m. A drawdown of 0.01 m was reached approximately 52 seconds after the pumping started in HFM14. There was a total recovery of c. 5.3 m during the recovery period lasting for approximately 7 days.

Table 6-3. General test data from the observation section HFM15: 85–95 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.61
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–7.04
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.36
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	7.65

Table 6-4. General test data from the observation section KFM05A: 0–114 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.33
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.12
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.21
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	5.45

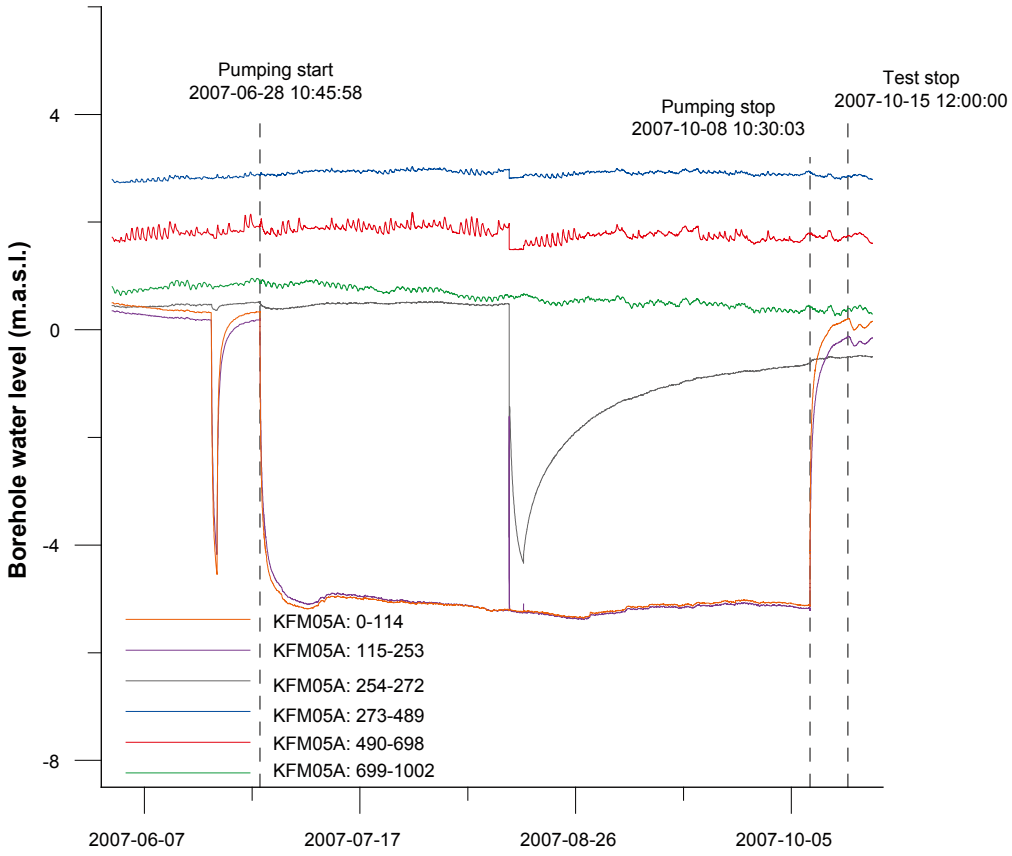


Figure 6-4. *Linear plot of pressure versus time in the observation sections in KFM05A during the interference test in HFM14.*

6.2.5 Observation section KFM05A: 115–253 m

In Figure 6-4 an overview of the pressure responses in observation borehole KFM05A is shown. General test data from the observation section KFM05A, 115–253 m, are presented in Table 6-5.

Comments on the test

A clear response to pumping was detected also in this section. The total drawdown during the flow period was c. 5.4 m. A drawdown of 0.01 m was reached approximately 6 minutes after the pumping started in HFM14. There was a total recovery of c. 5.1 m during the recovery period lasting for approximately 7 days.

Table 6-5. General test data from the observation section KFM05A: 115–253 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.18
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.18
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.12
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	5.36

6.2.6 Observation section KFM05A: 254–272 m

In Figure 6-4 an overview of the pressure responses in observation borehole KFM05A is shown. General test data from the observation section KFM05A, 254–272 m, are presented in Table 6-6.

Comments on the test

There are small signs indicating that this section might be slightly affected by the pumping. The response, however, is very weak. A jump to a new pressure level is indicated which is not connected to the pumping in HFM14. After this the pressure is slowly rising throughout the test period without ever returning to the pressure level recorded before the sudden pressure change. It still seems unlikely that this section is influenced by the pumping in HFM14.

6.2.7 Observation section KFM05A: 273–489 m

In Figure 6-4 an overview of the pressure responses in observation borehole KFM05A is shown. General test data from the observation section KFM05A, 273–489 m, are presented in Table 6-7.

Comments on the test

No effects of pumping can be seen in this section. It is unlikely that this section is influenced by pumping in HFM14. The pressure in the test section is showing a slight oscillating behaviour. This is believed to be natural fluctuations, mainly caused by so called tidal effects which, in part, have been studied previously in /35/.

6.2.8 Observation section KFM05A: 490–698 m

In Figure 6-4 an overview of the pressure responses in observation borehole KFM05A is shown. General test data from the observation section KFM05A, 490–698 m, are presented in Table 6-8.

Comments on the test

No effects of pumping can be seen in this section. It is improbable that this section is influenced by pumping in HFM14.

Table 6-6. General test data from the observation section KFM05A: 254–272 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.50
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.63
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.50
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.13

Table 6-7. General test data from the observation section KFM05A: 273–489 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	2.87
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	2.93
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	2.86
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.06

Table 6-8. General test data from the observation section KFM05A: 490–698 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.94
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.77
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	1.74
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.17

6.2.9 Observation section KFM05A: 699–1,002 m

In Figure 6-4 an overview of the pressure responses in observation borehole KFM05A is shown. General test data from the observation section KFM05A, 699–1,002 m, are presented in Table 6-9.

Comments on the test

There are some indications that this section may be weakly affected by the pumping in HFM14. There is a trend of decreasing pressure starting at the time of pump start and lasting for the duration of the test. The recovery period is a little too short but there are indications that the pressure is rising slightly from the time of pump stop.

6.2.10 Observation section HFM19: 0–103 m

In Figure 6-5 an overview of the pressure responses in observation borehole HFM19 is shown. General test data from the observation section HFM19, 0–103 m, are presented in Table 6-10. According to Table 3-1, the borehole is cased to 12.04 m. The uncased interval of this section is thus c. 12–103 m.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 6.3 m. A drawdown of 0.01 m was reached approximately 8 minutes after the pumping started in HFM14. There was a total recovery of c. 6.0 m during the recovery period that lasted for approximately 7 days.

Table 6-9. General test data from the observation section KFM05A: 699–1,002 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.88
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.43
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.40
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.45

Table 6-10. General test data from the observation section HFM19: 0–103 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.83
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.50
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.53
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	6.33

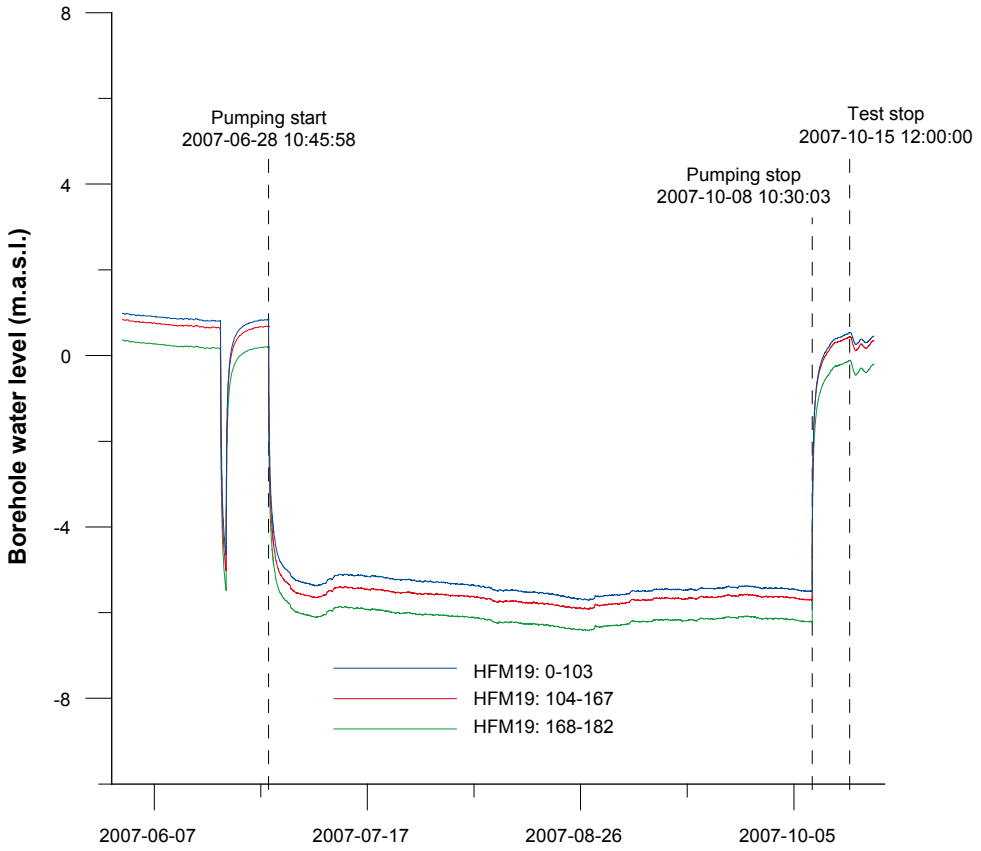


Figure 6-5. *Linear plot of pressure versus time in the observation sections in HFM19 during the interference test in HFM14.*

6.2.11 Observation section HFM19: 104–167 m

In Figure 6-5 an overview of the pressure responses in observation borehole HFM19 is shown. General test data from the observation section HFM19, 104–167 m, are presented in Table 6-11.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 6.3 m. A drawdown of 0.01 m was reached approximately 3 minutes after the pumping started in HFM14. There was a total recovery of c. 6.1 m during the recovery period that lasted for approximately 7 days.

Table 6-11. General test data from the observation section HFM19: 104–167 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.68
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.65
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.43
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	6.33

6.2.12 Observation section HFM19: 168–182 m

In Figure 6-5 an overview of the pressure responses in observation borehole HFM19 is shown. General test data from the observation section HFM19, 168–182 m, are presented in Table 6-12.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 6.4 m. A drawdown of 0.01 m was reached approximately 2 minutes after the pumping started in HFM14, which is the fastest responding section in HFM19. There was a total recovery of c. 6.1 m during the recovery period that lasted for approximately 7 days.

6.2.13 Observation section HFM13: 0–100 m

In Figure 6-6 an overview of the pressure responses in observation borehole HFM13 is shown. General test data from the observation section HFM13, 0–100 m, are presented in Table 6-13. According to Table 3-1, the borehole is cased to 14.9 m. The uncased interval of this section is thus c. 15 –100 m.

Comments on the test

This section indicates a clear response to pumping in HFM14. A total drawdown during the flow period of c. 2.2 m was registered and a drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 1.6 m during the recovery period that lasted for approximately 7 days.

Table 6-12. General test data from the observation section HFM19: 168–182 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.20
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–6.21
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.12
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	6.41

Table 6-13. General test data from the observation section HFM13: 0–100 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	2.49
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.29
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	1.91
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.20

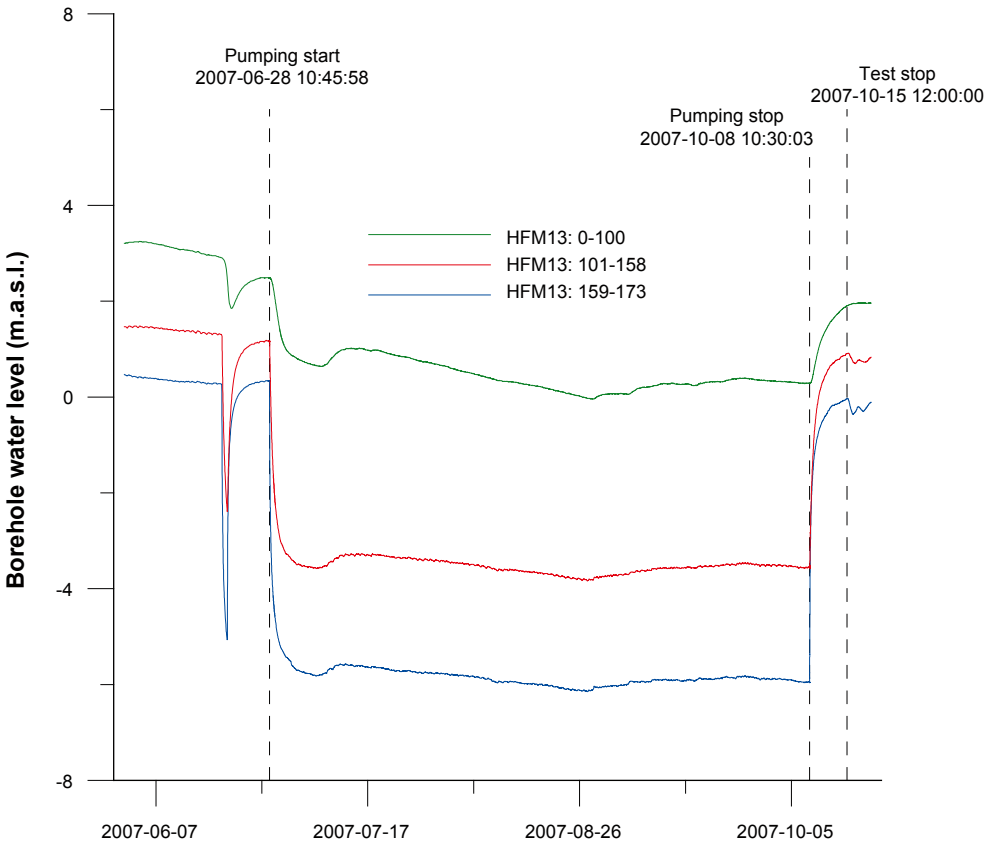


Figure 6-6. *Linear plot of pressure versus time in the observation sections in HFM13 during the interference test in HFM14.*

6.2.14 Observation section HFM13: 101–158 m

In Figure 6-6 an overview of the pressure responses in observation borehole HFM13 is shown. General test data from the observation section HFM13, 101–158 m, are presented in Table 6-14.

Comments on the test

This section also indicates a clear response to pumping in HFM14. A total drawdown during the flow period of c. 4.7 m was registered and a drawdown of 0.01 m was reached approximately 28 minutes after the pumping started in HFM14. There was a total recovery of c. 4.5 m during the recovery period that lasted for approximately 7 days.

Table 6-14. General test data from the observation section HFM13: 101–158 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.16
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–3.57
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.91
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	4.73

6.2.15 Observation section HFM13: 159–173 m

In Figure 6-6 an overview of the pressure responses in observation borehole HFM13 is shown. General test data from the observation section HFM13, 159–173 m, are presented in Table 6-15.

Comments on the test

This section of HFM13 indicates the strongest response to pumping in HFM14. A total drawdown during the flow period of c. 6.3 m was registered and a drawdown of 0.01 m was reached approximately 6 minutes after the pumping started in HFM14. There was a total recovery of c. 6.0 m during the recovery period of approximately 7 days.

6.2.16 Observation section KFM01C: 0–58 m

In Figure 6-7 an overview of the pressure responses in observation borehole KFM01C is shown. General test data from the observation section KFM01C, 0–58 m, are presented in Table 6-16. According to Table 3-1, the borehole is cased to 11.96 m. The uncased interval of this section is thus c. 12–58 m.

Comments on the test

The pumping in HFM14 caused a clear response in this section. The total drawdown during the flow period was c. 2.9 m. A drawdown of 0.01 m was reached approximately 13 minutes after the pumping started in HFM14. There was a total recovery of c. 2.7 m during the recovery period that lasted for approximately 7 days.

Table 6-15. General test data from the observation section HFM13: 159–173 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.34
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.96
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.03
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	6.30

Table 6-16. General test data from the observation section KFM01C: 0–58 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.08
Hydraulic head in test section before stop of flow period	h_p	m	–2.85
Hydraulic head in test section at stop of recovery period	h_F	m	–0.13
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.93

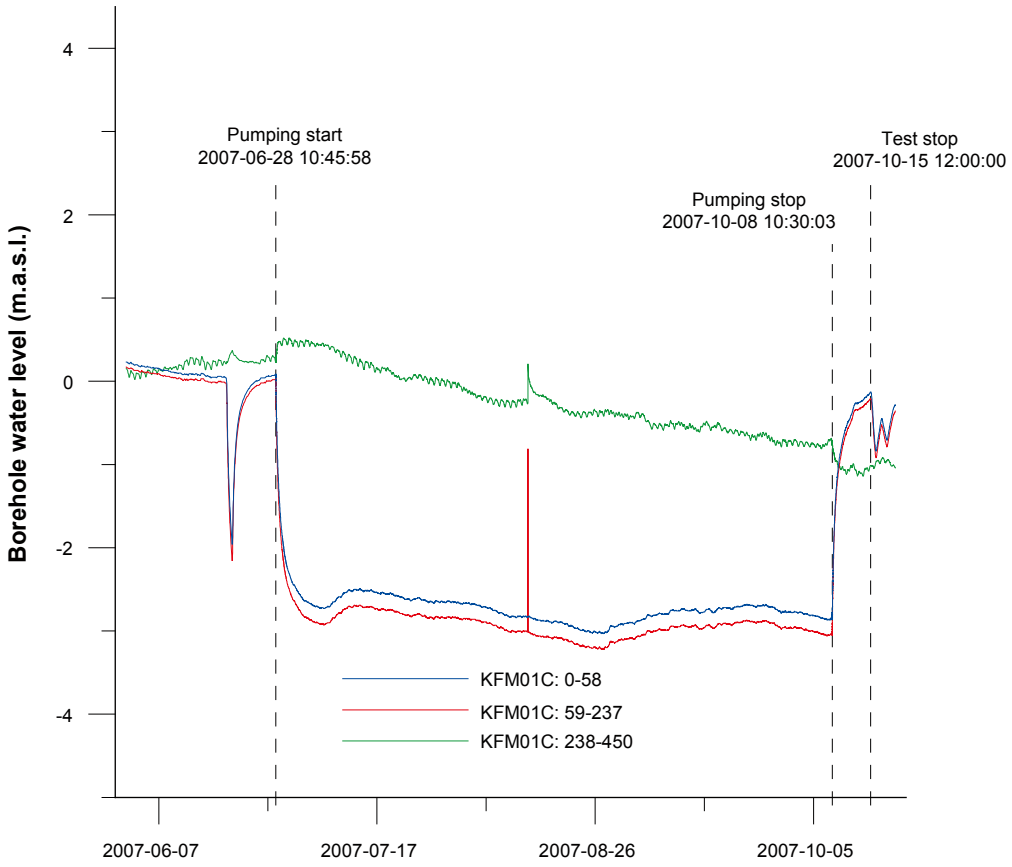


Figure 6-7. *Linear plot of pressure versus time in the observation sections in KFM01C during the interference test in HFM14.*

6.2.17 Observation section KFM01C: 59–237 m

In Figure 6-7 an overview of the pressure responses in observation borehole KFM01C is shown. General test data from the observation section KFM01C, 59–237 m, are presented in Table 6-17.

Comments on the test

The pumping in HFM14 caused a clear response in this section. The total drawdown during the flow period was c. 3.0 m. A drawdown of 0.01 m was reached approximately 11 minutes after the pumping started in HFM14. There was a total recovery of c. 2.8 m during the recovery period that lasted for approximately 7 days.

Table 6-17. General test data from the observation section KFM01C: 59–237 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.02
Hydraulic head in test section before stop of flow period	h_p	m	–3.03
Hydraulic head in test section at stop of recovery period	h_F	m	–0.22
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	3.05

6.2.18 Observation section KFM01C: 238–450 m

In Figure 6-7 an overview of the pressure responses in observation borehole KFM01C is shown. General test data from the observation section KFM01C, 238–450 m, are presented in Table 6-18.

Comments on the test

This section appears at a first glance to be affected by the pumping in HFM14 since the pressure is decreasing throughout the entire test period. At the start of pumping however, the pressure is rising and at the start of recovery the pressure is falling. No explanation has been found for this. Still it seems obvious that the section is to some extent responding to the drawdown in HFM14. The total drawdown is about 0.9 m. Since the pressure is increasing by c. 0.25 m at the beginning of the pumping period the drawdown may be underestimated. As for the recovery; since the pressure drops substantially at the beginning of the recovery period, a valid estimate of the recovery is not possible.

6.2.19 Observation section HFM01: 0–32.5 m

In Figure 6-8 an overview of the pressure responses in observation borehole HFM01 is shown. General test data from the observation section HFM01, 0–32.5 m, are presented in Table 6-19. According to Table 3-1, the borehole is cased to 31.93 m. The uncased interval of this section is thus c. 32–32.5 m.

Comments on the test

The pressure response to pumping in HFM14 is clearly observed in this observation section. The total drawdown during the flow period was c. 2.8 m. A drawdown of 0.01 m was reached approximately 60 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

Table 6-18. General test data from the observation section KFM01C: 238–450 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.23
Hydraulic head in test section before stop of flow period	h_p	m	–0.72
Hydraulic head in test section at stop of recovery period	h_F	m	–1.01
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.95

Table 6-19. General test data from the observation section HFM01: 0–32.5 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.36
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.46
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.12
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.82

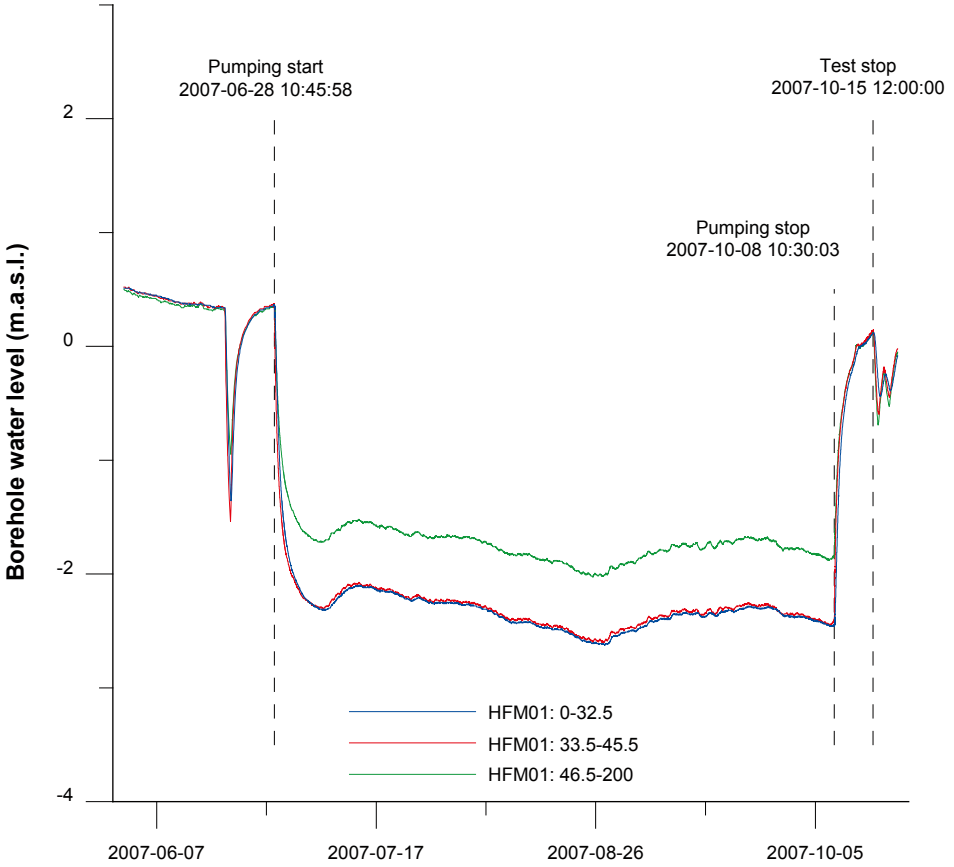


Figure 6-8. *Linear plot of pressure versus time in the observation sections in HFM01 during the interference test in HFM14.*

6.2.20 Observation section HFM01:33.5–45.5 m

In Figure 6-8 an overview of the pressure responses in observation borehole HFM01 is shown. General test data from the observation section HFM01, 33.5–45.5 m, are presented in Table 6-20.

Comments on the test

The pressure response to pumping in HFM14 is clearly observed in this observation section. The total drawdown during the flow period was c. 2.8 m. A drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

Table 6-20. General test data from the observation section HFM01: 33.5–45.5 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.37
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.42
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.14
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.79

6.2.21 Observation section HFM01:46.5–200 m

In Figure 6-8 an overview of the pressure responses in observation borehole HFM01 is shown. General test data from the observation section HFM01, 46.5–200 m, are presented in Table 6-21.

Comments on the test

The pressure response to pumping in HFM14 is clearly observed in this observation section. The total drawdown during the flow period was c. 2.2 m. A drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.0 m during the recovery period that lasted for approximately 7 days.

6.2.22 Observation section KFM01A: 0–108 m

In Figure 6-9 an overview of the pressure responses in observation borehole KFM01A is shown. General test data from the observation section KFM01A, 0–108 m, are presented in Table 6-22. According to Table 3-1, the borehole is cased to 101.99 m. The uncased interval of this section is thus c. 102–108 m.

Comments on the test

This section appears to be affected by the pumping in HFM14. The total drawdown during the flow period was c. 2.2 m and a drawdown of 0.01 m was reached approximately 23 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

Table 6-21. General test data from the observation section HFM01: 46.5–200 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.36
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.84
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.13
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.20

Table 6-22. General test data from the observation section KFM01A: 0–108 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.15
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.07
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–1.87
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.22

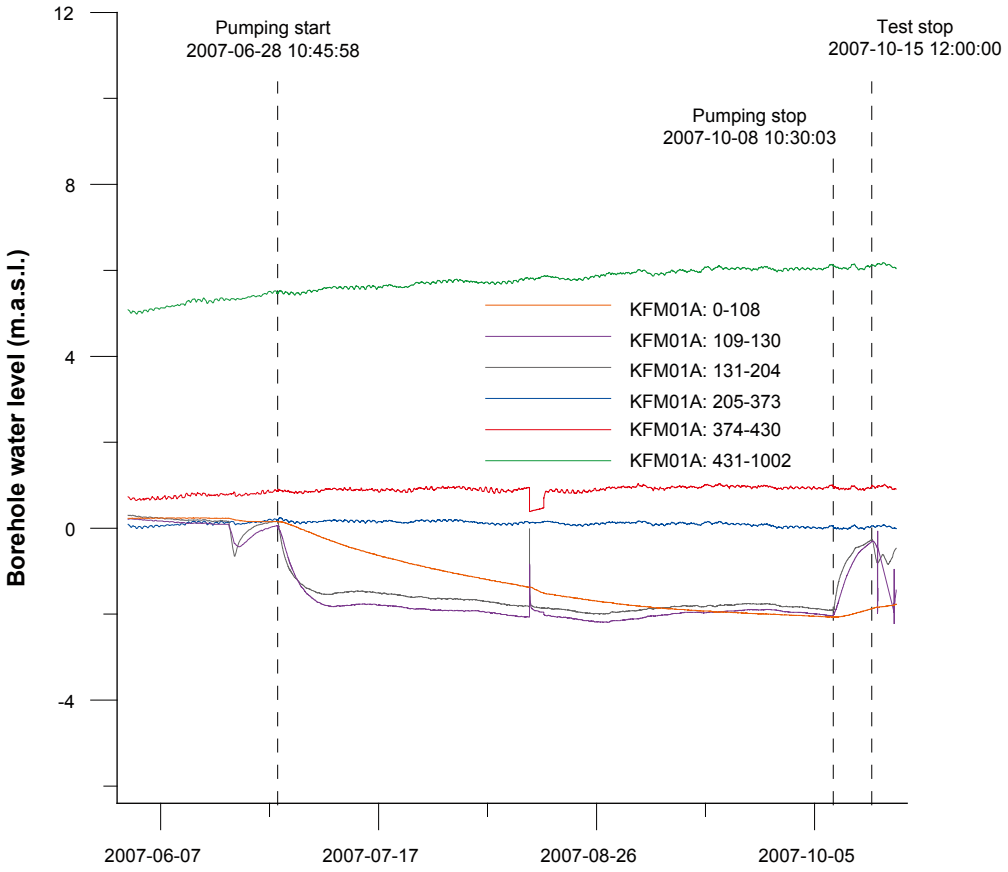


Figure 6-9. *Linear plot of pressure versus time in the observation sections in KFM01A during the interference test in HFM14.*

6.2.23 Observation section KFM01A: 109–130 m

In Figure 6-9 an overview of the pressure responses in observation borehole KFM01A is shown. General test data from the observation section KFM01A, 109–130 m, are presented in Table 6-23.

Comments on the test

The pressure response to pumping in HFM14 can be clearly observed in this observation section. The total drawdown during the flow period was c. 2.1 m. A drawdown of 0.01 m was reached approximately 46 minutes after the pumping started in HFM14. There was a total recovery of c. 1.7 m during the recovery period that lasted for approximately 7 days.

Table 6-23. General test data from the observation section KFM01A: 109–130 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.06
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.04
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.31
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.10

6.2.24 Observation section KFM01A: 131–204 m

In Figure 6-9 an overview of the pressure responses in observation borehole KFM01A is shown. General test data from the observation section KFM01A, 131–204 m, are presented in Table 6-24.

Comments on the test

The pressure response to pumping in HFM14 can be clearly observed also in this observation section. The total drawdown during the flow period was c. 2.1 m. A drawdown of 0.01 m was reached approximately 125 minutes after the pumping started. There was a total recovery of c. 1.6 m during the recovery period that lasted for approximately 7 days.

6.2.25 Observation section KFM01A: 205–373 m

In Figure 6-9 an overview of the pressure responses in observation borehole KFM01A is shown. General test data from the observation section KFM01A, 205–373 m, are presented in Table 6-25.

Comments on the test

This section appears to be virtually unaffected by the pumping in HFM14. There is nevertheless a possible weak indication of some response to the pumping in HFM14 which can be observed in the slope of the pressure curve. There is a total drawdown of ca 0.1 m observed in this test section.

6.2.26 Observation section KFM01A: 374–430 m

In Figure 6-9 an overview of the pressure responses in observation borehole KFM01A is shown. General test data from the observation section KFM01A, 374–430 m, are presented in Table 6-26.

Comments on the test

This section appears to be virtually unaffected by the pumping in HFM14.

Table 6-24. General test data from the observation section KFM01A: 131–204 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.16
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.90
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.27
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.06

Table 6-25. General test data from the observation section KFM01A: 205–373 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.18
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.05
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.05
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.13

Table 6-26. General test data from the observation section KFM01A: 374–430 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.87
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.97
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.97
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.10

6.2.27 Observation section KFM01A: 431–1,002 m

In Figure 6-9 an overview of the pressure responses in observation borehole KFM01A is shown. General test data from the observation section KFM01A, 431–1,002 m, are presented in Table 6-27.

Comments on the test

This section appears to be completely unaffected by the pumping in HFM14. The pressure in the test section is increasing during the entire test.

6.2.28 Observation section KFM01D: 0–153 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 0–153 m, are presented in Table 6-28. According to Table 3-1, the borehole is cased to 89.51 m. The uncased interval of this section is thus c. 90–153 m.

Comments on the test

A clear response to pumping in HFM14 is registered in this section. The total drawdown during the flow period was c. 2.1 m and a drawdown of 0.01 m was reached in about 3.5 hours. There was a total recovery of approximately 1.8 metres during the recovery period lasting for c. 7 days.

Table 6-27. General test data from the observation section KFM01A: 431–1,002 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	5.47
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	6.12
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	6.13
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.65

Table 6-28. General test data from the observation section KFM01D: 0–153 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.07
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.17
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.37
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.10

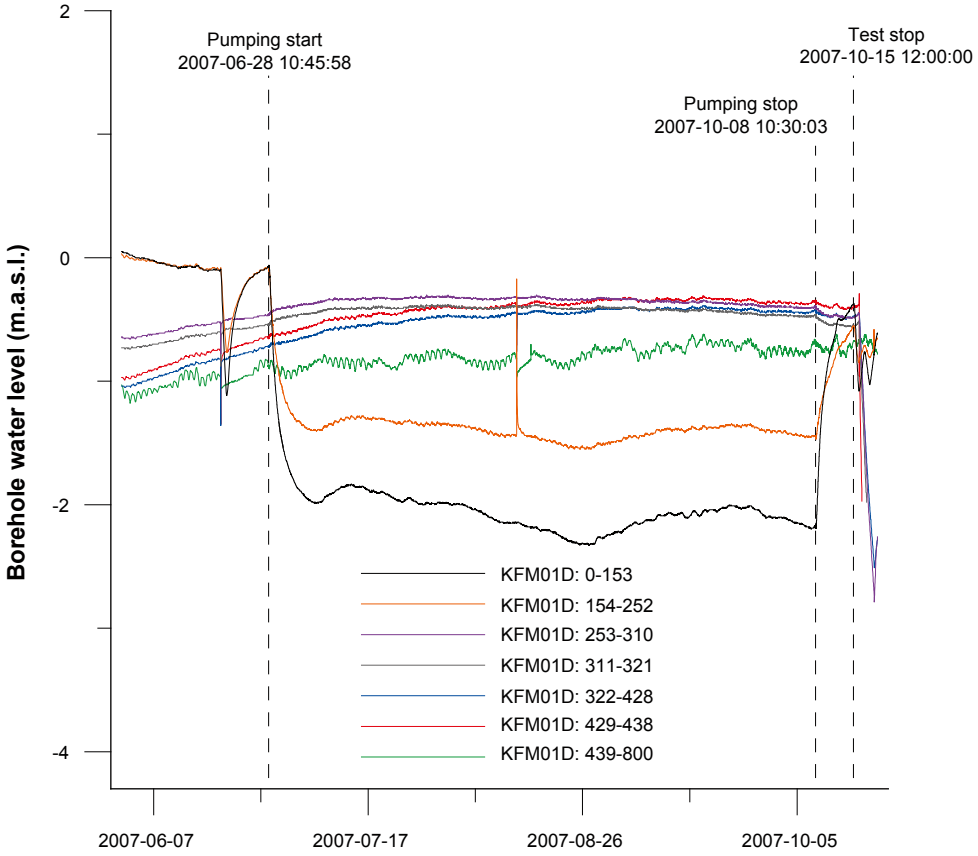


Figure 6-10. *Linear plot of pressure versus time in the observation sections in KFM01D during the interference test in HFM14.*

6.2.29 Observation section KFM01D: 154–252 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 154–252 m, are presented in Table 6-29.

Comments on the test

A clear response to pumping in HFM14 is registered in this section. The total drawdown during the flow period was c. 1.4 m and a drawdown of 0.01 m was reached in about 2 hours. There was a total recovery of approximately 0.9 metres during the recovery period lasting for c. 7 days.

6.2.30 Observation section KFM01D: 253–310 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 253–310 m, are presented in Table 6-30.

Table 6-29. General test data from the observation section KFM01D: 154–252 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.07
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.45
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.55
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.38

Table 6-30. General test data from the observation section KFM01D: 253–310 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.46
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.40
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.48
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.06

Comments on the test

No effects of pumping can be seen in this section. It is improbable that this section is influenced by pumping in HFM14.

6.2.31 Observation section KFM01D: 311–321 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 311–321 m, are presented in Table 6-31.

Comments on the test

No effects of pumping can be seen in this section. It is improbable that this section is influenced by pumping in HFM14.

6.2.32 Observation section KFM01D: 322–428 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 322–428 m, are presented in Table 6-32.

Comments on the test

No effects of pumping can be seen in this section. It is improbable that this section is influenced by pumping in HFM14.

Table 6-31. General test data from the observation section KFM01D: 311–321 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.54
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.47
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.55
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.07

Table 6-32. General test data from the observation section KFM01D: 322–428 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.72
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.42
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.48
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.30

6.2.33 Observation section KFM01D: 429–438 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 429–438 m, are presented in Table 6-33.

Comments on the test

No effects of pumping can be seen in this section. It is unlikely that this section is influenced by pumping in HFM14.

6.2.34 Observation section KFM01D: 439–800 m

In Figure 6-10 an overview of the pressure responses in observation borehole KFM01D is shown. General test data from the observation section KFM01D, 439–800 m, are presented in Table 6-34.

Comments on the test

No effects of pumping can be seen in this section. It is doubtful that this section is influenced by pumping in HFM14.

6.2.35 Observation section KFM01B: 0–100 m

In Figure 6-11 an overview of the pressure responses in observation borehole KFM01B is shown. General test data from the observation section KFM01B, 0–100 m, are presented in Table 6-35. According to Table 3-1, the borehole is cased to 9.09 m. The uncased interval of this section is thus c. 9–100 m.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.8 m. A drawdown of 0.01 m was reached approximately 20 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

Table 6-33. General test data from the observation section KFM01D: 429–438 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.64
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.36
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.40
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.28

Table 6-34. General test data from the observation section KFM01D: 439–800 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.88
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.69
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.68
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.19

Table 6-35. General test data from the observation section KFM01B: 0–100 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.38
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.44
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.18
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.82

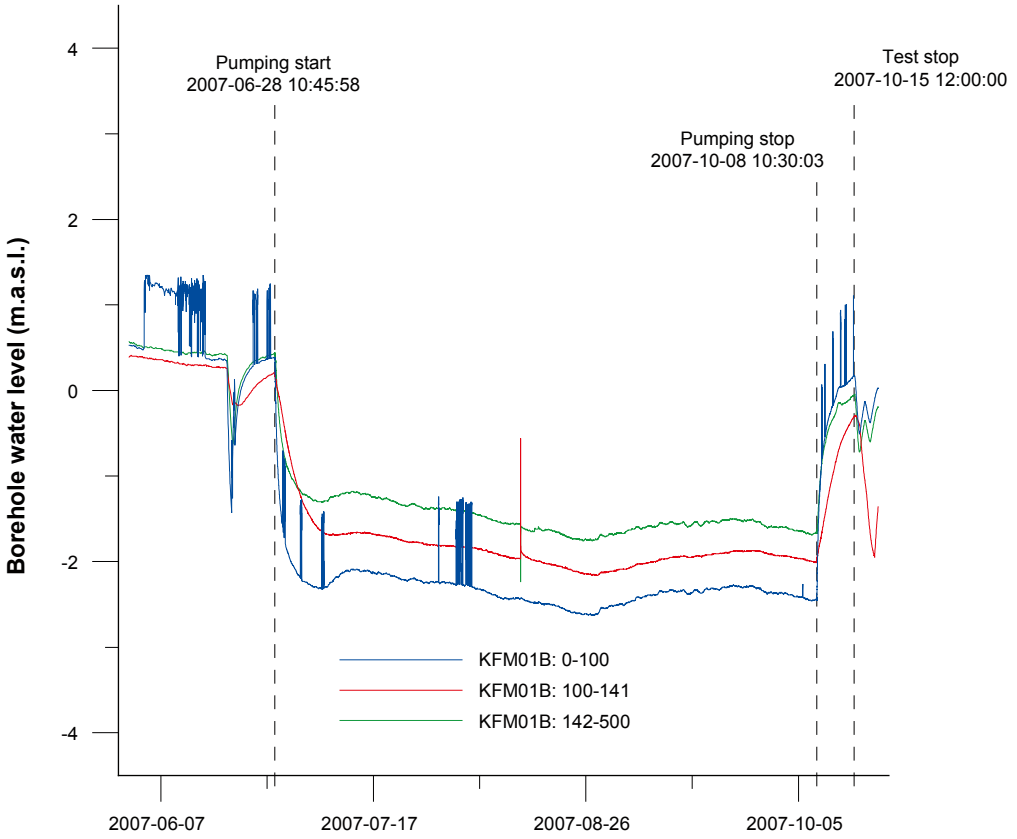


Figure 6-11. *Linear plot of pressure versus time in the observation sections in KFM01B during the interference test in HFM14.*

6.2.36 Observation section KFM01B: 101–141 m

In Figure 6-11 an overview of the pressure responses in observation borehole KFM01B is shown. General test data from the observation section KFM01B, 101–141 m, are presented in Table 6-36.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.2 m. A drawdown of 0.01 m was reached approximately 52 minutes after the pumping started in HFM14. There was a total recovery of c. 1.7 m during the recovery period that lasted for approximately 7 days.

Table 6-36. General test data from the observation section KFM01B: 101–141 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.21
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.00
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.30
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.21

6.2.37 Observation section KFM01B: 142–500 m

In Figure 6-11 an overview of the pressure responses in observation borehole KFM01B is shown. General test data from the observation section KFM01B, 142–500 m, are presented in Table 6-37.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.1 m. A drawdown of 0.01 m was reached approximately 74 minutes after the pumping started in HFM14. There was a total recovery of c. 1.6 m during the recovery period that lasted for approximately 7 days.

6.2.38 Observation section KFM10A: 0–152 m

In Figure 6-12 an overview of the pressure responses in observation borehole KFM10A is shown. General test data from the observation section KFM10A, 0–152 m, are presented in Table 6-38. According to Table 3-1, the borehole is cased to 60 m. The uncased interval of this section is thus c. 60–152 m.

Comments on the test

Although displaying the weakest response in this borehole, this section seems to be responding to the pumping in HFM14. The total drawdown was measured at c. 0.3 m and a drawdown of 0.01 m was reached approximately 9 hours into the flow period.

Table 6-37. General test data from the observation section KFM01B: 142–500 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.43
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.66
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.05
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.09

Table 6-38. General test data from the observation section KFM10A: 0–152 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.08
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.74
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.91
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.35

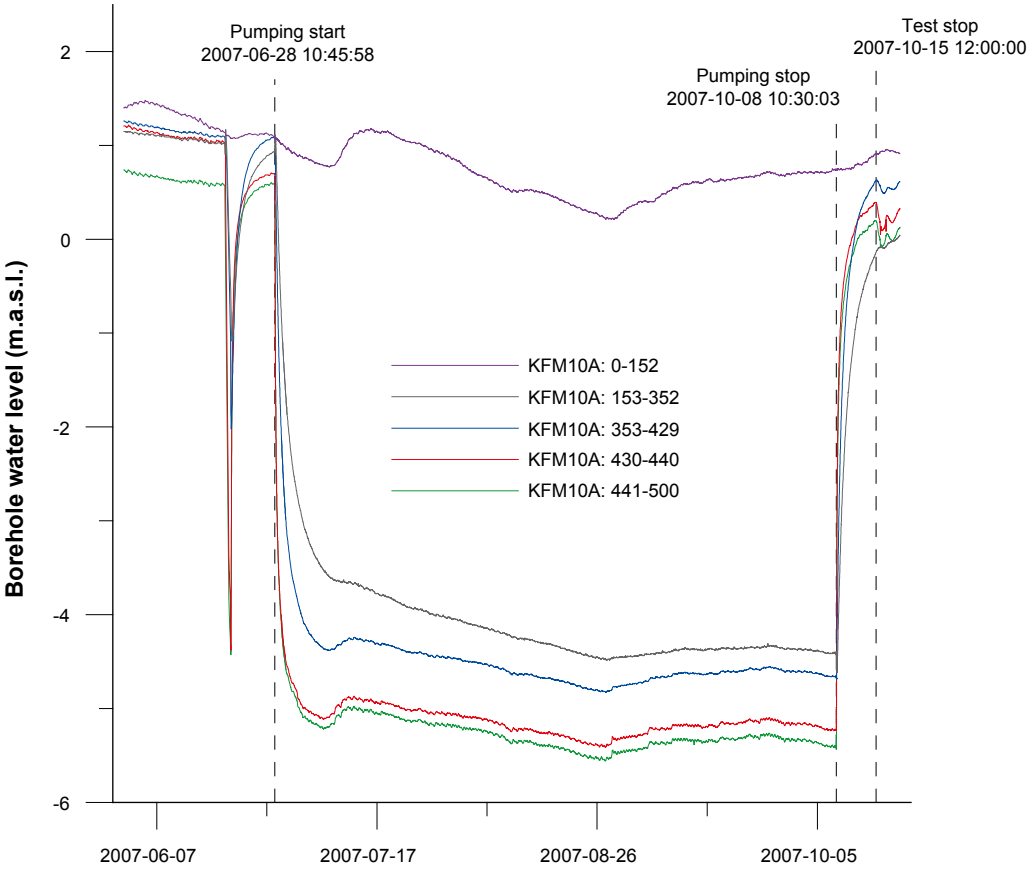


Figure 6-12. *Linear plot of pressure versus time in the observation sections in KFM10A during the interference test in HFM14.*

6.2.39 Observation section KFM10A: 153–352 m

In Figure 6-12 an overview of the pressure responses in observation borehole KFM10A is shown. General test data from the observation section KFM10A, 153–352 m, are presented in Table 6-39.

Comments on the test

The pressure response to pumping in HFM14 can be clearly observed also in this observation section. The total drawdown during the flow period was c. 5.3 m. A drawdown of 0.01 m was reached approximately 6 hours after the pumping started. This figure is misleading though, since there is an increase of pressure just following the start of pumping. The reason for this is not known. There was a total recovery of c. 4.2 m during the recovery period that lasted for approximately 7 days.

Table 6-39. General test data from the observation section KFM10A: 153–352 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.93
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–4.40
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.16
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	5.33

6.2.40 Observation section KFM10A: 353–429 m

In Figure 6-12 an overview of the pressure responses in observation borehole KFM10A is shown. General test data from the observation section KFM10A, 353–429 m, are presented in Table 6-40.

Comments on the test

An undisputable effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 5.7 m. A drawdown of 0.01 m was reached approximately 70 minutes after the pumping started. There was a total recovery of c. 5.3 m during the recovery period that lasted for approximately 7 days.

6.2.41 Observation section KFM10A: 430–440 m

In Figure 6-12 an overview of the pressure responses in observation borehole KFM10A is shown. General test data from the observation section KFM10A, 430–440 m, are presented in Table 6-41.

Comments on the test

A definite effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 5.9 m. A drawdown of 0.01 m was reached approximately 7 minutes after the pumping started. There was a total recovery of c. 5.6 m during the recovery period that lasted for approximately 7 days.

6.2.42 Observation section KFM10A: 441–500 m

In Figure 6-12 an overview of the pressure responses in observation borehole KFM10A is shown. General test data from the observation section KFM10A, 441–500 m, are presented in Table 6-42.

Comments on the test

A definite effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 6.0 m. A drawdown of 0.01 m was reached approximately 12 minutes after the pumping started. There was a total recovery of c. 5.6 m during the recovery period that lasted for approximately 7 days.

Table 6-40. General test data from the observation section KFM10A: 353–429 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.08
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–4.66
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.61
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	5.74

Table 6-41. General test data from the observation section KFM10A: 430–440 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.69
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.23
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.39
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	5.93

Table 6-42. General test data from the observation section KFM10A: 441–500 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.58
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.42
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.19
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	6.00

6.2.43 Observation section HFM32: 0–25 m

In Figure 6-13 an overview of the pressure responses in observation borehole HFM32 is shown. General test data from the observation section HFM32, 0–25 m, are presented in Table 6-43. According to Table 3-1, the borehole is cased to 6.03 m. The uncased interval of this section is thus c. 6–25 m.

Comments on the test

A weak but rather distinct effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 0.1 m. A drawdown of 0.01 m was reached approximately 6.5 hours after the pumping started. There was a total recovery of c. 0.14 m during the recovery period that lasted for approximately 7 days.

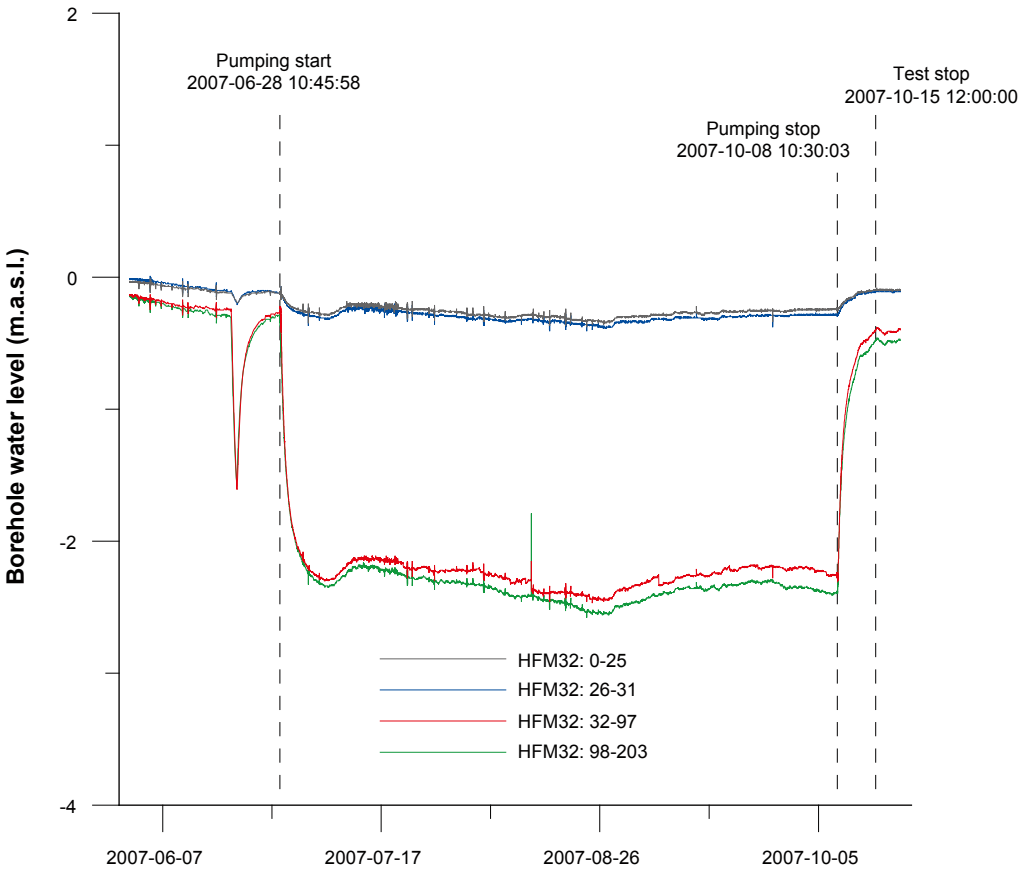


Figure 6-13. *Linear plot of pressure versus time in the observation sections in HFM32 during the interference test in HFM14.*

Table 6-43. General test data from the observation section HFM32: 0–25 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.12
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.24
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.10
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.12

6.2.44 Observation section HFM32: 26–31 m

In Figure 6-13 an overview of the pressure responses in observation borehole HFM32 is shown. General test data from the observation section HFM32, 26–31 m, are presented in Table 6-44.

Comments on the test

A weak but rather distinct effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 0.2 m. A drawdown of 0.01 m was reached approximately 6 hours after the pumping started. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.45 Observation section HFM32: 32–97 m

In Figure 6-13 an overview of the pressure responses in observation borehole HFM32 is shown. General test data from the observation section HFM32, 32–97 m, are presented in Table 6-45.

Comments on the test

An undisputable effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 2.0 m. A drawdown of 0.01 m was reached approximately 3.5 hours after the pumping started. The time to reach a 0.01 m drawdown is a little misleading though. This is because the pressure in the test section is rising at the beginning of the flow period. The reason for this is not known. There was a total recovery of c. 1.8 m during the recovery period that lasted for approximately 7 days.

Table 6-44. General test data from the observation section HFM32: 26–31 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.11
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.28
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.11
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.17

Table 6-45. General test data from the observation section HFM32: 32–97 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.27
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.24
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.40
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.97

6.2.46 Observation section HFM32: 98–203 m

In Figure 6-13 an overview of the pressure responses in observation borehole HFM32 is shown. General test data from the observation section HFM32, 98–203 m, are presented in Table 6-46.

Comments on the test

An undisputable effect from the pumping in HFM14 can be seen in this section. The total drawdown during the flow period was c. 2.1 m. A drawdown of 0.01 m was reached approximately 50 minutes after the pumping started. There was a total recovery of c. 1.9 m during the recovery period that lasted for approximately 7 days.

6.2.47 Observation section HFM03: 0–18 m

In Figure 6-14 an overview of the pressure responses in observation borehole HFM03 is shown. General test data from the observation section HFM03, 0–18 m, are presented in Table 6-47. According to Table 3-1, the borehole is cased to 13.1 m. The uncased interval of this section is thus c. 13–18 m.

Table 6-46. General test data from the observation section HFM32: 98–203 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.29
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.39
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.48
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.10

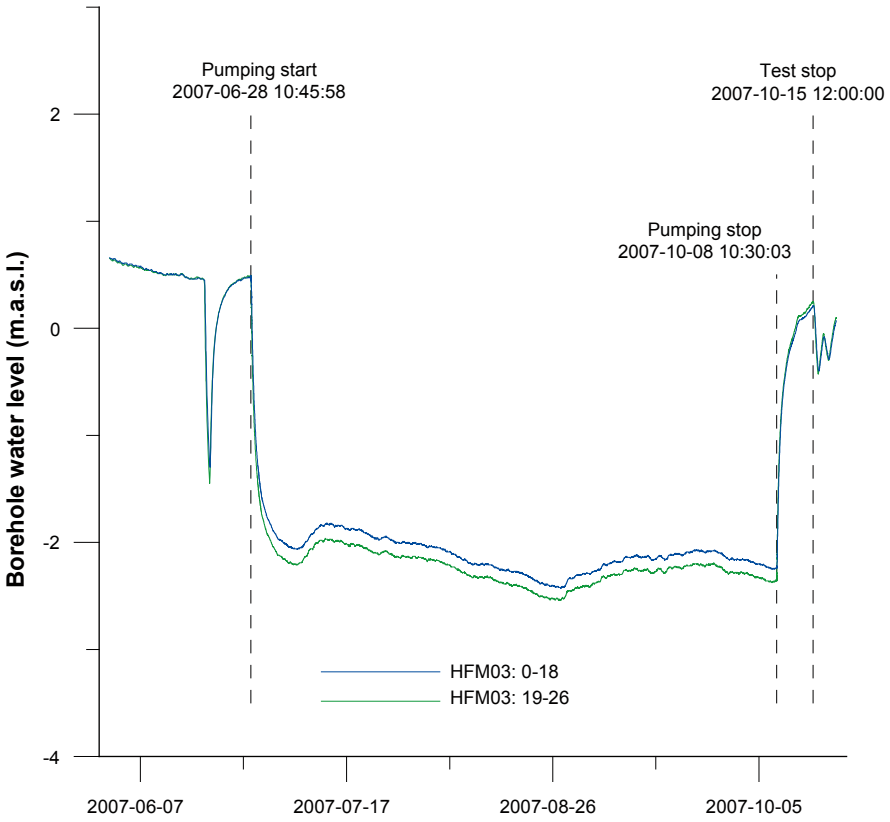


Figure 6-14. *Linear plot of pressure versus time in the observation sections in HFM03 during the interference test in HFM14.*

Table 6-47. General test data from the observation section HFM03: 0–18 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.48
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.24
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.20
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.72

Comments on the test

The pressure response to pumping in HFM14 is clearly observed in this observation section. The total drawdown during the flow period was c. 2.7 m. A drawdown of 0.01 m was reached approximately 29 minutes after the pumping started in HFM14. There was a total recovery of c. 2.4 m during the recovery period that lasted for approximately 7 days.

6.2.48 Observation section HFM03: 19–26 m

In Figure 6-14 an overview of the pressure responses in observation borehole HFM03 is shown. General test data from the observation section HFM03, 19–26 m, are presented in Table 6-48.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.8 m. A drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

6.2.49 Observation section HFM02: 0–37 m

In Figure 6-15 an overview of the pressure responses in observation borehole HFM02 is shown. General test data from the observation section HFM02, 0–37 m, are presented in Table 6-49. According to Table 3-1, the borehole is cased to 25.4 m. The uncased interval of this section is thus c. 25–37 m.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.8 m. A drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

Table 6-48. General test data from the observation section HFM03: 19–26 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.48
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.36
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.25
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.84

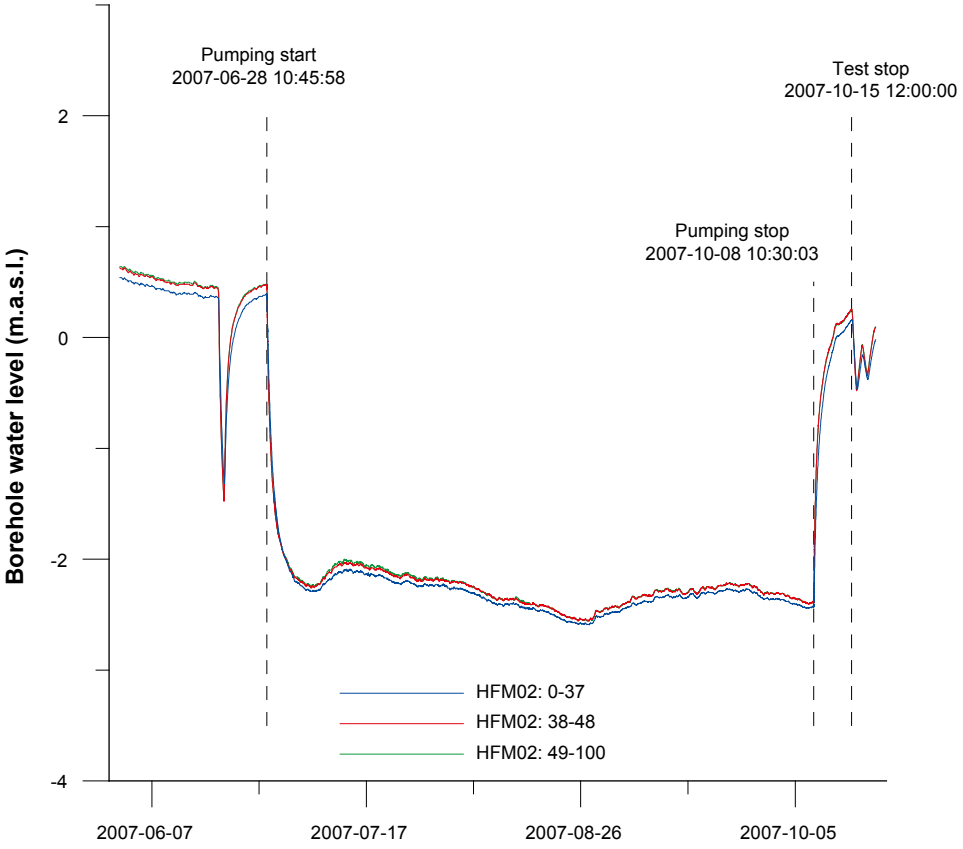


Figure 6-15. *Linear plot of pressure versus time in the observation sections in HFM02 during the interference test in HFM14.*

Table 6-49. General test data from the observation section HFM02: 0–37 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.39
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.43
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.15
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.82

6.2.50 Observation section HFM02: 38–48 m

In Figure 6-15 an overview of the pressure responses in observation borehole HFM02 is shown. General test data from the observation section HFM02, 38–48 m, are presented in Table 6-50.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.8 m. A drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

Table 6-50. General test data from the observation section HFM02: 38–48 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.47
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.38
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.25
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.85

6.2.51 Observation section HFM02: 49–100 m

In Figure 6-15 an overview of the pressure responses in observation borehole HFM02 is shown. General test data from the observation section HFM02, 49–100 m, are presented in Table 6-51.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 2.9 m. A drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

6.2.52 Observation section HFM27: 0–24 m

In Figure 6-16 an overview of the pressure responses in observation borehole HFM27 is shown. General test data from the observation section HFM27, 0–24 m, are presented in Table 6-52. According to Table 3-1, the borehole is cased to 12.03 m. The uncased interval of this section is thus c. 12–24 m.

Comments on the test

This section shows a clear response to pumping in HFM14. A total drawdown during the flow period of c. 2.6 m was registered and a drawdown of 0.01 m was reached approximately 28 minutes after the pumping started in HFM14. There was a total recovery of c. 2.4 m during the recovery period that lasted for approximately 7 days.

Table 6-51. General test data from the observation section HFM02: 49–100 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.48
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.38
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.25
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.86

Table 6-52. General test data from the observation section HFM27: 0–24 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.47
Hydraulic head in test section before stop of flow period	h_p	m	–2.15
Hydraulic head in test section at stop of recovery period	h_F	m	0.24
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.62

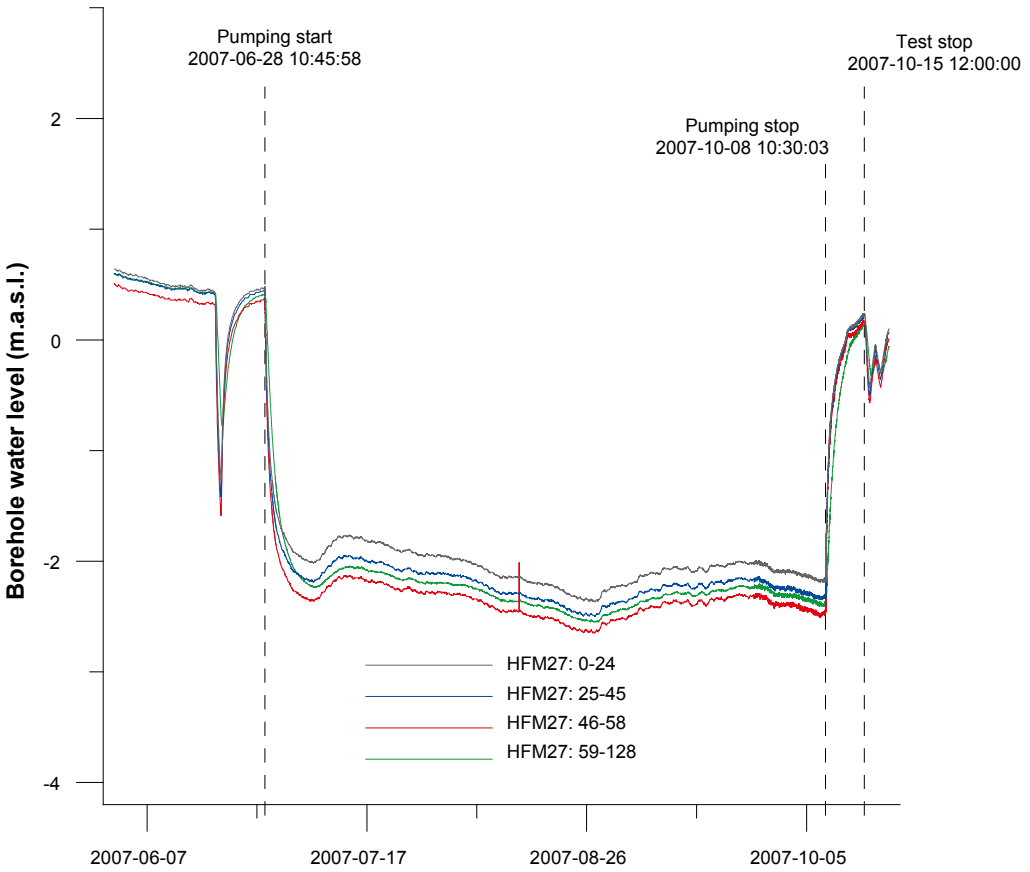


Figure 6-16. *Linear plot of pressure versus time in the observation sections in HFM27 during the interference test in HFM14.*

6.2.53 Observation section HFM27: 25–45 m

In Figure 6-16 an overview of the pressure responses in observation borehole HFM27 is shown. General test data from the observation section HFM27, 25–45 m, are presented in Table 6-53.

Comments on the test

This section is also demonstrating a clear response to pumping in HFM14. A total drawdown during the flow period of c. 2.8 m was registered and a drawdown of 0.01 m was reached approximately 14 minutes after the pumping started in HFM14. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

Table 6-53. General test data from the observation section HFM27: 25–45 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.45
Hydraulic head in test section before stop of flow period	h_p	m	–2.34
Hydraulic head in test section at stop of recovery period	h_F	m	0.23
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.79

6.2.54 Observation section HFM27: 46–58 m

In Figure 6-16 an overview of the pressure responses in observation borehole HFM27 is shown. General test data from the observation section HFM27, 46–58 m, are presented in Table 6-54.

Comments on the test

Also this section is displaying a clear response to pumping in HFM14. A total drawdown during the flow period of c. 2.8 m was registered and a drawdown of 0.01 m was reached approximately 12 minutes after the pumping started. There was a total recovery of c. 2.6 m during the recovery period that lasted for approximately 7 days.

6.2.55 Observation section HFM27: 59–128 m

In Figure 6-16 an overview of the pressure responses in observation borehole HFM27 is shown. General test data from the observation section HFM27, 59–128 m, are presented in Table 6-55.

Comments on the test

A clear response to pumping was found in this section. A total drawdown during the pumping period of c. 2.8 m was registered. A drawdown of 0.01 m was reached approximately 1 hour after the pumping started. There was a total recovery of about 2.5 m during the recovery period that lasted for approximately 7 days.

6.2.56 Observation section HFM24: 0–35 m

In Figure 6-17 an overview of the pressure responses in observation borehole HFM24 is shown. General test data from the observation section HFM24, 0–35 m, are presented in Table 6-56. According to Table 3-1, the borehole is cased to 18.03 m. The uncased interval of this section is thus c. 18–35 m.

Table 6-54. General test data from the observation section HFM27: 46–58 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.37
Hydraulic head in test section before stop of flow period	h_p	m	–2.46
Hydraulic head in test section at stop of recovery period	h_F	m	0.17
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.83

Table 6-55. General test data from the observation section HFM27: 59–128 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.42
Hydraulic head in test section before stop of flow period	h_p	m	–2.38
Hydraulic head in test section at stop of recovery period	h_F	m	0.14
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.80

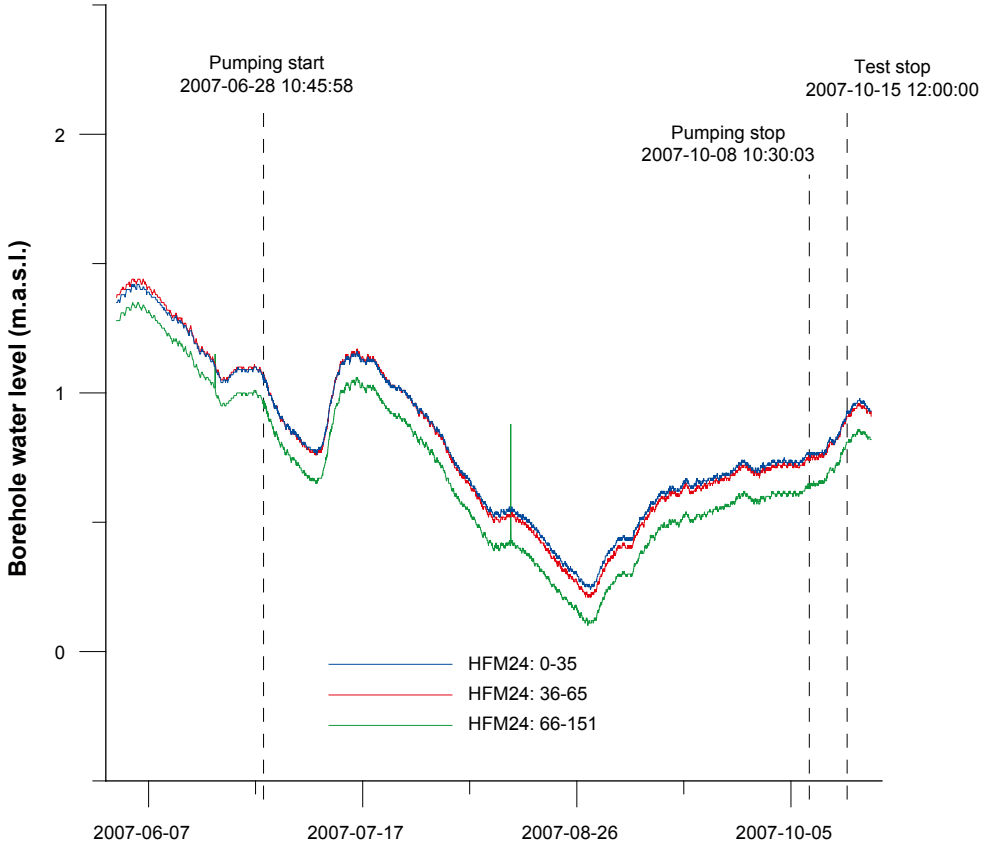


Figure 6-17. *Linear plot of pressure versus time in the observation section in HFM24 during the interference test in HFM14.*

Table 6-56. General test data from the observation section HFM24: 0–35 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.06
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.76
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.93
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.30

Comments on the test

This section was affected by pumping in HFM14. A total drawdown of c. 0.3 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 107 minutes after the pumping started. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.57 Observation section HFM24: 36–65 m

In Figure 6-17 an overview of the pressure responses in observation borehole HFM24 is shown. General test data from the observation section HFM24, 36–65 m, are presented in Table 6-57.

Table 6-57. General test data from the observation section HFM24: 36–65 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.06
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.75
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.91
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.31

Comments on the test

This section was affected by pumping in HFM14. A total drawdown of c. 0.3 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 6.5 hours after the pumping started. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.58 Observation section HFM24: 66–151 m

In Figure 6-17 an overview of the pressure responses in observation borehole HFM24 is shown. General test data from the observation section HFM24, 66–151 m, are presented in Table 6-58.

Comments on the test

This section was affected by pumping in HFM14. A total drawdown of c. 0.3 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 11.5 hours after the pumping started. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.59 Observation section KFM04A: 0–163 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 0–163 m, are presented in Table 6-59. According to Table 3-1, the borehole is cased to 106.95 m. The uncased interval of this section is thus c. 107–163 m.

Comments on the test

A clear but not so strong effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.2 m and a drawdown of 0.01 m was reached approximately 13 hours after the pumping started. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

Table 6-58. General test data from the observation section HFM24: 66–151 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.96
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.64
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.81
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.32

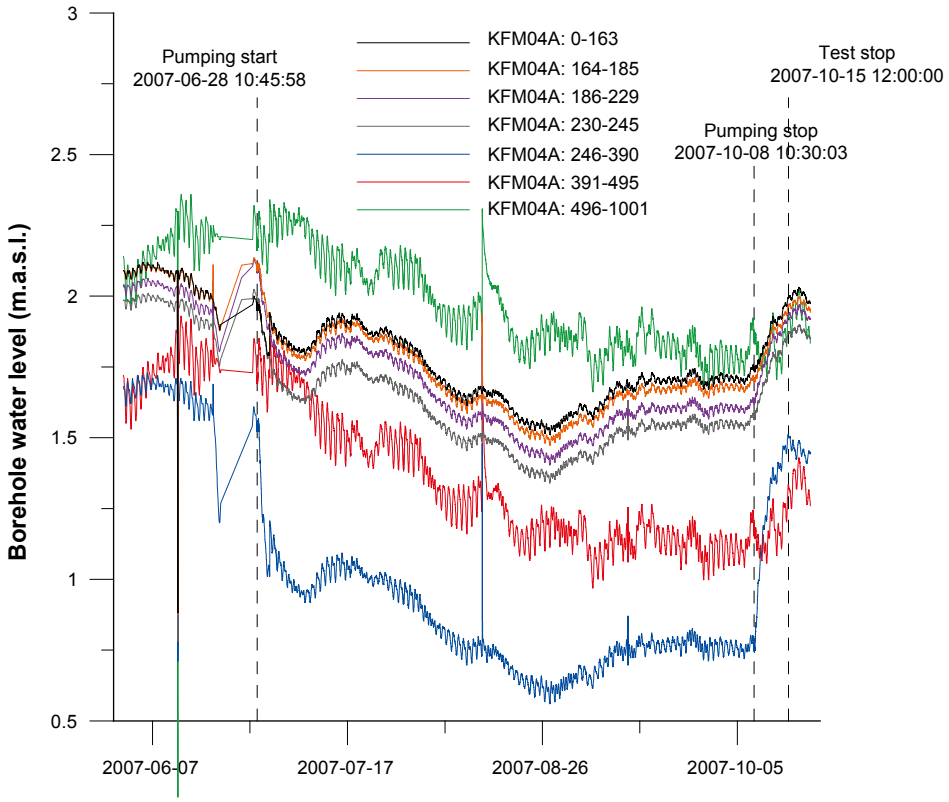


Figure 6-18. *Linear plot of pressure versus time in the observation sections in KFM04A during the interference test in HFM14.*

Table 6-59. General test data from the observation section KFM04A: 0–163 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	1.96
Hydraulic head in test section before stop of flow period	h_p	m	1.74
Hydraulic head in test section at stop of recovery period	h_F	m	2.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.22

6.2.60 Observation section KFM04A: 164–185 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 164–185 m, are presented in Table 6-60.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.4 m and a drawdown of 0.01 m was reached approximately 13 hours after the pumping started. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

Table 6-60. General test data from the observation section KFM04A: 164–185 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	2.10
Hydraulic head in test section before stop of flow period	h_p	m	1.71
Hydraulic head in test section at stop of recovery period	h_F	m	1.97
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.40

6.2.61 Observation section KFM04A: 186–229 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 186–229 m, are presented in Table 6-61.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.5 m and a drawdown of 0.01 m was reached approximately 10.5 hours after the pumping started. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

6.2.62 Observation section KFM04A: 230–245 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 230–245 m, are presented in Table 6-62.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.4 m and a drawdown of 0.01 m was reached approximately 10.5 hours after the pumping started. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

Table 6-61. General test data from the observation section KFM04A: 186–229 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	2.09
Hydraulic head in test section before stop of flow period	h_p	m	1.63
Hydraulic head in test section at stop of recovery period	h_F	m	1.94
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.47

Table 6-62. General test data from the observation section KFM04A: 230–245 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	1.98
Hydraulic head in test section before stop of flow period	h_p	m	1.57
Hydraulic head in test section at stop of recovery period	h_F	m	1.87
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.41

6.2.63 Observation section KFM04A: 246–390 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 246–390 m, are presented in Table 6-63.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.8 m and a drawdown of 0.01 m was reached approximately 10 hours after the pumping started. There was a total recovery of c. 0.7 m during the recovery period that lasted for approximately 7 days.

6.2.64 Observation section KFM04A: 391–495 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 391–495 m, are presented in Table 6-64.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.5 m and a drawdown of 0.01 m was reached approximately 46 hours after the pumping started. The time to reach a drawdown of 0.01 m is somewhat misleading. The oscillating behaviour of this section is rather strong which makes it hard to make an accurate estimation of the drawdown. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.65 Observation section KFM04A: 496–1,001 m

In Figure 6-18 an overview of the pressure responses in observation borehole KFM04A is shown. General test data from the observation section KFM04A, 496–1,001 m, are presented in Table 6-65.

Table 6-63. General test data from the observation section KFM04A: 246–390 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	1.53
Hydraulic head in test section before stop of flow period	h_p	m	0.76
Hydraulic head in test section at stop of recovery period	h_F	m	1.51
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.77

Table 6-64. General test data from the observation section KFM04A: 391–495 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	1.70
Hydraulic head in test section before stop of flow period	h_p	m	1.18
Hydraulic head in test section at stop of recovery period	h_F	m	1.33
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.52

Table 6-65. General test data from the observation section KFM04A: 496–1,001 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	2.17
Hydraulic head in test section before stop of flow period	h_p	m	1.86
Hydraulic head in test section at stop of recovery period	h_F	m	1.94
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.31

Comments on the test

This section may be influenced by the pumping in HFM14. A slight decreasing trend is present during the flow period and a weak increasing trend commences after stop of pumping. The strong oscillating behaviour in this section makes it difficult, however, to make good estimates of drawdown and recovery. Still, the total drawdown at the end of the flow period was c. 0.3 m. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.66 Observation section KFM06A: 0–150 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 0–150 m, are presented in Table 6-66. According to Table 3-1, the borehole is cased to 100.40 m. The uncased interval of this section is thus c. 100–150 m.

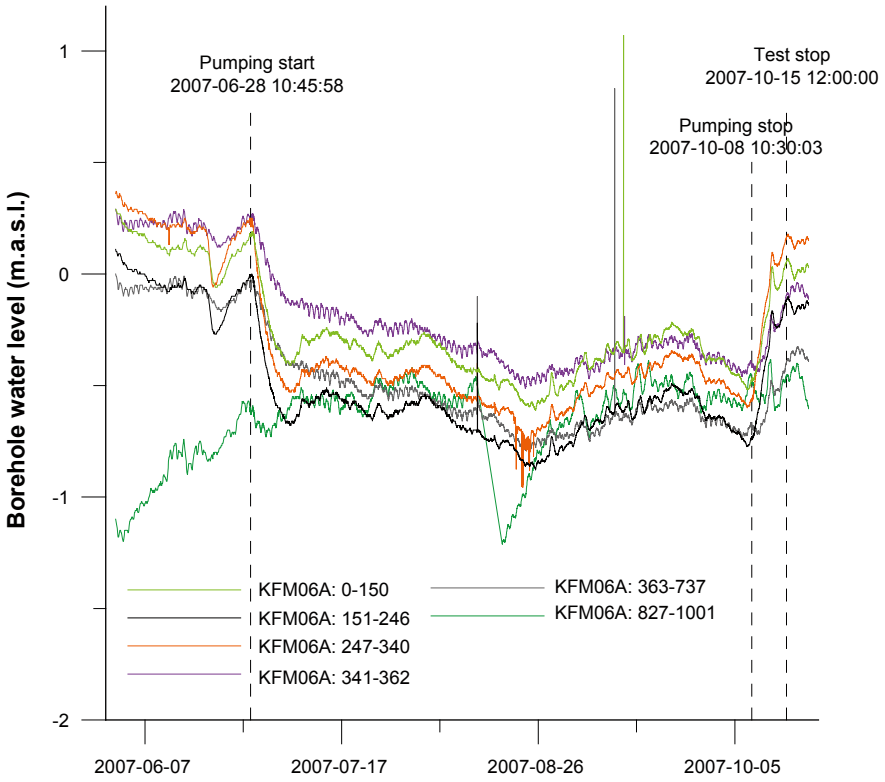


Figure 6-19a. *Linear plot of pressure versus time in the observation sections in KFM06A during the interference test in HFM14.*

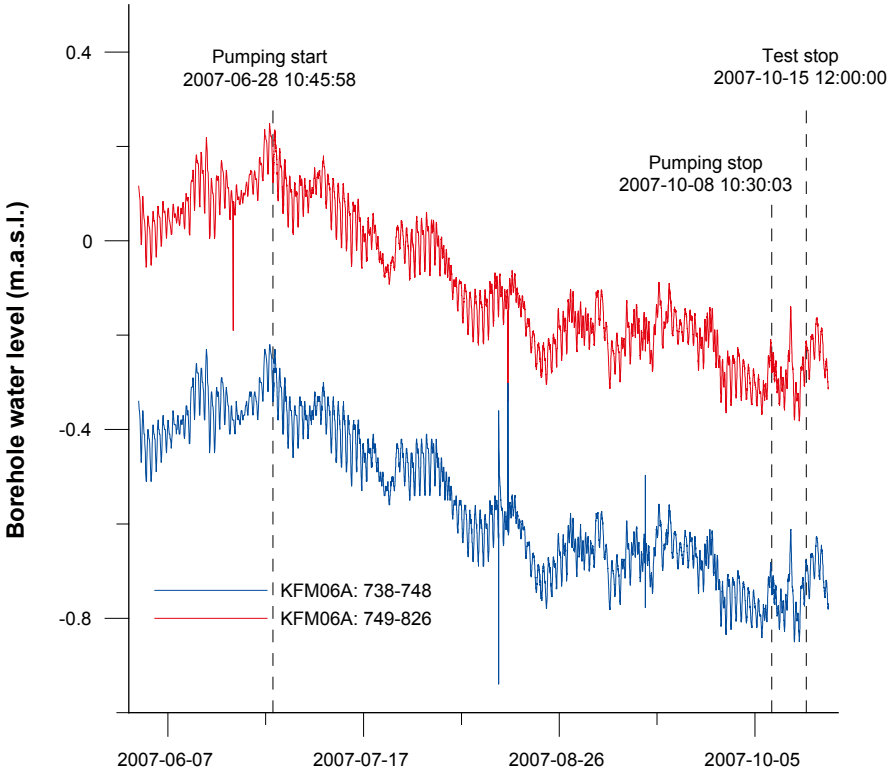


Figure 6-19b. *Higher resolution linear plot of pressure versus time in selected observation sections in KFM06A during the interference test in HFM14.*

Table 6-66. General test data from the observation section KFM06A: 0–150 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.18
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.47
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.05
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.65

Comments on the test

It seems apparent that this section is influenced by pumping in HFM14. The total drawdown during the flow period was c. 0.6 m. A drawdown of 0.01 m was reached approximately 16 hours after the pumping started. The total recovery during the recovery period of about 7 days was measured at c. 0.5 m.

6.2.67 Observation section KFM06A: 151–246 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 151–246 m, are presented in Table 6-67.

Table 6-67. General test data from the observation section KFM06A: 151–246 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.00
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.74
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.12
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.74

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.7 m and a drawdown of 0.01 m was reached approximately 9 hours after the pumping started. There was a total recovery of c. 0.6 m during the recovery period that lasted for approximately 7 days.

6.2.68 Observation section KFM06A: 247–340 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 247–340 m, are presented in Table 6-68.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 0.8 m and a drawdown of 0.01 m was reached approximately 10 hours after the pumping started. There was a total recovery of c. 0.7 m during the recovery period of approximately 7 days.

6.2.69 Observation section KFM06A: 341–362 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 341–362 m, are presented in Table 6-69.

Comments on the test

This section clearly responds to pumping in HFM14. The total drawdown at the end of the flow period was c. 0.6 m. A drawdown of 0.01 m was reached approximately 21 hours into the flow period. There was a total recovery of c. 0.3 m during the recovery period of approximately 7 days.

Table 6-68. General test data from the observation section KFM06A: 247–340 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.24
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.56
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.17
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.80

Table 6-69. General test data from the observation section KFM06A: 341–362 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.23
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.41
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.09
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.64

6.2.70 Observation section KFM06A: 363–737 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 363–737 m, are presented in Table 6-70.

Comments on the test

This section clearly responds to pumping in HFM14. The total drawdown at the end of the flow period was c. 0.6 m. A drawdown of 0.01 m was reached approximately 21 hours into the flow period. There was a total recovery of c. 0.3 m during the recovery period of approximately 7 days.

6.2.71 Observation section KFM06A: 738–748 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 738–748 m, are presented in Table 6-71.

Comments on the test

This observation section is probably slightly affected by the pumping in HFM14. There are weak indications of booth a slight drawdown as well as a slight recovery. It is however very hard to determine the drawdown quantitatively since the tidal effects have such a large impact on the pressure data from this section. There is a measured drawdown of c. 0.4 m during the flow period.

Table 6-70. General test data from the observation section KFM06A: 363–737 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.05
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.68
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.39
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.63

Table 6-71. General test data from the observation section KFM06A: 738–748 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.32
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.74
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.68
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.42

6.2.72 Observation section KFM06A: 749–826 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 749–826 m, are presented in Table 6-72.

Comments on the test

This observation section is probably to some extent affected by the pumping in HFM14. The pressure appearance is very similar to that of section KFM06A:738–748 m. There are weak indications of booth a slight drawdown as well as a slight recovery. It is however very hard to determine the drawdown quantitatively since the tidal effects have such a large impact on the pressure data from this section. There is a measured drawdown of c. 0.4 m during the flow period.

6.2.73 Observation section KFM06A: 827–1,001 m

In Figure 6-19a and 6-19b an overview of the pressure responses in observation borehole KFM06A is shown. General test data from the observation section KFM06A, 827–1,001 m, are presented in Table 6-73.

Comments on the test

This section appears to be completely unaffected by the pumping in HFM14. The pressure in this observation section is rising throughout most of the test. At one point the pressure falls instantaneously which is believed to be caused by service interference. After this the pressure rises slowly for most of test period.

6.2.74 Observation section KFM06C: 0–186 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 0–186 m, are presented in Table 6-74. According to Table 3-1, the borehole is cased to 100.12 m. The uncased interval of this section is thus c. 100–186 m.

Table 6-72. General test data from the observation section KFM06A: 749–826 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.14
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.27
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.21
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.41

Table 6-73. General test data from the observation section KFM06A: 827–1,001 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.61
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.47
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.46
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.14

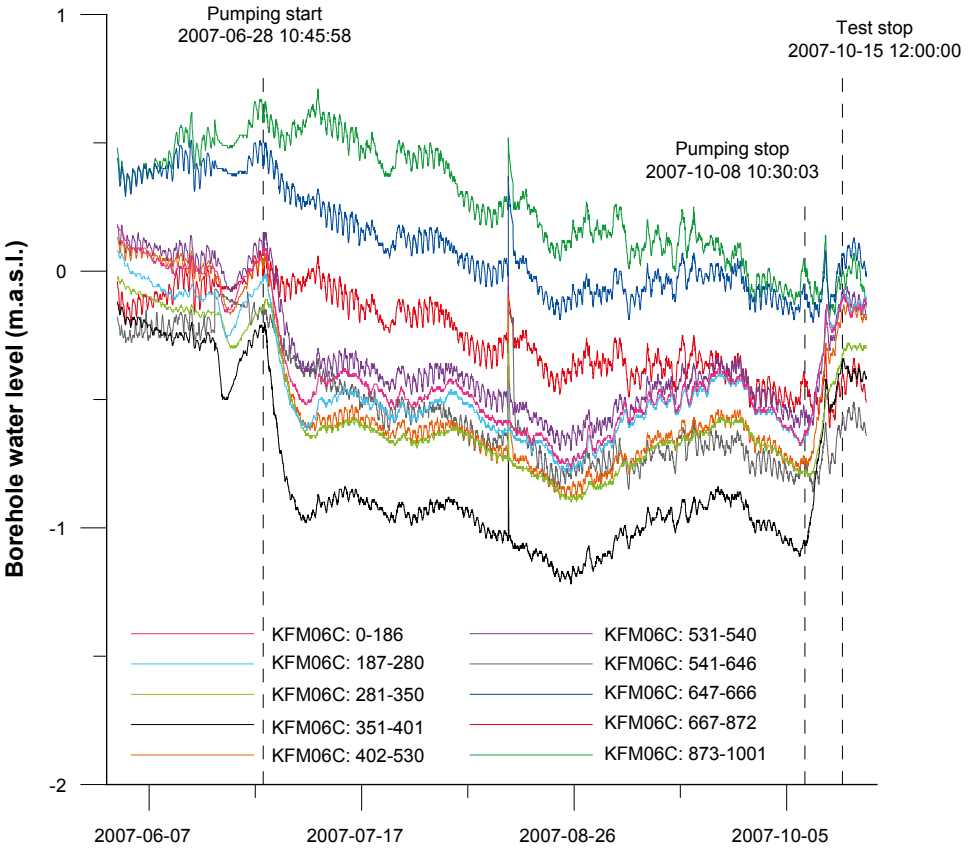


Figure 6-20. *Linear plot of pressure versus time in the observation sections in KFM06C during the interference test in HFM14.*

Table 6-74. General test data from the observation section KFM06C: 0–186 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.08
Hydraulic head in test section before stop of flow period	h_p	m	–0.63
Hydraulic head in test section at stop of recovery period	h_F	m	–0.11
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.71

Comments on the test

A clear response to pumping in HFM14 is registered in this section. The total drawdown during the flow period was c. 0.7 m and a drawdown of 0.01 m was reached in about 16 hours. There was a total recovery of approximately 0.5 metres during the recovery period lasting for c. 7 days.

6.2.75 Observation section KFM06C: 187–280 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 187–280 m, are presented in Table 6-75.

Table 6-75. General test data from the observation section KFM06C: 187–280 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.03
Hydraulic head in test section before stop of flow period	h_p	m	–0.64
Hydraulic head in test section at stop of recovery period	h_F	m	–0.10
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.61

Comments on the test

An apparent response to pumping in HFM14 is registered in this section. The total drawdown during the flow period was c. 0.6 m and a drawdown of 0.01 m was reached in about 18 hours. There was a total recovery of approximately 0.5 metres during the recovery period lasting for c. 7 days.

6.2.76 Observation section KFM06C: 281–350 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 281–350 m, are presented in Table 6-76.

Comments on the test

A clear response is visible in this observation section. The total drawdown during the flow period was c. 0.6 m and a drawdown of 0.01 m was reached in about 39 hours. There was a total recovery of approximately 0.5 metres during the recovery period lasting for c. 7 days.

6.2.77 Observation section KFM06C: 351–401 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 351–401 m, are presented in Table 6-77.

Comments on the test

A clear response to pumping in HFM14 is registered in this section. The total drawdown during the flow period was c. 0.8 m and a drawdown of 0.01 m was reached in about 12 hours. There was a total recovery of approximately 0.7 metres during the recovery period lasting for c. 7 days.

Table 6-76. General test data from the observation section KFM06C: 281–350 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.14
Hydraulic head in test section before stop of flow period	h_p	m	–0.78
Hydraulic head in test section at stop of recovery period	h_F	m	–0.32
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.64

Table 6-77. General test data from the observation section KFM06C: 351–401 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.22
Hydraulic head in test section before stop of flow period	h_p	m	–1.07
Hydraulic head in test section at stop of recovery period	h_F	m	–0.36
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.85

6.2.78 Observation section KFM06C: 402–530 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 402–530 m, are presented in Table 6-78.

Comments on the test

The response to pumping in HFM14 is apparent in this section. The total drawdown during the flow period was c. 0.8 m and a drawdown of 0.01 m was reached in about 20 hours. There was a total recovery of approximately 0.6 metres during the recovery period lasting for c. 7 days.

6.2.79 Observation section KFM06C: 531–540 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 531–540 m, are presented in Table 6-79.

Comments on the test

A clear response is visible in this observation section. The total drawdown during the flow period was c. 0.6 m and a drawdown of 0.01 m was reached in about 38 hours. There was a total recovery of approximately 0.5 metres during the recovery period lasting for c. 7 days.

Table 6-78. General test data from the observation section KFM06C: 402–530 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.02
Hydraulic head in test section before stop of flow period	h_p	m	–0.74
Hydraulic head in test section at stop of recovery period	h_F	m	–0.15
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.76

Table 6-79. General test data from the observation section KFM06C: 531–540 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.07
Hydraulic head in test section before stop of flow period	h_p	m	–0.56
Hydraulic head in test section at stop of recovery period	h_F	m	–0.08
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.63

6.2.80 Observation section KFM06C: 541–646 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 541–646 m, are presented in Table 6-80.

Comments on the test

This section is probably slightly affected by the pumping in HFM14. The total drawdown during the flow period was c. 0.6 m and a drawdown of 0.01 m was reached in about 5 hours. There was a total recovery of approximately 0.2 metres during the recovery period lasting for c. 7 days. This borehole section, as well as most sections in KFM06C, is strongly influenced by tidal effects which makes the interpretation of responses in the lower part of the borehole uncertain.

6.2.81 Observation section KFM06C: 647–666 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 647–666 m, are presented in Table 6-81.

Comments on the test

This section may be slightly affected by the pumping in HFM14. The total drawdown during the flow period was c. 0.5 m and a drawdown of 0.01 m was reached in about 63 hours. There was a total recovery of approximately 0.2 metres during the recovery period lasting for c. 7 days. This borehole section, as well as most sections in KFM06C, is strongly influenced by tidal effects which makes the interpretation of responses in the lower part of the borehole uncertain.

6.2.82 Observation section KFM06C: 667–872 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 667–872 m, are presented in Table 6-82.

Table 6-80. General test data from the observation section KFM06C: 541–646 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.14
Hydraulic head in test section before stop of flow period	h_p	m	–0.76
Hydraulic head in test section at stop of recovery period	h_F	m	–0.58
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.62

Table 6-81. General test data from the observation section KFM06C: 647–666 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.42
Hydraulic head in test section before stop of flow period	h_p	m	–0.10
Hydraulic head in test section at stop of recovery period	h_F	m	0.07
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.52

Table 6-82. General test data from the observation section KFM06C: 667–872 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.01
Hydraulic head in test section before stop of flow period	h_p	m	–0.44
Hydraulic head in test section at stop of recovery period	h_F	m	–0.41
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.43

Comments on the test

This section may be slightly affected by the pumping in HFM14. The total drawdown during the flow period was c. 0.4 m and a drawdown of 0.01 m was reached in about 63 hours. There was a no obvious recovery indicated during the recovery period lasting for c. 7 days. This borehole section, as well as most sections in KFM06C, is strongly influenced by tidal effects which makes the interpretation of responses in the lower part of the borehole uncertain.

6.2.83 Observation section KFM06C: 873–1,001 m

In Figure 6-20 an overview of the pressure responses in observation borehole KFM06C is shown. General test data from the observation section KFM06C, 873–1,001 m, are presented in Table 6-83.

Comments on the test

This section may be slightly affected by the pumping in HFM14. The total drawdown during the flow period was c. 0.6 m and a drawdown of 0.01 m was reached in about 38 hours. There was no obvious recovery indicated during the recovery period lasting for c. 7 days. This borehole section, as well as most sections in KFM06C, is strongly influenced by tidal effects which makes the interpretation of responses in the lower part of the borehole uncertain.

6.2.84 Observation section KFM06B: 0–26 m

In Figure 6-21 an overview of the pressure responses in observation borehole KFM06B is shown. General test data from the observation section KFM06B, 0–26 m, are presented in Table 6-84. According to Table 3-1, the borehole is cased to 4.61 m. The uncased interval of this section is thus c. 5–26 m.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 1.2 m and a drawdown of 0.01 m was reached approximately 140 minutes after the pumping started. There was a total recovery of c. 1.1 m during the recovery period of approximately 7 days.

Table 6-83. General test data from the observation section KFM06C: 873–1,001 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.60
Hydraulic head in test section before stop of flow period	h_p	m	0.01
Hydraulic head in test section at stop of recovery period	h_F	m	0.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.59

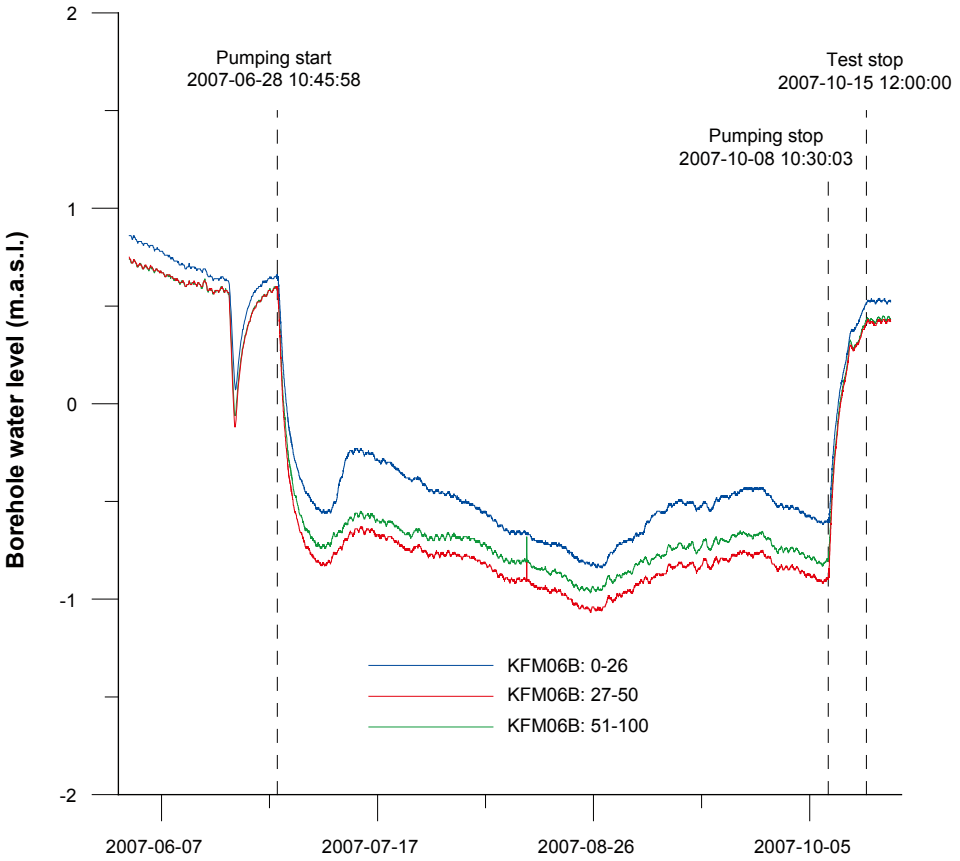


Figure 6-21. *Linear plot of pressure versus time in the observation sections in KFM06B during the interference test in HFM14.*

Table 6-84. General test data from the observation section KFM06B: 0–26 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.65
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.60
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.52
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.25

6.2.85 Observation section KFM06B: 27–50 m

In Figure 6-21 an overview of the pressure responses in observation borehole KFM06B is shown. General test data from the observation section KFM06B, 27–50 m, are presented in Table 6-85.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 1.5 m and a drawdown of 0.01 m was reached approximately 100 minutes after the pumping started. There was a total recovery of c. 1.3 m during the recovery period of approximately 7 days.

Table 6-85. General test data from the observation section KFM06B: 27–50 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.59
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.89
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.41
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.48

6.2.86 Observation section KFM06B: 51–100 m

In Figure 6-21 an overview of the pressure responses in observation borehole KFM06B is shown. General test data from the observation section KFM06B, 51–100 m, are presented in Table 6-86.

Comments on the test

A clear effect from pumping was observed in this observation section. The total drawdown at the end of the flow period was c. 1.4 m and a drawdown of 0.01 m was reached approximately 120 minutes after the pumping started. There was a total recovery of c. 1.2 m during the recovery period of approximately 7 days.

6.2.87 Observation section HFM10: 0–99 m

In Figure 6-22 an overview of the pressure responses in observation borehole HFM10 is shown. General test data from the observation section HFM10, 0–99 m, are presented in Table 6-87. According to Table 3-1, the borehole is cased to 11.8 m. The uncased interval of this section is thus c. 12–99 m.

Comments on the test

This section is most likely responding to the pumping in HFM14. There are no data available until mid September and so the drawdown is not possible to evaluate. There is however a clear effect detected at the stop of pumping and there was a total recovery of c. 0.2 m during the recovery period of approximately 7 days. It is probable that the response in this section is similar to that in section 100–150 m in this borehole.

Table 6-86. General test data from the observation section KFM06B: 51–100 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.59
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.80
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.43
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.39

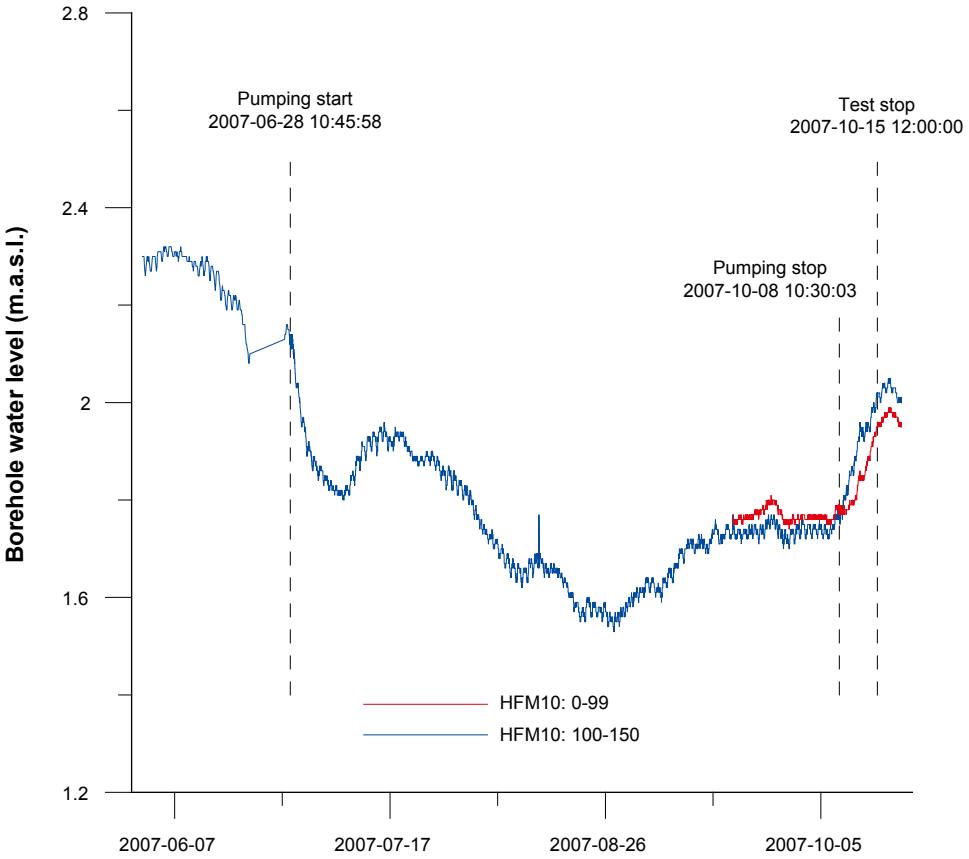


Figure 6-22. *Linear plot of pressure versus time in the observation sections in HFM10 during the interference test in HFM14.*

Table 6-87. General test data from the observation section HFM10: 0–99 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.79
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	1.95
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

6.2.88 Observation section HFM10: 100–150 m

In Figure 6-22 an overview of the pressure responses in observation borehole HFM10 is shown. General test data from the observation section HFM10, 100–150 m, are presented in Table 6-88.

Comments on the test

A probable pressure response to pumping in HFM14 is indicated in this section. The response at recovery is very similar to that of section HFM10: 0–99 m. There is a decreasing pressure trend prior to the start of pumping but it still seems likely that this section is affected by the pumping in HFM14. The total drawdown at the end of the flow period was c. 0.4 m and a drawdown of 0.01 m was reached approximately 12 hours after the pumping started. A total recovery of c. 0.2 m was measured during the recovery period of approximately 7 days.

Table 6-88. General test data from the observation section HFM10: 100–150 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	2.13
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.77
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	2.02
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.36

6.2.89 Observation section HFM16: 0–53 m

In Figure 6-23 an overview of the pressure responses in observation borehole HFM16 is shown. General test data from the observation section HFM16, 0–53 m, are presented in Table 6-89. According to Table 3-1, the borehole is cased to 12.02 m. The uncased interval of this section is thus c. 12–53 m.

Comments on the test

The pumping in HFM14 caused a clear response in this section. The total drawdown during the flow period was c. 1.5 m. A drawdown of 0.01 m was reached approximately 40 minutes after the pumping started in HFM14. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

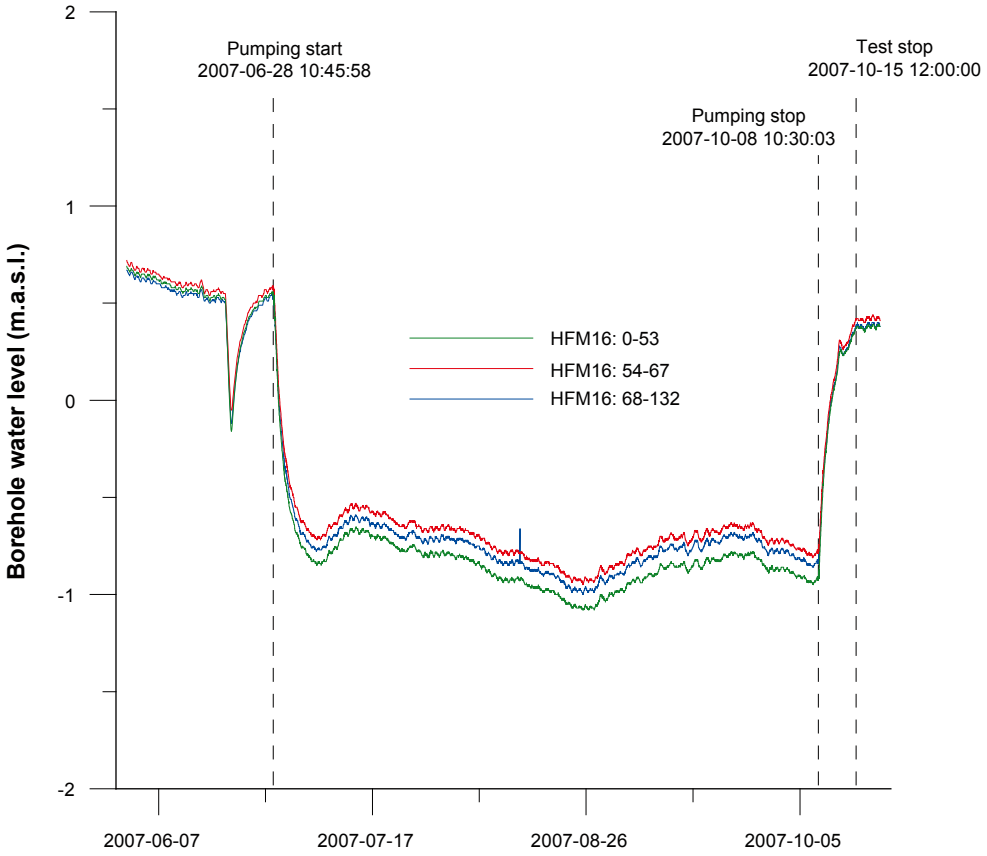


Figure 6-23. *Linear plot of pressure versus time in the observation sections in HFM16 during the interference test in HFM14.*

Table 6-89. General test data from the observation section HFM16: 0–53 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.55
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.92
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.37
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.47

6.2.90 Observation section HFM16: 54–67 m

In Figure 6-23 an overview of the pressure responses in observation borehole HFM16 is shown. General test data from the observation section HFM16, 54–67 m, are presented in Table 6-90.

Comments on the test

The pumping in HFM14 caused a clear response in this section. The total drawdown during the flow period was c. 1.4 m. A drawdown of 0.01 m was reached approximately 73 minutes after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.91 Observation section HFM16: 68–132 m

In Figure 6-23 an overview of the pressure responses in observation borehole HFM16 is shown. General test data from the observation section HFM16, 68–132 m, are presented in Table 6-91.

Comments on the test

The pumping in HFM14 caused a clear response in this section. The total drawdown during the flow period was c. 1.4 m. A drawdown of 0.01 m was reached approximately 98 minutes after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

Table 6-90. General test data from the observation section HFM16: 54–67 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.58
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.78
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.41
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.36

Table 6-91. General test data from the observation section HFM16: 68–132 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.53
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.83
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.38
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.36

6.2.92 Observation section HFM09: 0–50 m

In Figure 6-24 an overview of the pressure responses in observation borehole HFM09 is shown. General test data from the observation section HFM09, 0–50 m, are presented in Table 6-92. According to Table 3-1, the borehole is cased to 17.02 m. The uncased interval of this section is thus c. 17–50 m.

Comments on the test

This section is responding to the pumping in HFM14. The total drawdown during the flow period was measured at c. 0.4 m and a drawdown of 0.01 m was reached approximately 12 hours after the pumping started in HFM14. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

Table 6-92. General test data from the observation section HFM09: 0–50 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	2.49
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	2.10
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	2.36
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.39

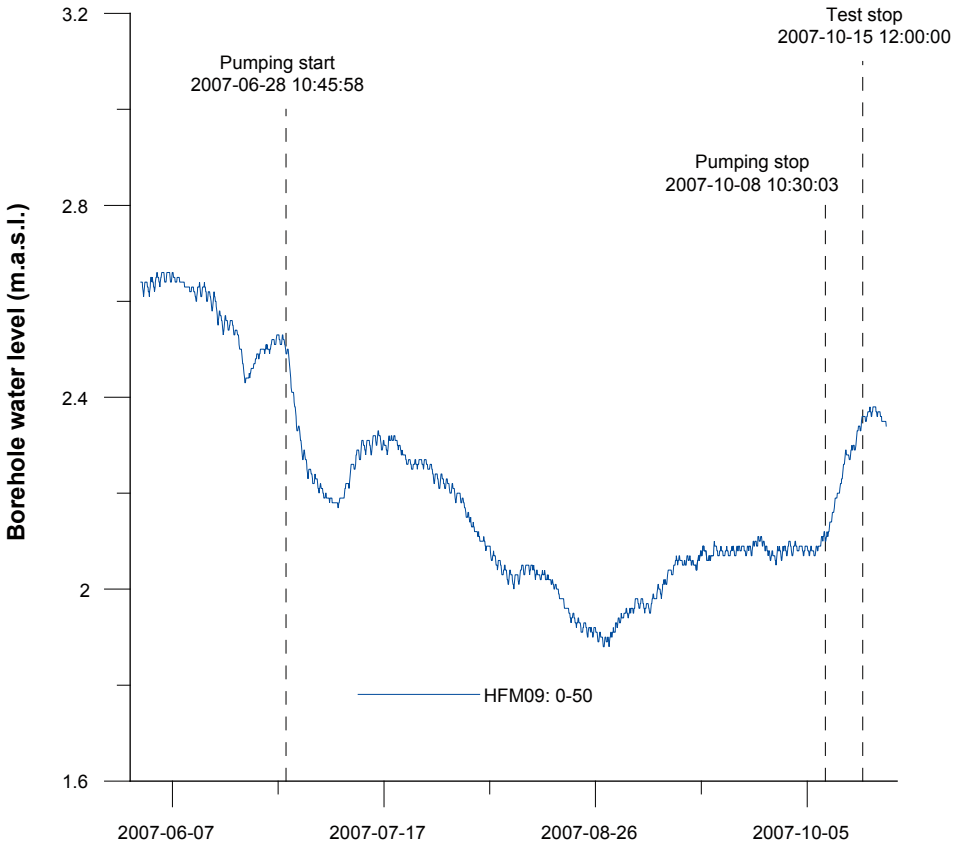


Figure 6-24. *Linear plot of pressure versus time in the observation section in HFM09 during the interference test in HFM14.*

6.2.93 Observation section KFM07B: 0–74 m

In Figure 6-25 an overview of the pressure responses in observation borehole KFM07B is shown. General test data from the observation section KFM07B, 0–74 m, are presented in Table 6-93. According to Table 3-1, the borehole is cased to 65.29 m. The uncased interval of this section is thus c. 65–74 m.

Comments on the test

This section appears to be completely unaffected by the pumping in HFM14.

Table 6-93. General test data from the observation section KFM07B: 0–74 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.19
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.16
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.16
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.03

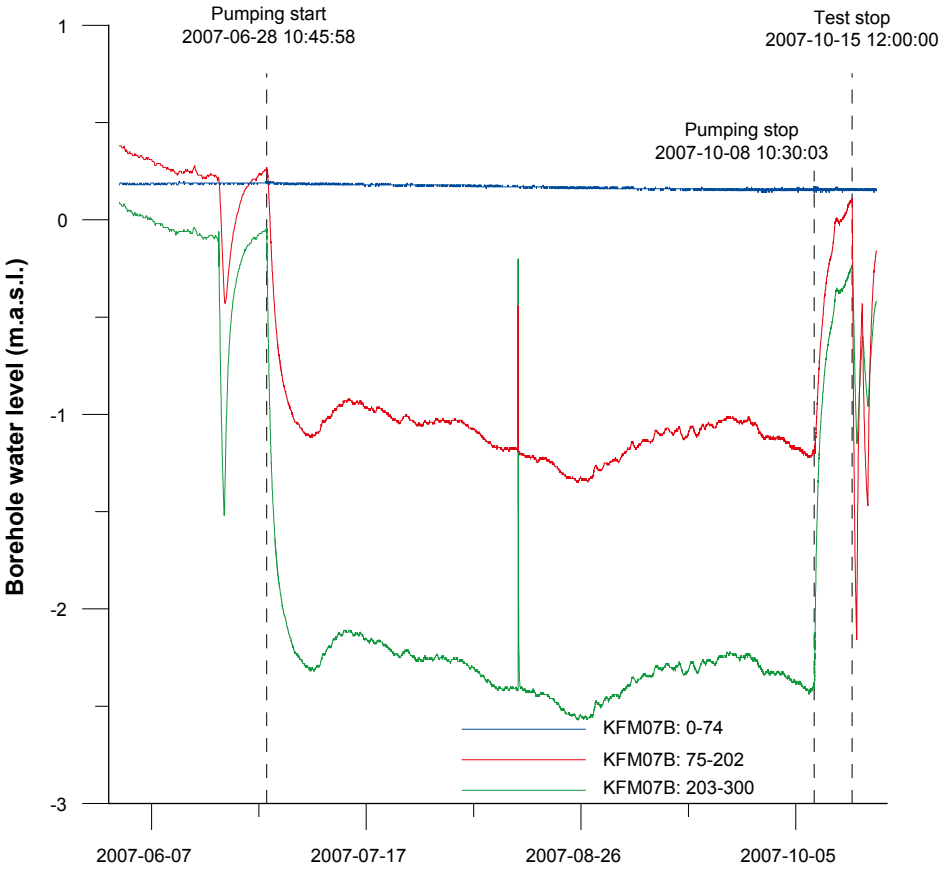


Figure 6-25. *Linear plot of pressure versus time in the observation sections in KFM07B during the interference test in HFM14.*

6.2.94 Observation section KFM07B: 75–202 m

In Figure 6-25 an overview of the pressure responses in observation borehole KFM07B is shown. General test data from the observation section KFM07B, 75–202 m, are presented in Table 6-94.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.4 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 170 minutes after the pumping started in HFM14. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

6.2.95 Observation section KFM07B: 203–300 m

In Figure 6-25 an overview of the pressure responses in observation borehole KFM07B is shown. General test data from the observation section KFM07B, 203–300 m, are presented in Table 6-95.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 2.4 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 33 minutes after the pumping started in HFM14. There was a total recovery of c. 2.2 m during the recovery period that lasted for approximately 7 days.

6.2.96 Observation section HFM21: 0–21 m

In Figure 6-26 an overview of the pressure responses in observation borehole HFM21 is shown. General test data from the observation section HFM21, 0–21 m, are presented in Table 6-96. According to Table 3-1, the borehole is cased to 12.03 m. The uncased interval of this section is thus c. 12–21 m.

Table 6-94. General test data from the observation section KFM07B: 75–202 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.26
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.19
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.11
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.45

Table 6-95. General test data from the observation section KFM07B: 203–300 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.05
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.41
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.23
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	2.36

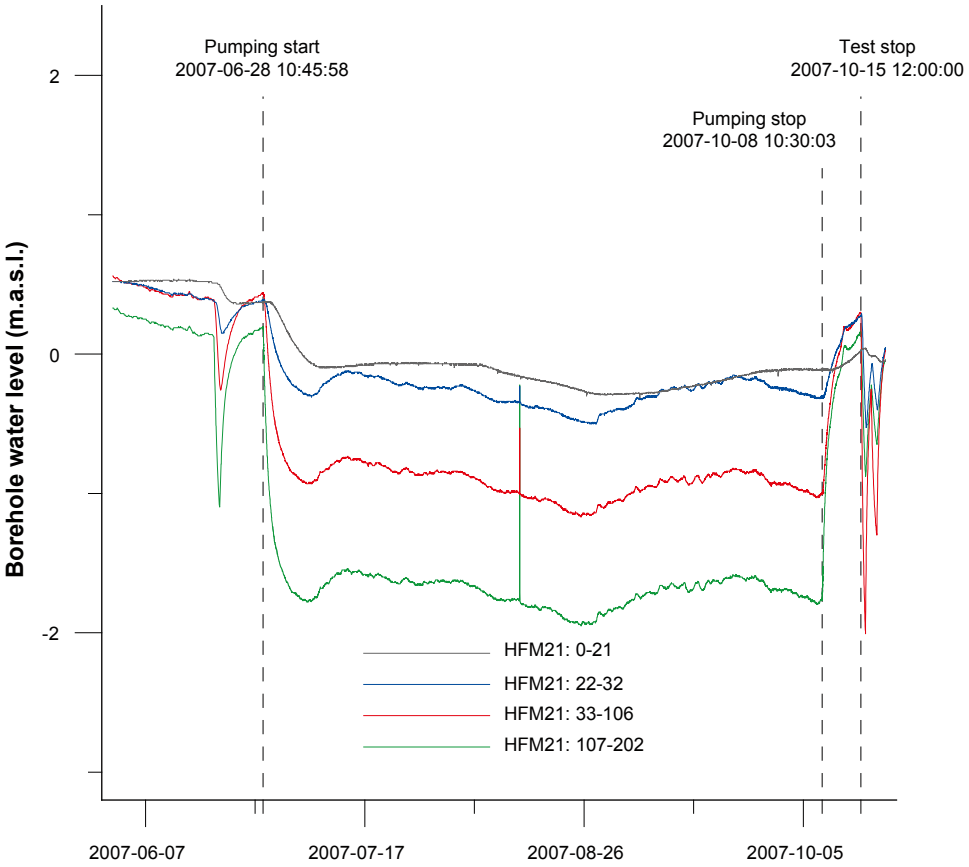


Figure 6-26. *Linear plot of pressure versus time in the observation sections in HFM21 during the interference test in HFM14.*

Table 6-96. General test data from the observation section HFM21: 0–21 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.38
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.11
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.02
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.49

Comments on the test

The pumping in HFM14 is causing this section to respond. A total drawdown of c. 0.5 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 24 hours after the pumping started in HFM14. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.97 Observation section HFM21: 22–32 m

In Figure 6-26 an overview of the pressure responses in observation borehole HFM21 is shown. General test data from the observation section HFM21, 22–32 m, are presented in Table 6-97.

Table 6-97. General test data from the observation section HFM21: 22–32 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.38
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.31
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.28
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.69

Comments on the test

This section is clearly responding to the pumping in HFM14. A total drawdown of c. 0.7 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 12 hours after the pumping started in HFM14. There was a total recovery of c. 0.6 m during the recovery period that lasted for approximately 7 days.

6.2.98 Observation section HFM21: 33–106 m

In Figure 6-26 an overview of the pressure responses in observation borehole HFM21 is shown. General test data from the observation section HFM21, 33–106 m, are presented in Table 6-98.

Comments on the test

This section is clearly responding to the pumping in HFM14. A total drawdown of c. 1.4 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 103 minutes after the pumping started in HFM14. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

6.2.99 Observation section HFM21: 107–202 m

In Figure 6-26 an overview of the pressure responses in observation borehole HFM21 is shown. General test data from the observation section HFM21, 107–202 m, are presented in Table 6-99.

Comments on the test

The pumping in HFM14 is clearly causing this section to respond. A total drawdown of c. 1.9 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 40 minutes after the pumping started in HFM14. There was a total recovery of c. 1.9 m during the recovery period that lasted for approximately 7 days.

Table 6-98. General test data from the observation section HFM21: 33–106 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.44
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.00
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.30
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.44

Table 6-99. General test data from the observation section HFM21: 107–202 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.19
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.76
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.16
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.95

6.2.100 Observation section KFM07C: 0–110 m

In Figure 6-27 an overview of the pressure responses in observation borehole KFM07C is shown. General test data from the observation section KFM07C, 0–110 m, are presented in Table 6-100. According to Table 3-1, the borehole is cased to 84.79 m. The uncased interval of this section is thus c. 85–110 m.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.4 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 192 minutes after the pumping started in HFM14. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

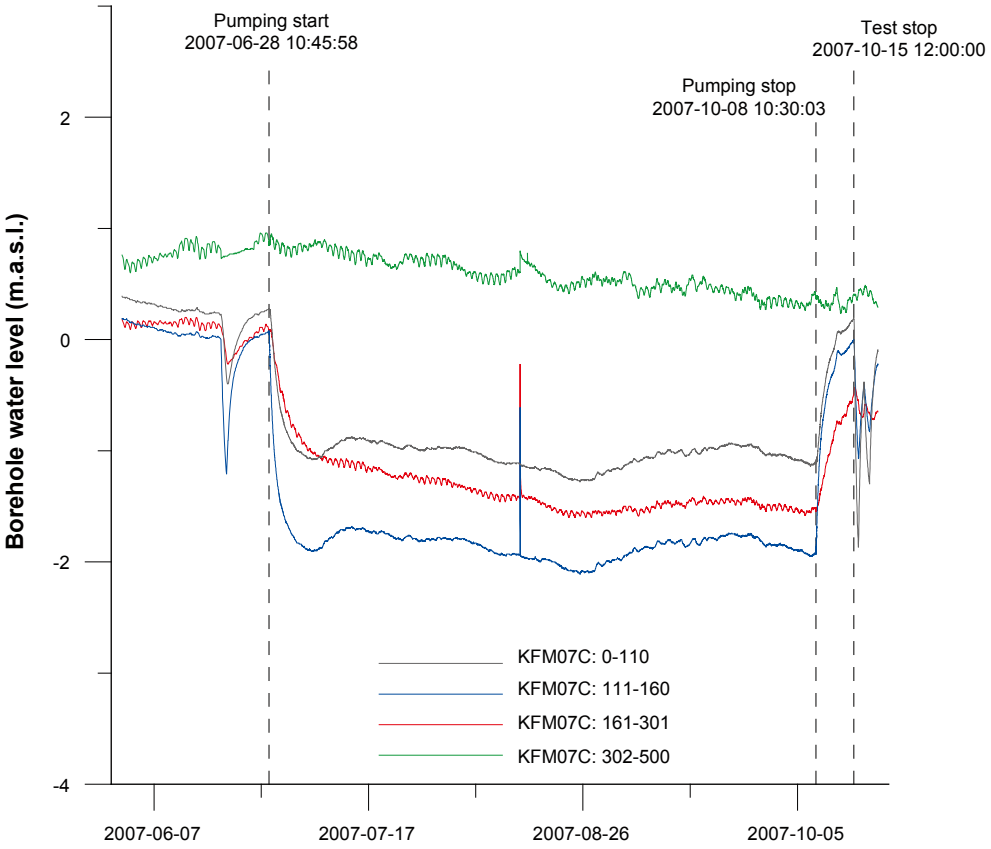


Figure 6-27. *Linear plot of pressure versus time in the observation section in KFM07C during the interference test in HFM14.*

Table 6-100. General test data from the observation section KFM07C: 0–110 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.27
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.11
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.19
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.38

6.2.101 Observation section KFM07C: 111–160 m

In Figure 6-27 an overview of the pressure responses in observation borehole KFM07C is shown. General test data from the observation section KFM07C, 111–160 m, are presented in Table 6-101.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 2.0 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 36 minutes after the pumping started in HFM14. There was a total recovery of c. 1.9 m during the recovery period that lasted for approximately 7 days.

6.2.102 Observation section KFM07C: 161–301 m

In Figure 6-27 an overview of the pressure responses in observation borehole KFM07C is shown. General test data from the observation section KFM07C, 161–301 m, are presented in Table 6-102.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.6 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 9 hours after the pumping started in HFM14. There was a total recovery of c. 1.0 m during the recovery period that lasted for approximately 7 days.

Table 6-101. General test data from the observation section KFM07C: 111–160 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.07
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.92
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.99

Table 6-102. General test data from the observation section KFM07C: 161–301 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.08
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.53
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.50
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.61

6.2.103 Observation section KFM07C: 302–500 m

In Figure 6-27 an overview of the pressure responses in observation borehole KFM07C is shown. General test data from the observation section KFM07C, 302–500 m, are presented in Table 6-103.

Comments on the test

This section may be affected by the pumping in HFM14. A decreasing pressure trend is present for the duration of the flow period and changes are recorded at pumping start and stop. A total drawdown of c. 0.5 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 64 hours after the pumping started in HFM14. There was a total recovery of c. 1.1 m during the recovery period that lasted for approximately 7 days.

6.2.104 Observation section KFM07A: 0–148 m

In Figure 6-28 an overview of the pressure responses in observation borehole KFM07A is shown. General test data from the observation section KFM07A, 0–148 m, are presented in Table 6-104. According to Table 3-1, the borehole is cased to 100.10 m. The uncased interval of this section is thus c. 100–148 m.

Comments on the test

This observation section is clearly responding to the pumping in HFM14. There was a total drawdown measured at approximately 1.4 m and a drawdown of 0.01 metres was reached c. 4 hours into the flow period. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

6.2.105 Observation section KFM07A: 149–190 m

In Figure 6-28 an overview of the pressure responses in observation borehole KFM07A is shown. General test data from the observation section KFM07A, 149–190 m, are presented in Table 6-105.

Table 6-103. General test data from the observation section KFM07C: 302–500 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.86
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.38
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.41
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.48

Table 6-104. General test data from the observation section KFM07A: 0–148 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.14
Hydraulic head in test section before stop of flow period	h_p	m	–1.28
Hydraulic head in test section at stop of recovery period	h_F	m	0.03
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.42

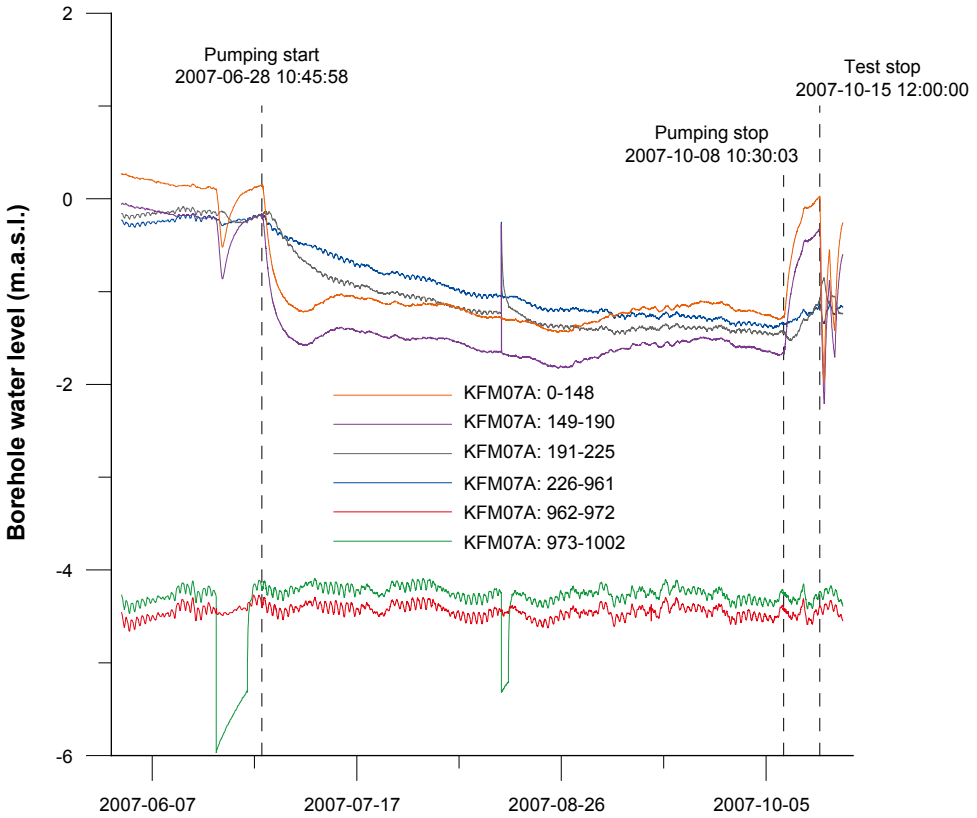


Figure 6-28. *Linear plot of pressure versus time in the observation sections in KFM07A during the interference test in HFM14.*

Table 6-105. General test data from the observation section KFM07A: 149–190 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.17
Hydraulic head in test section before stop of flow period	h_p	m	–1.67
Hydraulic head in test section at stop of recovery period	h_F	m	–0.33
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.50

Comments on the test

This observation section is clearly responding to the pumping in HFM14. There was a total drawdown measured at approximately 1.5 m and a drawdown of 0.01 metres was reached c.112 minutes into the flow period. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

6.2.106 Observation section KFM07A: 191–225 m

In Figure 6-28 an overview of the pressure responses in observation borehole KFM07A is shown. General test data from the observation section KFM07A, 191–225 m, are presented in Table 6-106.

Table 6-106. General test data from the observation section KFM07A: 191–225 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.20
Hydraulic head in test section before stop of flow period	h_p	m	–1.44
Hydraulic head in test section at stop of recovery period	h_F	m	–1.09
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.24

Comments on the test

This observation section is responding to the pumping in HFM14. There was a total drawdown measured at approximately 1.2 m and a drawdown of 0.01 metres was reached c. 47 hours into the flow period. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

6.2.107 Observation section KFM07A: 226–961 m

In Figure 6-28 an overview of the pressure responses in observation borehole KFM07A is shown. General test data from the observation section KFM07A, 226–961 m, are presented in Table 6-107.

Comments on the test

This observation section is responding slightly to the pumping in HFM14. There was a total drawdown measured at approximately 1.1 m and a drawdown of 0.01 metres was reached c. 17 hours into the flow period. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.108 Observation section KFM07A: 962–972 m

In Figure 6-28 an overview of the pressure responses in observation borehole KFM07A is shown. General test data from the observation section KFM07A, 962–972 m, are presented in Table 6-108.

Comments on the test

This section appears to be unaffected by the pumping in HFM14.

Table 6-107. General test data from the observation section KFM07A: 226–961 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.20
Hydraulic head in test section before stop of flow period	h_p	m	–1.35
Hydraulic head in test section at stop of recovery period	h_F	m	–1.15
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.15

Table 6-108. General test data from the observation section KFM07A: 962–972 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–4.39
Hydraulic head in test section before stop of flow period	h_p	m	–4.43
Hydraulic head in test section at stop of recovery period	h_F	m	–4.39
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.04

6.2.109 Observation section KFM07A: 973–1,001 m

In Figure 6-28 an overview of the pressure responses in observation borehole KFM07A is shown. General test data from the observation section KFM07A, 973–1,001 m, are presented in Table 6-109.

Comments on the test

This section appears to be unaffected by the pumping in HFM14.

6.2.110 Observation section KFM09B: 0–200 m

In Figure 6-29 an overview of the pressure responses in observation borehole KFM09B is shown. General test data from the observation section KFM09B, 0–200 m, are presented in Table 6-110. According to Table 3-1, the borehole is cased to 9.120 m. The uncased interval of this section is thus c. 9–200 m.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 0.9 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 8 hours after the pumping started in HFM14. There was a total recovery of c. 0.7 m during the recovery period that lasted for approximately 7 days.

Table 6-109. General test data from the observation section KFM07A: 973–1,001 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–4.20
Hydraulic head in test section before stop of flow period	h_p	m	–4.25
Hydraulic head in test section at stop of recovery period	h_F	m	–4.23
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.05

Table 6-110. General test data from the observation section KFM09B: 0–200 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–0.10
Hydraulic head in test section before stop of flow period	h_p	m	–0.99
Hydraulic head in test section at stop of recovery period	h_F	m	–0.30
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.89

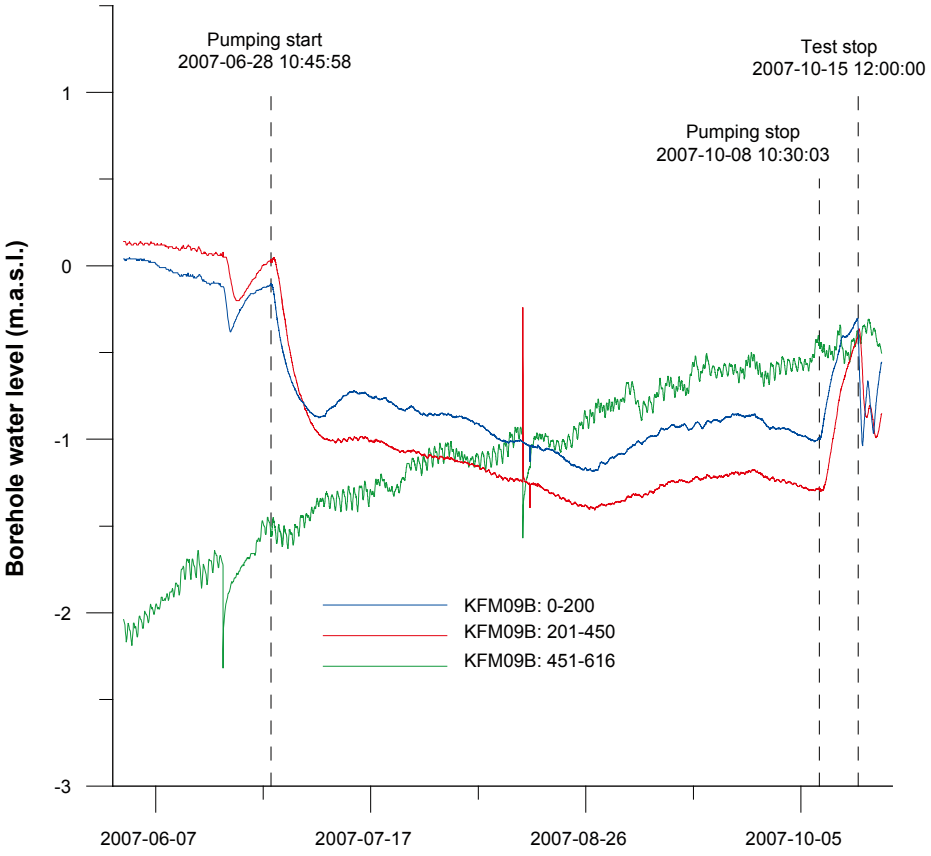


Figure 6-29. *Linear plot of pressure versus time in the observation sections in KFM09B during the interference test in HFM14.*

6.2.111 Observation section KFM09B: 201–450 m

In Figure 6-29 an overview of the pressure responses in observation borehole KFM09B is shown. General test data from the observation section KFM09B, 201–450 m, are presented in Table 6-111.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.3 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 20 hours after the pumping started in HFM14. There was a total recovery of c. 0.9 m during the recovery period that lasted for approximately 7 days.

Table 6-111. General test data from the observation section KFM09B: 201–450 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.03
Hydraulic head in test section before stop of flow period	h_p	m	–1.28
Hydraulic head in test section at stop of recovery period	h_F	m	–0.42
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.31

6.2.112 Observation section KFM09B: 451–616 m

In Figure 6-29 an overview of the pressure responses in observation borehole KFM09B is shown. General test data from the observation section KFM09B, 451–616 m, are presented in Table 6-112.

Comments on the test

This section does not appear to respond at all to pumping in HFM14. The pressure is increasing throughout the entire test period.

6.2.113 Observation section HFM22: 0–222 m

In Figure 6-30 an overview of the pressure responses in observation borehole HFM22 is shown. General test data from the observation section HFM22, 0–222 m, are presented in Table 6-113. According to Table 3-1, the borehole is cased to 12.03 m. The uncased interval of this section is thus c. 12–222 m.

Table 6-112. General test data from the observation section KFM09B: 451–616 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–1.55
Hydraulic head in test section before stop of flow period	h_p	m	–0.45
Hydraulic head in test section at stop of recovery period	h_F	m	–0.38
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–1.10

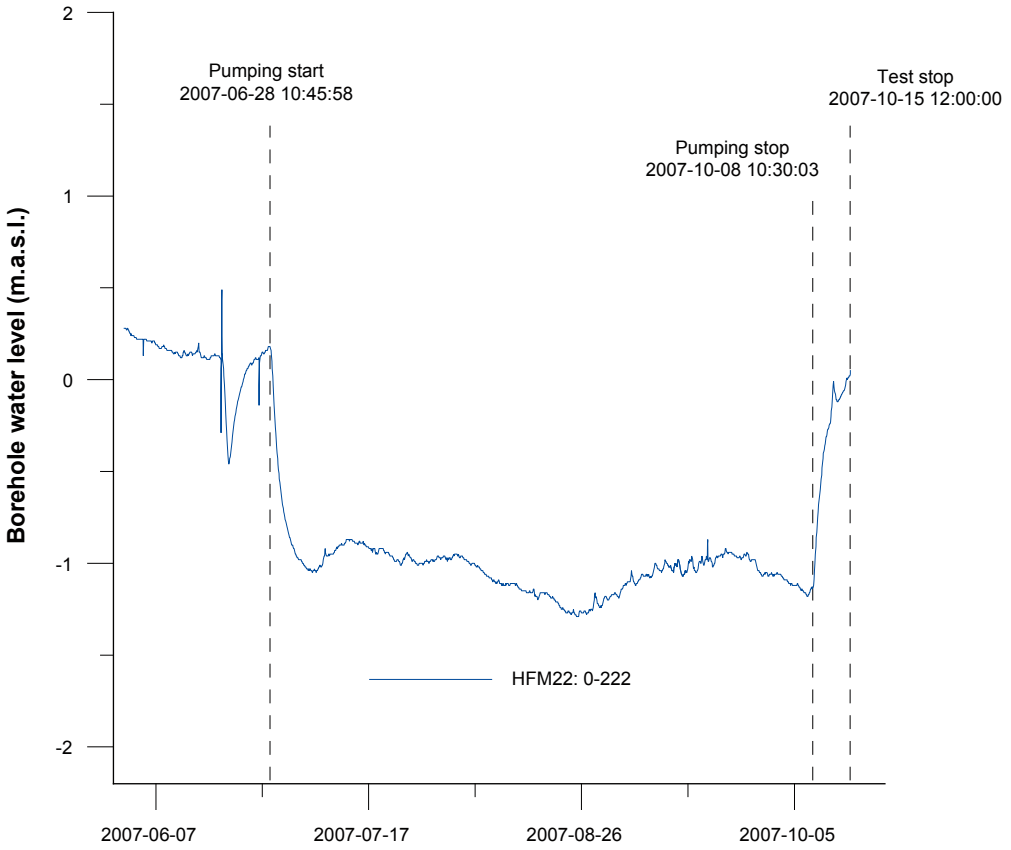


Figure 6-30. *Linear plot of pressure versus time in the observation section in HFM22 during the interference test in HFM14.*

Table 6-113. General test data from the observation section HFM22: 0–222 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.18
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.13
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.03
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.31

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.3 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 134 minutes after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.114 Observation section HFM20: 0–48 m

In Figure 6-31 an overview of the pressure responses in observation borehole HFM20 is shown. General test data from the observation section HFM20, 0–48 m, are presented in Table 6-114. According to Table 3-1, the borehole is cased to 12.03 m. The uncased interval of this section is thus c. 12–48 m.

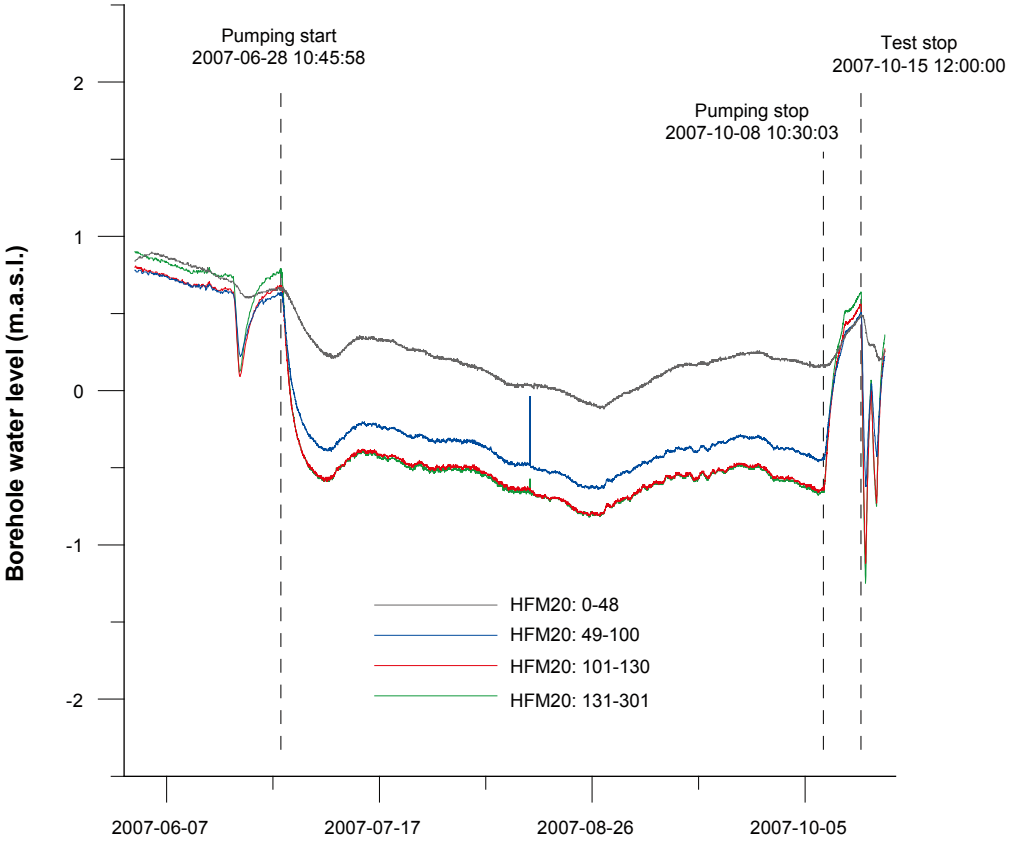


Figure 6-31. *Linear plot of pressure versus time in the observation sections in HFM20 during the interference test in HFM14.*

Table 6-114. General test data from the observation section HFM20: 0–48 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.66
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.16
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.48
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.50

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 0.5 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 14 hours after the pumping started in HFM14. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

6.2.115 Observation section HFM20: 49–100 m

In Figure 6-31 an overview of the pressure responses in observation borehole HFM20 is shown. General test data from the observation section HFM20, 49–100 m, are presented in Table 6-115.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.1 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 8 hours after the pumping started in HFM14. There was a total recovery of c. 0.9 m during the recovery period that lasted for approximately 7 days.

6.2.116 Observation section HFM20: 101–130 m

In Figure 6-31 an overview of the pressure responses in observation borehole HFM20 is shown. General test data from the observation section HFM20, 101–130 m, are presented in Table 6-116.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.3 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 3 hours after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

Table 6-115. General test data from the observation section HFM20: 49–100 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.62
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.44
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.50
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.06

Table 6-116. General test data from the observation section HFM20: 101–130 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.68
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.64
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.56
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.32

6.2.117 Observation section HFM20: 131–301 m

In Figure 6-31 an overview of the pressure responses in observation borehole HFM20 is shown. General test data from the observation section HFM20, 131–301 m, are presented in Table 6-117.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.4 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 4 hours after the pumping started in HFM14. There was a total recovery of c. 1.3 m during the recovery period that lasted for approximately 7 days.

6.2.118 Observation section KFM08A: 0–1,001 m

In Figure 6-32 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 0–1,001 m, are presented in Table 6-118. According to Table 3-1, the borehole is cased to 100.200 m. The uncased interval of this section is thus c. 100–1,001 m.

Comments on the test

This borehole is probably not responding, or responding very weakly to the pumping in HFM14. Due to lack of data, no support for the conclusion can be derived from the recovery period.

Table 6-117. General test data from the observation section HFM20: 131–301 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.77
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.65
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.64
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.42

Table 6-118. General test data from the observation section KFM08A: 0–1,001 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.69
Hydraulic head in test section before stop of flow period	h_p	m	–
Hydraulic head in test section at stop of recovery period	h_F	m	–
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

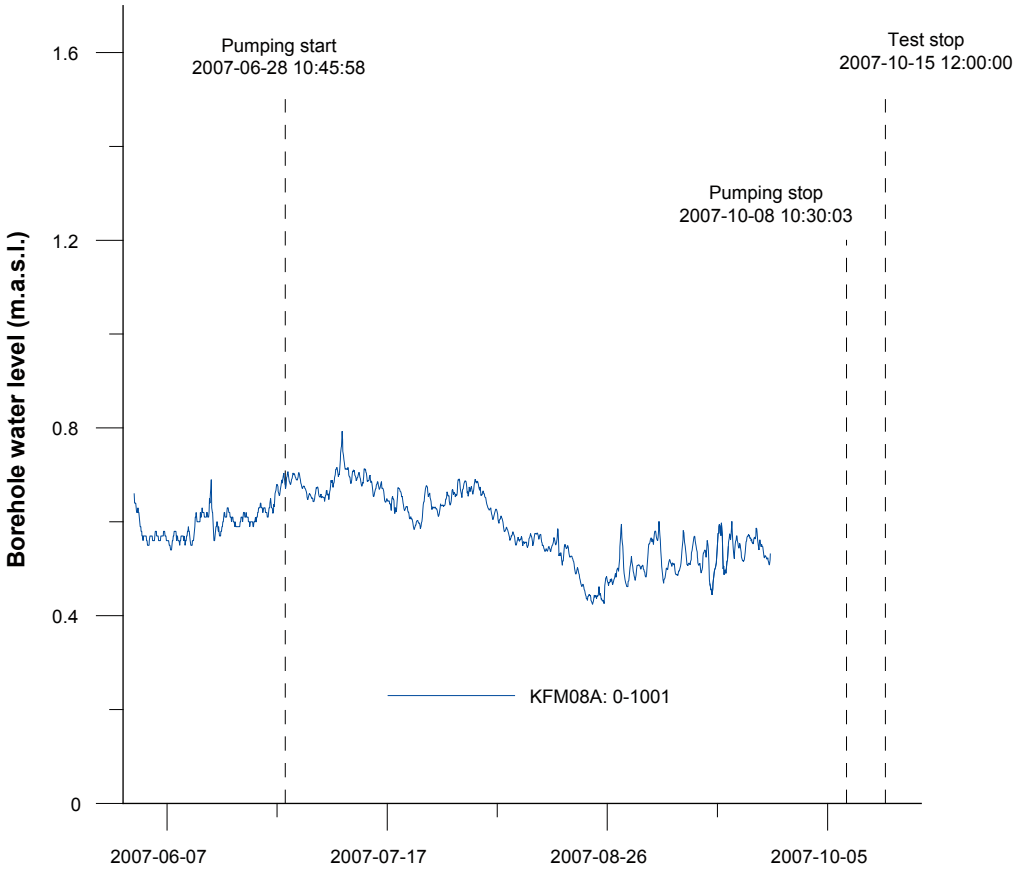


Figure 6-32. *Linear plot of pressure versus time in the observation sections in KFM08A during the interference test in HFM14.*

6.2.119 Observation section KFM08B: 0–70 m

In Figure 6-33 an overview of the pressure responses in observation borehole KFM08B is shown. General test data from the observation section KFM08B, 0–70 m, are presented in Table 6-119. According to Table 3-1, the borehole is cased to 5.58 m. The uncased interval of this section is thus c. 6–70 m.

Comments on the test

This section is likely to be influenced by the pumping in HFM14. The response is not very strong but changes in the pressure are evident in connection to start and stop of pumping. A total drawdown of c. 0.4 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 13 hours after the pumping started in HFM14. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

Table 6-119. General test data from the observation section KFM08B: 0–70 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.05
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.31
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.03
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.36

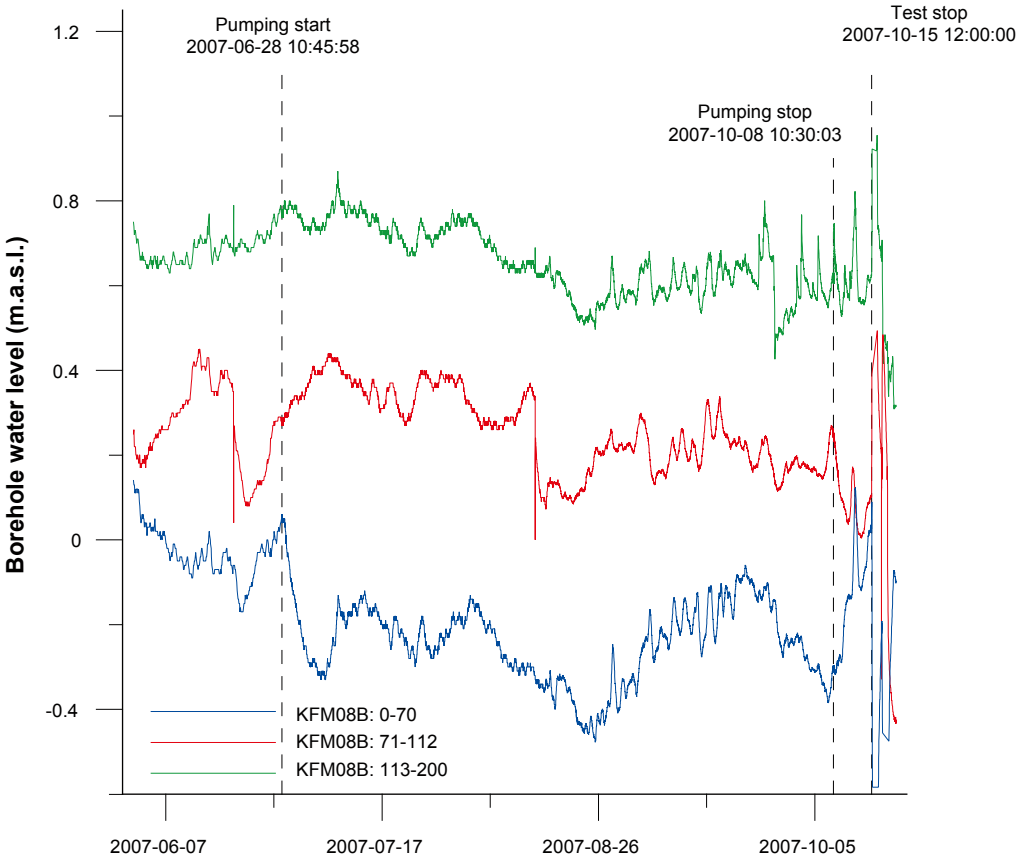


Figure 6-33. *Linear plot of pressure versus time in the observation sections in KFM08B during the interference test in HFM14.*

6.2.120 Observation section KFM08B: 71–112 m

In Figure 6-33 an overview of the pressure responses in observation borehole KFM08B is shown. General test data from the observation section KFM08B, 71–112 m, are presented in Table 6-120.

Comments on the test

No response to pumping is detected in this section. It is unlikely that this section is influenced by pumping in HFM14. The pressure in the test section is displaying a very erratic behaviour which does not seem to be connected to the pumping in HFM14.

Table 6-120. General test data from the observation section KFM08B: 71–112 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.28
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.25
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.10
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.03

6.2.121 Observation section KFM08B: 113–200 m

In Figure 6-33 an overview of the pressure responses in observation borehole KFM08B is shown. General test data from the observation section KFM08B, 113–200 m, are presented in Table 6-121.

Comments on the test

No clear response to pumping is detected in this section. This section is probably not influenced by pumping in HFM14. Even though there is a slight change in the trend of the pressure curve following the start of pumping which could be interpreted as a very slight response, it is not clear enough to rule out natural causes.

6.2.122 Observation section HFM30: 0–60 m

In Figure 6-34 an overview of the pressure responses in observation borehole HFM30 is shown. General test data from the observation section HFM30, 0–60 m, are presented in Table 6-122. According to Table 3-1, the borehole is cased to 18.03 m. The uncased interval of this section is thus c. 18–70 m.

Comments on the test

There was no registration of pressure until after the start of pumping in this section. No draw-down calculation has therefore been done. The section does however seem to be affected by the pumping in HFM14. There was a total recovery of about 0.1 m during the recovery period lasting for c. 7 days.

6.2.123 Observation section HFM30: 61–73 m

In Figure 6-34 an overview of the pressure responses in observation borehole HFM30 is shown. General test data from the observation section HFM30, 61–73 m, are presented in Table 6-123.

Table 6-121. General test data from the observation section KFM08B: 113–200 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.77
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.62
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.62
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.15

Table 6-122. General test data from the observation section HFM30: 0–60 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–
Hydraulic head in test section before stop of flow period	h_p	m	2.12
Hydraulic head in test section at stop of recovery period	h_F	m	2.23
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

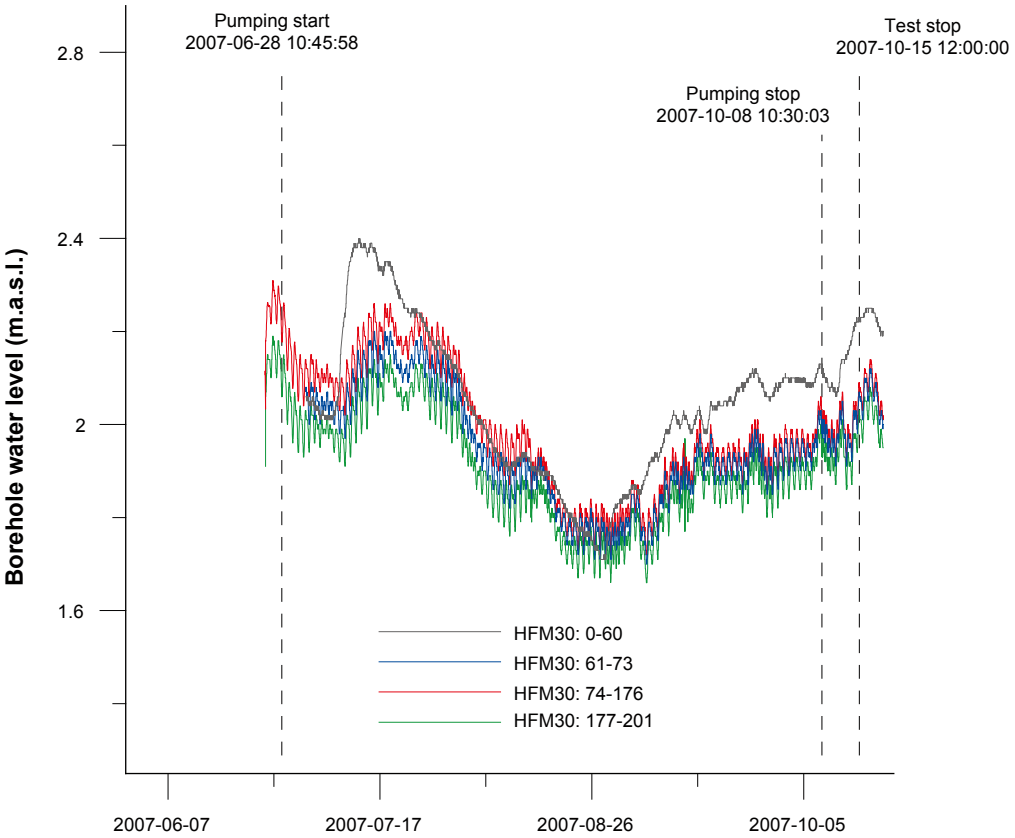


Figure 6-34. *Linear plot of pressure versus time in the observation sections in HFM30 during the interference test in HFM14.*

Table 6-123. General test data from the observation section HFM30: 61–73 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–
Hydraulic head in test section before stop of flow period	h_p	m	2.00
Hydraulic head in test section at stop of recovery period	h_F	m	2.07
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There was no registration of pressure until after the start of pumping in this section. No drawdown calculation has therefore been done. This section may however be somewhat affected by the pumping in HFM14. There was a total recovery of about 0.1 m during the recovery period lasting for c. 7 days.

6.2.124 Observation section HFM30: 74–176 m

In Figure 6-34 an overview of the pressure responses in observation borehole HFM30 is shown. General test data from the observation section HFM30, 74–176 m, are presented in Table 6-124.

Table 6-124. General test data from the observation section HFM30: 74–176 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	2.19
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	2.01
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	2.09
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.18

Comments on the test

This section may be influenced by the pumping in HFM14. There are clear signs of drawdown induced by the pumping in HFM14 but the recovery is very weak or not present at all. A total drawdown of c. 0.2 m was registered during the flow period. Due to the strong oscillating behaviour of the pressure in this section it is very hard to establish the time to reach a drawdown of 0.01 m. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.125 Observation section HFM30: 177–201 m

In Figure 6-34 an overview of the pressure responses in observation borehole HFM30 is shown. General test data from the observation section HFM30, 177–201 m, are presented in Table 6-125.

Comments on the test

This section may be influenced by the pumping in HFM14. There are clear signs of drawdown induced by the pumping in HFM14 but the recovery is very weak or not present at all. A total drawdown of c. 0.1 m was registered during the flow period. Due to the strong oscillating behaviour of the pressure in this section it is not possible to establish the time to reach a drawdown of 0.01 m. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.126 Observation section HFM25: 0–188 m

In Figure 6-35 an overview of the pressure responses in observation borehole HFM25 is shown. General test data from the observation section HFM25, 0–188 m, are presented in Table 6-126. According to Table 3-1, the borehole is cased to 9.04 m. The uncased interval of this section is thus c. 9–188 m.

Table 6-125. General test data from the observation section HFM30: 177–201 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	2.08
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.95
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	2.02
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.13

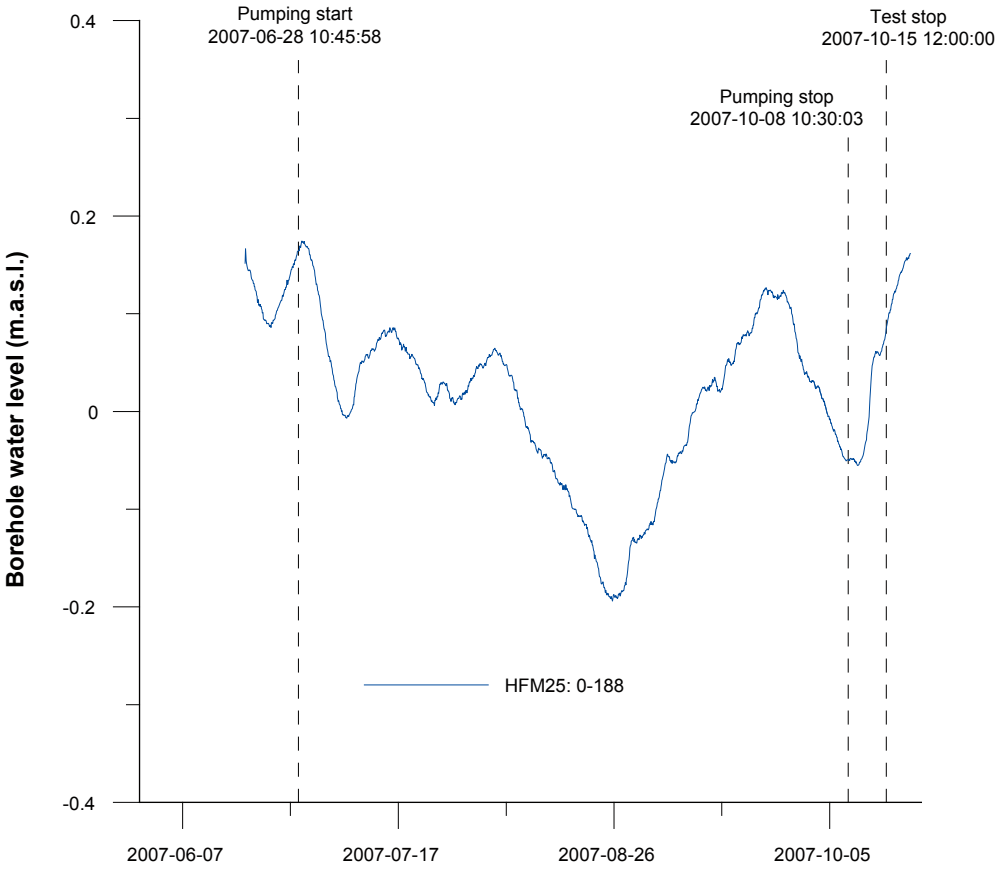


Figure 6-35. *Linear plot of pressure versus time in the observation section in HFM25 during the interference test in HFM14.*

Table 6-126. General test data from the observation section HFM25: 0–188 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	0.16
Hydraulic head in test section before stop of flow period	h_p	m	–0.05
Hydraulic head in test section at stop of recovery period	h_F	m	0.09
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.21

Comments on the test

This section appears to be responding to the pumping in HFM14. A total drawdown of c. 0.2 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 54 hours after the pumping started in HFM14. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.127 Observation section KFM09A: 0–300 m

In Figure 6-36 an overview of the pressure responses in observation borehole KFM09A is shown. General test data from the observation section KFM09A, 0–300 m, are presented in Table 6-127. According to Table 3-1, the borehole is cased to 7.79 m. The uncased interval of this section is thus c. 8–300 m.

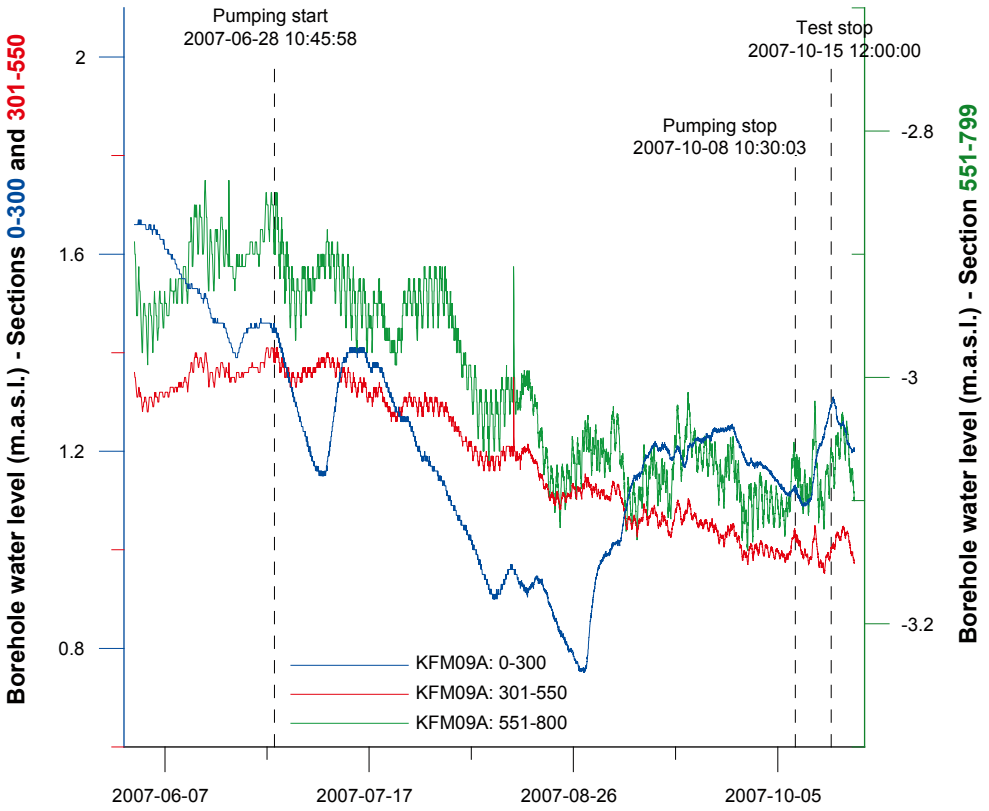


Figure 6-36. *Linear plot of pressure versus time in the observation sections in KFM09A during the interference test in HFM14. Make notice of the different axis scales.*

Table 6-127. General test data from the observation section KFM09A: 0–300 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	1.45
Hydraulic head in test section before stop of flow period	h_p	m	1.12
Hydraulic head in test section at stop of recovery period	h_F	m	1.29
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.33

Comments on the test

This section appears to be responding to the pumping in HFM14. A total drawdown of c. 0.3 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 8 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.128 Observation section KFM09A: 301–550 m

In Figure 6-36 an overview of the pressure responses in observation borehole KFM09A is shown. General test data from the observation section KFM09A, 301–550 m, are presented in Table 6-128.

Table 6-128. General test data from the observation section KFM09A: 301–550 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	1.39
Hydraulic head in test section before stop of flow period	h_p	m	1.03
Hydraulic head in test section at stop of recovery period	h_F	m	1.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.36

Comments on the test

Even though there are indications of a slight change of slope in the pressure trend in conjunction with the start of pumping, it is not possible to say with any certainty if this section is responding to the pumping in HFM14. There was a total drawdown of c. 0.4 m registered during the flow period.

6.2.129 Observation section KFM09A: 551–800 m

In Figure 6-36 an overview of the pressure responses in observation borehole KFM09A is shown. General test data from the observation section KFM09A, 551–800 m, are presented in Table 6-129.

Comments on the test

Even though there are indications of a slight change of slope in the pressure trend in conjunction with the start of pumping, it is not possible to say with any certainty if this section is responding to the pumping in HFM14. There was a total drawdown of c. 0.2 m registered during the flow period.

6.2.130 Observation section HFM28: 0–151 m

In Figure 6-37 an overview of the pressure responses in observation borehole HFM28 is shown. General test data from the observation section HFM28, 0–151 m, are presented in Table 6-130. According to Table 3-1, the borehole is cased to 12.03 m. The uncased interval of this section is thus c. 12–151 m.

Table 6-129. General test data from the observation section KFM09A: 551–800 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–2.88
Hydraulic head in test section before stop of flow period	h_p	m	–3.07
Hydraulic head in test section at stop of recovery period	h_F	m	–3.06
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.19

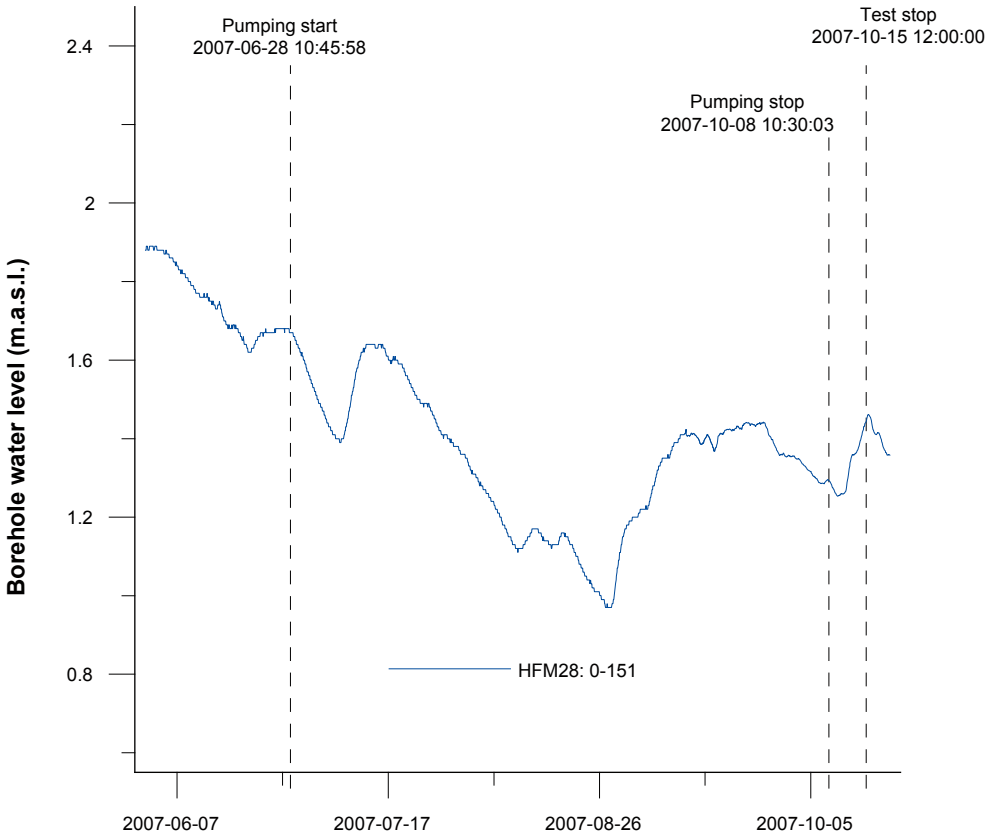


Figure 6-37. *Linear plot of pressure versus time in the observation section in HFM28 during the interference test in HFM14.*

Table 6-130. General test data from the observation section HFM28: 0–151 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.67
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.29
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	1.45
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.38

Comments on the test

This section is clearly influenced by the pumping in HFM14. A total drawdown of c. 0.4 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 14 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.131 Observation section HFM23: 0–212 m

In Figure 6-38 an overview of the pressure responses in observation borehole HFM23 is shown. General test data from the observation section HFM23, 0–212 m, are presented in Table 6-131. According to Table 3-1, the borehole is cased to 20.80 m. The uncased interval of this section is thus c. 21–212 m.

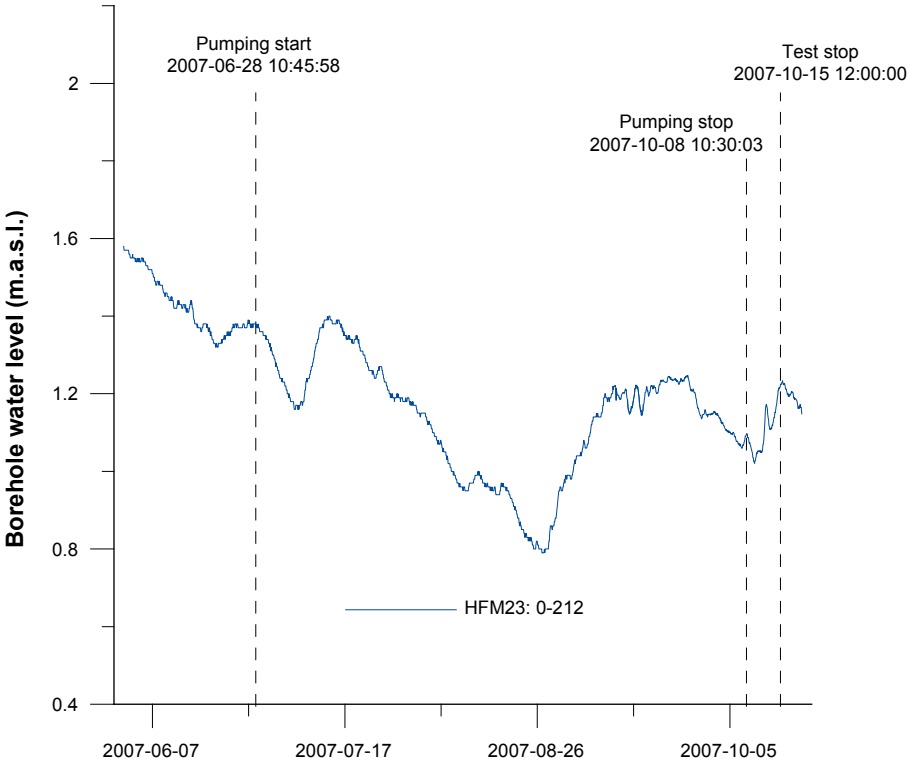


Figure 6-38. *Linear plot of pressure versus time in the observation section in HFM23 during the interference test in HFM14.*

Table 6-131. General test data from the observation section HFM23: 0–212 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.38
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.10
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	1.23
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.28

Comments on the test

There are indications that this section is responding to the pumping in HFM14. The pressure in the section is decreasing during some time prior to the start of pumping (but not immediately prior to the start of pumping), but the rate of change is visibly changing at the start of pumping, and later also after stop of pumping which is interpreted as an effect from the pumping. A total drawdown of c. 0.3 m was registered during the flow period and a drawdown of 0.01 m was reached approximately 14 hours after the pumping started in HFM14. The total measured recovery during the c. 7 days recovery period was about 0.1 m.

6.2.132 Observation section HFM38: 0–23 m

In Figure 6-39 an overview of the pressure responses in observation borehole HFM38 is shown. General test data from the observation section HFM38, 0–23 m, are presented in Table 6-132. According to Table 3-1, the borehole is cased to 9.05 m. The uncased interval of this section is thus c. 9–23 m.

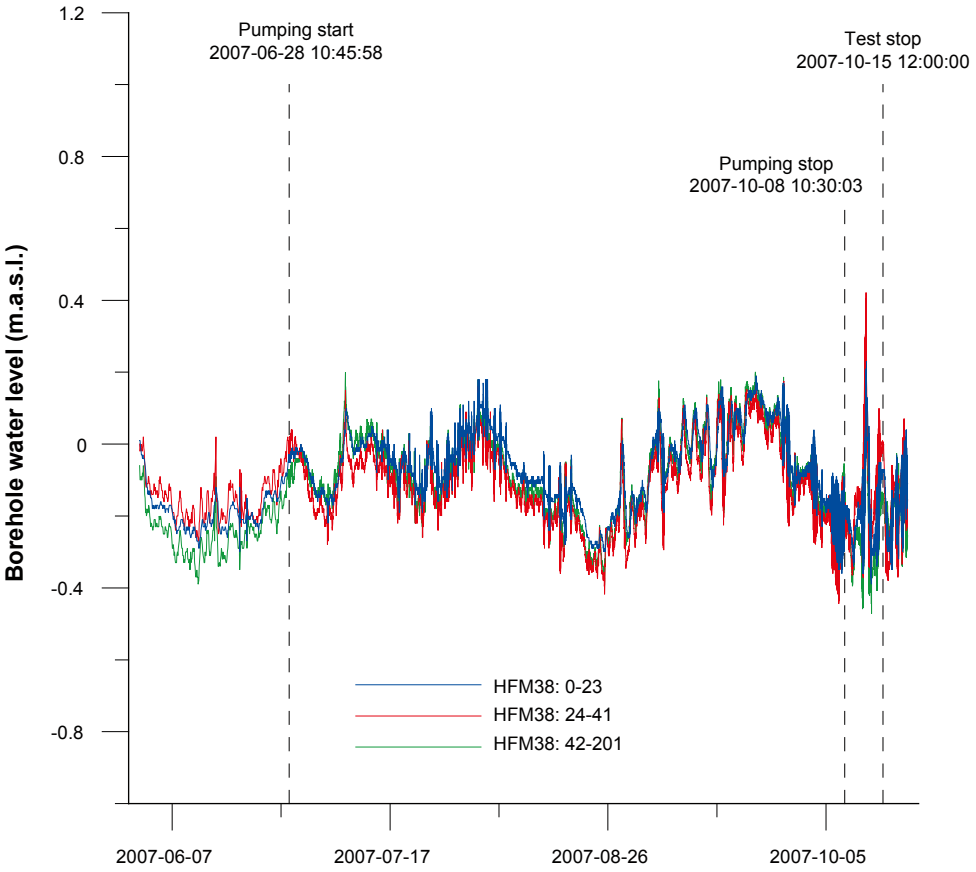


Figure 6-39. Linear plot of pressure versus time in the observation section in HFM38 during the interference test in HFM14.

Table 6-132. General test data from the observation section HFM38: 0–23 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.04
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.19
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.08
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.15

Comments on the test

Weak indications of a response to pumping were detected in this section. The total drawdown during the flow period was c. 0.1 m. A drawdown of 0.01 m was reached approximately 82 hours after the pumping started in HFM14. There was a pressure recovery of c. 0.1 m during the recovery period lasting for approximately 7 days. The fact that the pressure is flatting out in conjunction with the stop of pumping and the change in the pressure trend that seems to be connected with the start of pumping provide an indication of the presence of a hydraulic connection with the pumping borehole; even though it is not very strong.

6.2.133 Observation section HFM38: 24–41 m

In Figure 6-39 an overview of the pressure responses in observation borehole HFM38 is shown. General test data from the observation section HFM38, 24–41 m, are presented in Table 6-133.

Table 6-133. General test data from the observation section HFM38: 24–41 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.01
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.18
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.17

Comments on the test

Weak indications of a response to pumping were detected in this section. The total drawdown during the flow period was c. 0.2 m. A drawdown of 0.01 m was reached approximately 53 hours after the pumping started in HFM14. There was a pressure recovery of c. 0.2 m during the recovery period lasting for approximately 7 days. The fact that the pressure is flatting out in conjunction with the stop of pumping and the change in the pressure trend that seems to be connected with the start of pumping provide an indication of the presence of a hydraulic connection with the pumping borehole; even though it is not very strong.

6.2.134 Observation section HFM38: 42–201 m

In Figure 6-39 an overview of the pressure responses in observation borehole HFM38 is shown. General test data from the observation section HFM38, 42–201 m, are presented in Table 6-134.

Comments on the test

Weak indications of a response to pumping were detected in this section. The total drawdown during the flow period was c. 0.1 m. A drawdown of 0.01 m was reached approximately 86 hours after the pumping started in HFM14. The fact that the pressure is flatting out in conjunction with the stop of pumping and the change in the pressure trend that seems to be connected with the start of pumping provide an indication of the presence of a hydraulic connection with the pumping borehole; even though it is not very strong.

6.2.135 Observation section HFM29: 0–200 m

In Figure 6-40 an overview of the pressure responses in observation borehole HFM29 is shown. General test data from the observation section HFM29, 0–200 m, are presented in Table 6-135. According to Table 3-1, the borehole is cased to 9.03 m. The uncased interval of this section is thus c. 9–200 m.

Table 6-134. General test data from the observation section HFM38: 42–201 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.08
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.16
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.14
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.08

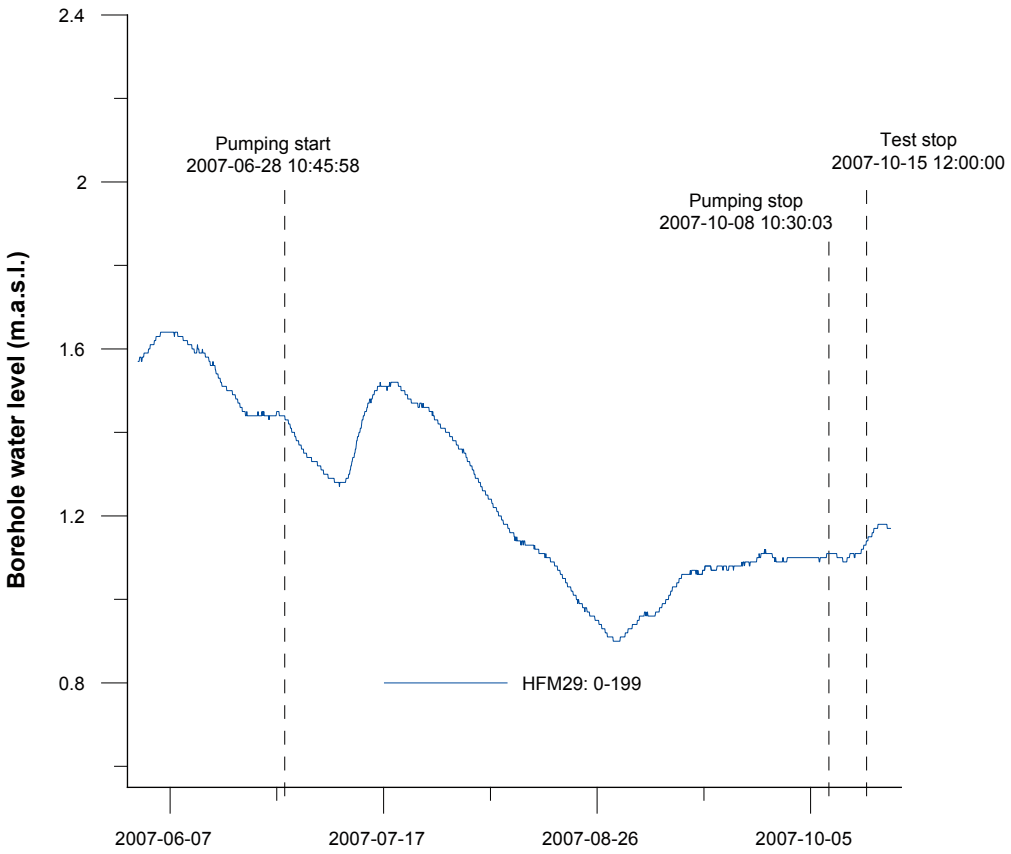


Figure 6-40. *Linear plot of pressure versus time in the observation section in HFM29 during the interference test in HFM14.*

Table 6-135. General test data from the observation section HFM29: 0–200 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	1.44
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	1.11
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	1.14
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.33

Comments on the test

Indications of a response to pumping were detected in this section. The total drawdown during the flow period was c. 0.3 m. A drawdown of 0.01 m was reached approximately 10 hours after the pumping started in HFM14. There was very little pressure recovery during the recovery period lasting for approximately 7 days.

6.2.136 Observation section HFM17: 0–211 m

In Figure 6-41 an overview of the pressure responses in observation borehole HFM17 is shown. General test data from the observation section HFM17, 0–211 m, are presented in Table 6-136. According to Table 3-1, the borehole is cased to 8.00 m. The uncased interval of this section is thus c. 8–211 m.

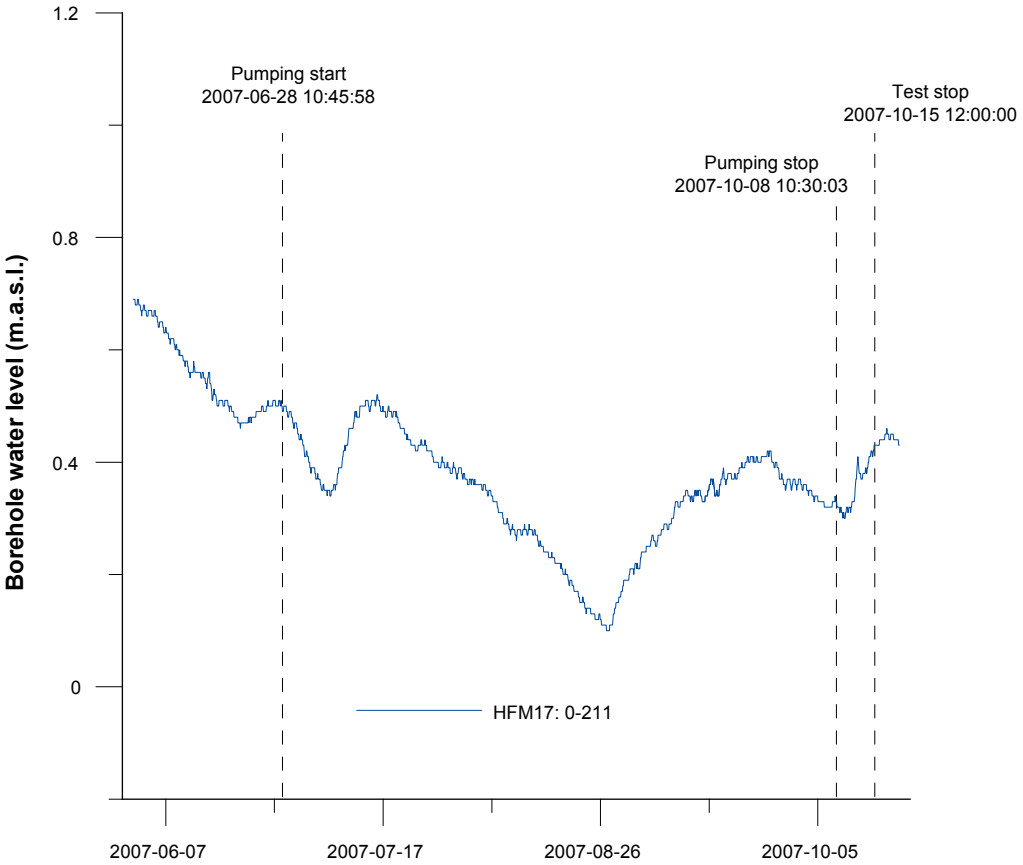


Figure 6-41. *Linear plot of pressure versus time in the observation section in HFM17 during the interference test in HFM14.*

Table 6-136. General test data from the observation section HFM17: 0–211 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.50
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.33
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.43
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.17

Comments on the test

Indications of a response to pumping were detected in this section. The total drawdown during the flow period was c. 0.2 m. A drawdown of 0.01 m was reached approximately 18 hours after the pumping started in HFM14. The pressure was decreasing already prior to the pump start (but not immediately prior to the start of pumping), but there is still a change in the slope of the pressure curve in connection with the start of pumping. There is also a recovery of c. 0.1 m measured during the recovery period that lasted for approximately 7 days.

6.2.137 Observation section KFM02B: 0–130 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 0–130 m, are presented in Table 6-137. According to Table 3-1, the borehole is cased to 86.60 m. The uncased interval of this section is thus c. 87–130 m.

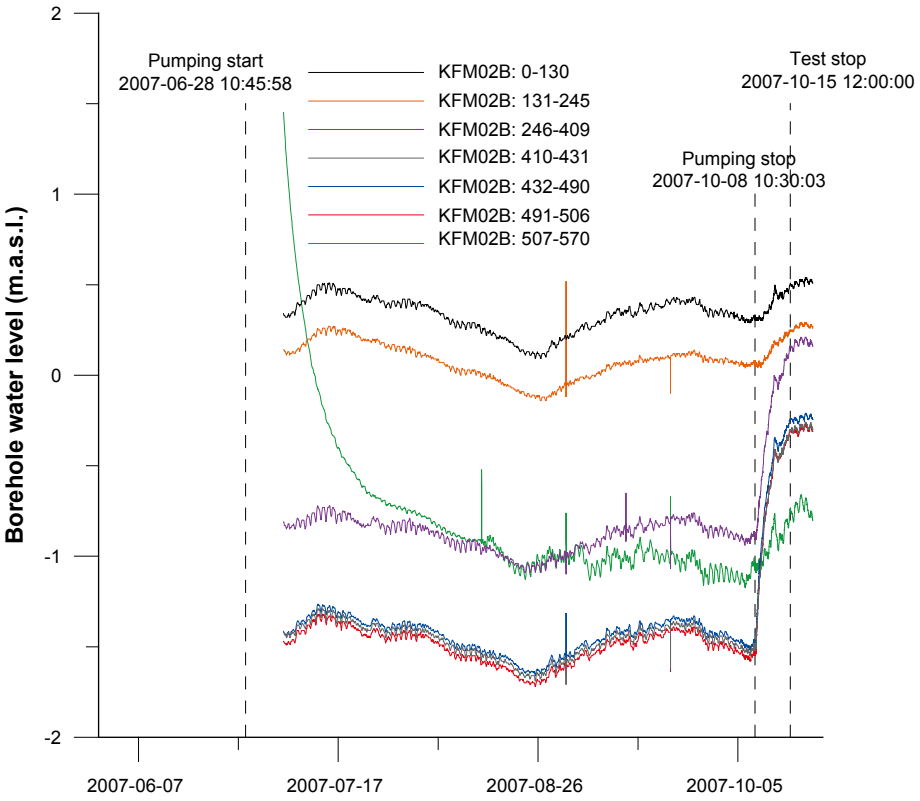


Figure 6-42. *Linear plot of pressure versus time in the observation sections in KFM02B during the interference test in HFM14.*

Table 6-137. General test data from the observation section KFM02B: 0–130 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.31
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.51
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from the recovery it is evident that this section is responding to the pumping in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.138 Observation section KFM02B: 131–245 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 131–245 m, are presented in Table 6-138.

Table 6-138. General test data from the observation section KFM02B: 131–245 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.06
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.25
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from the recovery it is evident that this section is responding to the pumping in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.139 Observation section KFM02B: 246–409 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 246–409 m, are presented in Table 6-139.

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from the recovery it is evident that this section is responding to the pumping in HFM14. There was a total recovery of c. 1.1 m during the recovery period that lasted for approximately 7 days.

6.2.140 Observation section KFM02B: 410–431 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 410–431 m, are presented in Table 6-140.

Table 6-139. General test data from the observation section KFM02B: 246–409 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.90
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.16
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-140. General test data from the observation section KFM02B: 410–431 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.51
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.30
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from the recovery it is evident that this section is responding to the pumping in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.141 Observation section KFM02B: 432–490 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 432–490 m, are presented in Table 6-141.

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from the recovery it is evident that this section is responding to the pumping in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.142 Observation section KFM02B: 491–506 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 491–506 m, are presented in Table 6-142.

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from the recovery it is evident that this section is responding to the pumping in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

Table 6-141. General test data from the observation section KFM02B: 432–490 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.48
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.25
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-142. General test data from the observation section KFM02B: 491–506 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.54
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.31
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

6.2.143 Observation section KFM02B: 507–570 m

In Figure 6-42 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 507–570 m, are presented in Table 6-143.

Comments on the test

There are no data available for this section until the 6th of July. The drawdown can thus not be estimated. Still, from inspection of the pressure curve, especially when looking at the part of the recovery, it seems likely that the section is reacting in a similar way as the other deep sections and responding to the pumping in HFM14. There was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

6.2.144 Observation section KFM02A: 0–132 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 0–132 m, are presented in Table 6-144. According to Table 3-1, the borehole is cased to 11.80 m. The uncased interval of this section is thus c. 12–132 m.

Comments on the test

A relatively clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 0.3 m. A drawdown of 0.01 m was reached approximately 40 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.145 Observation section KFM02A: 133–240 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 133–240 m, are presented in Table 6-145.

Table 6-143. General test data from the observation section KFM02B: 507–570 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.05
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.74
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-144. General test data from the observation section KFM02A: 0–132 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.60
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.32
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.50
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.28

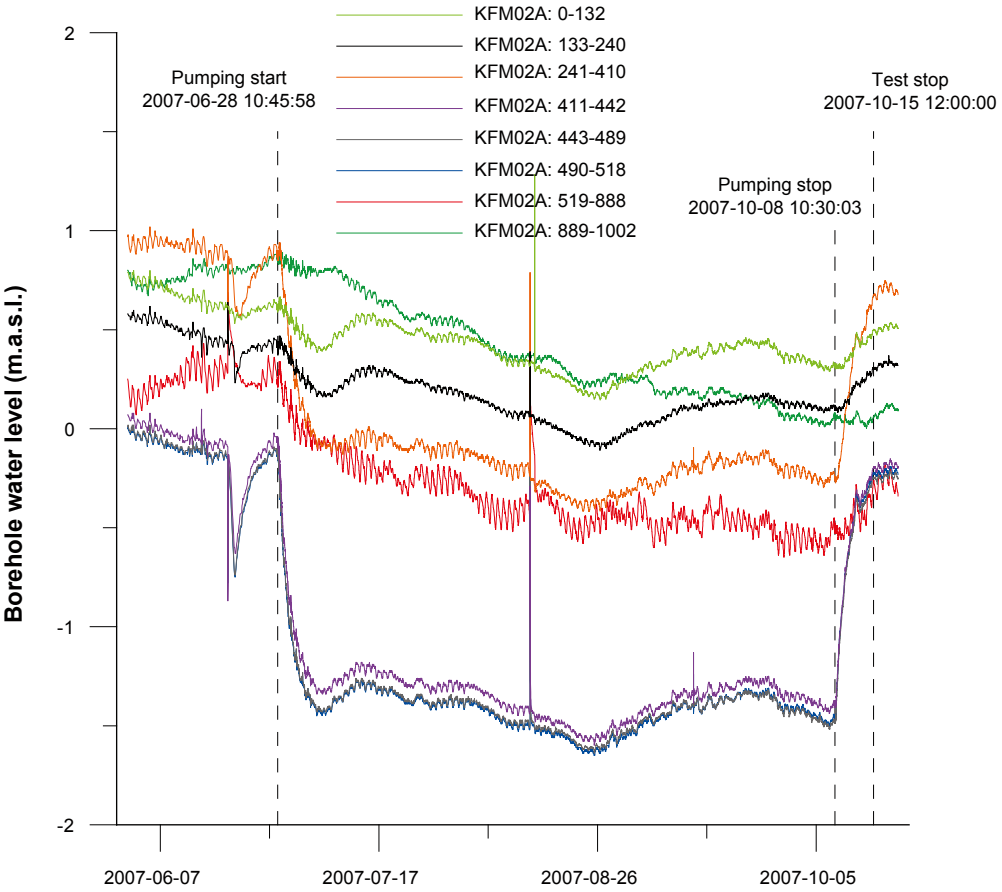


Figure 6-43. *Linear plot of pressure versus time in the observation sections in KFM02A during the interference test in HFM14.*

Table 6-145. General test data from the observation section KFM02A: 133–240 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.42
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.10
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.31
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.32

Comments on the test

A relatively clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 0.3 m. A drawdown of 0.01 m was reached approximately 22 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.146 Observation section KFM02A: 241–410 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 241–410 m, are presented in Table 6-146.

Table 6-146. General test data from the observation section KFM02A: 241–410 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.87
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.25
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.68
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.12

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 1.1 m. A drawdown of 0.01 m was reached approximately 16 hours after the pumping started in HFM14. There was a total recovery of c. 0.9 m during the recovery period that lasted for approximately 7 days.

6.2.147 Observation section KFM02A: 411–442 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 411–442 m, are presented in Table 6-147.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 1.3 m. A drawdown of 0.01 m was reached approximately 114 minutes after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.148 Observation section KFM02A: 443–489 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 443–489 m, are presented in Table 6-148.

Table 6-147. General test data from the observation section KFM02A: 411–442 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.06
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.40
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.19
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.34

Table 6-148. General test data from the observation section KFM02A: 443–489 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.12
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.48
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.25
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.36

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 1.4 m. A drawdown of 0.01 m was reached approximately 131 minutes after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.149 Observation section KFM02A: 490–518 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 490–518 m, are presented in Table 6-149.

Comments on the test

A clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 1.3 m. A drawdown of 0.01 m was reached approximately 44 minutes after the pumping started in HFM14. There was a total recovery of c. 1.2 m during the recovery period that lasted for approximately 7 days.

6.2.150 Observation section KFM02A: 519–888 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 519–888 m, are presented in Table 6-150.

Comments on the test

A relatively clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 0.7 m. A drawdown of 0.01 m was reached approximately 19 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

Table 6-149. General test data from the observation section KFM02A: 490–518 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.12
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.46
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.22
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.34

Table 6-150. General test data from the observation section KFM02A: 519–888 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.23
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.50
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.27
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.73

6.2.151 Observation section KFM02A: 889–1,002 m

In Figure 6-43 an overview of the pressure responses in observation borehole KFM02A is shown. General test data from the observation section KFM02A, 889–1,002 m, are presented in Table 6-151.

Comments on the test

This section is not responding as clearly as the other sections of this borehole. There is a definite change in the trend of the pressure at the start and stop of pumping which is still interpreted as some sort of response. The total drawdown during the flow period was c. 0.8 m. A drawdown of 0.01 m was reached approximately 45 hours after the pumping started in HFM14 and there was a total recovery of c. 0.01 m during the recovery period that lasted for approximately 7 days.

6.2.152 Observation section HFM05: 0–138 m

In Figure 6-44 an overview of the pressure responses in observation borehole HFM05 is shown. General test data from the observation section HFM05, 0–138 m, are presented in Table 6-152. According to Table 3-1, the borehole is cased to 11.87 m. The uncased interval of this section is thus c. 12–138 m.

Comments on the test

There are no data from the start of pumping in this section. An estimate of drawdown can thus not be performed. When looking at the recovery however, this section appears to be clearly affected by the pumping even though not so strongly. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.153 Observation section HFM05: 139–200 m

In Figure 6-44 an overview of the pressure responses in observation borehole HFM05 is shown. General test data from the observation section HFM05, 139–200 m, are presented in Table 6-153.

Table 6-151. General test data from the observation section KFM02A: 889–1,002 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.86
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.07
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.06
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.79

Table 6-152. General test data from the observation section HFM05: 0–138 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.40
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.55
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

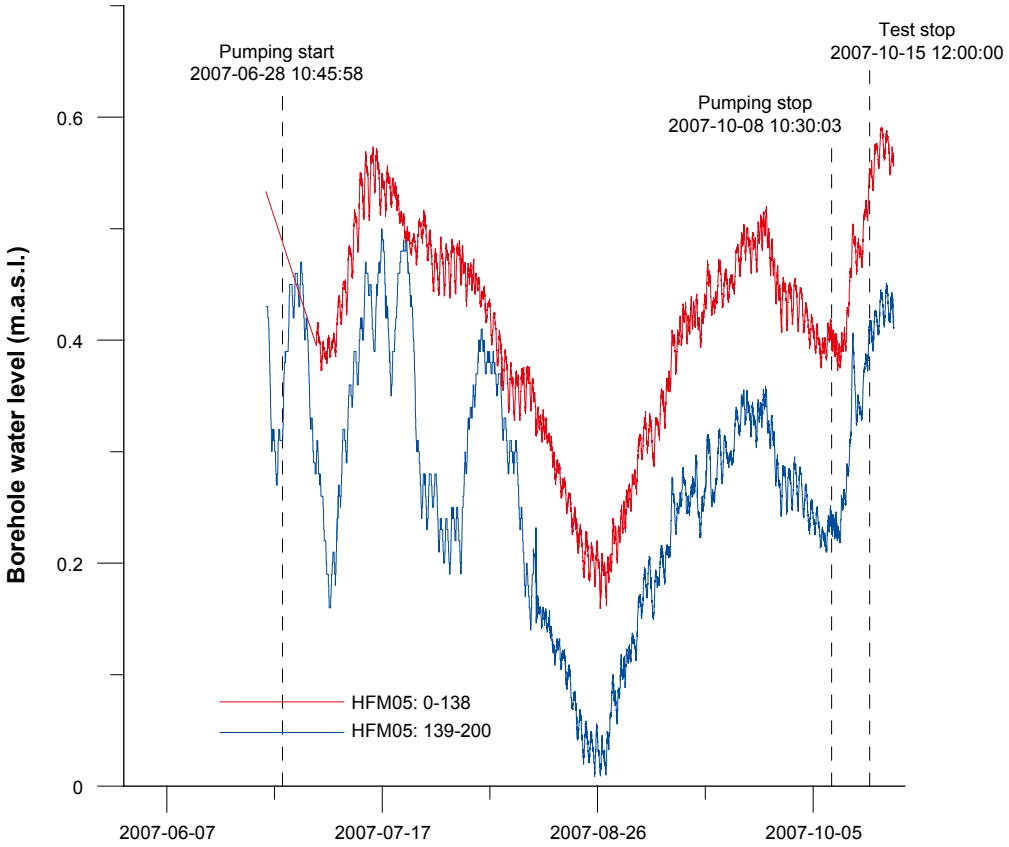


Figure 6-44. *Linear plot of pressure versus time in the observation sections in HFM05 during the interference test in HFM14.*

Table 6-153. General test data from the observation section HFM05: 139–200 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.31
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.24
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.42
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.07

Comments on the test

The data from this section display a very erratic behaviour. When looking at the recovery however, this section appears to be clearly affected by the pumping even though not so strongly. The total drawdown during the flow period was c. 0.1 m and there was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.154 Observation section HFM33: 0–140 m

In Figure 6-45 an overview of the pressure responses in observation borehole HFM33 is shown. General test data from the observation section HFM33, 0–140 m, are presented in Table 6-154. According to Table 3-1, the borehole is cased to 12.04 m. The uncased interval of this section is thus c. 12–140 m.

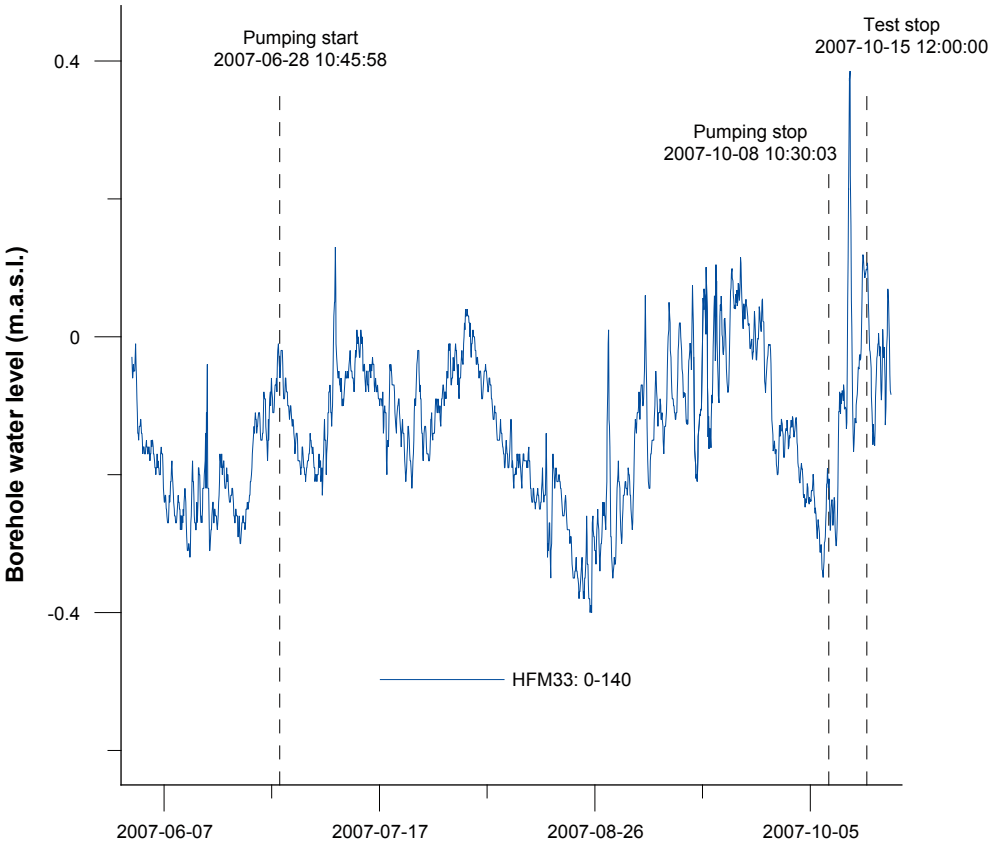


Figure 6-45. *Linear plot of pressure versus time in the observation section in HFM33 during the interference test in HFM14.*

Table 6-154. General test data from the observation section HFM33: 0–140 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.02
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.21
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.10
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.19

Comments on the test

This section may be affected by the pumping in HFM14. There is a distinct change of slope in the pressure curve at the start of pumping and the pressure appears to rise as an effect of turning off the pump. The effect is not very strong though and when looking at the overall appearance of the pressure curve it gives the impression of a non-responding section. Still, the total drawdown during the flow period was c. 0.2 m. A drawdown of 0.01 m was reached approximately 14 hours after the pumping started in HFM14 and there was a total recovery of c. 0.3 m during the recovery period that lasted for approximately 7 days.

6.2.155 Observation section HFM04: 0–57 m

In Figure 6-46 an overview of the pressure responses in observation borehole HFM04 is shown. General test data from the observation section HFM04, 0–57 m, are presented in Table 6-155. According to Table 3-1, the borehole is cased to 12.12 m. The uncased interval of this section is thus c. 12–57 m.

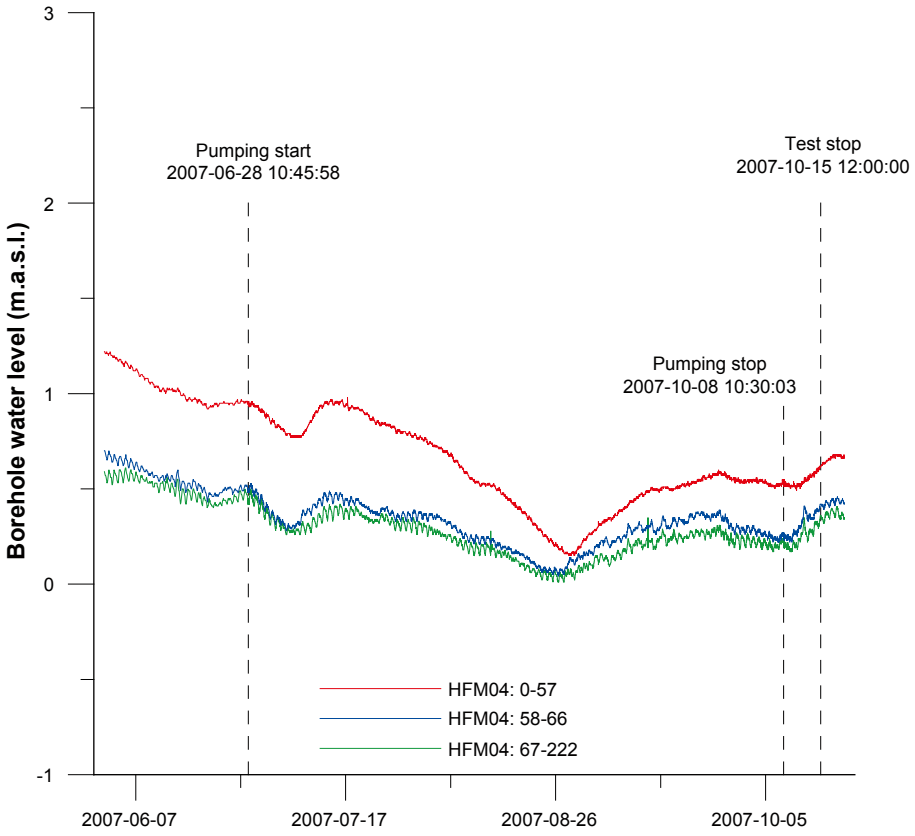


Figure 6-46. *Linear plot of pressure versus time in the observation sections in HFM04 during the interference test in HFM14.*

Table 6-155. General test data from the observation section HFM04: 0–57 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.96
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.54
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.62
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.42

Comments on the test

This section is relatively clearly influenced by the pumping in HFM14. There are signs of responses especially at the times of start and stop of pumping. The total drawdown during the flow period was c. 0.4 m. A drawdown of 0.01 m was reached approximately 20 hours after the pumping started in HFM14. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.156 Observation section HFM04: 58–66 m

In Figure 6-46 an overview of the pressure responses in observation borehole HFM04 is shown. General test data from the observation section HFM04, 58–66 m, are presented in Table 6-156.

Table 6-156. General test data from the observation section HFM04: 58–66 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.49
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.25
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.42
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.24

Comments on the test

A relatively clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 0.2 m and a drawdown of 0.01 m was reached approximately 39 hours after the pumping started in HFM14. There was a total recovery of c. 0.2 m during the recovery period that lasted for approximately 7 days.

6.2.157 Observation section HFM04: 67–222 m

In Figure 6-46 an overview of the pressure responses in observation borehole HFM04 is shown. General test data from the observation section HFM04, 67–222 m, are presented in Table 6-157.

Comments on the test

A relatively clear response to pumping was recorded in this section. The total drawdown during the flow period was c. 0.2 m and a drawdown of 0.01 m was reached approximately 45 hours after the pumping started in HFM14. There was a total recovery of c. 0.1 m during the recovery period that lasted for approximately 7 days.

6.2.158 Observation section HFM12: 0–56.5 m

In Figure 6-47 an overview of the pressure responses in observation borehole HFM12 is shown. General test data from the observation section HFM12, 0–56.5 m, are presented in Table 6-158. According to Table 3-1, the borehole is cased to 14.90 m. The uncased interval of this section is thus c. 15–57 m.

Comments on the test

The pressure data from this observation section are a little noisy. However, it seems this section is responding to pumping. It is not a very strong response but the pressure curve is clearly changing slope at both start and stop of pumping. There was only a slight total drawdown, less than 0.1 m, during the flow period but a drawdown of 0.01 m was reached approximately 20 hours after the pumping started in HFM14. The recovery was also less than 0.1 m during the recovery period that lasted for approximately 7 days.

Table 6-157. General test data from the observation section HFM04: 67–222 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.43
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.22
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.36
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.21

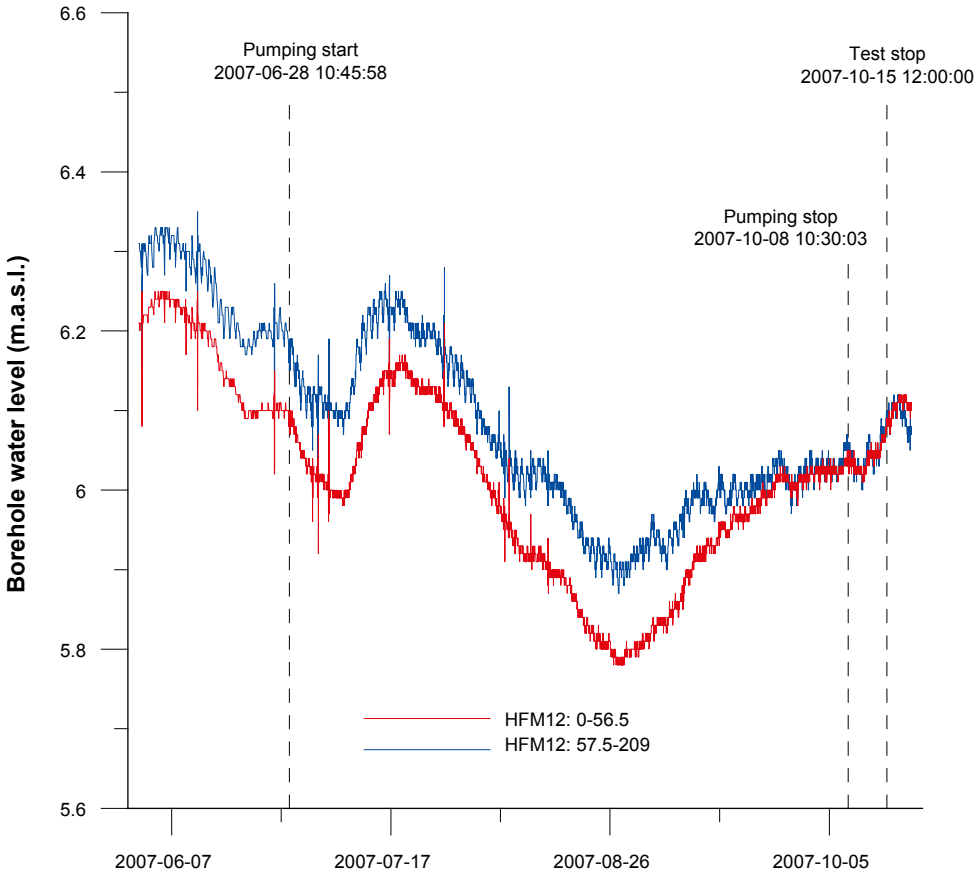


Figure 6-47. *Linear plot of pressure versus time in the observation sections in HFM12 during the interference test in HFM14.*

Table 6-158. General test data from the observation section HFM12: 0–56.5 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	6.09
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	6.05
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	6.08
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.04

6.2.159 Observation section HFM12: 57.5–210 m

In Figure 6-47 an overview of the pressure responses in observation borehole HFM12 is shown. General test data from the observation section HFM12, 57.5–210 m, are presented in Table 6-159.

Comments on the test

The response in this section is very similar to that of section 0–56.5 m. The data are a little noisy but it seems also this section is responding to pumping. It is not a very strong response but the pressure curve is clearly changing slope at both start and stop of pumping. There was a total drawdown of about 0.1 m, during the flow period and a drawdown of 0.01 m was reached approximately 21 hours after the pumping started in HFM14. The recovery was less than 0.1 m during the recovery period that lasted for approximately 7 days.

Table 6-159. General test data from the observation section HFM12: 57.5–210 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	6.17
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	6.05
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	6.09
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.12

6.2.160 Observation section KFM11A: 0–130 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 0–130 m, are presented in Table 6-160. According to Table 3-1, the borehole is cased to 70.77 m. The uncased interval of this section is thus c. 71–130 m.

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days.

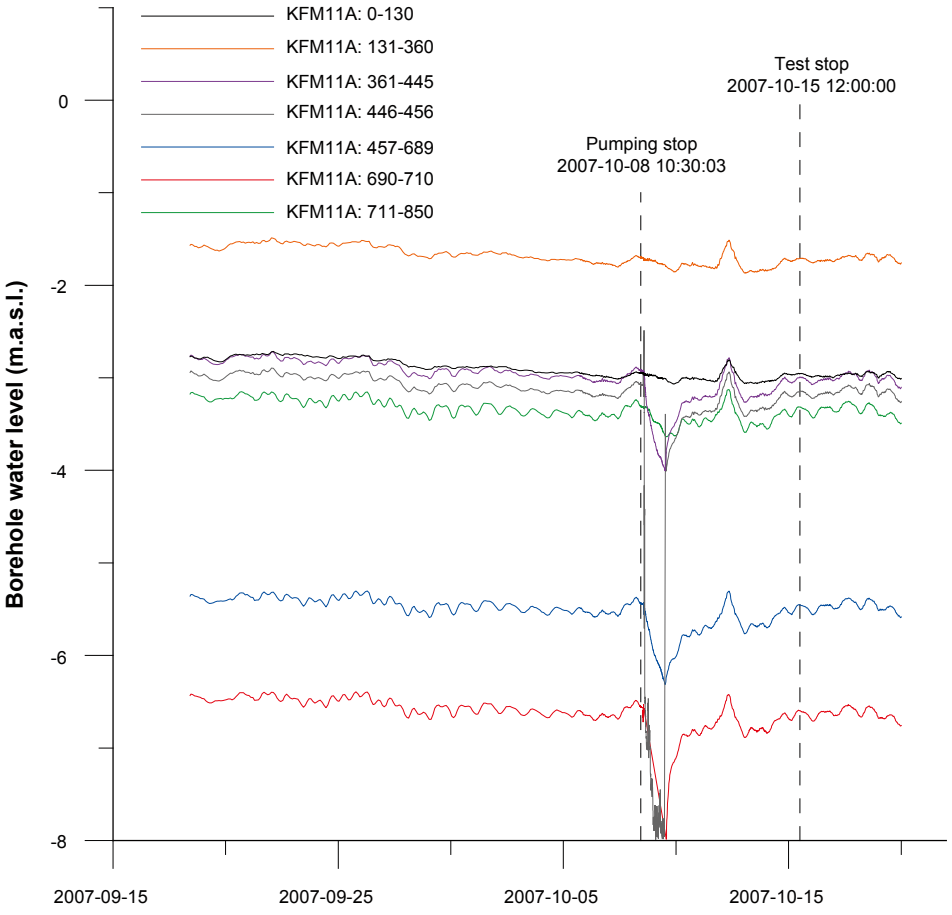


Figure 6-48. *Linear plot of pressure versus time in the observation sections in KFM11A during the interference test in HFM14. Make notice that the time scale is different than in other diagrams, the start of pumping is not included.*

Table 6-160. General test data from the observation section KFM11A: 0–130 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.95
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–2.95
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

6.2.161 Observation section KFM11A: 131–360 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 131–360 m, are presented in Table 6-161.

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days.

6.2.162 Observation section KFM11A: 361–445 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 361–445 m, are presented in Table 6-162.

Table 6-161. General test data from the observation section KFM11A: 131–360 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.71
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–1.70
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-162. General test data from the observation section KFM11A: 361–445 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.92
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–2.99
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days. At about the time of pumping stop something occurs which causes the pressure to drop instantaneously for unknown reasons. This may be the reason that the pressure appears to rise during the recovery period and this would make the apparent pressure recovery a fictitious one.

6.2.163 Observation section KFM11A: 446–456 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 446–456 m, are presented in Table 6-163.

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days. At about the time of pumping stop something occurs which causes the pressure to drop instantaneously for unknown reasons. This may be the reason that the pressure appears to rise during the recovery period and this would make the apparent pressure recovery a fictitious one.

6.2.164 Observation section KFM11A: 457–689 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 457–689 m, are presented in Table 6-164.

Table 6-163. General test data from the observation section KFM11A: 446–456 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–3.08
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–3.14
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-164. General test data from the observation section KFM11A: 457–689 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.44
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–5.45
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days. At about the time of pumping stop something occurs which causes the pressure to drop instantaneously for unknown reasons. This may be the reason that the pressure appears to rise during the recovery period and this would make the apparent pressure recovery a fictitious one.

6.2.165 Observation section KFM11A: 690–710 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 690–710 m, are presented in Table 6-165.

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days. At about the time of pumping stop something occurs which causes the pressure to drop instantaneously for unknown reasons. This may be the reason that the pressure appears to rise during the recovery period and this would make the apparent pressure recovery a fictitious one.

6.2.166 Observation section KFM11A: 711–850 m

In Figure 6-48 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 711–850 m, are presented in Table 6-166.

Table 6-165. General test data from the observation section KFM11A: 690–710 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–6.56
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–6.60
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-166. General test data from the observation section KFM11A: 711–850 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–3.31
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–3.31
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Comments on the test

There are no pressure data available from this section before the 18th of September. This makes the estimation of drawdown impossible. From inspection of the pressure curve it is not evident that this section is affected by the pumping in HFM14. There appears, however, to be a very slight change of slope in conjunction with the start of recovery even though there is no measured recovery during the recovery period lasting for approximately 7 days. At about the time of pumping stop something occurs which causes the pressure to drop instantaneously for unknown reasons. This may be the reason that the pressure appears to rise during the recovery period and this would make the apparent pressure recovery a fictitious one.

6.2.167 Observation section HFM11: 0–53 m

In Figure 6-49 an overview of the pressure responses in observation borehole HFM11 is shown. General test data from the observation section HFM11, 0–53 m, are presented in Table 6-167. According to Table 3-1, the borehole is cased to 11.90 m. The uncased interval of this section is thus c. 12–53 m.

Comments on the test

The pressure prior to pumping start displays a decreasing trend making it hard to say anything about the possible response in this section. The registered total drawdown is less than 0.1 m. The pressure is rising in conjunction with the start of the recovery period, indicating that there may be a weak hydraulic connection with HFM14. There is a total pressure recovery of about 0.1 m during the recovery period lasting for approximately 7 days.

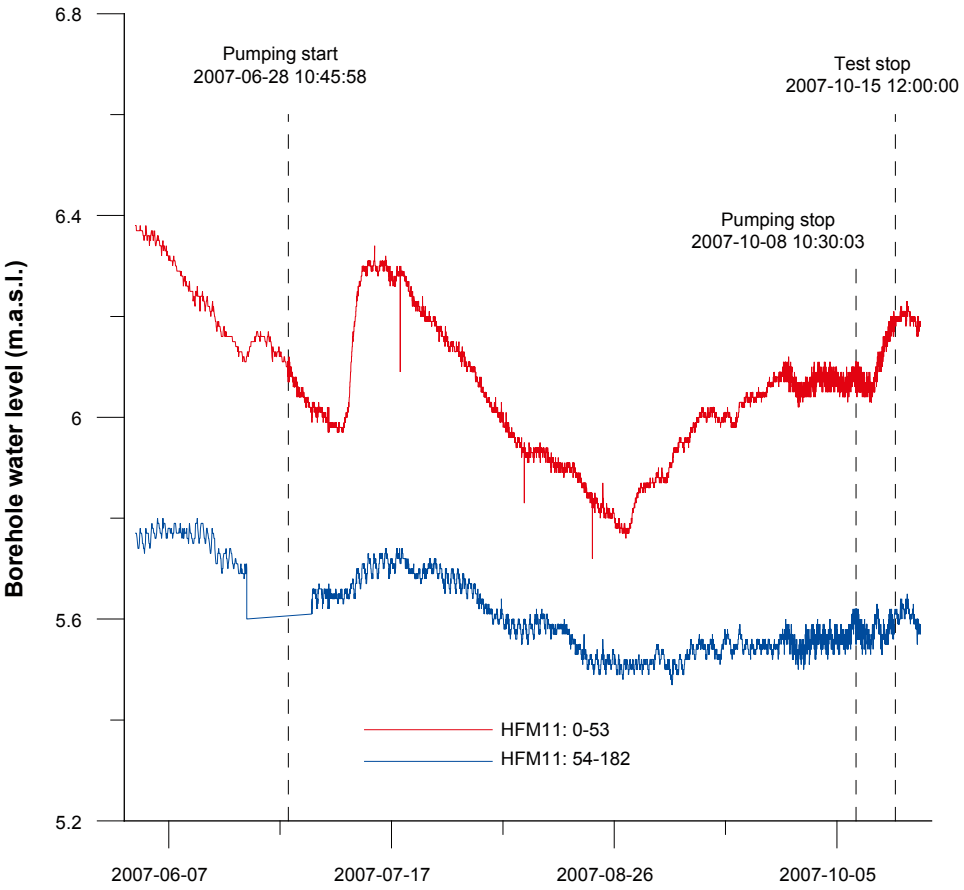


Figure 6-49. *Linear plot of pressure versus time in the observation sections in HFM11 during the interference test in HFM14.*

Table 6-167. General test data from the observation section HFM11: 0–53 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	6.10
Hydraulic head in test section before stop of flow period	h_p	m	6.06
Hydraulic head in test section at stop of recovery period	h_F	m	6.20
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.04

6.2.168 Observation section HFM11: 54–182 m

In Figure 6-49 an overview of the pressure responses in observation borehole HFM11 is shown. General test data from the observation section HFM11, 54–182 m, are presented in Table 6-168.

Comments on the test

There are data missing in this section from the time of pump start. There are no indications in the available data that this section is responding to the pumping in HFM14.

6.2.169 Observation section HFM18: 0–27 m

In Figure 6-50 an overview of the pressure responses in observation borehole HFM18 is shown. General test data from the observation section HFM18, 0–27 m, are presented in Table 6-169. According to Table 3-1, the borehole is cased to 9.00 m. The uncased interval of this section is thus c. 9–27 m.

Comments on the test

This section is probably not affected by the pumping in HFM14.

Table 6-168. General test data from the observation section HFM11: 54–182 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m	–
Hydraulic head in test section before stop of flow period	h_p	m	5.59
Hydraulic head in test section at stop of recovery period	h_F	m	5.61
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–

Table 6-169. General test data from the observation section HFM18: 0–27 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.11
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.19
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.28
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.08

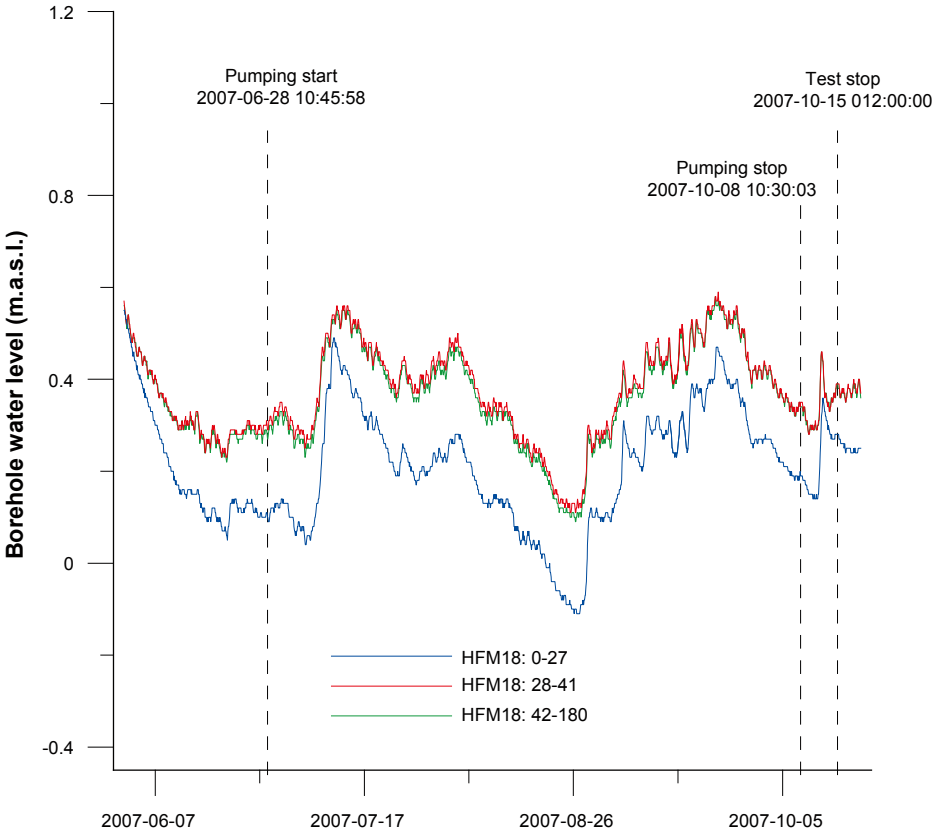


Figure 6-50. *Linear plot of pressure versus time in the observation sections in HFM18 during the interference test in HFM14.*

6.2.170 Observation section HFM18: 28–41 m

In Figure 6-50 an overview of the pressure responses in observation borehole HFM18 is shown. General test data from the observation section HFM18, 28–41 m, are presented in Table 6-170.

Comments on the test

This section is probably not affected by the pumping in HFM14.

6.2.171 Observation section HFM18: 42–180 m

In Figure 6-50 an overview of the pressure responses in observation borehole HFM18 is shown. General test data from the observation section HFM18, 42–180 m, are presented in Table 6-171.

Comments on the test

This section is probably not affected by the pumping in HFM14.

Table 6-170. General test data from the observation section HFM18: 28–41 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.30
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.35
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.39
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.05

Table 6-171. General test data from the observation section HFM18: 42–180 m during the interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.28
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.34
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.39
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.06

6.3 Interference test 2 in HFM14

The start and stop of pumping occurred on November 27 and December 13, respectively. The test stop is regarded at December 20th.

This test was performed mainly so that two boreholes, KFM08A and KFM08D which were not yet installed with monitoring equipment at the time of the first interference test, could be included in the response analysis in this report. Even though it is actually two separate tests, the pumping borehole is the same (HFM14) and the flow rate was also very similar in the two tests. This makes the comparison possible and plausible even though it is important to make the distinction between the two tests.

Since this test was added late in the process of writing this report, not all aspects of the analysis have been addressed. This must be regarded as a light version of evaluation for the sole purpose of getting plausible comparative data for the response analysis.

During the interference test the pressure was registered in the KFM08A and KFM08D. The pressure responses in all monitored observation sections are presented in Figures 6-52 and 6-53. All observation boreholes included in the test and their approximate distances to the pumping borehole HFM14 are marked in Figure 1-1.

The measured drawdown (s_p) at the end of the flow period and the estimated response time lag (dt_L) in all of the observation sections (test 1 and 2) are shown in Tables 6-203 and 6-204, respectively. The response time is defined as the time lag after start of pumping until a drawdown response of 0.01 m was observed in the actual observation section.

Just prior to the printing of this report, also boreholes KFM11A and KFM02B were included in this test. These boreholes were also not installed with monitoring equipment at the time of pumping start for the first interference test. Partial data were available from KFM02B, but not from the entire first test. KFM11A and KFM02B were, however, not intended to be included in the second interference test when the test performance was planned. As a result the HMS logging intervals for these boreholes were not adjusted prior to the start of pumping. This is important especially when it comes to the response analysis where the time to reach a 0.01 m drawdown plays an important part. The time resolution for these two boreholes is as large as 2 hours, which makes the comparison to responses in other boreholes somewhat precarious. It turned out, KFM11A did not respond at all to the pumping, which makes the caution unnecessary for that borehole. Several sections of KFM02A did, however, respond.

All pressure data presented in this report have been corrected for atmospheric pressure changes by subtracting the latter pressure from the measured (absolute) pressure. This is also true for the data received from the HMS. It should be observed that no further corrections of the measured drawdown have been made, e.g. due to natural trends, precipitation, tidal effects etc, as discussed below. All times presented are Swedish normal times (winter time).

No reports of meteorological conditions have been assembled for the time of this test.

No transient evaluation of the pressure responses in the pumping borehole or the observation sections have been performed for this test.

6.3.1 Pumping borehole HFM14: 0–150 m, second pumping

General test data for the pumping test in HFM14 are presented in Table 6-172. According to Table 3-1, the borehole is cased to 6.0 m. The uncased interval of this section is thus c. 6–150 m.

Table 6-172. General test data for the second pumping test in HFM14: 0–150 m.

General test data **Pumping borehole**	**HFM14**		
Test type[1)]	Constant Rate withdrawal and recovery test		
Test section (open borehole/packed-off section):	open borehole		
Test No	2		
Field crew	(GEOSIGMA AB)		
Test equipment system			
General comment	Interference test		
	Nomenclature	**Unit**	**Value**
Borehole length	L	m	150.50
Casing length	L_c	m	6.00
Test section- secup	Secup	m	6.00
Test section- seclow	Seclow	m	150.50
Test section length	L_w	m	144.50
Test section diameter[2)]	$2 \cdot r_w$	mm	136–138
Test start (start of pressure registration)		yymmdd hh:mm	071127 08:45
Packer expanded		yymmdd hh:mm:ss	
Start of flow period		yymmdd hh:mm:ss	071127 09:20:19
Stop of flow period		yymmdd hh:mm:ss	071213 09:08:10
Test stop (stop of pressure registration)		yymmdd hh:mm	071220 06:00:00
Total flow time	t_p	min	23,028
Total recovery time	t_F	min	9,892

Pressure data			
Relative pressure in test section before start of flow period	p_i	kPa	170.70
Relative pressure in test section before stop of flow period	p_p	kPa	58.83
Relative pressure in test section at stop of recovery period	p_F	kPa	172.02
Pressure change during flow period (p_i–p_p)	dp_p	kPa	111.87

Flow data			
Flow rate from test section just before stop of flow period	Q_p	m^3/s	0.00582
Mean (arithmetic) flow rate during flow period	Q_m	m^3/s	0.00576
Total volume discharged during flow period	V_p	m^3	7,962

Manual groundwater level measurements in HFM14 (6.0–150.5 m)			**GW level**	
Date **YYYY-MM-DD**	**Time** **tt:mm**	**Time** **(min)**	**(m b ToC)**	**(m.a.s.l.)**
2007-10-25	10:48	–47,397	4.16	0.32
2007-11-26	12:27	–1,218	3.75	0.67

[1)] Constant Head injection and recovery or Constant Rate withdrawal and recovery

[2)] Nominal diameter

Comments on the test

The test was performed as a constant-flow rate pumping test. The mean flow rate was c. 346 L/min and the duration of the flow period was c. 16 days. An approximately constant flow rate was reached within minutes after the start of pumping. For reasons not known the flow rate suddenly drops on the knight before the 29th of November. The flow is manually set back to the intended flow rate on the 30th of November. On one more occasion another small adjustment was made to regulate the flow rate during the run of the test, as can be observed in Figure 6-51. Small natural changes in pressure or flow rate can also be identified during the entire flow period. The final drawdown in HFM14 was approximately 11 m. The pressure recovery was measured for about 7 days. Overviews of the flow rate and pressure responses in HFM14 are presented in Figure 6-51.

Interpreted flow regimes

No transient evaluation has been performed for this borehole.

Interpreted parameters

No transient evaluation has been performed for this borehole.

6.3.2 Observation section KFM08D: 0–160 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 0–160 m, are presented in Table 6-173. According to Table 3-1, the borehole is cased to 58.80 m. The uncased interval of this section is thus c. 59–160 m.

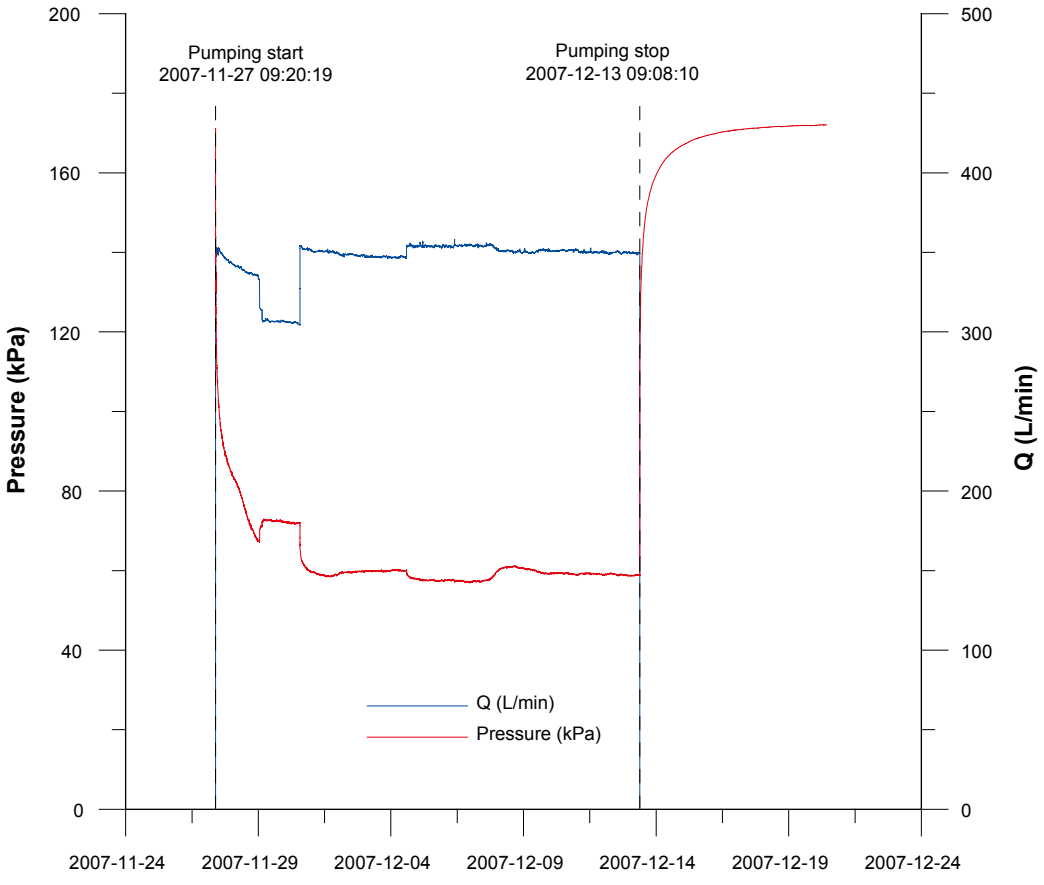


Figure 6-51. *Linear plot of flow rate and pressure versus time in the pumping borehole HFM14 during the second interference test in HFM14.*

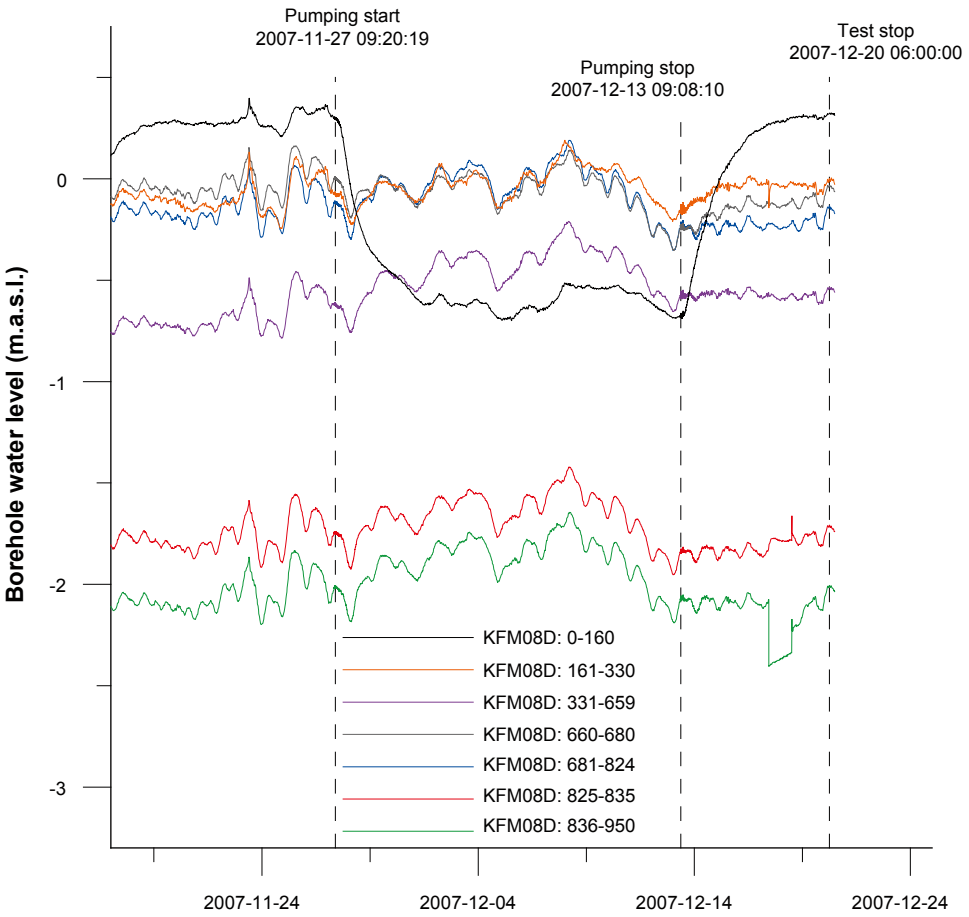


Figure 6-52. *Linear plot of pressure versus time in the observation sections in KFM08D during the second interference test in HFM14.*

Table 6-173. General test data from the observation section KFM08D: 0–160 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.30
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.68
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.32
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.97

Comments on the test

This section is clearly affected by the pumping in HFM14. The total drawdown during the flow period was c. 1.0 m. A drawdown of 0.01 m was reached approximately 199 minutes after start of pumping in HFM14. There was a total recovery of c. 1.0 m during the recovery period lasting for approximately 7 days.

6.3.3 Observation section KFM08D: 161–330 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 161–330 m, are presented in Table 6-174.

Table 6-174. General test data from the observation section KFM08D: 161–330 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.07
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.15
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.08

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.4 Observation section KFM08D: 331–659 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 331–659 m, are presented in Table 6-175.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.5 Observation section KFM08D: 660–680 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 660–680 m, are presented in Table 6-176.

Table 6-175. General test data from the observation section KFM08D: 331–659 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.62
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.58
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.54
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.05

Table 6-176. General test data from the observation section KFM08D: 660–680 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.00
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.24
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.03
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.24

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.6 Observation section KFM08D: 681–824 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 681–824 m, are presented in Table 6-177.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.7 Observation section KFM08D: 825–835 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 825–835 m, are presented in Table 6-178.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.8 Observation section KFM08D: 836–950 m

In Figure 6-52 an overview of the pressure responses in observation borehole KFM08D is shown. General test data from the observation section KFM08D, 836–950 m, are presented in Table 6-179.

Table 6-177. General test data from the observation section KFM08D: 681–824 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.11
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.23
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.13
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.11

Table 6-178. General test data from the observation section KFM08D: 825–835 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–1.74
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.84
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–1.71
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.10

Table 6-179. General test data from the observation section KFM08D: 836–950 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–2.01
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.07
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–2.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.06

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.9 Observation section KFM08A: 0–161 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 0–160 m, are presented in Table 6-180. According to Table 3-1, the borehole is cased to 100.20 m. The uncased interval of this section is thus c. 100–161 m.

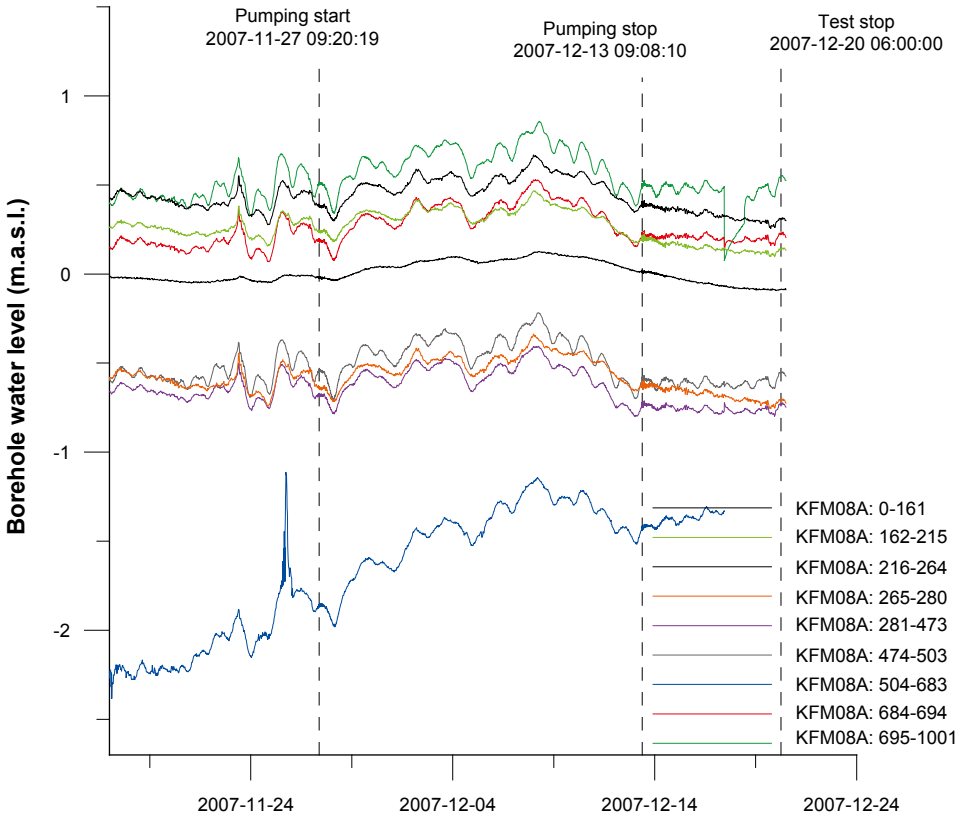


Figure 6-53. *Linear plot of pressure versus time in the observation sections in KFM08A during the second interference test in HFM14.*

Table 6-180. General test data from the observation section KFM08A: 0–161 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.02
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.01
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.09
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.03

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.10 Observation section KFM08A: 162–215 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 162–215 m, are presented in Table 6-181.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.11 Observation section KFM08A: 216–264 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 216–264 m, are presented in Table 6-182.

Table 6-181. General test data from the observation section KFM08A: 162–215 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.24
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.20
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.14
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.04

Table 6-182. General test data from the observation section KFM08A: 216–264 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.38
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.39
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.31
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.02

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.12 Observation section KFM08A: 265–280 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 265–280 m, are presented in Table 6-183.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.13 Observation section KFM08A: 281–473 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 281–473 m, are presented in Table 6-184.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.14 Observation section KFM08A: 474–503 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 474–503 m, are presented in Table 6-185.

Table 6-183. General test data from the observation section KFM08A: 265–280 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.64
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.63
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.70
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.01

Table 6-184. General test data from the observation section KFM08A: 281–473 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.68
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.74
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.73
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.06

Table 6-185. General test data from the observation section KFM08A: 474–503 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.54
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.59
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.55
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.05

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.15 Observation section KFM08A: 504–683 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 504–683 m, are presented in Table 6-186.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.16 Observation section KFM08A: 684–694 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 684–694 m, are presented in Table 6-187.

Table 6-186. General test data from the observation section KFM08A: 504–683 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–1.86
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.86
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–3.61
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.00

Table 6-187. General test data from the observation section KFM08A: 684–694 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.19
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.19
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.23
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.00

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.17 Observation section KFM08A: 695–1,001 m

In Figure 6-53 an overview of the pressure responses in observation borehole KFM08A is shown. General test data from the observation section KFM08A, 695–1,001 m, are presented in Table 6-188.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected.

6.3.18 Observation section KFM02B: 0–130 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 0–160 m, are presented in Table 6-189. According to Table 3-1, the borehole is cased to 86.60 m. The uncased interval of this section is thus c. 87–130 m.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. There is a slight change in the slope of the pressure curve, primarily at the start of the recovery period which may indicate a minor response.

Table 6-188. General test data from the observation section KFM08A: 695–1,001 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.51
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.49
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.55
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.01

Table 6-189. General test data from the observation section KFM02B: 0–130 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.75
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.86
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.96
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.11

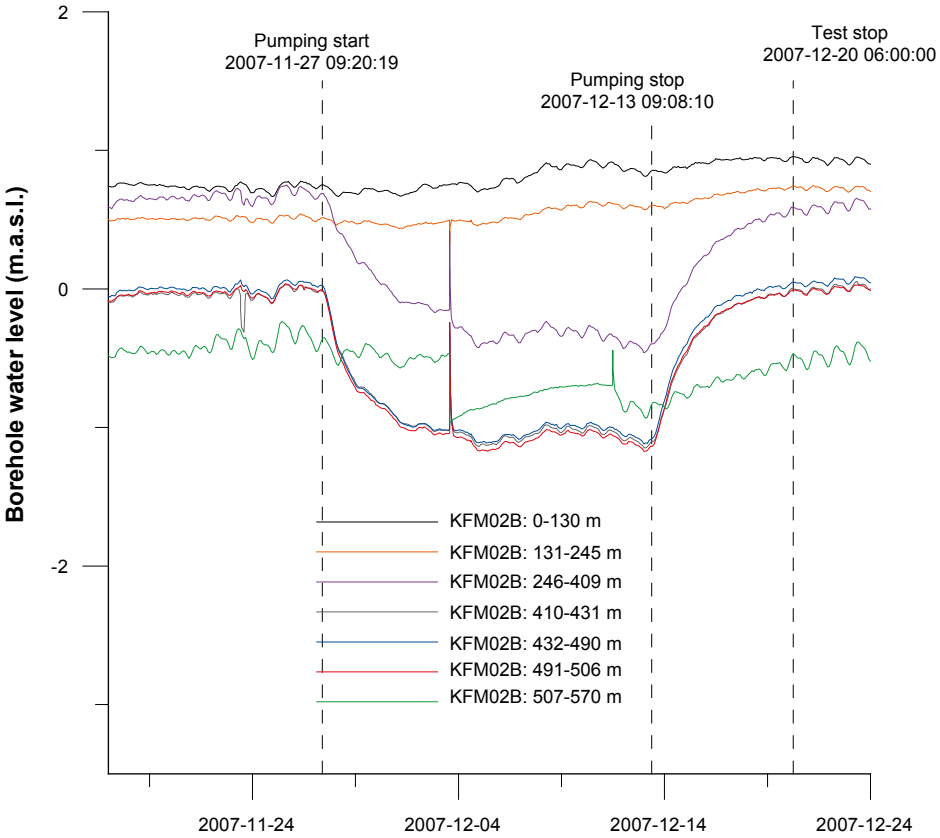


Figure 6-54. *Linear plot of pressure versus time in the observation sections in KFM02B during the second interference test in HFM14.*

6.3.19 Observation section KFM02B: 131–245 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 131–245 m, are presented in Table 6-190.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. There is a slight change in the slope of the pressure curve, primarily at the start of the recovery period which may indicate a minor response.

Table 6-190. General test data from the observation section KFM02B: 131–245 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.51
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	0.60
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.74
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.09

6.3.20 Observation section KFM02B: 246–409 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 246–409 m, are presented in Table 6-191.

Comments on the test

From the shape of the pressure curve at the time of pumping start and pumping stop it is apparent that this section is affected by the pumping in HFM14. A total drawdown of c. 1.1 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 3 hours after the pumping started in HFM14. There was a total recovery of c. 1.0 m during the recovery period that lasted for approximately 7 days.

6.3.21 Observation section KFM02B: 410–431 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 410–431 m, are presented in Table 6-192.

Comments on the test

A clear response to pumping was recorded in this observation section. A total drawdown of c. 1.1 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 3 hours after the pumping started in HFM14. There was a total recovery of c. 1.1 m during the recovery period that lasted for approximately 7 days.

6.3.22 Observation section KFM02B: 432–490 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 432–490 m, are presented in Table 6-193.

Table 6-191. General test data from the observation section KFM02B: 246–409 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.69
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.40
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.58
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.08

Table 6-192. General test data from the observation section KFM02B: 410–431 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.01
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.10
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.00
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.09

Table 6-193. General test data from the observation section KFM02B: 432–490 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.03
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.08
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	0.05
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.10

Comments on the test

This section is clearly responding to the pumping in HFM14. A total drawdown of c. 1.1 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 40 minutes after the pumping started in HFM14. There was a total recovery of c. 1.1 m during the recovery period that lasted for approximately 7 days.

6.3.23 Observation section KFM02B: 491–506 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 491–506 m, are presented in Table 6-194.

Comments on the test

A clear response to pumping was registered in this observations section. A total drawdown of c. 1.1 m was measured during the flow period. A drawdown of 0.01 m was reached approximately 40 minutes after the pumping started in HFM14. There was a total recovery of c. 1.1 m during the recovery period that lasted for approximately 7 days.

6.3.24 Observation section KFM02B: 507–570 m

In Figure 6-54 an overview of the pressure responses in observation borehole KFM02B is shown. General test data from the observation section KFM02B, 507–570 m, are presented in Table 6-195.

Table 6-194. General test data from the observation section KFM02B: 491–506 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	0.00
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.14
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.01
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	1.13

Table 6-195. General test data from the observation section KFM02B: 507–570 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–0.38
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–0.82
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–0.46
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.45

Comments on the test

This section may be slightly affected by the pumping in HFM14. At the time of recovery it appears the pressure is increasing in response to the stop of pumping. The response, however, is not very strong. During the flow period the pressure in this section suddenly drops dramatically, after which the pressure slowly returns towards the levels prior to the drop. The reason for this is suspected to be instrumental or due to service. As a result, the apparent drawdown is fictitiously large.

6.3.25 Observation section KFM11A: 0–130 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 0–130 m, are presented in Table 6-196. According to Table 3-1, the borehole is cased to 70.77 m. The uncased interval of this section is thus c. 71–130 m.

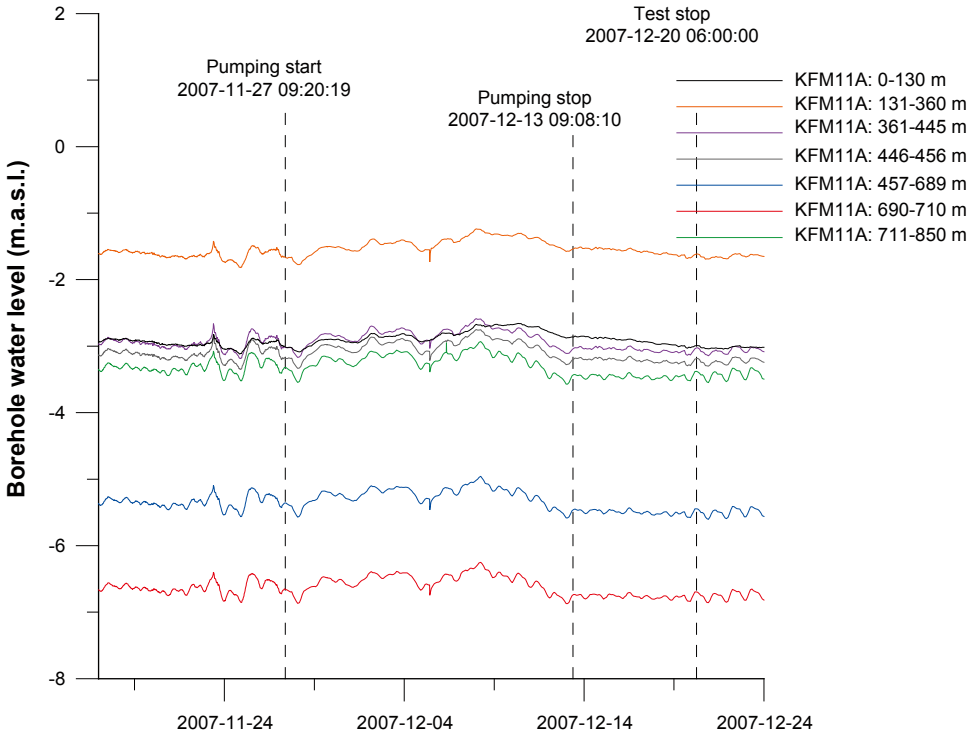


Figure 6-55. *Linear plot of pressure versus time in the observation sections in KFM11A during the second interference test in HFM14.*

Table 6-196. General test data from the observation section KFM11A: 0–130 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–3.00
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–2.86
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–2.99
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.14

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

6.3.26 Observation section KFM11A: 131–360 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 131–360 m, are presented in Table 6-197.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

6.3.27 Observation section KFM11A: 361–445 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 361–445 m, are presented in Table 6-198.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

Table 6-197. General test data from the observation section KFM11A: 131–360 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–1.66
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–1.54
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–1.61
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	–0.12

Table 6-198. General test data from the observation section KFM11A: 361–445 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–3.01
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–3.03
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–3.03
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.03

6.3.28 Observation section KFM11A: 446–456 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 446–456 m, are presented in Table 6-199.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

6.3.29 Observation section KFM11A: 457–689 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 457–689 m, are presented in Table 6-200.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

6.3.30 Observation section KFM11A: 690–710 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 690–710 m, are presented in Table 6-201.

Table 6-199. General test data from the observation section KFM11A: 446–456 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–3.17
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–3.20
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–3.19
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.02

Table 6-200. General test data from the observation section KFM11A: 457–689 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–5.36
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–5.46
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–5.45
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.10

Table 6-201. General test data from the observation section KFM11A: 690–710 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–6.65
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–6.73
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–6.70
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.09

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

6.3.31 Observation section KFM11A: 711–850 m

In Figure 6-55 an overview of the pressure responses in observation borehole KFM11A is shown. General test data from the observation section KFM11A, 711–850 m, are presented in Table 6-202.

Comments on the test

This section does not appear to be responding to the pumping in HFM14, or is very weakly affected. Even though the pressure is increasing slightly in conjunction with the stop of pumping, it is not strong enough to say with any certainty that the section is affected, especially since there are no real signs of decreasing pressure at the time of pumping start.

6.4 Response analysis for interference tests 1 and 2

A response analysis according to the methodology description for interference tests was made. However, because there was only one test performed, no response matrix was prepared. The response time lags (dt_L) in the observation sections during pumping in HFM14 are shown in Table 6-203. The lag times were derived from the drawdown curves in the observation borehole sections at an actual drawdown of 0.01 m. No corrections of the drawdown for any possible natural trend during the interference tests or other corrections have been made. Because of the oscillating behaviour of the measured pressure in some of the observation sections, see for instance Figure 6-53, it was many times difficult to determine the exact time to reach a 0.01 m drawdown. It was possible, however, to make an approximate estimate from the drawdown curves.

Only observation sections in which an assumed, relatively clear, pressure response was recorded are included in the response analysis. In Tables 6-203 and 6-204 only sections comprised in the response analysis are presented, that is only sections showing a reasonably clear response to pumping in HFM14.

Table 6-202. General test data from the observation section KFM11A: 711–850 m during the second interference test in HFM14.

Pressure data	Nomenclature	Unit	Value
Hydraulic head in test section before start of flow period	h_i	m.a.s.l.	–3.32
Hydraulic head in test section before stop of flow period	h_p	m.a.s.l.	–3.43
Hydraulic head in test section at stop of recovery period	h_F	m.a.s.l.	–3.38
Hydraulic head change during flow period (h_i–h_p)	dh_p	m	0.11

Table 6-203. Calculated response lag times and normalized response time lags for the responding observation sections included in the interference tests.

Pumping borehole	Observation borehole	Section (m)	dt_L[s = 0.01 m] (s)	r_s (m)	dt_L[s = 0.01 m]/r_s^2 (s/m^2)	r_s^2/dt_L[s = 0.01 m] (m^2/s)
HFM14	HFM15	0–84	2	33	1.88E–03	5.31E+02
	HFM15	85–95	2	71	3.93E–04	2.54E+03
HFM14	KFM05A	0–114	52	88	6.68E–03	1.50E+02
	KFM05A	115–253	332	123	2.19E–02	4.56E+01
HFM14	HFM19	0–103	462	183	1.38E–02	7.25E+01
	HFM19	104–167	172	225	3.40E–03	2.94E+02
	HFM19	168–182	102	248	1.66E–03	6.03E+02
HFM14	HFM13	0–100	842	319	8.27E–03	1.21E+02
	HFM13	101–158	1,662	302	1.82E–02	5.49E+01
	HFM13	159–173	342	297	3.89E–03	2.57E+02
HFM14	KFM01C	0–58	782	368	5.79E–03	1.73E+02
	KFM01C	59–237	642	350	5.24E–03	1.91E+02
HFM14	HFM01	0–32.5	3,602	376	2.55E–02	3.92E+01
	HFM01	33.5–45.5	842	378	5.91E–03	1.69E+02
	HFM01	46.5–200	842	381	5.80E–03	1.72E+02
HFM14	KFM01A	0–108	81,242	412	4.79E–01	2.09E+00
	KFM01A	109–130	2,762	416	1.60E–02	6.27E+01
	KFM01A	131–204	7,502	427	4.11E–02	2.43E+01
HFM14	KFM01D	0–153	12,482	407	7.55E–02	1.33E+01
	KFM01D	154–252	7,022	419	4.00E–02	2.50E+01
HFM14	KFM01B	0–100	1,172	416	6.78E–03	1.48E+02
	KFM01B	101–141	3,122	438	1.63E–02	6.15E+01
	KFM01B	142–500	4,442	556	1.44E–02	6.95E+01
HFM14	KFM10A	0–152	33,242	632	8.32E–02	1.20E+01
	KFM10A	153–352	20,942	527	7.54E–02	1.33E+01
	KFM10A	353–429	4,202	503	1.66E–02	6.01E+01
	KFM10A	430–440	442	493	1.82E–03	5.51E+02
	KFM10A	441–500	712	485	3.02E–03	3.31E+02
HFM14	HFM32	0–25	23,642	511	9.05E–02	1.10E+01
	HFM32	26–31	20,942	512	7.99E–02	1.25E+01
	HFM32	32–97	13,262	518	4.95E–02	2.02E+01
	HFM32	98–203	2,942	546	9.86E–03	1.01E+02
HFM14	HFM03	0–18	1,742	532	6.15E–03	1.63E+02
	HFM03	19–26	842	532	2.97E–03	3.37E+02
HFM14	HFM02	0–37	842	536	2.93E–03	3.41E+02
	HFM02	38–48	842	536	2.93E–03	3.42E+02
	HFM02	49–100	842	539	2.90E–03	3.45E+02
HFM14	HFM27	0–24	1,692	562	5.36E–03	1.87E+02
	HFM27	25–45	832	564	2.61E–03	3.83E+02
	HFM27	46–58	692	573	2.10E–03	4.75E+02
	HFM27	59–128	3,602	602	9.94E–03	1.01E+02
HFM14	HFM24	0–35	14,222	651	3.36E–02	2.98E+01

Pumping borehole	Observation borehole	Section (m)	dt_L[s = 0.01 m] (s)	r_s (m)	dt_L[s = 0.01 m]/r_s^2 (s/m²)	r_s^2/dt_L[s = 0.01 m] (m²/s)
	HFM24	36–65	15,242	644	3.68E–02	2.72E+01
	HFM24	66–151	36,842	631	9.26E–02	1.08E+01
HFM14	KFM04A	0–163	46,442	804	7.19E–02	1.39E+01
	KFM04A	164–185	47,642	773	7.98E–02	1.25E+01
	KFM04A	186–229	38,042	776	6.31E–02	1.58E+01
	KFM04A	230–245	38,642	770	6.52E–02	1.53E+01
	KFM04A	246–390	35,642	749	6.36E–02	1.57E+01
HFM14	KFM06A	0–150	58,442	798	9.19E–02	1.09E+01
	KFM06A	151–246	31,442	793	5.00E–02	2.00E+01
	KFM06A	247–340	35,042	796	5.54E–02	1.81E+01
	KFM06A	341–362	76,442	810	1.16E–01	8.59E+00
	KFM06A	363–737	76,442	816	1.15E–01	8.71E+00
HFM14	KFM06C	0–186	56,642	892	7.11E–02	1.41E+01
	KFM06C	187–280	65,042	936	7.43E–02	1.35E+01
	KFM06C	281–350	141,242	1,007	1.39E–01	7.19E+00
	KFM06C	351–401	44,042	1,069	3.85E–02	2.60E+01
	KFM06C	402–530	72,842	1,091	6.12E–02	1.63E+01
	KFM06C	531–540	135,842	1,188	9.62E–02	1.04E+01
	KFM06C	541–646	19,442	1,238	1.27E–02	7.89E+01
HFM14	KFM06B	0–26	8,522	825	1.25E–02	7.99E+01
	KFM06B	27–50	6,002	824	8.85E–03	1.13E+02
	KFM06B	51–100	7,202	823	1.06E–02	9.41E+01
	HFM10	100–150	43,442	831	6.29E–02	1.59E+01
HFM14	HFM16	0–53	2,402	838	3.42E–03	2.92E+02
	HFM16	54–67	4,382	838	6.24E–03	1.60E+02
	HFM16	68–132	5,882	839	8.37E–03	1.20E+02
HFM14	HFM09	0–50	44,042	895	5.50E–02	1.82E+01
HFM14	KFM07B	75–202	10,082	984	1.04E–02	9.60E+01
	KFM07B	203–300	1,982	937	2.26E–03	4.43E+02
HFM14	HFM21	0–21	87,242	1,031	8.21E–02	1.22E+01
	HFM21	22–32	41,642	1,028	3.94E–02	2.54E+01
	HFM21	33–106	6,182	1,000	6.19E–03	1.62E+02
	HFM21	107–202	2,402	967	2.57E–03	3.90E+02
HFM14	KFM07C	0–110	11,522	1,057	1.03E–02	9.69E+01
	KFM07C	111–160	2,162	1,057	1.94E–03	5.16E+02
	KFM07C	161–301	33,242	1,058	2.97E–02	3.37E+01
HFM14	KFM07A	0–148	14,282	1,104	1.17E–02	8.53E+01
	KFM07A	149–190	6,722	1,124	5.32E–03	1.88E+02
	KFM07A	191–225	170,042	1,137	1.32E–01	7.60E+00
	KFM07A	226–961	62,042	1,162	4.59E–02	2.18E+01
HFM14	KFM09B	0–200	29,042	1,327	1.65E–02	6.06E+01
	KFM09B	201–450	73,442	1,222	4.92E–02	2.03E+01
HFM14	HFM22	0–222	8,042	1,227	5.34E–03	1.87E+02
HFM14	HFM20	0–48	51,842	1,289	3.12E–02	3.20E+01

Pumping borehole	Observation borehole	Section (m)	dt_L[s = 0.01 m] (s)	r_s (m)	dt_L[s = 0.01 m]/r_s^2 (s/m^2)	r_s^2/dt_L[s = 0.01 m] (m^2/s)
	HFM20	49–100	27,242	1,292	1.63E–02	6.13E+01
	HFM20	101–130	12,422	1,296	7.40E–03	1.35E+02
	HFM20	131–301	14,582	1,309	8.52E–03	1.17E+02
HFM14	KFM08B	0–70	45,242	1,303	2.67E–02	3.75E+01
HFM14	HFM25	0–188	195,242	1,372	1.04E–01	9.64E+00
HFM14	KFM09A	0–300	30,242	1,342	1.68E–02	5.95E+01
HFM14	HFM28	0–151	51,242	1,349	2.82E–02	3.55E+01
HFM14	HFM23	0–212	51,242	1,373	2.72E–02	3.68E+01
HFM14	HFM29	0–200	36,842	1,500	1.64E–02	6.10E+01
HFM14	HFM17	0–211	65,642	1,537	2.78E–02	3.60E+01
HFM14	KFM02A	0–132	143,042	1,571	5.80E–02	1.72E+01
	KFM02A	133–240	78,842	1,571	3.19E–02	3.13E+01
	KFM02A	241–410	59,042	1,576	2.38E–02	4.21E+01
	KFM02A	411–442	6,842	1,594	2.69E–03	3.71E+02
	KFM02A	443–489	7,862	1,603	3.06E–03	3.27E+02
	KFM02A	490–518	2,642	1,610	1.02E–03	9.81E+02
HFM14	HFM33	0–140	51,242	1,729	1.71E–02	5.83E+01
HFM14	HFM04	0–57	71,642	1,747	2.35E–02	4.26E+01
	HFM04	58–66	139,442	1,747	4.57E–02	2.19E+01
	HFM04	67–222	161,042	1,759	5.21E–02	1.92E+01
HFM14	HFM12	0–56.5	72,242	1,882	2.04E–02	4.90E+01
	HFM12	57.5–210	76,442	1,912	2.09E–02	4.78E+01
HFM14	KFM02B [1)]	246–409	9,581	1,555	3.96E–03	2.52E+02
	KFM02B [1)]	410–431	9,581	1,561	3.93E–03	2.54E+02
	KFM02B [1)]	432–490	2,381	1,566	9.71E–04	1.03E+03
	KFM02B [1)]	491–506	2,381	1,570	9.65E–04	1.04E+03
HFM14	KFM08D [1)]	0–160	11,921	1,260	7.51E–03	1.33E+02

[1)] Borehole measured during the second, shorter interference test. Not inserted in table by order of distance from HFM14.

Table 6-204. Drawdown and normalized drawdown for the responding observation sections included in the interference test.

Pumping borehole	Flow rate Q_p (m^3/s)	Observation borehole	Section (m)	s_p (m)	s_p/Q_p (s/m^2)
HFM14	0.005813	HFM15	0–84	7.85	1.3505E+03
	0.005813	HFM15	85–95	7.65	1.3161E+03
HFM14	0.005813	KFM05A	0–114	5.45	9.3761E+02
	0.005813	KFM05A	115–253	5.36	9.2213E+02
HFM14	0.005813	HFM19	0–103	6.33	1.0890E+03
	0.005813	HFM19	104–167	6.33	1.0890E+03
	0.005813	HFM19	168–182	6.41	1.1028E+03
HFM14	0.005813	HFM13	0–100	2.20	3.7849E+02
	0.005813	HFM13	101–158	4.73	8.1374E+02
	0.005813	HFM13	159–173	6.30	1.0838E+03
HFM14	0.005813	KFM01C	0–58	2.93	5.0407E+02
	0.005813	KFM01C	59–237	3.05	5.2472E+02
HFM14	0.005813	HFM01	0–32.5	2.82	4.8515E+02
	0.005813	HFM01	33.5–45.5	2.79	4.7999E+02
	0.005813	HFM01	46.5–200	2.20	3.7849E+02
HFM14	0.005813	KFM01A	0–108	2.22	3.8193E+02
	0.005813	KFM01A	109–130	2.10	3.6128E+02
	0.005813	KFM01A	131–204	2.06	3.5440E+02
HFM14	0.005813	KFM01D	0–153	2.10	3.6128E+02
	0.005813	KFM01D	154–252	1.38	2.3741E+02
HFM14	0.005813	KFM01B	0–100	2.82	4.8515E+02
	0.005813	KFM01B	101–141	2.21	3.8021E+02
	0.005813	KFM01B	142–500	2.09	3.5956E+02
HFM14	0.005813	KFM10A	0–152	0.35	5.9623E+01
	0.005813	KFM10A	153–352	5.33	9.1773E+02
	0.005813	KFM10A	353–429	5.74	9.8777E+02
	0.005813	KFM10A	430–440	5.93	1.0194E+03
	0.005813	KFM10A	441–500	6.00	1.0326E+03
HFM14	0.005813	HFM32	0–25	0.12	2.0645E+01
	0.005813	HFM32	26–31	0.17	2.9247E+01
	0.005813	HFM32	32–97	1.97	3.3892E+02
	0.005813	HFM32	98–203	2.10	3.6128E+02
HFM14	0.005813	HFM03	0–18	2.72	4.6795E+02
	0.005813	HFM03	19–26	2.84	4.8859E+02
HFM14	0.005813	HFM02	0–37	2.82	4.8469E+02
	0.005813	HFM02	38–48	2.85	4.9031E+02
	0.005813	HFM02	49–100	2.86	4.9276E+02
HFM14	0.005813	HFM27	0–24	2.62	4.5074E+02
	0.005813	HFM27	25–45	2.79	4.7999E+02
	0.005813	HFM27	46–58	2.83	4.8687E+02
	0.005813	HFM27	59–128	2.80	4.8171E+02
HFM14	0.005813	HFM24	0–35	0.30	5.1612E+01

Pumping borehole	Flow rate Q_p (m^3/s)	Observation borehole	Section (m)	s_p (m)	s_p/Q_p (s/m^2)
	0.005813	HFM24	36–65	0.31	5.3332E+01
	0.005813	HFM24	66–151	0.32	5.5053E+01
HFM14	0.005813	KFM04A	0–163	0.22	3.7768E+01
	0.005813	KFM04A	164–185	0.40	6.8209E+01
	0.005813	KFM04A	186–229	0.47	8.0114E+01
	0.005813	KFM04A	230–245	0.41	7.1120E+01
	0.005813	KFM04A	246–390	0.77	1.3266E+02
HFM14	0.005813	KFM06A	0–150	0.65	1.1254E+02
	0.005813	KFM06A	151–246	0.74	1.2689E+02
	0.005813	KFM06A	247–340	0.80	1.3826E+02
	0.005813	KFM06A	341–362	0.64	1.0970E+02
	0.005813	KFM06A	363–737	0.63	1.0924E+02
HFM14	0.005813	KFM06C	0–186	0.71	1.2215E+02
	0.005813	KFM06C	187–280	0.61	1.0494E+02
	0.005813	KFM06C	281–350	0.64	1.1011E+02
	0.005813	KFM06C	351–401	0.85	1.4623E+02
	0.005813	KFM06C	402–530	0.76	1.3075E+02
	0.005813	KFM06C	531–540	0.63	1.0838E+02
	0.005813	KFM06C	541–646	0.62	1.0666E+02
HFM14	0.005813	KFM06B	0–26	1.25	2.1505E+02
	0.005813	KFM06B	27–50	1.48	2.5462E+02
	0.005813	KFM06B	51–100	1.39	2.3841E+02
	0.005813	HFM10	100–150	0.36	6.1934E+01
HFM14	0.005813	HFM16	0–53	1.47	2.5290E+02
	0.005813	HFM16	54–67	1.36	2.3397E+02
	0.005813	HFM16	68–132	1.36	2.3397E+02
HFM14	0.005813	HFM09	0–50	0.39	6.7095E+01
HFM14	0.005813	KFM07B	75–202	1.45	2.4946E+02
	0.005813	KFM07B	203–300	2.36	4.0601E+02
HFM14	0.005813	HFM21	0–21	0.49	8.3610E+01
	0.005813	HFM21	22–32	0.69	1.1871E+02
	0.005813	HFM21	33–106	1.44	2.4774E+02
	0.005813	HFM21	107–202	1.95	3.3548E+02
HFM14	0.005813	KFM07C	0–110	1.38	2.3741E+02
	0.005813	KFM07C	111–160	1.99	3.4236E+02
	0.005813	KFM07C	161–301	1.61	2.7698E+02
HFM14	0.005813	KFM07A	0–148	1.42	2.4430E+02
	0.005813	KFM07A	149–190	1.50	2.5806E+02
	0.005813	KFM07A	191–225	1.24	2.1333E+02
	0.005813	KFM07A	226–961	1.15	1.9784E+02
HFM14	0.005813	KFM09B	0–200	0.89	1.5338E+02
	0.005813	KFM09B	201–450	1.31	2.2586E+02
HFM14	0.005813	HFM22	0–222	1.31	2.2537E+02
HFM14	0.005813	HFM20	0–48	0.50	8.6020E+01

Pumping borehole	Flow rate Q_p (m^3/s)	Observation borehole	Section (m)	s_p (m)	s_p/Q_p (s/m^2)
	0.005813	HFM20	49–100	1.06	1.8264E+02
	0.005813	HFM20	101–130	1.32	2.2709E+02
	0.005813	HFM20	131–301	1.42	2.4430E+02
HFM14	0.005813	KFM08B	0–70	0.36	6.1135E+01
HFM14	0.005813	HFM25	0–188	0.21	3.6806E+01
HFM14	0.005813	KFM09A	0–300	0.33	5.5963E+01
HFM14	0.005813	HFM28	0–151	0.38	6.5008E+01
HFM14	0.005813	HFM23	0–212	0.28	4.8734E+01
HFM14	0.005813	HFM29	0–200	0.33	5.6773E+01
HFM14	0.005813	HFM17	0–211	0.17	2.9247E+01
HFM14	0.005813	KFM02A	0–132	0.28	4.9011E+01
	0.005813	KFM02A	133–240	0.32	5.5053E+01
	0.005813	KFM02A	241–410	1.12	1.9278E+02
	0.005813	KFM02A	411–442	1.34	2.3053E+02
	0.005813	KFM02A	443–489	1.36	2.3326E+02
	0.005813	KFM02A	490–518	1.34	2.3053E+02
HFM14	0.005813	HFM33	0–140	0.19	3.1983E+01
HFM14	0.005813	HFM04	0–57	0.42	7.2256E+01
	0.005813	HFM04	58–66	0.24	4.1289E+01
	0.005813	HFM04	67–222	0.21	3.6128E+01
HFM14	0.005813	HFM12	0–56.5	0.04	6.8816E+00
	0.005813	HFM12	57.5–210	0.12	2.0645E+01
HFM14	0.005813	KFM02B [1)]	246–409	1.08	1.8650E+02
	0.005813	KFM02B [1)]	410–431	1.09	1.8739E+02
	0.005813	KFM02B [1)]	432–490	1.10	1.9010E+02
	0.005813	KFM02B [1)]	491–506	1.13	1.9462E+02
HFM14	0.005813	KFM08D [1)]	0–160	0.97	1.6755E+02

[1)] Borehole measured during the second, shorter interference test. Not inserted in table by order of distance from HFM14.

It must be emphasized that section KFM08D: 0–160, which was observed only during the shorter second interference test, is still included in the response analysis. This is possible since the same pumping borehole was used and the flow rate was very similar to that of the first interference test. Since the conditions, naturally, were not identical in the two tests, the comparison must, however, be regarded as approximate.

Just prior to the printing of this report, also boreholes KFM11A and KFM02B were included in this test. These boreholes were also not installed with monitoring equipment at the time of pumping start for the first interference test. Partial data were available from KFM02B, but not from the entire first test. KFM11A and KFM02B were, however, not intended to be included in the second interference test when the test performance was planned. As a result the HMS logging intervals for these boreholes were not adjusted prior to the start of pumping. This is important especially when it comes to the response analysis where the time to reach a 0.01 m drawdown plays an important part. The time resolution for these two boreholes is as large as 2 hours, which makes the comparison to responses in other boreholes somewhat precarious.

It turned out, KFM11A did not respond at all to the pumping, which makes the caution unnecessary for that borehole. Several sections of KFM02A did, however, respond.

No in-depth analysis has been performed for the responding sections in KFM02B. The results are included in tables and response diagrams (Figures 6-56 through 6-58) for simple comparison reasons only. Due to the low time resolution of the pressure data, it is reasonable to think that some of the affected sections in KFM02A actually responded faster than is reported. Because of this, the response ranking depicted in the response diagrams must be regarded as approximations for this borehole.

The normalized response time with respect to the distance to the pumping borehole was calculated. This time is inversely related to the hydraulic diffusivity (T/S) of the formation. Also the inverse of above mentioned parameter was calculated since it is more closely related to the hydraulic diffusivity. In addition, the normalized drawdown with respect to the flow rate was calculated and is presented in Table 6-204.

In Figure 6-56 a response diagram, showing the presumptive responding observation sections, is presented. In this figure the observation sections are represented by different symbols. In the response diagram, observation sections represented by data points lying to the left generally indicate a better connectivity, a higher hydraulic diffusivity, in regard to the pumping borehole section than sections represented by data points further to the right in the diagram.

The following parameters are used in Tables 6-203 and 6-204 as well as in Figures 6-56–6-58:

$dt_L[s = 0.01\ m] / r_s^2$ = normalized response time with respect to the distance r_s (s/m^2).

$dt_L[s = 0.01\ m]$ = time after start of pumping (s) at a drawdown s = 0.01 m in the observation section.

r_s = 3D-distance between the hydraulic point of application (hydr. p.a.) in the pumping borehole and observation borehole (m).

s_p/Q_p = normalized drawdown with respect to the pumping flow rate (s/m^2).

s_p = drawdown at stop of pumping in the actual observation borehole/section (m).

Q_p = pumping flow rate by the end of the flow period (m^3/s).

The (normalized) response time lag for many of the observation sections included in the interference test, where a response was detected, must be considered as rough estimates. The main reason for this is, as mentioned above, the difficulty to make an estimate of this parameter due to the oscillating pressure. In addition, some sections display a sudden increase in pressure in conjunction with the start of pumping. This causes the response times to be misleadingly long.

The response diagram in Figure 6-56 together with diagrams 6-57 and 6-58 can be used to group observation sections by the strength of their responses and so the observation sections with the most distinct responses can be identified. Figure 6-56 indicates that the largest drawdown was found in section HFM15: 0–84 m and the weakest response in section KFM07B: 0–74 m. The most delayed response, with respect to distance, occurred in section KFM01A: 0–108 m.

Some of the sections that are found in the upper left part of Figure 6-56 are likely to represent sections with more or less direct responses along fracture zones between borehole HFM14 and the actual observations sections.

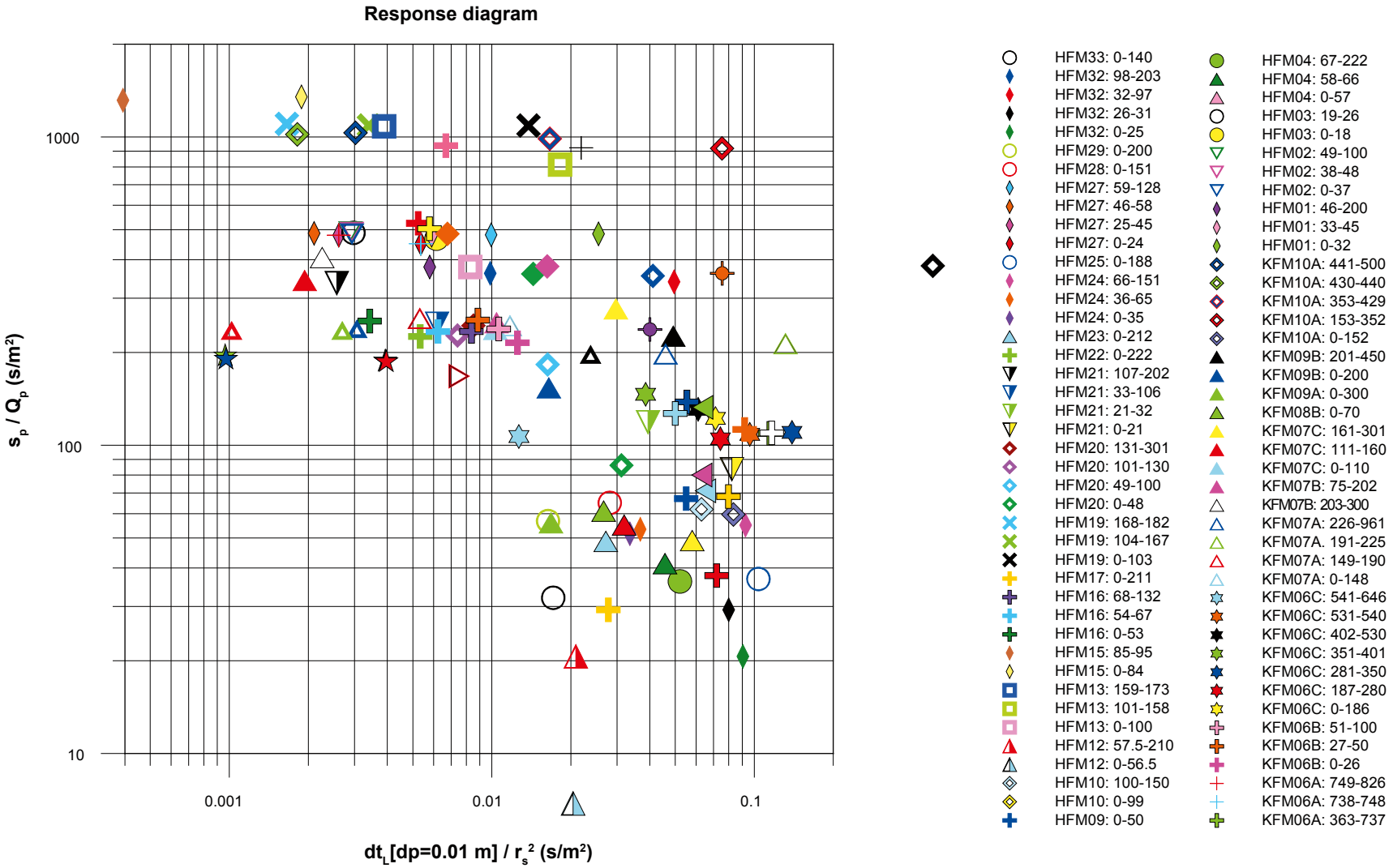


Figure 6-56. *Response diagram showing the responses in the presumed responding observation sections during the interference test in HFM14.*

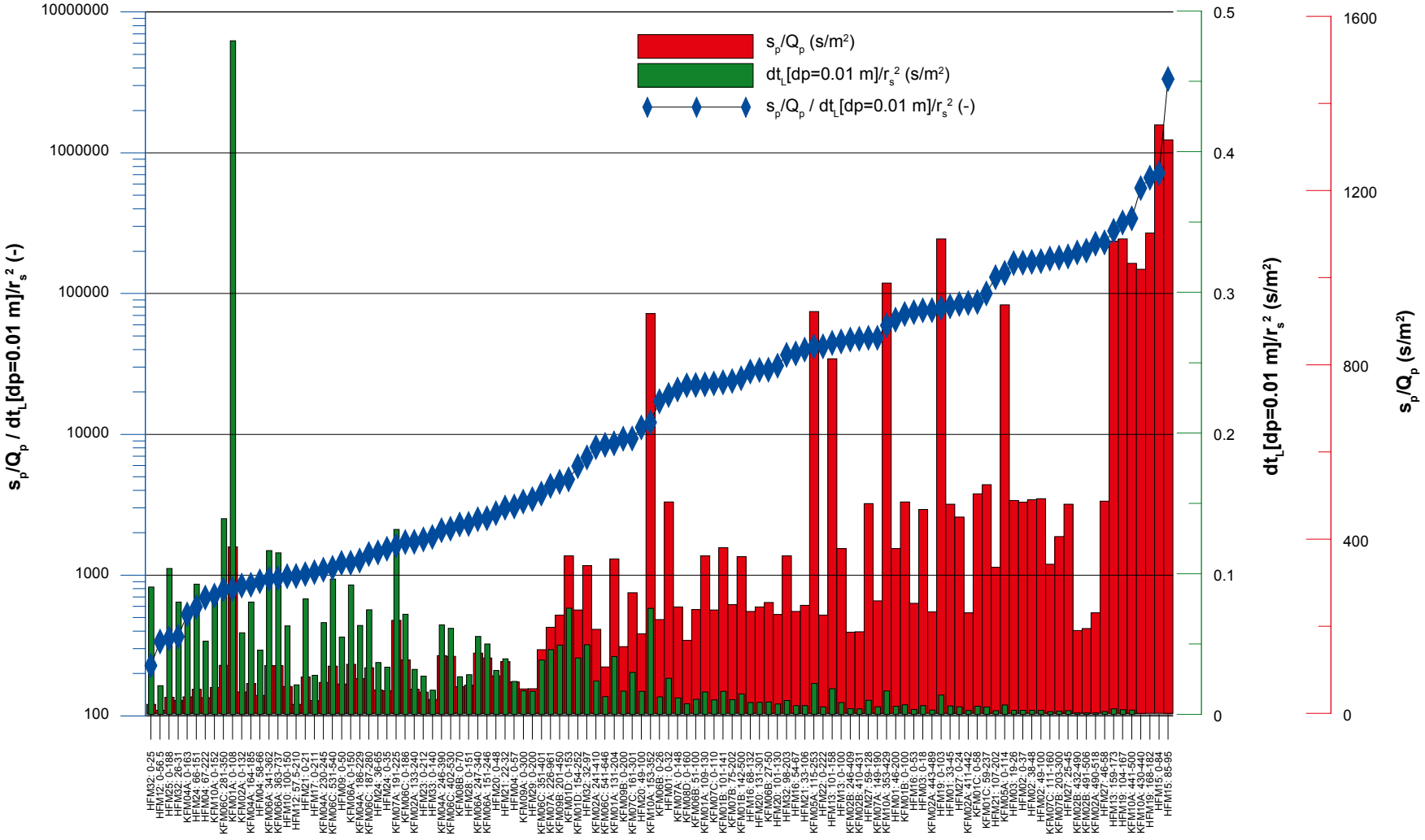


Figure 6-57. *Diagram showing normalized drawdown, normalized response time and the ratio between the two parameters for the responding sections in the interference tests. The observation sections are sorted by the magnitude of the ratio.*

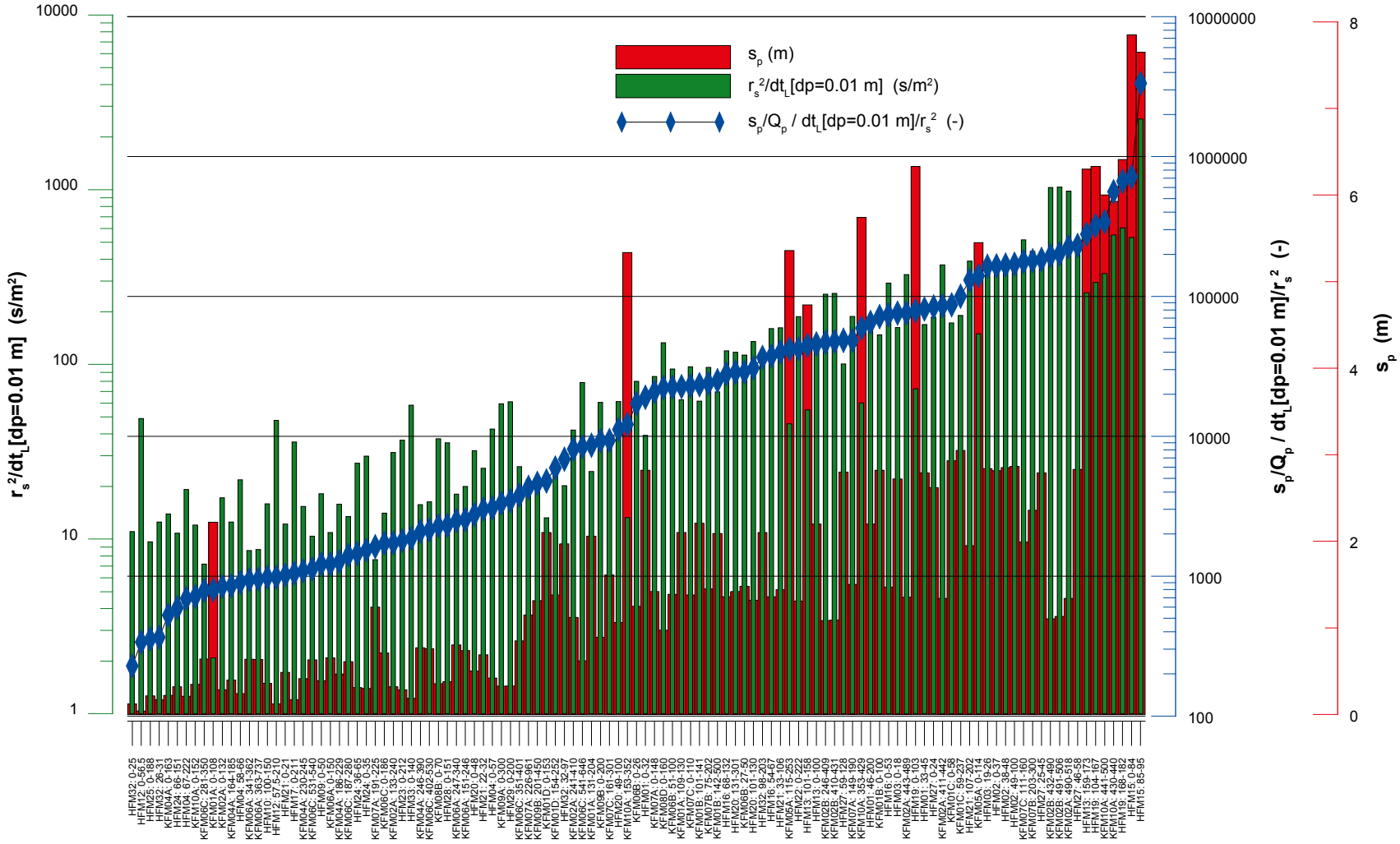


Figure 6-58. *Diagram showing drawdown, the inverse of the normalized response time and the same ratio that was previously presented in Figure 6-57, for the responding sections in the interference tests. The observation sections are sorted by the magnitude of the ratio.*

Figure 6-57 displays the same parameters as in the response diagram, but in a different type of diagram. In this diagram a third index is also displayed, i.e. the ratio between the two indices in the response diagram. Clearly, sections with higher ratios correspond to sections which are hydraulically well connected to the pumping borehole. In the diagram, all observation sections that responded in a fairly clear fashion to pumping in HFM14 are included. In Figure 6-57 section KFM01A: 0–108 m undoubtedly stands out as having the most delayed response. This section demonstrates the weakest and most uncertain response, which can also be observed in the response diagram (Figure 6-56). All sections are ranked so that sections showing the weakest responses are located to the left in the diagram and observation sections with stronger responses are located to the right.

Another version of Figure 6-57 is displayed in Figure 6-58. The units on the axes are somewhat different even though this figure is indicating the same phenomenon as is shown in Figure 6-57.

The maps displayed in Figure 6-59 (also in Appendix 2, A2-17 through A2-19) are an attempt at illustrating the progression of the response both spatially and in time. There are three maps to make up the third spatial dimension, depth, which is divided into three layers. The time dimension is illustrated by the colour of the symbols marking the different drill sites. Each drill site included in the test is represented by the one borehole, located on that drill site, which exhibits the quickest response. Obviously, not nearly all sections included in the interference test are represented in this series of figures. It is only an approximation of the way the response propagates in time.

Four observation sections stand out as responding most strongly. These sections, HFM15: 0–84 m, HFM15: 85–95 m, HFM19: 168–182 m and KFM10A: 430–440 m, together with at least three other sections; HFM19: 104–167 m, HFM13: 159–173 m and KFM10A: 441–500 m, demonstrate responses that are distinct enough to be characterized as potential zone responses between HFM14 and the actual sections.

6.5 Transient evaluation of responses in selected sections

Quantitative transient evaluation was made for six selected observation sections, decided upon in consultation with the activity leader, see Table 6-205. The flow rate was stable during the entire flow period except some minor fluctuations in the very beginning of the flow period cf. Figure 6-1.

Table 6-205. Selected test sections for transient evaluation and their distances from HFM14@20 m (point of application).

Borehole	Section no.	Interval (m)	Distance from HFM14@20 m	Drawdown, s_P (m)
HFM01	2	33.5–45.5	377	2.79
HFM13	1	159–173	297	6.30
HFM15	1	85–95	72	7.65
HFM19	1	168–182	247	6.41
HFM32	3	26–31	512	0.17
KFM10A	2	430–440	493	5.93

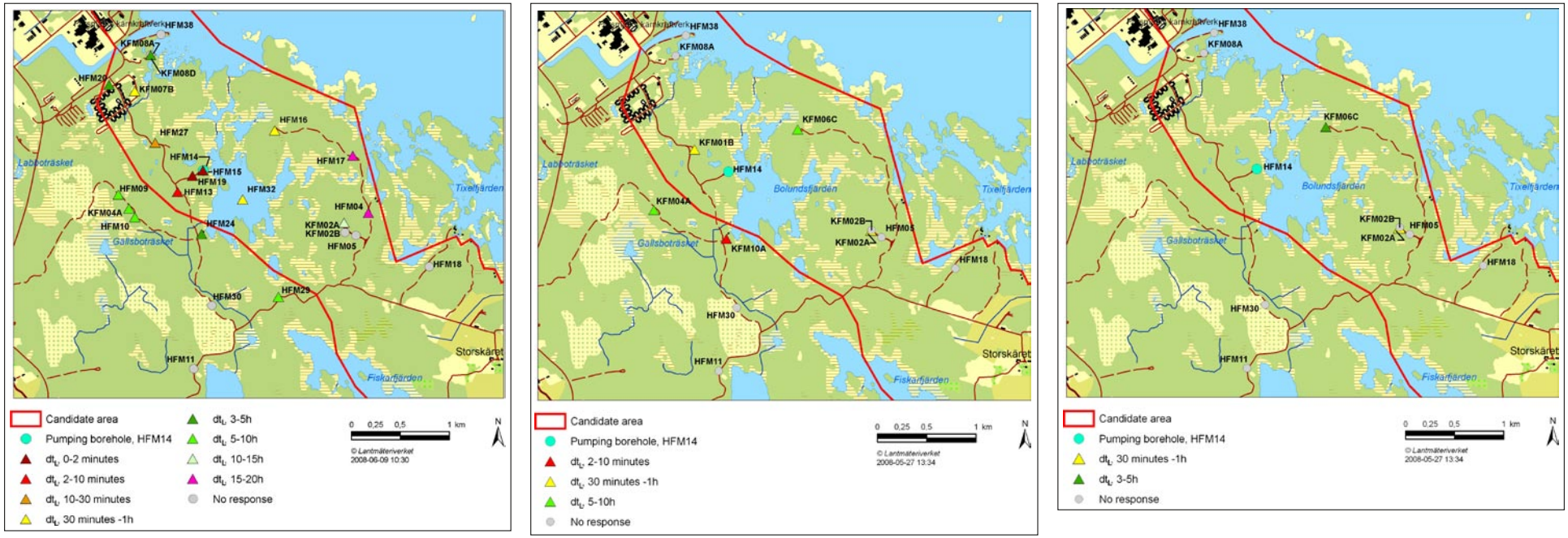


Figure 6-59. *Each of the maps show responses in (from left to right) sections located between 0-300 m, 301-500 m and below 500 m along the boreholes. Each symbol represents the borehole, at a specific drill site, which shows the quickest response. Some boreholes are represented in the maps only to show the location of a drill site. Larger maps are given in Appendix 2 (A2-17 through A2-19).*

No corrections of the tests data, e.g. for natural pressure trends during the interference test, have been made before the transient analysis. However, the test data are affected by both precipitation and variations of the sea level, see Appendix 2, Figure A2:17. These combined effects caused the groundwater heads in the boreholes to slightly increase after c. 1 week and c. 2 months of pumping, respectively, but is not considered to affect the transient evaluation of the selected test sections in a significant way since the total drawdown in most of these sections was rather high (except in HFM32:3). Both the drawdown and recovery period of the interference test were analysed for the selected test sections. They are both represented by log-log diagrams in Appendix 2, although only one of the evaluations, either from drawdown or from recovery, is chosen as representative. The evaluations are discussed below.

In addition, estimation of the hydraulic diffusivity of these sections was made from the response time lag, see Section 6.5.7. The time lags were estimated from the corrected drawdown curves. Comparison was made of the estimated hydraulic diffusivity from the time lag and from the transient test evaluation, respectively.

Abbreviations of flow regimes and hydraulic boundaries that may appear in the text:

WBS = Wellbore storage.

PRF = Pseudo-radial flow regime.

PLF = Pseudo-linear flow regime.

PSF = Pseudo-spherical flow regime.

PSS = Pseudo-stationary flow regime.

NFB = No-flow boundary.

CHB = Constant – head boundary.

6.5.1 Observation section HFM01: 33.5–45.5 m

Interpreted flow regimes

Both the drawdown and recovery period are dominated by pseudo-radial flow during intermediate times transitioning to pseudo-spherical (leaky) flow by the end.

Interpreted parameters

The results from the transient evaluation of the flow and recovery period are in good agreement. Transient evaluation of the drawdown period was chosen as the most representative even though diagrams from both periods are presented in this report. The transient evaluation was performed using the Hantush-Jacob model for confined leaky aquifers. Transient, quantitative interpretation of the drawdown and recovery period is shown in log-log diagrams in Figure A2-5 and A2-6, Appendix 2. The results from the transient evaluation are summarized in Table 6-210.

According to Table 6-203 the section has a relatively good hydraulic connection to the pumping borehole HFM14. However, the estimated hydraulic parameters may not be quite representative of the formation close to the observation section but rather to an adjacent fracture zone. That is, it could actually be a strong secondary response as opposed to a primary response.

6.5.2 Observation section HFM13: 159–173 m

Interpreted flow regimes

Both the drawdown and recovery period are dominated by pseudo-radial flow during intermediate times transitioning to pseudo-spherical (leaky) flow by the end.

Interpreted parameters

The results from the transient evaluation of the flow and recovery period are in good agreement. Transient evaluation of the flow period was chosen as the most representative even though diagrams from both periods are presented in this report. The transient evaluation was performed using the Hantush-Jacob model for confined leaky aquifers. Transient, quantitative interpretation of the flow and recovery period is shown in log-log diagrams in Figure A2-7 and A2-8, Appendix 2. The results from the transient evaluation are summarized in Table 6-210.

The section has a good hydraulic connection to the pumping borehole HFM14, cf. Figure 6-56. Thus the estimated hydraulic parameters may represent the hydraulic conditions between these boreholes and in the vicinity of the observation section.

6.5.3 Observation section HFM15: 85–95 m

Interpreted flow regimes

Both the drawdown and recovery period are dominated by an initial pseudo-linear flow regime transitioning to pseudo-radial flow during intermediate times and pseudo-spherical (leaky) flow by the end. A very fast response was observed (see Table 6-203) indicating very good hydraulic communication with the pumping borehole HFM14.

Interpreted parameters

The results from the transient evaluation of the flow and recovery period are in good agreement. Transient evaluation of the flow period was chosen as the most representative even though diagrams from both periods are presented in this report. The transient evaluation was performed using the Hantush-Jacob model for confined leaky aquifers. The transient interpretation of the flow and recovery period is shown in log-log diagrams in Figure A2-9 and A2-10, Appendix 2. The results from the transient evaluation are summarized in Table 6-210.

The section has a very good hydraulic connection to the pumping borehole HFM14, cf. Figure 6-56. Thus the estimated hydraulic parameters can be assumed to represent the hydraulic conditions between these boreholes and in the vicinity of the observation section.

6.5.4 Observation section HFM19: 168–182 m

Interpreted flow regimes

Both the drawdown and recovery period are dominated by pseudo-radial flow during intermediate times transitioning to pseudo-spherical (leaky) flow by the end.

Interpreted parameters

The results from the transient evaluation of the flow and recovery period are in good agreement. Transient evaluation of the flow period was chosen as the most representative even though diagrams from both periods are presented in this report. The transient evaluation was performed using the Hantush-Jacob model for confined leaky aquifers. The transient interpretation of the flow and recovery period is shown in log-log diagrams in Figure A2-11 and A2-12, Appendix 2. The results from the transient evaluation are summarized in Table 6-210.

The section has a very good hydraulic connection to the pumping borehole HFM14. Thus the estimated hydraulic parameters can be assumed to represent the hydraulic conditions between these boreholes and in the vicinity of the observation section.

6.5.5 Observation section HFM32: 26–31 m

Interpreted flow regimes

A very weak response occurred in this section. The response is dominated by pseudo-spherical (leaky) flow approaching pseudo-stationary flow.

Interpreted parameters

The results from the transient evaluation of the flow and recovery period are in good agreement. Transient evaluation of the flow period was chosen as the most representative even though diagrams from both periods are presented in this report. The transient evaluation was performed using the Hantush-Jacob model for confined leaky aquifers. The transient interpretation of the flow and recovery period is shown in log-log diagrams in Figures A2-13 and A2-14, Appendix 2. The results from the transient evaluation are summarized in Table 6-210.

The section has a bad hydraulic connection to the pumping borehole HFM14, cf. Figure 6-56. This makes the evaluation quite uncertain and possibly not representative of the formation close to the observation section. The evaluated parameters may possibly reflect the conditions close to the pumping borehole HFM14 rather than the rock volume around the observation section.

6.5.6 Observation section KFM10A: 430–440 m

Interpreted flow regimes

Both the drawdown and recovery period are dominated by pseudo-radial flow during intermediate times transitioning to pseudo-spherical (leaky) flow by the end.

Interpreted parameters

The results from the transient evaluation of the flow and recovery period are in good agreement. Transient evaluation of the drawdown period was chosen as the most representative even though diagrams from both periods are presented in this report. The transient evaluation was performed using the Hantush-Jacob model for confined leaky aquifers. Transient, quantitative interpretation of the drawdown and recovery period is shown in log-log diagrams in Figure A2-15 and A2-16, Appendix 2. The results from the transient evaluation are summarized in Table 6-210.

According to Table 6-203 the section has a good hydraulic connection to the pumping borehole HFM14. However, the estimated hydraulic parameters are significantly higher than those from the previous single-hole injection tests, cf. Table 3-4. Thus, the results from the interference test may not be quite representative of the formation close to the observation section but rather to an adjacent fracture zone, suggesting that the response may possibly be a strong secondary response rather than a primary response.

6.5.7 Estimation of the hydraulic diffusivity of the sections

The hydraulic diffusivity of observation sections can be estimated from the response time lag in the section according to Streltsova (1988) /37/:

$$T/S = r_s^2 / [4 \cdot dt_L \cdot (1+dt_L/t_p) \cdot ln(1+t_p/dt_L)] \quad (6\text{-}1)$$

The time lag dt_L is based on a drawdown s = 0.01 m in the observation section. The estimated time lags based on the corrected drawdown in the selected sections are shown in Table 6-206 together with the corresponding hydraulic diffusivity T/S of the sections. For comparison, the ratio of the estimated transmissivity and storativity T_o/S_o from the transient evaluation of the responses in these sections during the interference tests is also presented.

Table 6-206 shows that there is a fairly good agreement between the estimated hydraulic diffusivity of the sections based on the response time lags and from the results of the transient evaluation, respectively. This is also illustrated in Figure 6-60.

Table 6-206. Estimated response time lags and hydraulic diffusivity for the selected observation sections from the interference tests in HFM14 at Forsmark.

Pumping borehole	Observation borehole	Section (m)	dt_L[s = 0.01 m] (s)	r_s (m)	T/S (m^2/s)	T_o /S_o (m^2/s)
HFM14	HFM01	33.5–45.5	842	377	4.56	6.56
HFM14	HFM13	159–173	342	297	6.35	21.9
HFM14	HFM15	85–95	2	72	42.4	7.65
HFM14	HFM19	168–182	102	247	13.2	27.9
HFM14	HFM32	26–31	20,942	512	0.52	0.44
HFM14	KFM10A	430–440	442	493	13.9	38.8

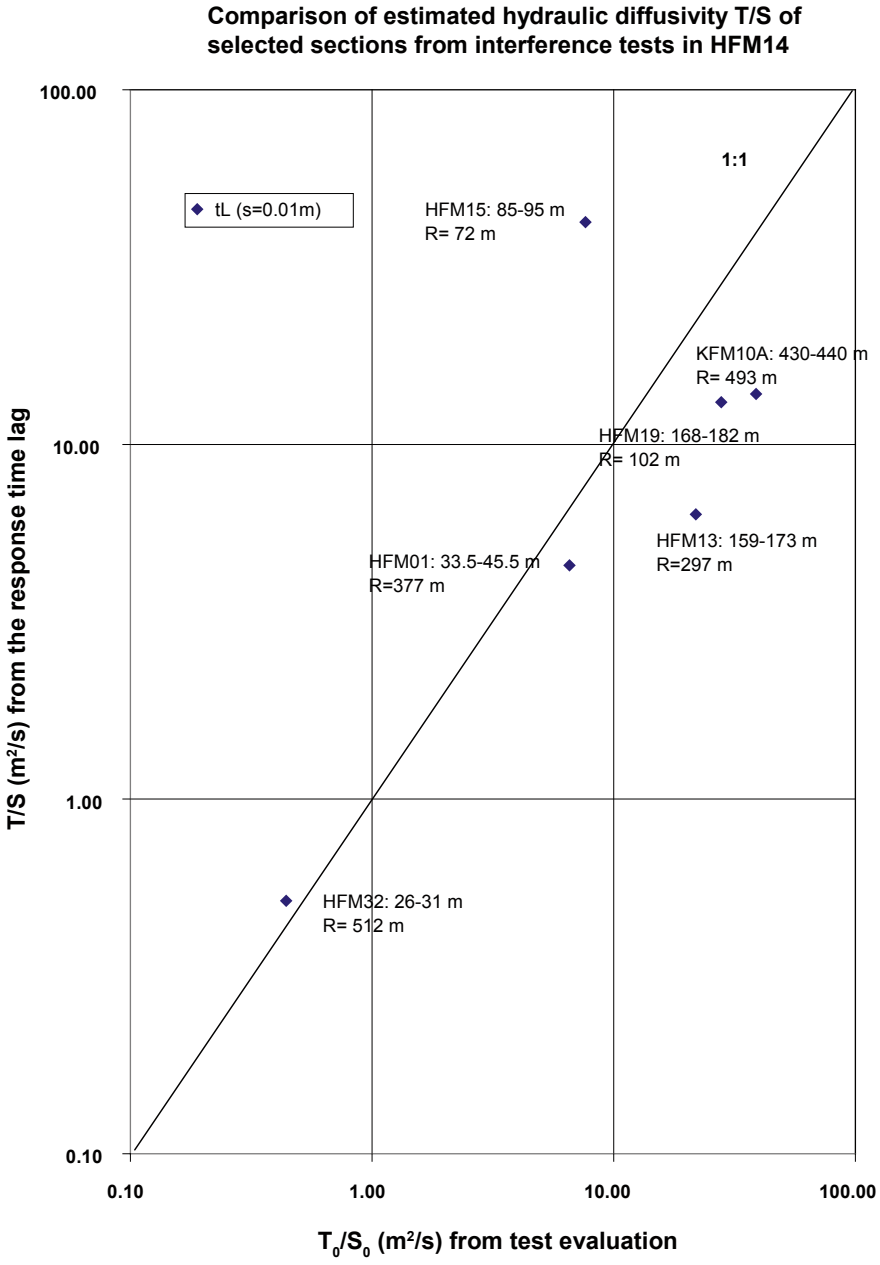


Figure 6-60. *Comparison of estimated hydraulic diffusivity of selected observation sections from the interference tests in HFM14 at Forsmark.*

6.6 Summary of the results of the interference tests

A compilation of measured test data from the interference test in HFM14 is shown in Tables 6-207 and 6-208. In Tables 6-209 and 6-210 calculated hydraulic parameters for the pumping borehole and five observation sections selected for quantitative evaluation are presented.

Out of the 185 observation sections included in the two interference tests, 76 did not respond at all to pumping in HFM14 or responded very weakly. Of the remaining 109 sections, approximately 50% responded with a drawdown of more than 0.5 m. Four observation sections stand out as responding most strongly. These sections, HFM15: 0–84 m, HFM15: 85–95 m, HFM19: 168–182 m and KFM10A: 430–440 m, together with at least three other sections; HFM19: 104–167 m, HFM13: 159–173 m and KFM10A: 441–500 m, demonstrate responses that are distinct enough to be characterized as potential zone responses between HFM14 and the actual sections. In KFM08D, section 0–160 m is clearly affected by the pumping in HFM14. Neither any of the other sections in KFM08D nor any of the sections in KFM08A can be said to respond clearly to the pumping in HFM14.

The estimated T-value for HFM14 in Table 6-209 from transient evaluation is in good agreement with that ($T = 4.7 \cdot 10^{-4}$ m^2/s) from the previous single-hole pumping test and flow logging in this borehole, /1/. The estimated transmissivities from observation sections HFM01: 33.5–45.5 m and KFM10A: 430–440 m are significantly higher than the T-values obtained from single-hole tests from previous investigations (/2/ and /34/), cf. Table 3-4. Thus, the results from the interference test may not be quite representative of the formation close to the observation section but rather to an adjacent fracture zone, suggesting that the response may possibly be a strong secondary response rather than a primary response. The estimated T-values from the other observation sections correspond well to those from previous single-hole investigations.

The results of the interference tests show a fairly good agreement between the estimated hydraulic diffusivity of the sections based on the response time lags and from the results of the transient evaluation, respectively.

Table 6-207. Summary of test data from the pumping borehole during the interference test performed in HFM14 in the Forsmark area.

Pumping borehole ID	Section (m)	Test Type[1)]	h_i (m)	h_p (m)	h_F (m)	Q_p (m^3/s)	Q_m (m^3/s)	V_p (m^3)
HFM14	6–150	1B	16.89	4.88	16.55	0.00582	0.00581	51,220
HFM14 [2)]	6–150	1B	17.39	5.99	17.53	0.00582	0.00576	7,962

[1)] 1B: Pumping test-submersible pump, 2: Interference test (observation borehole during pumping in another borehole).

[2)] Second pumping.

Table 6-208. Summary of test data from the observation sections involved in the interference tests performed in HFM14 in the Forsmark area.

Pumping borehole ID	Borehole ID	Section (m)	Test Type[1)]	h_i (m)	h_p (m)	h_F (m)
HFM14	HFM15	0–84	2	0.65	–7.20	0.29
		85–95	2	0.61	–7.04	0.36
HFM14	KFM05A	0–114	2	0.33	–5.12	0.21
		115–253	2	0.18	–5.18	–0.12
		254–272	2	0.50	–0.63	–0.50
		273–489	2	2.87	2.93	2.86
		490–698	2	1.94	1.77	1.74
		699–1,002	2	0.88	0.43	0.40
HFM14	HFM19	0–103	2	0.83	–5.50	0.53
		104–167	2	0.68	–5.65	0.43
		168–182	2	0.20	–6.21	–0.12
HFM14	HFM13	0–100	2	2.49	0.29	1.91
		101–158	2	1.16	–3.57	0.91
		159–173	2	0.34	–5.96	–0.03
HFM14	KFM01C	0–58	2	0.08	–2.85	–0.13
		59–237	2	0.02	–3.03	–0.22
		238–450	2	0.23	–0.72	–1.01
HFM14	HFM01	0–32.5	2	0.36	–2.46	0.12
		33.5–45.5	2	0.37	–2.42	0.14
		46.5–200	2	0.36	–1.84	0.13
HFM14	KFM01A	0–108	2	0.15	–2.07	–1.87
		109–130	2	0.06	–2.04	–0.31
		131–204	2	0.16	–1.90	–0.27
		205–373	2	0.18	0.05	0.05
		374–430	2	0.87	0.97	0.97
		431–1,002	2	5.47	6.12	6.13
HFM14	KFM01D	0–153	2	–0.07	–2.17	–0.37
		154–252	2	–0.07	–1.45	–0.55
		253–310	2	–0.46	–0.40	–0.48
		311–321	2	–0.54	–0.47	–0.55
		322–428	2	–0.72	–0.42	–0.48
		429–438	2	–0.64	–0.36	–0.40
		439–800	2	–0.88	–0.69	–0.68
HFM14	KFM01B	0–100	2	0.38	–2.44	0.18
		101–141	2	0.21	–2.00	–0.30
		142–500	2	0.43	–1.66	–0.05
HFM14	KFM10A	0–152	2	1.08	0.74	0.91
		153–352	2	0.93	–4.40	–0.16
		353–429	2	1.08	–4.66	0.61
		430–440	2	0.69	–5.23	0.39
		441–500	2	0.58	–5.42	0.19
HFM14	HFM32	0–25	2	–0.12	–0.24	–0.10
		26–31	2	–0.11	–0.28	–0.11

Pumping borehole ID	Borehole ID	Section (m)	Test Type[1)]	h_i (m)	h_p (m)	h_F (m)
		32–97	2	–0.27	–2.24	–0.40
		98–203	2	–0.29	–2.39	–0.48
HFM14	HFM03	0–18	2	0.48	–2.24	0.20
		19–26	2	0.48	–2.36	0.25
HFM14	HFM02	0–37	2	0.39	–2.43	0.15
		38–48	2	0.47	–2.38	0.25
		49–100	2	0.48	–2.38	0.25
HFM14	HFM27	0–24	2	0.47	–2.15	0.24
		25–45	2	0.45	–2.34	0.23
		46–58	2	0.37	–2.46	0.17
		59–128	2	0.42	–2.38	0.14
HFM14	HFM24	0–35	2	1.06	0.76	0.93
		36–65	2	1.06	0.75	0.91
		66–151	2	0.96	0.64	0.81
HFM14	KFM04A	0–163	2	1.96	1.74	2.00
		164–185	2	2.10	1.71	1.97
		186–229	2	2.09	1.63	1.94
		230–245	2	1.98	1.57	1.87
		246–390	2	1.53	0.76	1.51
		391–495	2	1.70	1.18	1.33
		496–1,001	2	2.17	1.86	1.94
HFM14	KFM06A	0–150	2	0.18	–0.47	0.05
		151–246	2	0.00	–0.74	–0.12
		247–340	2	0.24	–0.56	0.17
		341–362	2	0.23	–0.41	–0.09
		363–737	2	–0.05	–0.68	–0.39
		738–748	2	–0.32	–0.74	–0.68
		749–826	2	0.14	–0.27	–0.21
		827–1,001	2	–0.61	–0.47	–0.46
HFM14	KFM06C	0–186	2	0.08	–0.63	–0.11
		187–280	2	–0.03	–0.64	–0.10
		281–350	2	–0.14	–0.78	–0.32
		351–401	2	–0.22	–1.07	–0.36
		402–530	2	0.02	–0.74	–0.15
		531–540	2	0.07	–0.56	–0.08
		541–646	2	–0.14	–0.76	–0.58
		647–666	2	0.42	–0.10	0.07
		667–872	2	–0.01	–0.44	–0.41
		873–1,001	2	0.60	0.01	0.00
HFM14	KFM06B	0–26	2	0.65	–0.60	0.52
		27–50	2	0.59	–0.89	0.41
		51–100	2	0.59	–0.80	0.43
HFM14	HFM10	0–99	2	–	1.79	1.95

Pumping borehole ID	Borehole ID	Section (m)	Test Type[1)]	h_i (m)	h_p (m)	h_F (m)
		100–150	2	2.13	1.77	2.02
HFM14	HFM16	0–53	2	0.55	–0.92	0.37
		54–67	2	0.58	–0.78	0.41
		68–132	2	0.53	–0.83	0.38
HFM14	HFM09	0–50	2	2.49	2.10	2.36
HFM14	KFM07B	0–74	2	0.19	0.16	0.16
		75–202	2	0.26	–1.19	0.11
		203–300	2	–0.05	–2.41	–0.23
HFM14	HFM21	0–21	2	0.38	–0.11	0.02
		22–32	2	0.38	–0.31	0.28
		33–106	2	0.44	–1.00	0.30
		107–202	2	0.19	–1.76	0.16
HFM14	KFM07C	0–110	2	0.27	–1.11	0.19
		111–160	2	0.07	–1.92	0.00
		161–301	2	0.08	–1.53	–0.50
		302–500	2	0.86	0.38	0.41
HFM14	KFM07A	0–148	2	0.14	–1.28	0.03
		149–190	2	–0.17	–1.67	–0.33
		191–225	2	–0.20	–1.44	–1.09
		226–961	2	–0.20	–1.35	–1.15
		962–972	2	–4.39	–4.43	–4.39
		973–1,001	2	–4.20	–4.25	–4.23
HFM14	KFM09B	0–200	2	–0.10	–0.99	–0.30
		201–450	2	0.03	–1.28	–0.42
		451–616	2	–1.55	–0.45	–0.38
HFM14	HFM22	0–222	2	0.18	–1.13	0.03
HFM14	HFM20	0–48	2	0.66	0.16	0.48
		49–100	2	0.62	–0.44	0.50
		101–130	2	0.68	–0.64	0.56
		131–301	2	0.77	–0.65	0.64
HFM14	KFM08B	0–70	2	0.05	–0.31	0.03
		71–112	2	0.28	0.25	0.10
		113–200	2	0.77	0.62	0.62
HFM14	HFM30	0–60	2	–	2.12	2.23
		61–73	2	–	2.00	2.07
		74–176	2	2.19	2.01	2.09
		177–201	2	2.08	1.95	2.02
HFM14	HFM25	0–188	2	0.16	–0.05	0.09
HFM14	KFM09A	0–300	2	1.45	1.12	1.29
		301–550	2	1.39	1.03	1.00
		551–800	2	–2.88	–3.07	–3.06
HFM14	HFM28	0–151	2	1.67	1.29	1.45
HFM14	HFM23	0–212	2	1.38	1.10	1.23

Pumping borehole ID	Borehole ID	Section (m)	Test Type[1)]	h_i (m)	h_p (m)	h_F (m)
HFM14	HFM38	0–23	2	–0.04	–0.19	–0.08
		24–41	2	–0.01	–0.18	0.00
		42–201	2	–0.08	–0.16	–0.14
HFM14	HFM29	0–200	2	1.44	1.11	1.14
HFM14	HFM17	0–211	2	0.50	0.33	0.43
HFM14	KFM02B	0–130	2	–	–1.05	–0.74
		131–245	2	–	0.06	0.25
		246–409	2	–	–0.90	0.16
		410–431	2	–	–1.51	–0.30
		432–490	2	–1.55	–1.48	–0.25
		491–506	2	–	–1.54	–0.31
		507–570	2	–	–1.05	–0.74
HFM14	KFM02A	0–132	2	0.60	0.32	0.50
		133–240	2	0.42	0.10	0.31
		241–410	2	0.87	–0.25	0.68
		411–442	2	–0.06	–1.40	–0.19
		443–489	2	–0.12	–1.48	–0.25
		490–518	2	–0.12	–1.46	–0.22
		519–888	2	0.23	–0.50	–0.27
		889–1,002	2	0.86	0.07	0.06
HFM14	HFM05	0–138	2	–	0.40	0.55
		139–200	2	0.31	0.24	0.42
HFM14	HFM33	0–140	2	–0.02	–0.21	0.10
HFM14	HFM04	0–57	2	0.96	0.54	0.62
		58–66	2	0.49	0.25	0.42
		67–222	2	0.43	0.22	0.36
HFM14	HFM12	0–56.5	2	6.09	6.05	6.08
		57.5–210	2	6.17	6.05	6.09
HFM14	KFM11A	0–130	2	–	–2.95	–2.95
		131–360	2	–	–1.71	–1.70
		361–445	2	–	–2.92	–2.99
		446–456	2	–	–3.08	–3.14
		457–689	2	–	–5.44	–5.45
		690–710	2	–	–6.56	–6.60
		711–850	2	–	–3.31	–3.31
HFM14	HFM11	0–53	2	6.10	6.06	6.20
		54–182	2	–	5.59	5.61
HFM14	HFM18	0–27	2	0.11	0.19	0.28
		28–41	2	0.30	0.35	0.39
		42–180	2	0.28	0.34	0.39
HFM14	KFM08D [2)]	0–160	2	0.30	–0.68	0.32
		161–330	2	–0.07	–0.15	0.00

Pumping borehole ID	Borehole ID	Section (m)	Test Type[1)]	h_i (m)	h_p (m)	h_F (m)
		331–659	2	–0.62	–0.58	–0.54
		660–680	2	0.00	–0.24	–0.03
		681–824	2	–0.11	–0.23	–0.13
		825–835	2	–1.74	–1.84	–1.71
		836–950	2	–2.01	–2.07	–2.00
HFM14	KFM08A [2)]	0–161	2	–0.02	0.01	–0.09
		162–215	2	0.24	0.20	0.14
		216–264	2	0.38	0.39	0.31
		265–280	2	–0.64	–0.63	–0.70
		281–473	2	–0.68	–0.74	–0.73
		474–503	2	–0.54	–0.59	–0.55
		504–683	2	–1.86	–1.86	–3.61
		684–694	2	0.19	0.19	0.23
		695–1,001	2	0.51	0.49	0.55
HFM14	KFM11A [2)]	0–130	2	–3.00	–2.86	–2.99
		131–360	2	–1.66	–1.54	–1.61
		361–445	2	–3.01	–3.03	–3.03
		446–456	2	–3.17	–3.20	–3.19
		457–689	2	–5.36	–5.46	–5.45
		690–710	2	–6.65	–6.73	–6.70
		711–850	2	–3.32	–3.43	–3.38
HFM14	KFM02B [2)]	0–130	2	0.75	0.86	0.96
		131–245	2	0.51	0.60	0.74
		246–409	2	0.69	–0.40	0.58
		410–431	2	–0.01	–1.10	0.00
		432–490	2	0.03	–1.08	0.05
		491–506	2	0.00	–1.14	–0.01
		507–570	2	–0.38	–0.82	–0.46

[1)] 1B: Pumping test-submersible pump, 2: Interference test (observation borehole during pumping in another borehole).

[2)] Borehole measured during the second, shorter interference test. Not inserted in table by order of distance from HFM14.

Table 6-209. Summary of calculated hydraulic parameters from the single-hole test in HFM14 in the Forsmark area.

Pumping borehole ID	Section (m)	Test type	Q/s (m^2/s)	T_M (m^2/s)	T_T (m^2/s)	ζ (–)	C (m^3/Pa)	S* (–)
HFM14	6–150	1B	$4.8 \cdot 10^{-4}$	$6.1 \cdot 10^{-4}$	$3.7 \cdot 10^{-4}$	–6.2	$2.9 \cdot 10^{-6}$	$1.5 \cdot 10^{-5}$

Table 6-210. Summary of calculated hydraulic parameters from the interference test between HFM14 and the observation boreholes HFM01, HFM13, HFM15, HFM19, HFM32 and KFM10A, respectively, in the Forsmark area.

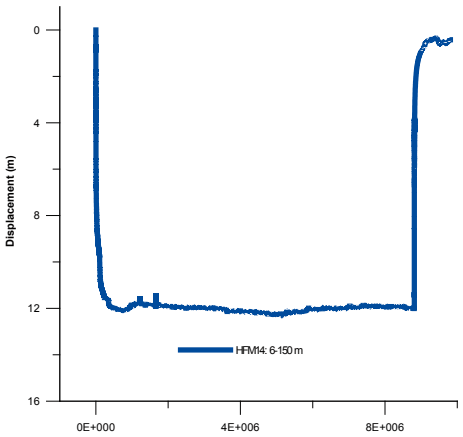
Pumping borehole ID	Observation borehole ID	Section (m)	Test type	T_o (m^2/s)	S_o (–)	T_o/S_o (m^2/s)	K'/b' (s^{-1})
HFM14	HFM01	33.5–45.5	2	$5.9 \cdot 10^{-4}$	$9.0 \cdot 10^{-5}$	$6.6 \cdot 10^{0}$	$1.7 \cdot 10^{-10}$
	HFM13	159–173	2	$3.5 \cdot 10^{-4}$	$1.6 \cdot 10^{-5}$	$2.2 \cdot 10^{1}$	$4.8 \cdot 10^{-11}$
	HFM15	85–95	2	$3.9 \cdot 10^{-4}$	$5.1 \cdot 10^{-5}$	$7.6 \cdot 10^{0}$	$1.6 \cdot 10^{-10}$
	HFM19	168–182	2	$3.9 \cdot 10^{-4}$	$1.4 \cdot 10^{-5}$	$2.8 \cdot 10^{1}$	$3.9 \cdot 10^{-11}$
	HFM32	26–31	2	$1.5 \cdot 10^{-4}$	$3.4 \cdot 10^{-4}$	$4.4 \cdot 10^{-1}$	$5.4 \cdot 10^{-9}$
	KFM10A	430–440	2	$3.3 \cdot 10^{-4}$	$8.5 \cdot 10^{-6}$	$3.9 \cdot 10^{1}$	$2.9 \cdot 10^{-11}$

Q/s = specific flow for the pumping/injection borehole.
T_M = steady state transmissivity from Moye's equation.
T_T = transmissivity from transient evaluation of single-hole test.
T_o = transmissivity from transient evaluation of interference test.
S_o = storativity from transient evaluation of interference test.
T_o/S_o = hydraulic diffusivity (m^2/s).
K'/b' = leakage coefficient from transient evaluation of interference test.
S* = assumed storativity by the estimation of the skin factor in single hole tests.
C = wellbore storage coefficient.
ζ = skin factor.

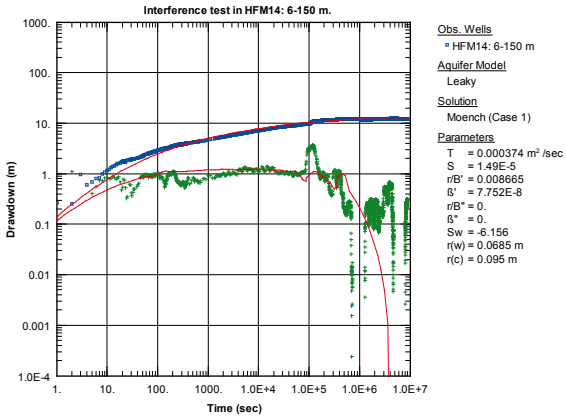
Test Summary Sheet – Pumping section HFM14: 6–150 m

Project:	PLU	Test type:	1B
Area:	Forsmark	Test no:	1
Borehole ID:	HFM14	Test start:	2007-06-25 14:58
Test section (m):	6–150	Responsible for test performance:	GEOSIGMA AB K Gokall-Norman
Section diameter, 2·rw (m):	0.137	Responsible for test evaluation:	GEOSIGMA AB J-E Ludvigson

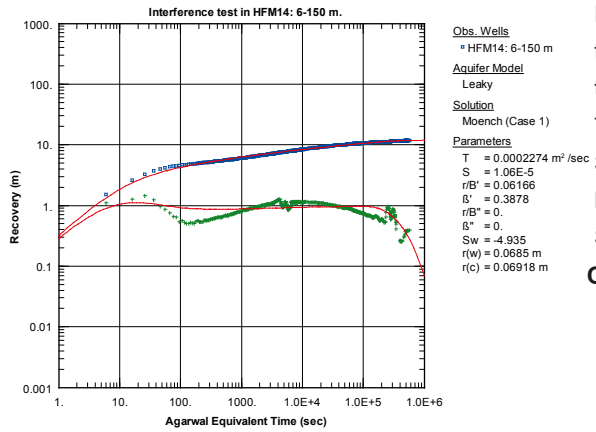
Linear plot pressure – Entire test period



Log-Log plot incl. derivate – Flow period



Log-Log plot incl. derivative – Recovery period



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa)			
p_i (kPa)	165.72		
p_p(kPa)	47.87	p_F (kPa)	162.43
Q_p (m³/s)	0.00582		
tp (s)	8,811,845	t_F (s)	610,197
S*	$1.49 \cdot 10^{-5}$	S*	$1.1 \cdot 10^{-5}$
EC_w (mS/m)			
Te_w(gr C)			
Derivative fact.	0.2	Derivative fact.	0.2
Results		**Results**	
Q/s (m²/s)	$4.8 \cdot 10^{-4}$		
T_{Moye}(m²/s)	$6.1 \cdot 10^{-4}$		
Flow regime:	PRF	Flow regime:	PRF
t_1 (s)	2,000	dt_{e1} (s)	2,000
t_2 (s)	70,000	dt_{e2} (s)	50,000
T_w (m²/s)	$3.7 \cdot 10^{-4}$	T_w (m²/s)	$2.3 \cdot 10^{-4}$
S_w (–)	$1.5 \cdot 10^{-5}$	S_w (–)	$1.1 \cdot 10^{-5}$
K_{sw} (m/s)		K_{sw} (m/s)	
S_{sw} (1/m)		S_{sw} (1/m)	
C (m³/Pa)	$2.9 \cdot 10^{-6}$	C (m³/Pa)	–
C_D (–)		C_D (–)	
ξ (–)	–6.2	ξ (–)	–4.9
T_{GRF}(m²/s)		T_{GRF}(m²/s)	
S_{GRF}(–)		S_{GRF}(–)	
D_{GRF} (–)		D_{GRF} (–)	

Interpreted formation and well parameters.

Flow regime:	PRF	C (m³/Pa)	$2.9 \cdot 10^{-6}$
t_1 (s)	2,000	C_D (–)	
t_2 (s)	70,000	ξ (–)	–6.2
T_T (m²/s)	$3.7 \cdot 10^{-4}$		
S (–)	$1.5 \cdot 10^{-5}$		
K_s (m/s)			
S_s (1/m)			

Comments: All pressure data are relative pressures.

7 References

/1/ **Lindquist A, Ludvigson J-E, 2006.** Forsmark site investigation. Pumping test and flow logging in borehole HFM14 and pumping test in KFM05A (0–114 m) SKB P-06-140, Svensk Kärnbränslehantering AB.

/2/ **Ludvigson J-E, Jönsson S, Levén J, 2003.** Forsmark site investigation. Pumping tests and flow logging – Boreholes KFM01A (0–100 m), HFM01, HFM02 and HFM03. SKB P-03-33, Svensk Kärnbränslehantering AB.

/3/ **Ludvigson J-E, Levén J, Jönsson S, 2004.** Forsmark site investigation. Single-hole injection tests in borehole KFM01A. SKB P-04-95, Svensk Kärnbränslehantering AB.

/4/ **Ludvigson J-E, Jönsson S, Jönsson J, 2004.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM13, HFM14 and HFM15. SKB P-04-71, Svensk Kärnbränslehantering AB.

/5/ **Gokall-Norman K, Ludvigson J-E, Hjerne C, 2005.** Forsmark site investigation. Single-hole injection tests in borehole KFM05A. SKB P-05-56, Svensk Kärnbränslehantering AB.

/6/ **Ludvigson J-E, Källgården J, Hjerne C, 2004.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM17, HFM18 and HFM19. SKB P-04-72, Svensk Kärnbränslehantering AB.

/7/ **Jönsson J, Hjerne C, Ludvigson J-E, 2005.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM20, HFM21 and HFM22. SKB P-05-14, Svensk Kärnbränslehantering AB.

/8/ **Sokolnicki M, Rouhiainen P, 2005.** Forsmark site investigation. Difference flow logging in borehole KFM07A. SKB P-05-63, Svensk Kärnbränslehantering AB.

/9/ **Gokall-Norman K, Svensson T, Ludvigson J-E, 2005.** Forsmark site investigation. Single-hole injection tests in borehole KFM07A. SKB P-05-133, Svensk Kärnbränslehantering AB.

/10/ **Hjerne C, Ludvigson J-E, 2005.** Forsmark site investigation. Single-hole injection tests in borehole KFM04A. SKB P-04-293, Svensk Kärnbränslehantering AB.

/11/ **Ludvigson J-E, Källgården J, Jönsson J, 2004.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM09 and HFM10. SKB P-04-74, Svensk Kärnbränslehantering AB.

/12/ **Hjerne C, Ludvigson J-E, Lindquist A, 2005.** Forsmark site investigation. Single-hole injection tests in boreholes KFM06A and KFM06B. SKB P-05-165, Svensk Kärnbränslehantering AB.

/13/ **Ludvigson J-E, Jönsson S, Hjerne C, 2004.** Forsmark site investigation. Pumping tests and flow logging – Boreholes KFM06A (0–100 m) and HFM16. SKB P-04-65, Svensk Kärnbränslehantering AB.

/14/ **Rouhiainen P, Pöllänen J, 2004.** Forsmark site investigation. Difference flow logging in borehole KFM02A. SKB P-04-188, Svensk Kärnbränslehantering AB.

/15/ **Pöllänen J, Sokolnicki M, Rouhainen P, 2004.** Difference flow logging in borehole KFM05A. Forsmark site investigation. SKB P-04-191. Svensk Kärnbränslehantering AB.

/16/ **Gustavsson E, Ludvigson J-E, Hjerne C, Florberger J, 2006.** Forsmark site investigation. Single-hole injection tests in borehole KFM01C. SKB P-06-165. Svensk Kärnbränslehantering AB.

/17/ **Jönsson S, Ludvigson J-E, 2006.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM24, HFM32. SKB P-06-96, Svensk Kärnbränslehantering AB.

/18/ **Jönsson S, Ludvigson J-E, 2006.** Forsmark site investigation. Pumping tests and flow logging – boreholes HFM23, HFM27 and HFM28. SKB P-06-191, Svensk Kärnbränslehantering AB.

/19/ **Rouhiainen P, Pöllänen J, 2004.** Forsmark site investigation. Difference flow logging in borehole KFM04A. SKB P-04-190, Svensk Kärnbränslehantering AB.

/20/ **Hjerne C, Ludvigson J-E, Lindquist A, 2005.** Forsmark site investigation. Single-hole injection tests in boreholes KFM06A and KFM06B. SKB P-05-165, Svensk Kärnbränslehantering AB.

/21/ **Lindquist A, Ludvigson J-E, Gokall-Norman K, 2006.** Forsmark site investigation. Single-hole injection tests in borehole KFM06C. SKB P-06-23, Svensk Kärnbränslehantering AB.

/22/ **Gokall-Norman K, Lindquist A, Ludvigson J-E, Gustavsson E, 2006.** Forsmark site investigation. Single-hole injection tests and pressure pulse tests in borehole KFM07B. SKB P-06-86, Svensk Kärnbränslehantering AB.

/23/ **Sokolnicki M, Rouhiainen P, 2005.** Forsmark site investigation. Difference flow logging in borehole KFM08A. SKB P-05-43, Svensk Kärnbränslehantering AB.

/24/ **Lindquist A, Ludvigson J-E, Svensson T, 2006.** Forsmark site investigation. Single-hole injection tests and pressure pulse tests in borehole KFM08B. SKB P-05-235, Svensk Kärnbränslehantering AB.

/25/ **Jönsson S, Ludvigson J-E, 2006.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM25, HFM26. SKB P-06-139, Svensk Kärnbränslehantering AB.

/26/ **Lindquist A, Ludvigson J-E, Harrström J, Svensson T, 2006.** Forsmark site investigation. Single-hole injection tests in borehole KFM09A. SKB P-06-52, Svensk Kärnbränslehantering AB.

/27/ **Ludvigson J-E, Jönsson S, Svensson T, 2003.** Forsmark site investigation. Pumping tests and flow logging – Boreholes KFM02A (0–100 m), HFM04 and HFM05. SKB P-03-34, Svensk Kärnbränslehantering AB.

/28/ **Ludvigson J-E, Jönsson S, Jönsson J, 2003.** Forsmark site investigation. Pumping tests and flow logging – Boreholes HFM11 and HFM12. SKB P-04-64, Svensk Kärnbränslehantering AB.

/29/ **Källgården J, Ludvigson J-E, Jönsson J, 2004.** Forsmark site investigation. Single-hole injection tests in borehole KFM02A. SKB P-04-100, Svensk Kärnbränslehantering AB.

/30/ **Walger E, Jönsson S, Ludvigson J-E, 2006.** Forsmark site investigation. Pumping tests and flow logging. Boreholes HFM36, HFM37 and HFM38. SKB P-07-22, Svensk Kärnbränslehantering AB.

/31/ **Väisäsvaara J, Pöllänen J, 2006.** Forsmark site investigation. Difference flow logging in borehole KFM02B. SKB P-07-83. Svensk Kärnbränslehantering AB.

/32/ **Gustavsson E, Jönsson S, Ludvigson J-E, 2006.** Forsmark site investigation. Pumping tests and flow logging. Boreholes HFM33, HFM34 and HFM35. SKB P-06-193, Svensk Kärnbränslehantering AB.

/33/ **Gokall-Norman K, Ludvigson J-E, 2007.** Forsmark site investigation. Hydraulic interference test in borehole HFM14**.** SKB P-06-196. Svensk Kärnbränslehantering AB.

/34/ **Sokolnicki M, Pöllänen J, Pekkanen J, 2006.** Forsmark site investigation. Difference flow logging in borehole KFM10A. SKB P-06-190. Svensk Kärnbränslehantering AB.

/35/ **Ludvigson J-E, Jönsson S, Levén J, 2004.** Forsmark site investigation. Hydraulic evaluation of pumping activities prior to hydro-geochemical sampling in borehole KFM03A – Comparison with results from difference flow logging. SKB P-04-96, Svensk Kärnbränslehantering AB.

/36/ **Hantush M S, 1955.** Nonsteady radial flow in an infinite leaky aquifer. Am. Geophys. Union Trans., v. 36, no 1, pp. 95–100.

/37/ **Streltsova T D, 1988**. Well testing in heterogeneous formations. Exxon Monograph. John Wiley and sons.

Appendix 1

List of data files

Files are named: Interferenstest_Pumphål_”BhID”_”YYYYMMDD”_”hhmm”_”File Type”. Interferenstest_Pumphål is just an internal marker. “BhID” is the name of the borehole, after that the datafile start time is given. Pumpin and Ref_Da are parts of the original file names produced by the HTHB data logger. Ref_Da contains constants of calibration and background data. Pumpin contains data from pumping tests (no combined flow logging).

Bh ID	Test section (m)	Test type[1]	Test no	Test start Date, time YYYY-MM-DD tt:mm:ss	Test stop Date, time YYYY-MM-DD tt:mm:ss	Datafile, start Date, time YYYY-MM-DD tt:mm:ss	Datafile, stop Date, time YYYY-MM-DD tt:mm:ss	Data files of raw and primary data	Content (parameters)[2]	Comments
HFM14	6–150	1B	1	2007-06-25 14:58:23	2007-10-15 12:00:00	2007-06-19 09:14:48	2007-10-25 08:38:27	Interferenstest_Pumphål_ HFM14_20070319_1615_Ref_Da00.DAT	P, Q	Pressure and flow registration in HFM14 for interference.
HFM14	6–150	1B	1	2007-06-25 14:58:23	2007-10-15 12:00:00	2007-03-19 16:15:07	2007-10-26 10:26:07	Interferenstest_Pumphål_ HFM14_20070619_0914_Pumpin00.DAT	C, R	
HFM14	6–150	1B	2	2007-11-27 08:45:04	2007-12-20 06:00:00	2007-11-01 09:08:15	2007-12-20 09:57:52	Interferenstest_Pumphål_ HFM14_20071220_0957_Pumpin00.DAT	P, Q	Pressure and flow registration in HFM14 for interference.
HFM14	6–150	1B	2	2007-11-27 08:45:04	2007-12-20 06:00:00	2007-03-19 16:15:07	2007-12-13 09:07:53	Interferenstest_Pumphål_ HFM14_20070319_1615_Ref_Da00.DAT	C, R	

[1)] 1B: Pumping test-submersible pump, 2: Interference test (observation borehole during pumping in another borehole).

[2)] P = Pressure, Q = Flow, Te = Temperature, EC = El. conductivity. SPR = Single Point Resistance, C = Calibration file, R = Reference file, Sp= Spinner rotations.

Appendix 2

Test diagrams and meteorological data

Nomenclature for AQTESOLV:

T = transmissivity (m^2/s).

S = storativity (–).

K_Z/K_r = ratio of hydraulic conductivities in the vertical and radial direction (set to 1).

Sw = skin factor.

r(w) = borehole radius (m).

r(c) = effective casing radius (m).

r/B = leakage coefficient (s^{-1}).

b = thickness of formation (m).

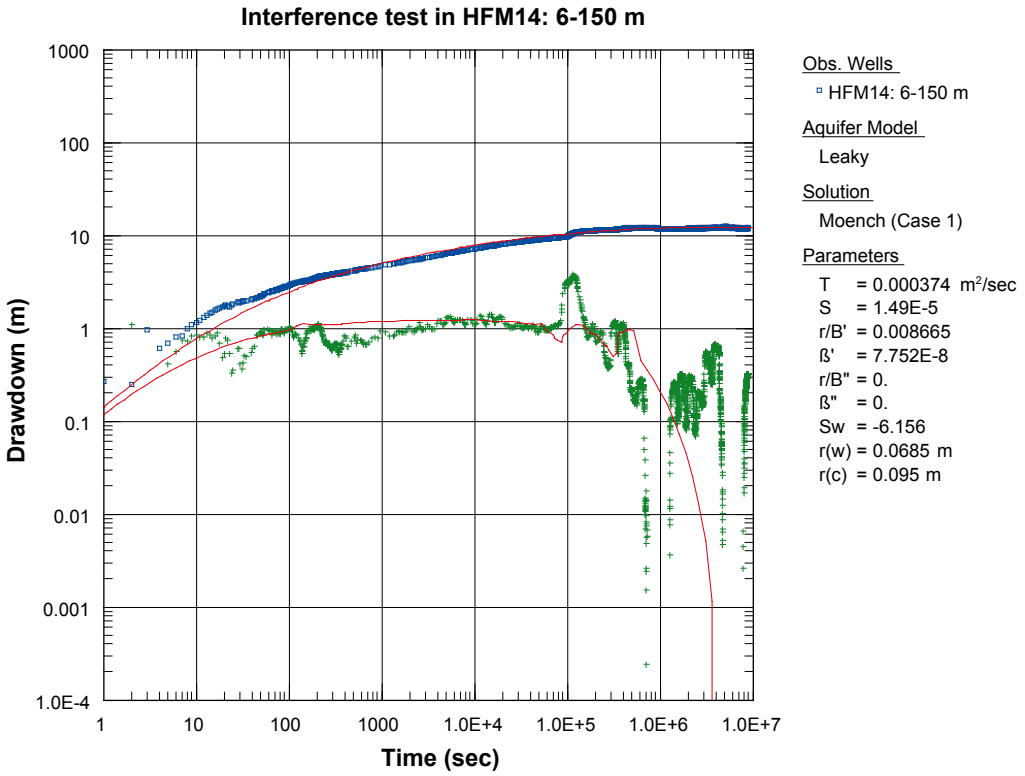


Figure A2-1. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in HFM14 during the first interference test in HFM14.*

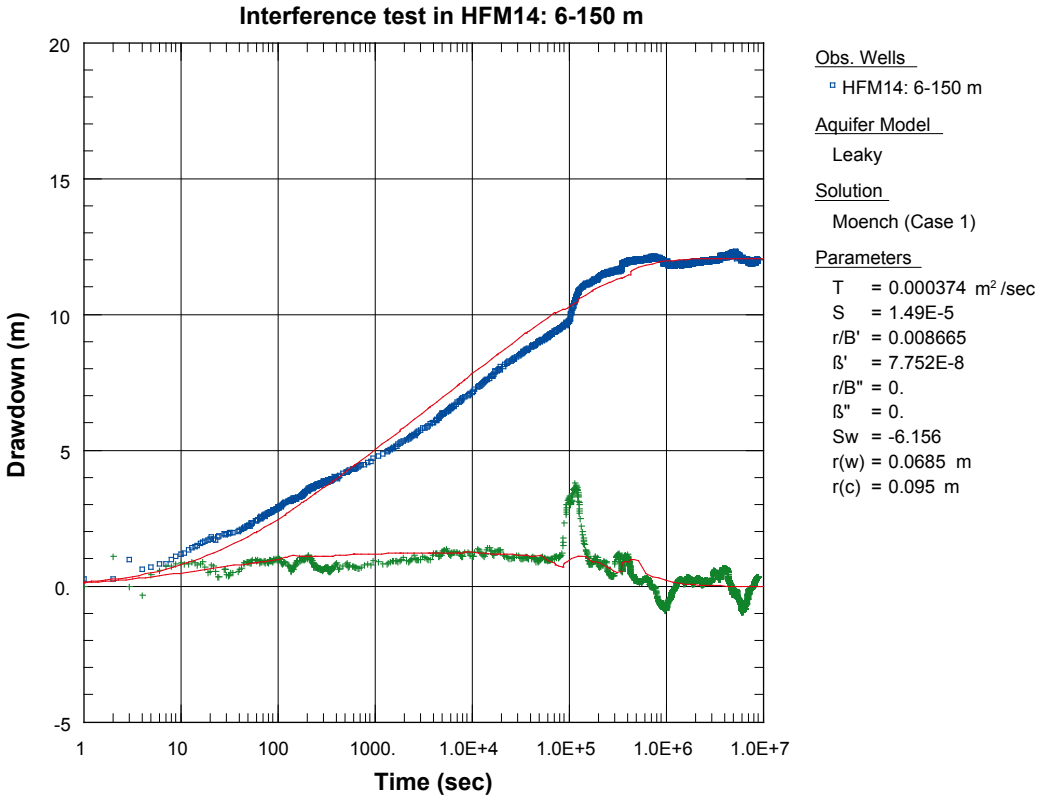


Figure A2-2. *Lin-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in HFM14 during the first interference test in HFM14.*

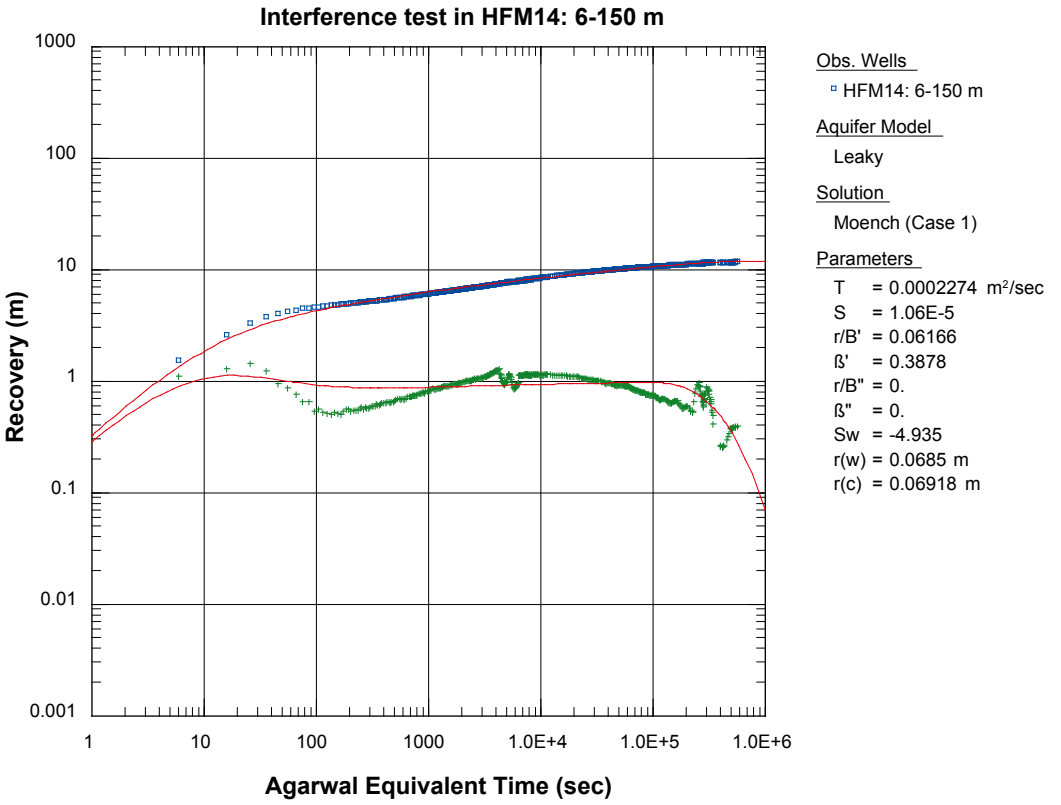


Figure A2-3. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in HFM14 during the first interference test in HFM14.*

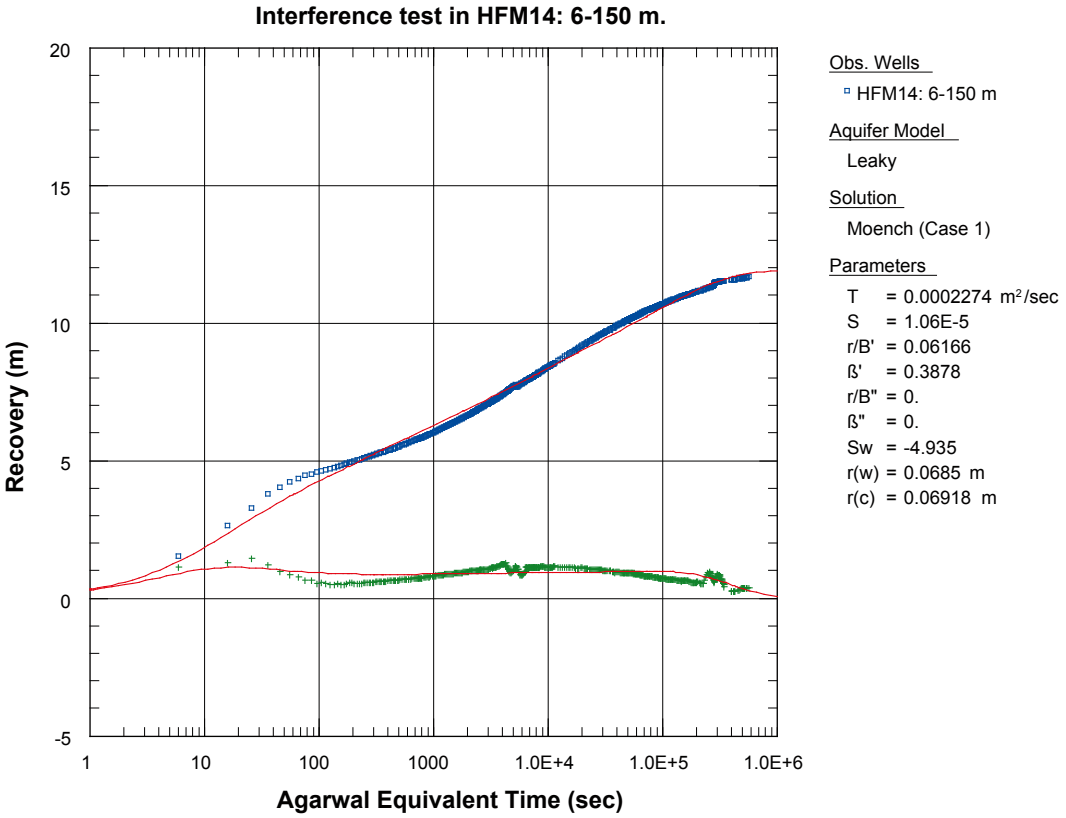


Figure A2-4. *Lin-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in HFM14 during the first interference test in HFM14.*

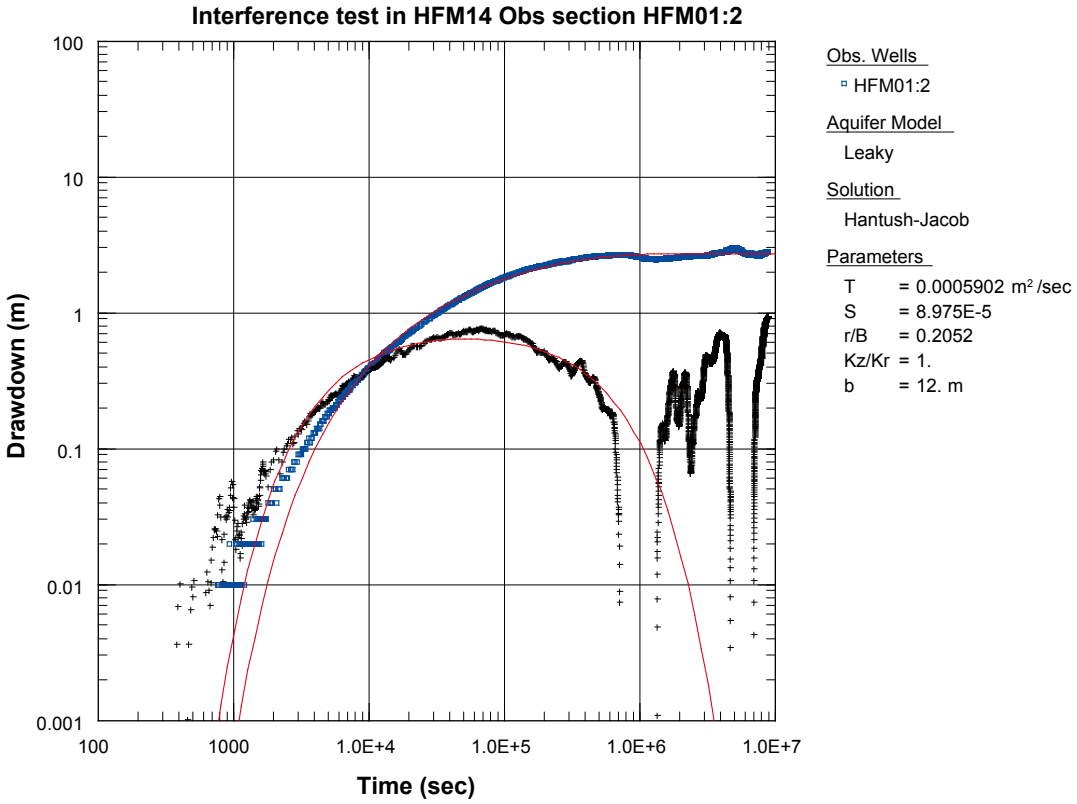


Figure A2-5. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in section HFM01:2 during the interference test in HFM14.*

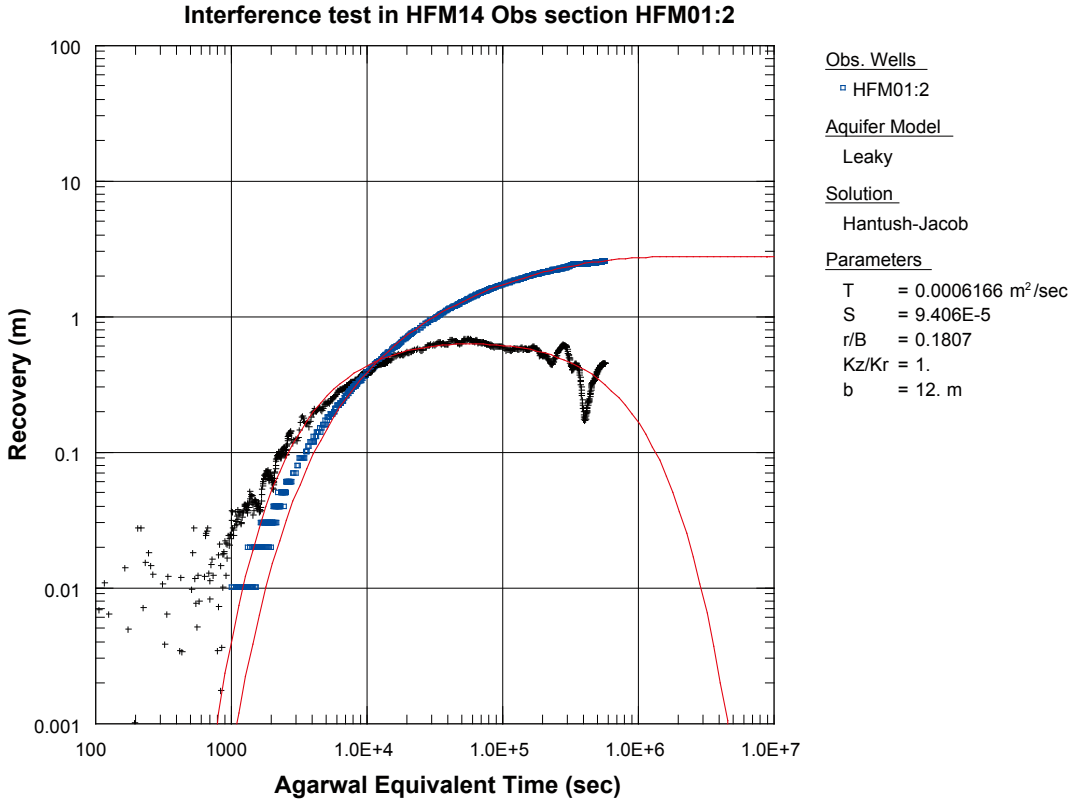


Figure A2-6. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in section HFM01:2 during the interference test in HFM14.*

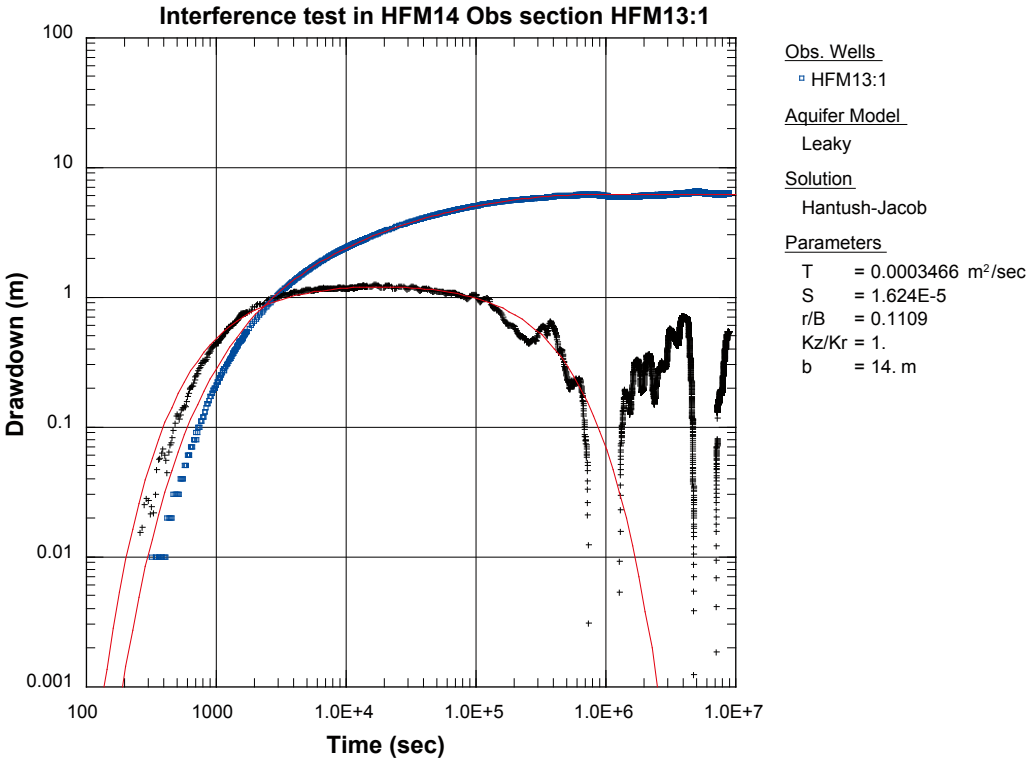


Figure A2-7. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in section HFM13:1 during the interference test in HFM14.*

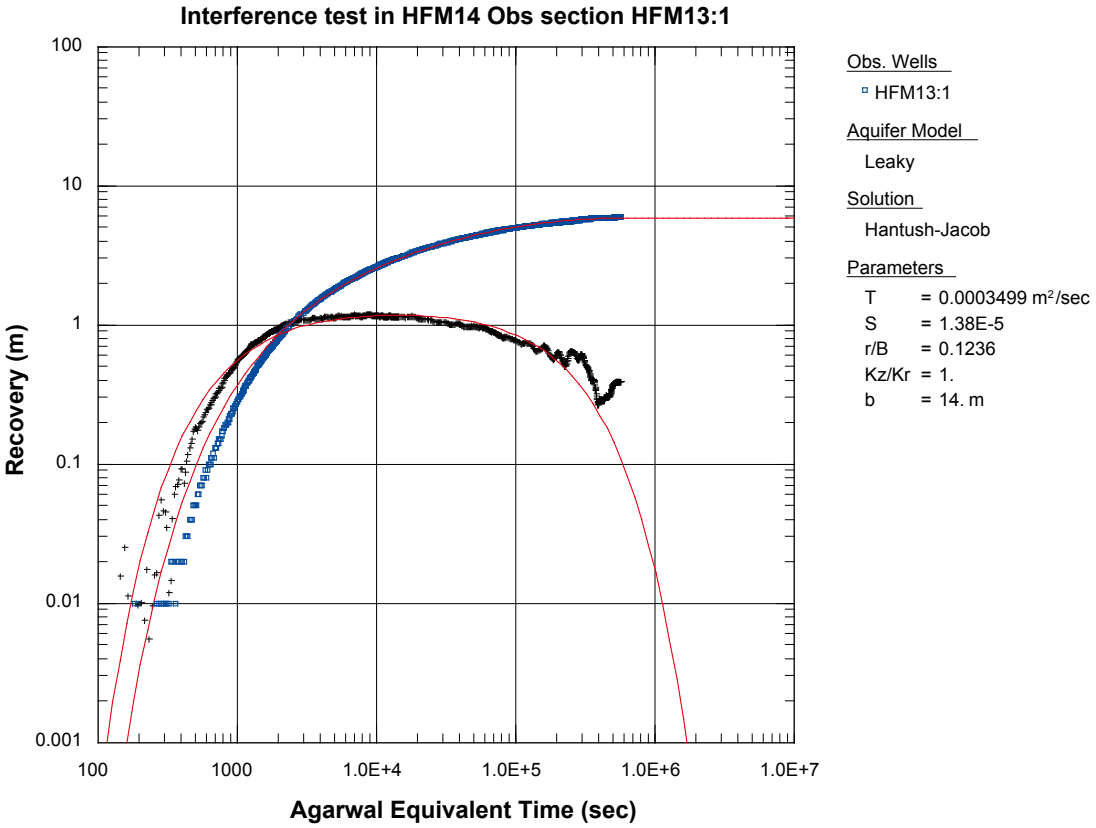


Figure A2-8. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in section HFM13:1 during the interference test in HFM14.*

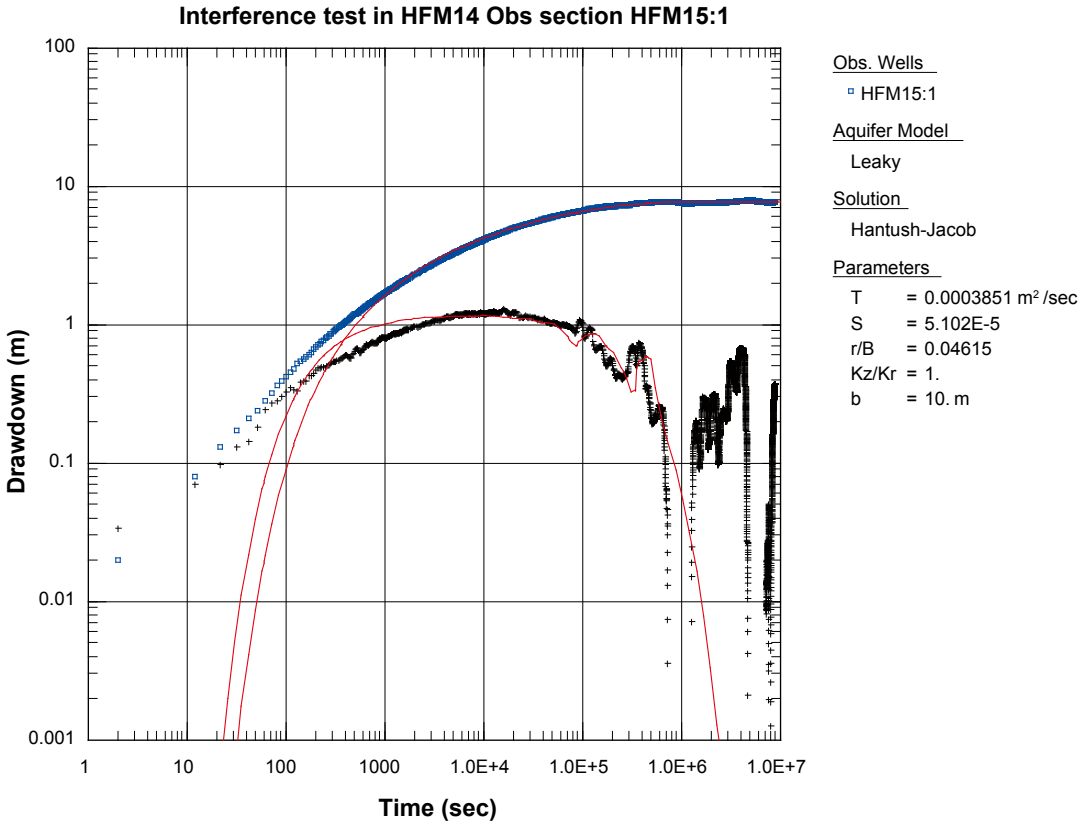


Figure A2-9. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in section HFM15:1 during the interference test in HFM14.*

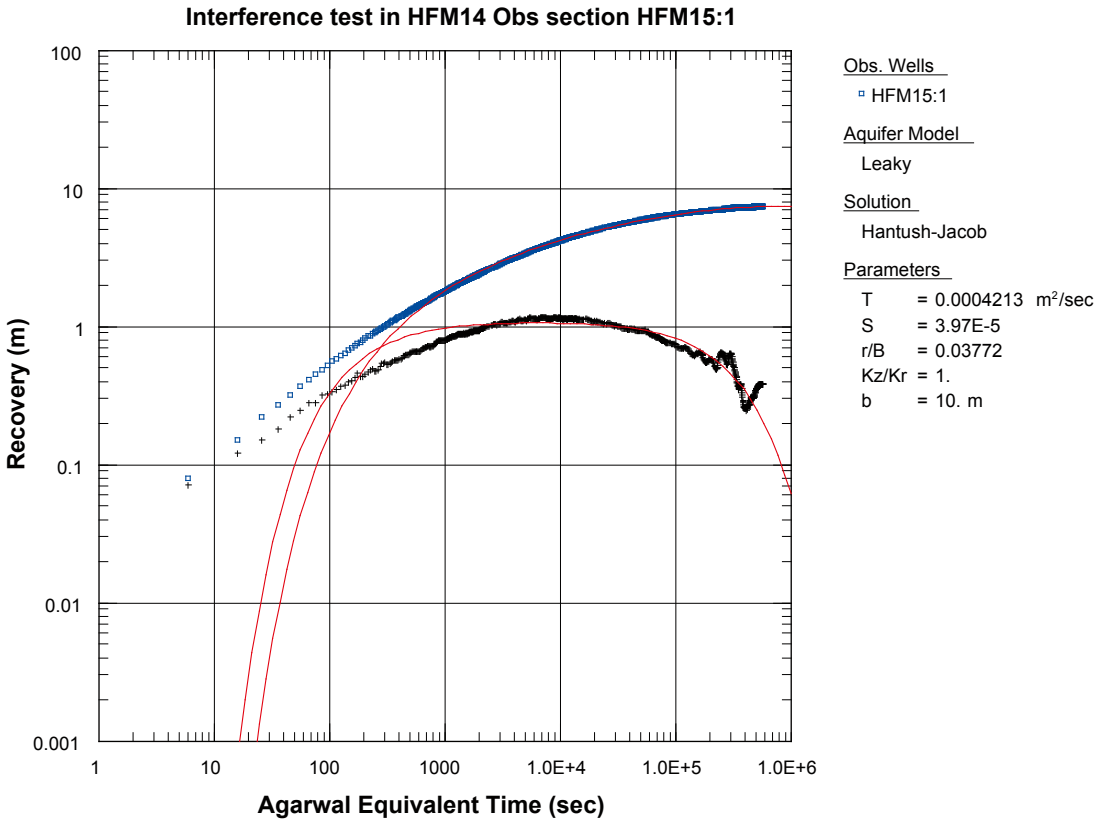


Figure A2-10. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in section HFM15:1 during the interference test in HFM14.*

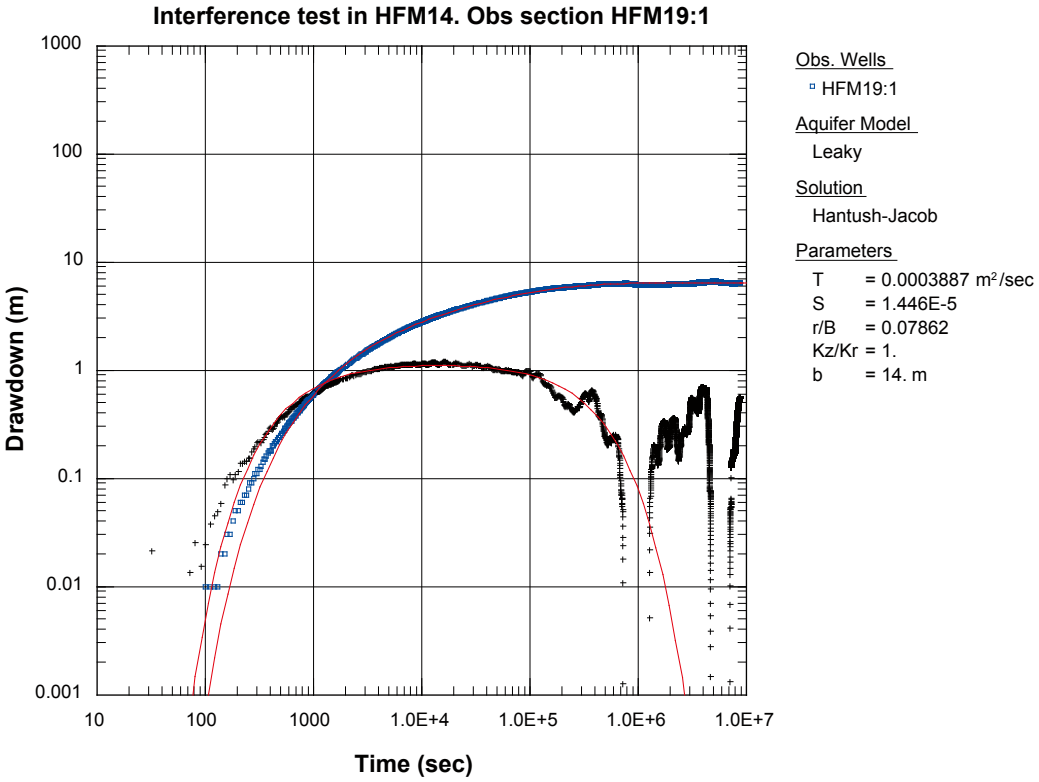


Figure A2-11. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in observation section HFM19:1 m during the interference test in HFM14.*

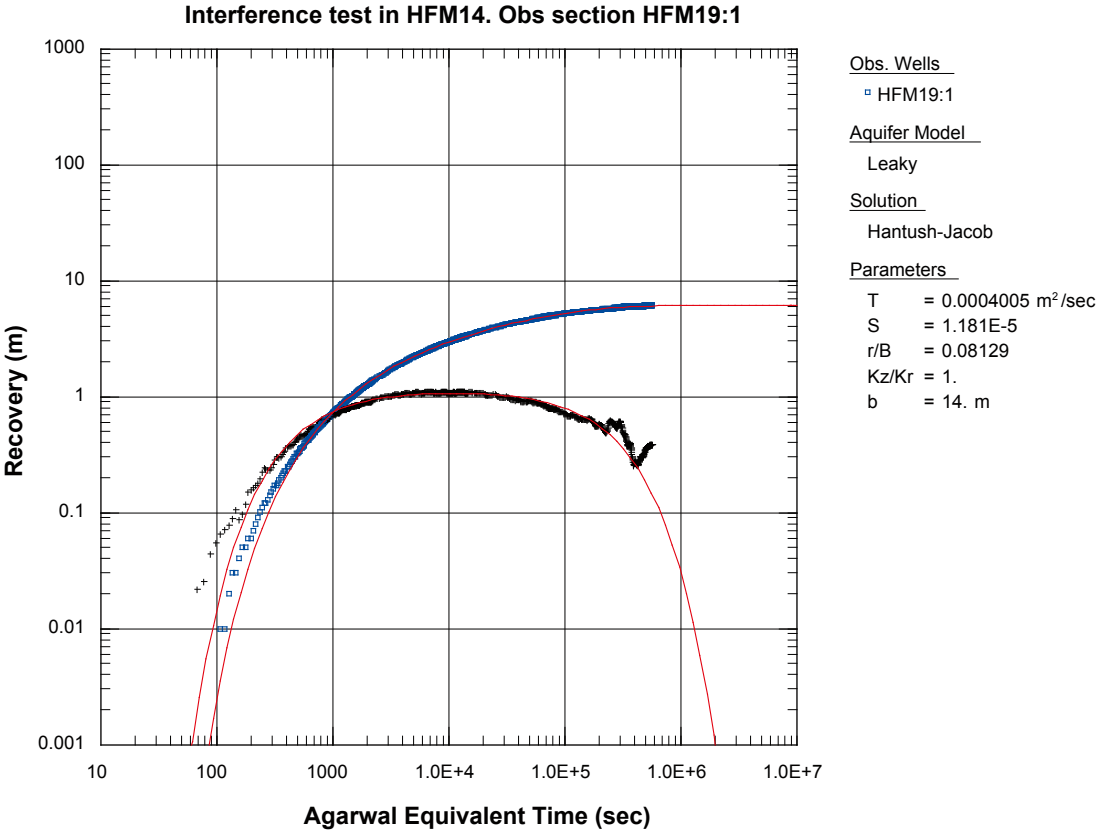


Figure A2-12. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in section HFM19:1 during the interference test in HFM14.*

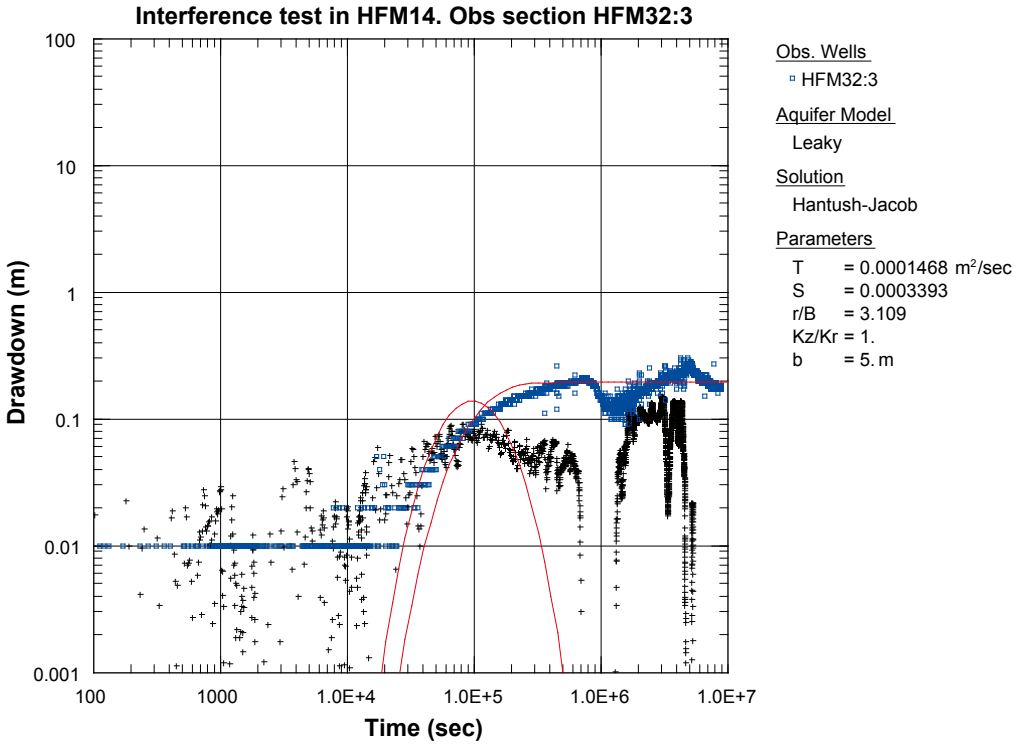


Figure A2-13. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in observation section HFM32:3 m during the interference test in HFM14.*

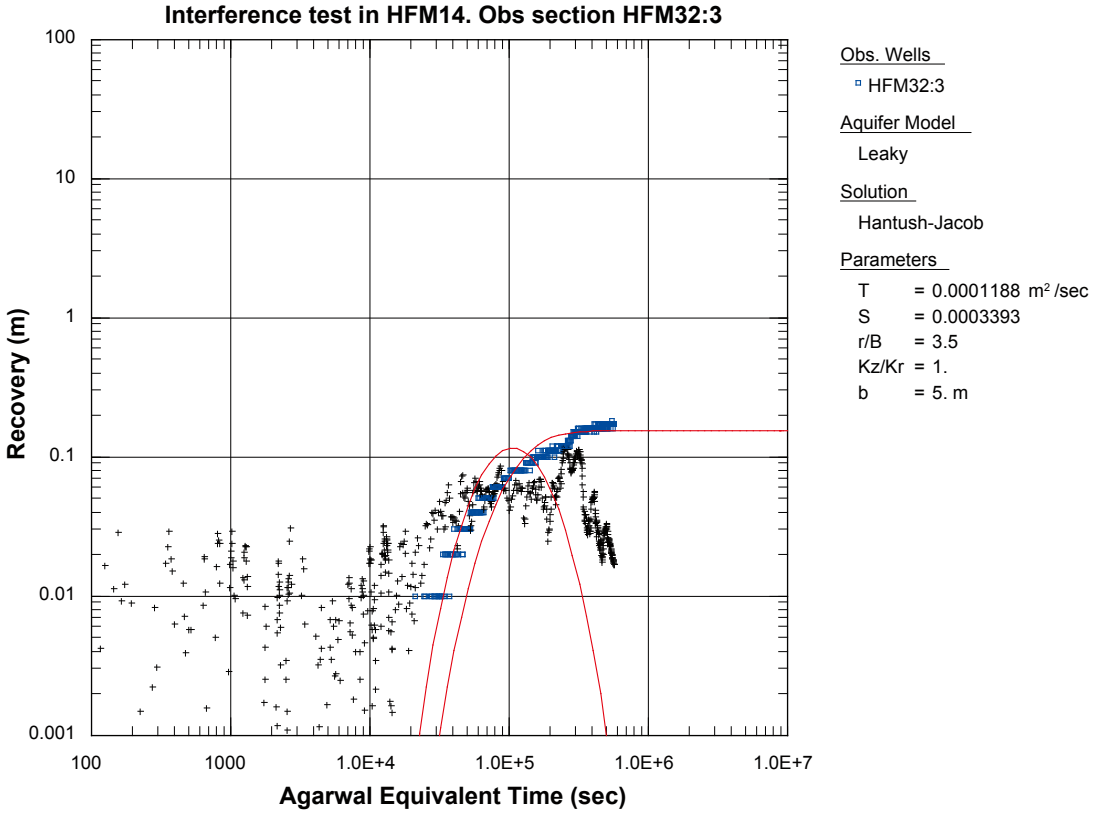


Figure A2-14. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in section HFM32:3 during the interference test in HFM14.*

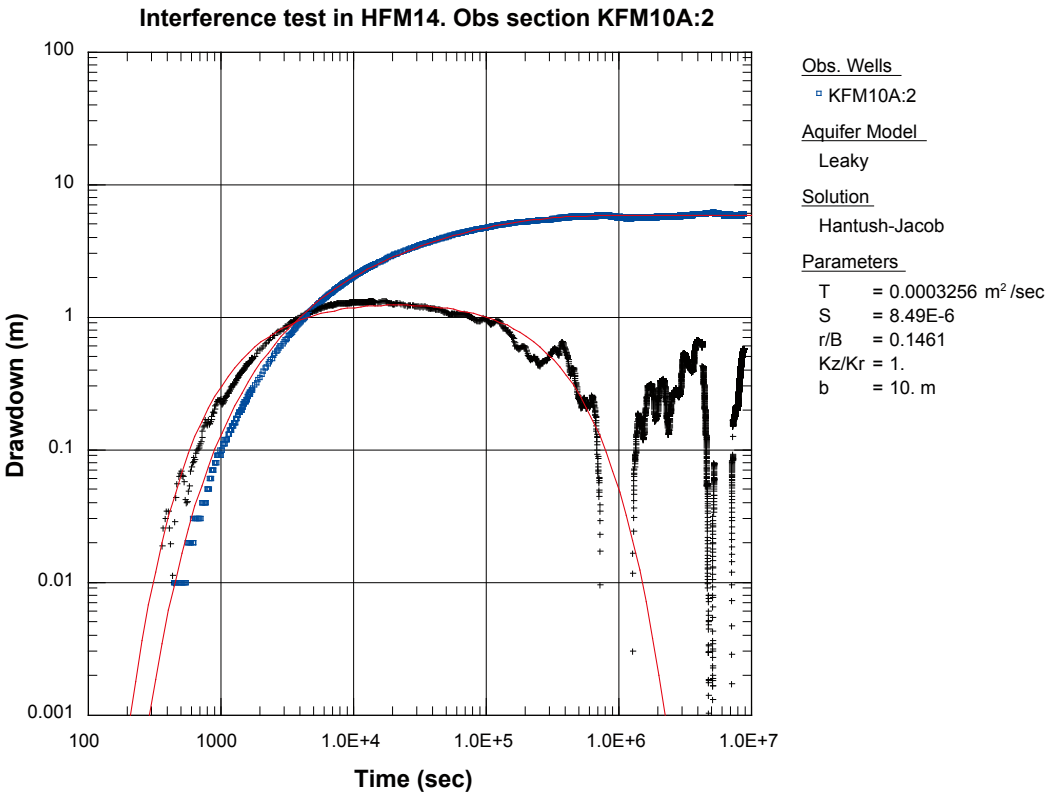


Figure A2-15. *Log-log plot of drawdown (▫) and drawdown derivative, ds/d(ln t) (+), versus time in observation section KFM10:2 m during the interference test in HFM14.*

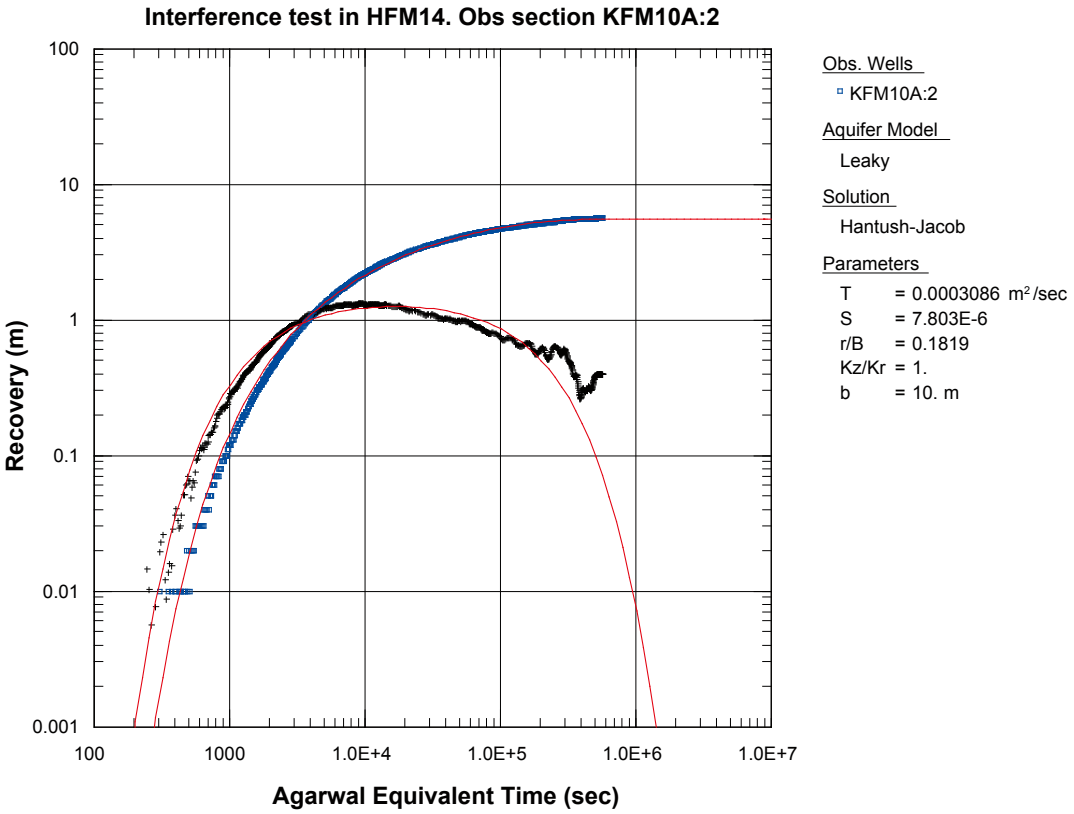


Figure A2-16. *Log-log plot of pressure recovery (▫) and derivative, dsp/d(ln dte) (+), versus equivalent time in section KFM10:2 during the interference test in HFM14.*

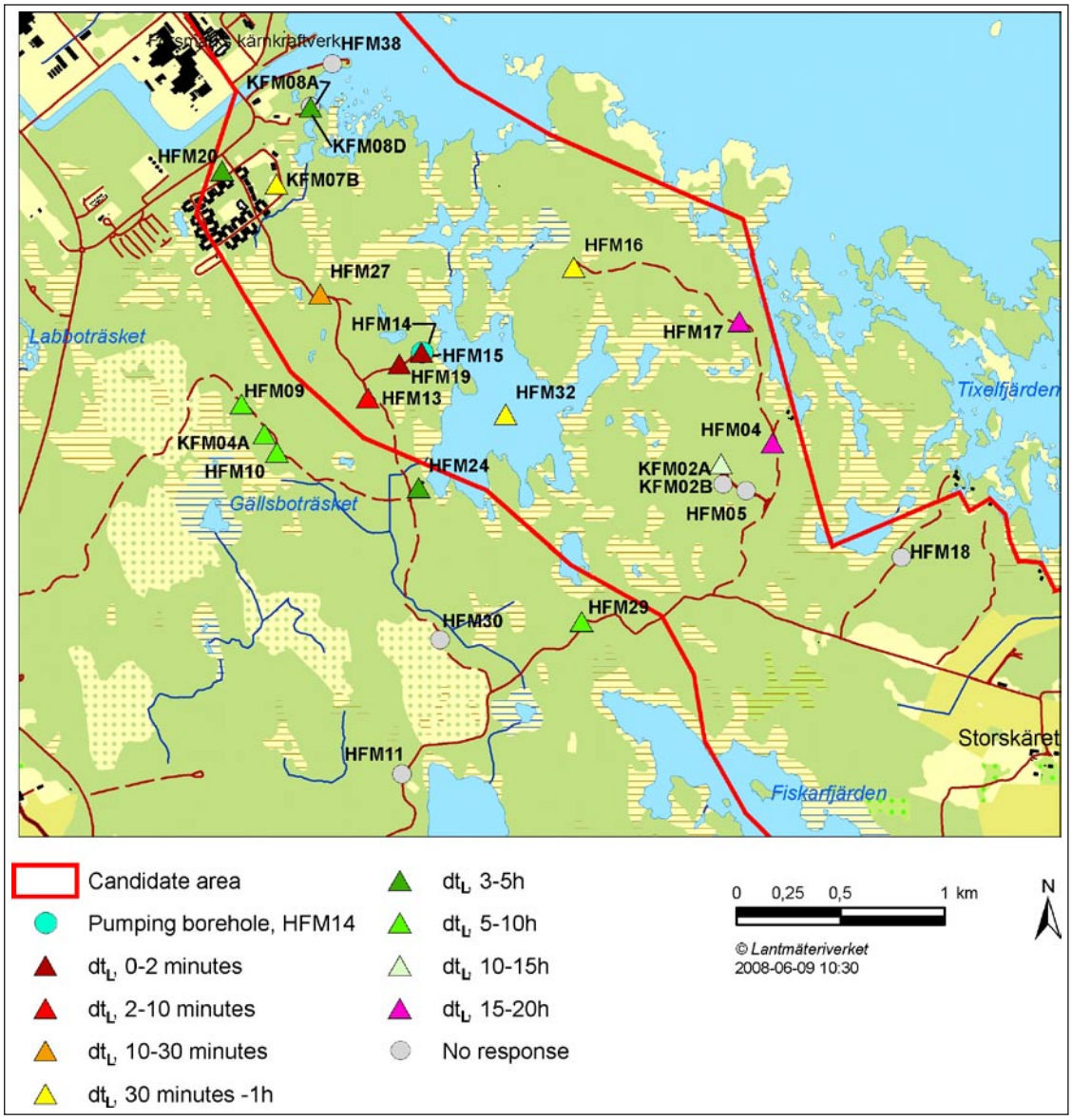


Figure A2-17. *Symbols in this diagram represent the borehole section, at a specific drill site, which has the quickest response. This map displays responses recorded in sections located between 0 and 300 m along the boreholes.*

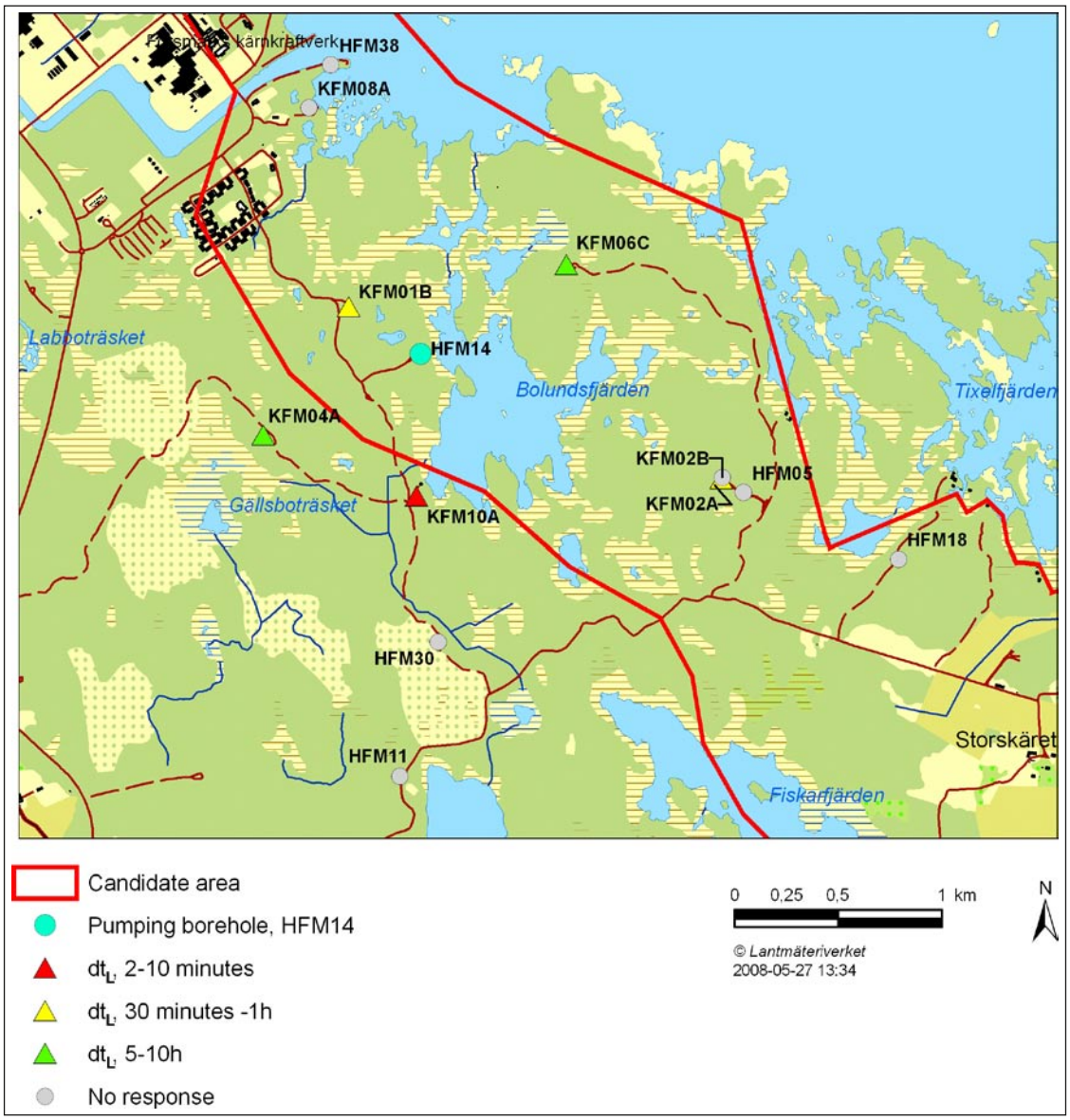


Figure A2-18. *Symbols in this diagram represent the borehole section, at a specific drill site, which has the quickest response. This map displays responses recorded in sections located between 301 and 500 m along the boreholes. Some boreholes are represented in the map onlytest to show the location of a drill site.*

Figure A2-19. *Symbols in this diagram represent the borehole section, at a specific drill site, which has the quickest response. This map displays responses recorded in sections located below 501 m along the boreholes. Some boreholes are represented in the map only to show the location of a drill site.*

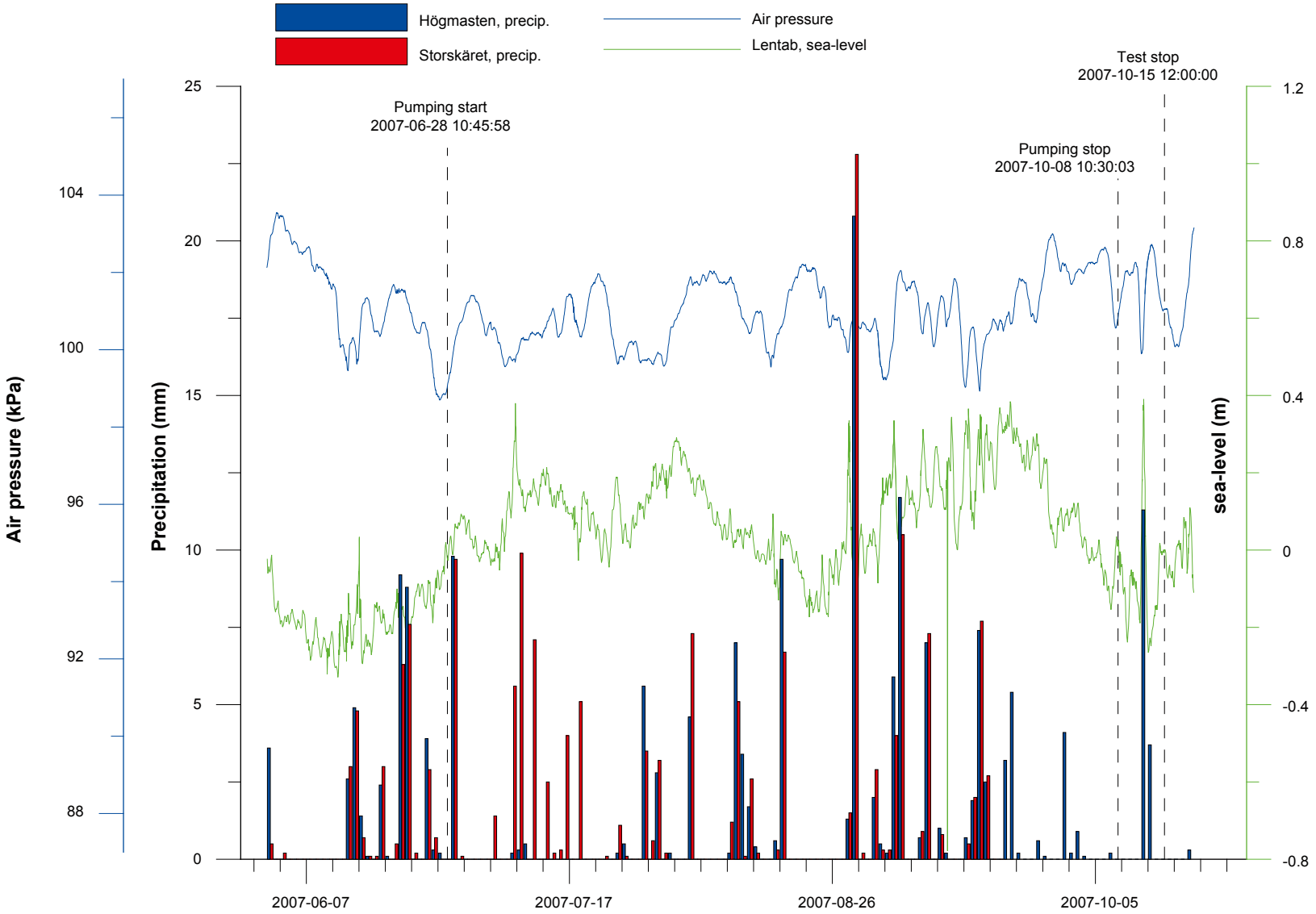


Figure A2-20. *24 hours summed precipitation in the Forsmark area during the first interference test in HFM14. Also air-pressure and sea-level are included in the diagram.*

Appendix 3

Result tables to Sicada – Test 1

Result tables to Sicada from the single-hole test in HFM14

plu_s_hole_test_d

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
HFM14	2007-06-25 14:58	2007-10-15 12:00	6.00	150.50		1B	1	2007-06-28 10:45:58	2007-10-08 10:30:03

cont.

(m**3/s) flow_rate_end_qp	value_type_qp	(m**3/s) mean_flow_rate_qm	(m**3/s) q_measl__l	(m**3/s) q_measl__u	(m**3) tot_volume_vp	(s) dur_flow_phase_tp	(s) dur_rec_phase_tf	(m) initial_head_hi	(m) head_at_flow_end_hp
5.8209E–03	0	5.8126E–03			5.1220E+04	8811845.00	610197.00	16.89	4.88

cont.

(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf	(oC) fluid_temp_tew	(mS/m) fluid_elcond_ecw	(mg/l) fluid_salinity_tdsw	(mg/l) fluid_salinity_tdswm	reference	(no_unit) comments	(m) lp
16.55										

Sicada – description of plu_s_hole_test_d

PLU Injection and Pumping tests. General information

Sicada Header	Header	Unit	Explanation
Idcode	Borehole		ID for borehole
Secup	Borehole secup	(m)	Length coordinate along the borehole for the upper limit of the test section
Seclow	Borehole seclow	(m)	Length coordinate along the borehole for the lower limit of the test section
Test_type	Test type (1–7)	(–)	1A: Pumping test – wireline eq., 1B:Pumping test-submersible pump, 1C: Pumpingtest-airlift pumping, 2: Interference test, 3: Injection test, 4: Slug test, 4B: Pulse test 5A: Difference flow logging-PFL-DIFF-sequential, 5B: Difference flow logging-PFL-DIFF-overlapping, 6:Flow logging_Impeller,7:Grain size analysis
start_date	Date for test start	YYYY- MM-DD hh::mm	Date for the start of the pumping or injection test (YYYY-MM-DD hh:mm)
start_flow_period	Start flow/injection	YYYY- MM-DD hh::mm:ss	Date and time for the start of the pumping or injection period (YYYY-MM-DD hh:mm:ss)
stop_flow_period	Start flow/injection	YYYY- MM-DD hh::mm:ss	Date and time for the end of the pumping or injection period (YYYY-M-M DD hh:mm:ss)
mean_flow_rate_qm	Q_m	(m^3/s)	Arithmetric mean flow rate during flow (pumping/injection) period.
flow_rate_end_qp	Q_p	(m^3/s)	Flow rate at the end of the flow (pumping/injection) period.
value_type_qp			Code for Q_p-value; –1 means Q_p< lower measurement limit, 0 means measured value, 1 means Q_p> upper measurement value of flowrate
q_measl_l	Qmeasl_L	(m^3/s)	Estimated lower measurement limit for flow rate
q_measl_u	Qmeasl_U	(m^3/s)	Estimated upper measurement limit for flow rate
total_volume_vp	V_p	(m^3)	Total volume pumped or injected water during the flow period.
dur_flow_phase_tp	t_p	(s)	Duration of the flow period.
dur_rec_phase_tf	t_F	(s)	Duration of the recovery period.
initial_head_hi	h_i	(m)	Hydraulic head in test section at start of the flow period.
head_at_flow_end_hp	h_p	(m)	Hydraulic head in test section at stop of the flow period.
final_head_hf	h_F	(m)	Hydraulic head in test section at stop of the recovery period..
initial_press_pi	p_i	(kPa)	Ground water pressure in test section at start of the flow period.
press_at_flow_end_pp	p_p	(kPa)	Ground water pressure in test section at stop of the flow period.
final_press_pf	p_F	(kPa)	Ground water pressure in test section at stop of the recovery period.

Sicada Header	Header	Unit	Explanation
fluid_temp_tew	Te_w	(C°)	Measured borehole fluid temperature in the test section (representative for evaluated parameters, in general the last temperature value)
fluid_elcond_ecw	EC_w	(mS/m)	Measured electric conductivity of the borehole fluid in the test section (representative for evaluated parameters, in general the last EC value)
fluid_salinity_tdsw	TDS_w	(mg/L)	Calculated total dissolved solids of the borehole fluid in the test section, based on EC-measurement
fluid_salinity_tdswn	TDS_{wn}	(mg/L)	Measured total dissolved solids of the borehole fluid in the test section, based on water sampling and chemical analysis
reference	references		SKB report No for reports describing data and evaluation
comments	comments		Short comment to data

plu_s_hole_test_ed1

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(m) lp	(m) seclen_class
HFM14	2007-06-25 14:58	2007-10-15 12:00	6.00	150.50		1B	1	20.00	

cont.

(m**2/s) spec_capacity_q_s	value_type_q_s	(m**2/s) transmissivity_tq	value_type_tq	bc_tq	(m**2/s) transmissivity_moye	value_type_tm	bc_tm	(m/s) hydr_cond_moye	(m) formation_width_b
4.84E–04	0				6.13E–04	0	0	4.26E–06	144.00

cont.

(m) width_of_channel_b	(m**3/s) tb	(m**3/s) l_measl_tb	(m**3/s) u_measl_tb	(m) sb	(m) assumed_sb	(m) leakage_factor_lf	(m**2/s) transmissivity_tt	value_type_tt	bc_tt
							3.70E–04	0	1

cont.

(m**2/s)	(m**2/s)				(m)		(1/s)	(m/s)	
l_measl_q_s	u_measl_q_s	storativity_s	assumed_s	s_bc	ri	ri_index	leakage_coeff	hydr_cond_ksf	value_type_ksf
2.00E–06	2.00E–02		1.50E–05						

cont.

(m/s)	(m/s)	(1/m)	(1/m)	(m**3/pa)			(s)	(s)	(s)
l_measl_ksf	u_measl_ksf	spec_storage_ssf	assumed_ssf	c	cd	skin	dt1	dt2	t1
				2.89E–06		–6.20E+00			2,000.00

cont.

(s)	(s)	(s)	(kPa)	(m**2/s)					(m**3/pa)	
t2	dte1	dte2	p_horner	transmissivity_t_nlr	storativity_s_nlr	value_type_t_nlr	bc_t_nlr	c_nlr	cd_nlr	
70,000.00	2,000.00	50,000.00								

cont.

	(m**2/s)					
skin_nlr	transmissivity_t_grf	value_type_t_grf	bc_t_grf	storativity_s_grf	flow_dim_grf	comment

Sicada – description of plu_s_hole_test_ed1

PLU Single hole tests, pumping and injection. Basic evaluation

Sicada Header	Header	Unit	Explanation
idcode	Borehole		ID for borehole
secup	Borehole secup	m	Length coordinate along the borehole for the upper limit of the test section
seclow	Borehole seclow	(m)	Length coordinate along the borehole for the lower limit of the test section
test_type	Test type (1– 7)	(–)	1A: Pumpingtest-wireline eq., 1B: Pumpingtest-submersible pump, 1C: Pumpingtest-airlift pumping, 2: Interference test, 3: Injection test, 4: Slug test, 4B: Pulse Test, 5A: Flowlogging-PFL-DIFF_sequential, 5B: Flowlogging-PFL-DIFF_overlapping, 6: Flowlogging-Impeller, 7: Grain size analysis
formation_type	Formation type	(–)	1: Rock, 2: Soil (Superficial deposits)
seclen_class		(m)	Planned ordinary test interval during a test campaign when a great part of a borehole is tested. The test interval length might differ due to border conditions (e.g borehole end) but is still considered to be included in the same section length class.
start_date		YYYY-MM-DD hh:mm	Date for the start of the test (YYYY-MM-DD hh:mm)
lp	L_p	(m)	Hydraulic point of application for a test section, based on the geometric midpoint of test section or the main point of transmissivity distribution in test section
spec_capacity_q_s	Q/s	m^2/s	Specific capacity, generally estimated from Q_p, s_p or dh_p
value_type_q_s			Code for Q/s; –1 means Q/s< lower measurement limit, 0 means measured value,–1 means Q/s > upper measurement limit.
transmissivity_tq	T_Q	m^2/s	Transmissivity, based on Q/s and a function T = f(Q/s), see e.g. Rhén et al. (1997) s. 190. The function used should be refered to in ”Comments”.
transmissivity_moye	T_M	m^2/s	Transmissivity (T_M)based on Moye (1967)
value_type_tm			Code for T_M ; –1 means T_M < lower measurement limit, 0 means measured value,–1 means T_M > upper measurement limit.
formation_width_b	b	m	Representative aquifer thickness for inferred transmissivity, generally estimated as test section length L_w
width_of_channel_b	B	m	Inferred width of formation for evaluated TB
tb	TB	m^3/s	Flow capacity in 1D formation of width B and transmissivity T based on transient evaluation. Considered best estimate from transient evaluation of flow period or recovery period.
l_measl_tb	TB-measl-L	m^3/s	Estimated lower measurement limit for evaluated TB.
u_measl_tb	TB-measl-L	m^3/s	Estimated upper measurement limit for evaluated TB.
sb	SB	m	Storage capacity of 1D formation of width B and storativity S based on transient evaluation. Considered best estimate from transient evaluation of flow period or recovery period.
assumed_sb	SB*	m	Assumed storage capacity of 1D formation of width B and storativity S based on transient evaluation.

Sicada Header	Header	Unit	Explanation
ri_index	ri-index		**ri-index= 0**: Pressure response indicates that the size of the hydraulic feature is greater than radius of influence based on time for last pressure response measured (tp = t2). Size of hydraulic feature greater than radius of influence based on t2.
			ri-index= 1: Pressure response indicates that the hydraulic feature assigned the representative transmissivity is connected to hydraulic feature with less transmissivity or barrier boundary. Size of hydraulic feature estimated as radius of influence based on t2. (Size of feature somewhat under estimated using t2- but error considered as small.)
			ri-index= –1: Pressure response indicates that the hydraulic feature assigned the representative transmissivity is connected to hydraulic feature with greater transmissivity or a constant head boundary. Size of hydraulic feature estimated as radius of influence based on t2. (Size of feature somewhat under estimated using t2- but error considered as small.)
bc_s	S-BC		Calculated by using S if S = value or S = f(T) if S* = value
leakage_factor_lf	L_f	m	Leakage factor. $L_f = (K \cdot b \cdot c_f)^{0.5}$ where K represents the aquifer conditions. c_f = b´/K´ based on 1D linear flow model. Considered best estimate from transient evaluation of flow period or recovery period.
transmissivity_tt	T_T	m^2/s	Transmissivity (T) of formation, based on 2D radial flow model. Considered best estimate from transient evaluation of flow period or recovery period.
value_type_tt			Code for T_T; –1 means T_T < lower measurement limit, 0 means measured value,–1 means T_T > upper measurement limit.
l_measl_q_s	Q/s-measl-L	m^2/s	Estimated measurement limit for evaluated T (T_T, T_Q, T_M). If estimated T equals Q/s-measl in the table actual T is considered to be equal or less than Q/s-measl
u_measl_q_s	Q/s-measl-U	m^2/s	Estimated measurement limit for evaluated T (T_T, T_Q, T_M). If estimated T equals Q/s-measl in the table actual T is considered to be equal or grater than Q/s-measl
storativity_s	S	(–)	Storativity (Storage coefficient) of formation based on 2D radial flow model. Considered best estimate from transient evaluation of flow period or recovery period.
assumed_s	S*		Assumed storativity of formation based on 2D radial flow model.
leakage_koeff	K´/b´	(1/s)	Leakage coefficient evaluated from 2D radial flow model. K´= hydraulic conductivity across the aquitard, b´ = water saturated thickness of aquitard (leaky formation). Considered best estimate from transient evaluation of flow period or recovery period.
hydr_kond_ksf	K_{sf}	m/s	Hydraulic conductivity of formation, based on 3D spherical flow model. Considered best estimate from transient evaluation of flow period or recovery period.
value_type_ksf			Code for K_{Sf}; –1 means K_{Sf} < lower measurement limit, 0 means measured value,–1 means K_{Sf} > upper measurement limit.
l_measl_ksf	K_S-measl-L	m/s	Estimated lower measurement limit for evaluated K_{sf}.
u_measl_ksf	K_S-measl-U	m/s	Estimated upper measurement limit for evaluated K_{sf}.
spec_storage_ss	S_{sf}	1/m	Specific storage of formation based on 3D spherical flow model. Considered best estimate from transient evaluation of flow period or recovery period.
assumed_ss	S_{sf}*	1/m	Assumed specific storage of formation based on 3D spherical flow model.
c	C	(m^3/Pa)	Wellbore storage coefficient. Considered best estimate from transient evaluation of flow period or recovery period.

Sicada Header	Header	Unit	Explanation
cd	C_D	(–)	Dimensionless wellbore storage coefficient, $C_D = C \cdot \rho_w g / (2\pi \cdot S \cdot r_w^2)$.
skin	ξ		Skin factor. Considered best estimate from transient evaluation of flow period or recovery period.
dt1	dt_1	s	Estimated start time after pump/injection start or recovery start, for the period used for the evaluated parameter
dt1	dt_2	s	Estimated stop time after pump/injection start or recovery start, for the period used for the evaluated parameter
dte1	dt_{e1}		Start time for evaluated parameter from start of recovery period.
dte2	dt_{e2}		Stop time for evaluated parameter from start of recovery period.
t1	t_1		Start time for evaluated parameter from start of flow period.
t2	t_2		Stop time for evaluated parameter from start of flow period.
p_horner	p^*		Horner extrapolated pressure (used as an estimation of natural pressure of the test section)
transmissivity_t_nlr	T_{ILR}	m^2/s	Transmissivity, based on Non Linear Regression of the entire test sequence.
storativity_s_nlr	S_{ILR}	(–)	Storativity, based on Non Linear Regression of the entire test sequence.
c_nlr	C_{ILR}	(m^3/Pa)	Wellbore storage coefficient, based on Non Linear Regression of entire test sequence.
cd_nlr	$C_{D,ILR}$		Dimensionless wellbore storage coefficient, based on Non Linear Regression of entire test sequence.
skin_nlr	ξ_{NLR}		Skin factor, based on Non Linear Regression of entire test sequence.
transmissivity_t_grf	T_{GRF}	m^2/s	Transmissivity, based on the Generalized Radial Flow model (Baker, 1988). Considered best estimate from transient evaluation of flow period or recovery period.
storativity_s_grf	S_{GRF}	(–)	Storativity, based on Generalised Radial Flow model. Considered best estimate from transient evaluation of flow period or recovery period.
flow_dim_grf	D_{GRF}	(–)	Inferred flow dimension, based on the Generalized Radial Flow model (Barker, 1988). Considered best estimate from transient evaluation of flow period or recovery period.
comment	comment		comments on the test

Result table to Sicada from the interference test in HFM14

plu_inf_test_obs_d

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
HFM15	2007-06-01 01:00	2007-10-20 00:00	0.00	84.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM15	2007-06-01 01:00	2007-10-20 00:00	85.00	95.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
						2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM05A	2007-06-01 01:00	2007-10-20 00:00	0.00	114.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM05A	2007-06-01 01:00	2007-10-20 00:00	115.00	253.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM05A	2007-06-01 01:00	2007-10-20 00:00	254.00	272.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM05A	2007-06-01 01:00	2007-10-20 00:00	273.00	489.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM05A	2007-06-01 01:00	2007-10-20 00:00	490.00	698.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM05A	2007-06-01 01:00	2007-10-20 00:00	699.00	1,002.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM19	2007-06-01 01:00	2007-10-20 00:00	0.00	103.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM19	2007-06-01 01:00	2007-10-20 00:00	104.00	167.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM19	2007-06-01 01:00	2007-10-20 00:00	168.00	182.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM13	2007-06-01 01:00	2007-10-20 00:00	0.00	100.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM13	2007-06-01 01:00	2007-10-20 00:00	101.00	158.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM13	2007-06-01 01:00	2007-10-20 00:00	159.00	173.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01C	2007-06-01 01:00	2007-10-20 00:00	0.00	58.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01C	2007-06-01 01:00	2007-10-20 00:00	59.00	237.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01C	2007-06-01 01:00	2007-10-20 00:00	238.00	450.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM01	2007-06-01 01:00	2007-10-20 00:00	0.00	32.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM01	2007-06-01 01:00	2007-10-20 00:00	33.00	45.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
HFM01	2007-06-01 01:00	2007-10-20 00:00	46.00	200.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01A	2007-06-01 01:00	2007-10-20 00:00	0.00	108.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01A	2007-06-01 01:00	2007-10-20 00:00	109.00	130.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01A	2007-06-01 01:00	2007-10-20 00:00	131.00	204.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01A	2007-06-01 01:00	2007-10-20 00:00	205.00	373.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01A	2007-06-01 01:00	2007-10-20 00:00	374.00	430.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01A	2007-06-01 01:00	2007-10-20 00:00	431.00	1,002.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01D	2007-06-01 01:00	2007-10-20 00:00	0.00	153.00		2	1	2007-06-28 10:45:58	2007-10-08 10:30:03

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
KFM01D	2007-06-01 01:00	2007-10-20 00:00	154.00	252.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01D	2007-06-01 01:00	2007-10-20 00:00	253.00	310.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01D	2007-06-01 01:00	2007-10-20 00:00	311.00	321.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01D	2007-06-01 01:00	2007-10-20 00:00	322.00	428.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01D	2007-06-01 01:00	2007-10-20 00:00	429.00	438.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01D	2007-06-01 01:00	2007-10-20 00:00	439.00	800.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01B	2007-06-01 01:00	2007-10-20 00:00	0.00	100.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01B	2007-06-01 01:00	2007-10-20 00:00	101.00	141.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM01B	2007-06-01 01:00	2007-10-20 00:00	142.00	500.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM10A	2007-06-01 01:00	2007-10-20 00:00	0.00	152.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM10A	2007-06-01 01:00	2007-10-20 00:00	153.00	352.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM10A	2007-06-01 01:00	2007-10-20 00:00	353.00	429.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM10A	2007-06-01 01:00	2007-10-20 00:00	430.00	440.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM10A	2007-06-01 01:00	2007-10-20 00:00	441.00	500.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM32	2007-06-01 01:00	2007-10-20 00:00	0.00	25.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM32	2007-06-01 01:00	2007-10-20 00:00	26.00	31.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM32	2007-06-01 01:00	2007-10-20 00:00	32.00	97.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM32	2007-06-01 01:00	2007-10-20 00:00	98.00	203.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM03	2007-06-01 01:00	2007-10-20 00:00	0.00	18.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM03	2007-06-01 01:00	2007-10-20 00:00	19.00	26.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM02	2007-06-01 01:00	2007-10-20 00:00	0.00	37.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM02	2007-06-01 01:00	2007-10-20 00:00	38.00	48.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM02	2007-06-01 01:00	2007-10-20 00:00	49.00	100.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM27	2007-06-01 01:00	2007-10-20 00:00	0.00	24.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM27	2007-06-01 01:00	2007-10-20 00:00	25.00	45.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM27	2007-06-01 01:00	2007-10-20 00:00	46.00	58.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM27	2007-06-01 01:00	2007-10-20 00:00	59.00	128.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM24	2007-06-01 01:00	2007-10-20 00:00	0.00	35.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
HFM24	2007-06-01 01:00	2007-10-20 00:00	36.00	65.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM24	2007-06-01 01:00	2007-10-20 00:00	66.00	151.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	0.00	163.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	164.00	185.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	186.00	229.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	230.00	245.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	246.00	390.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	391.00	495.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM04A	2007-06-01 01:00	2007-10-20 00:00	496.00	1,001.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	0.00	150.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	151.00	246.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	247.00	340.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	341.00	362.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	363.00	737.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	738.00	748.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	749.00	826.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06A	2007-06-01 01:00	2007-10-20 00:00	827.00	1,001.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	0.00	186.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	187.00	280.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	281.00	350.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	351.00	401.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	402.00	530.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	531.00	540.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	541.00	646.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	647.00	666.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	667.00	872.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06C	2007-06-01 01:00	2007-10-20 00:00	873.00	1,001.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06B	2007-06-01 01:00	2007-10-20 00:00	0.00	26.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06B	2007-06-01 01:00	2007-10-20 00:00	27.00	50.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM06B	2007-06-01 01:00	2007-10-20 00:00	51.00	100.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM10	2007-06-01 01:00	2007-10-20 00:00	0.00	99.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
HFM10	2007-06-01 01:00	2007-10-20 00:00	100.00	150.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM16	2007-06-01 01:00	2007-10-20 00:00	0.00	53.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM16	2007-06-01 01:00	2007-10-20 00:00	54.00	67.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM16	2007-06-01 01:00	2007-10-20 00:00	68.00	132.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM09	2007-06-01 01:00	2007-10-20 00:00	0.00	50.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07B	2007-06-01 01:00	2007-10-20 00:00	0.00	74.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07B	2007-06-01 01:00	2007-10-20 00:00	75.00	202.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07B	2007-06-01 01:00	2007-10-20 00:00	203.00	300.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM21	2007-06-01 01:00	2007-10-20 00:00	0.00	21.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM21	2007-06-01 01:00	2007-10-20 00:00	22.00	32.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM21	2007-06-01 01:00	2007-10-20 00:00	33.00	106.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM21	2007-06-01 01:00	2007-10-20 00:00	107.00	202.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07C	2007-06-01 01:00	2007-10-20 00:00	0.00	110.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07C	2007-06-01 01:00	2007-10-20 00:00	111.00	160.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07C	2007-06-01 01:00	2007-10-20 00:00	161.00	301.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07C	2007-06-01 01:00	2007-10-20 00:00	302.00	500.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07A	2007-06-01 01:00	2007-10-20 00:00	0.00	148.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07A	2007-06-01 01:00	2007-10-20 00:00	149.00	190.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07A	2007-06-01 01:00	2007-10-20 00:00	191.00	225.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07A	2007-06-01 01:00	2007-10-20 00:00	226.00	961.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07A	2007-06-01 01:00	2007-10-20 00:00	962.00	972.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM07A	2007-06-01 01:00	2007-10-20 00:00	973.00	1,001.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM09B	2007-06-01 01:00	2007-10-20 00:00	0.00	200.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM09B	2007-06-01 01:00	2007-10-20 00:00	201.00	450.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM09B	2007-06-01 01:00	2007-10-20 00:00	451.00	616.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM22	2007-06-01 01:00	2007-10-20 00:00	0.00	222.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM20	2007-06-01 01:00	2007-10-20 00:00	0.00	48.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM20	2007-06-01 01:00	2007-10-20 00:00	49.00	100.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM20	2007-06-01 01:00	2007-10-20 00:00	101.00	130.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
HFM20	2007-06-01 01:00	2007-10-20 00:00	131.00	301.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM08B	2007-06-01 01:00	2007-10-20 00:00	0.00	70.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM08B	2007-06-01 01:00	2007-10-20 00:00	71.00	112.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM08B	2007-06-01 01:00	2007-10-20 00:00	113.00	200.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM30	2007-06-01 01:00	2007-10-20 00:00	0.00	60.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM30	2007-06-01 01:00	2007-10-20 00:00	61.00	73.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM30	2007-06-01 01:00	2007-10-20 00:00	74.00	176.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM30	2007-06-01 01:00	2007-10-20 00:00	177.00	201.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM25	2007-06-01 01:00	2007-10-20 00:00	0.00	188.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM09A	2007-06-01 01:00	2007-10-20 00:00	0.00	300.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM09A	2007-06-01 01:00	2007-10-20 00:00	301.00	550.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM09A	2007-06-01 01:00	2007-10-20 00:00	551.00	800.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM28	2007-06-01 01:00	2007-10-20 00:00	0.00	151.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM23	2007-06-01 01:00	2007-10-20 00:00	0.00	212.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM38	2007-06-01 01:00	2007-10-20 00:00	0.00	23.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM38	2007-06-01 01:00	2007-10-20 00:00	24.00	41.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM38	2007-06-01 01:00	2007-10-20 00:00	42.00	201.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM29	2007-06-01 01:00	2007-10-20 00:00	0.00	200.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM17	2007-06-01 01:00	2007-10-20 00:00	0.00	211.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	0.00	130.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	131.00	245.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	246.00	409.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	410.00	431.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	432.00	490.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	491.00	506.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02B	2007-06-01 01:00	2007-10-20 00:00	507.00	570.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	0.00	132.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	133.00	240.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
KFM02A	2007-06-01 01:00	2007-10-20 00:00	241.00	410.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	411.00	442.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	443.00	489.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	490.00	518.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	519.00	888.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM02A	2007-06-01 01:00	2007-10-20 00:00	889.00	1,002.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM05	2007-06-01 01:00	2007-10-20 00:00	0.00	138.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM05	2007-06-01 01:00	2007-10-20 00:00	139.00	200.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM33	2007-06-01 01:00	2007-10-20 00:00	0.00	140.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM04	2007-06-01 01:00	2007-10-20 00:00	0.00	57.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM04	2007-06-01 01:00	2007-10-20 00:00	58.00	66.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM04	2007-06-01 01:00	2007-10-20 00:00	67.00	222.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM12	2007-06-01 01:00	2007-10-20 00:00	0.00	56.50	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM12	2007-06-01 01:00	2007-10-20 00:00	57.50	210.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	0.00	130.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	131.00	360.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	361.00	445.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	446.00	456.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	457.00	689.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	690.00	710.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
KFM11A	2007-06-01 01:00	2007-10-20 00:00	711.00	850.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM11	2007-06-01 01:00	2007-10-20 00:00	0.00	53.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM11	2007-06-01 01:00	2007-10-20 00:00	54.00	182.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM18	2007-06-01 01:00	2007-10-20 00:00	0.00	28.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM18	2007-06-01 01:00	2007-10-20 00:00	28.00	41.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03
HFM18	2007-06-01 01:00	2007-10-20 00:00	42.00	180.00	2	1		2007-06-28 10:45:58	2007-10-08 10:30:03

cont.

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_distance_rs	(m) shortest_distance_rt	(s) time_lag_press_dtl	(m) initial_head_hi	(m) head_at_flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf
HFM14	0.00	150.50	50.00	32.60		2.00	0.65	–7.20	0.29			
HFM14	0.00	150.50	89.00	71.30		2.00	0.61	–7.04	0.36			
HFM14	0.00	150.50										
HFM14	0.00	150.50	109.00	88.20		52.00	0.33	–5.12	0.21			
HFM14	0.00	150.50	145.00	123.10		332.00	0.18	–5.18	–0.12			
HFM14	0.00	150.50	256.00	232.70			0.50	–0.63	–0.50			
HFM14	0.00	150.50	292.00	268.50			2.87	2.93	2.86			
HFM14	0.00	150.50	594.00	568.20			1.94	1.77	1.74			
HFM14	0.00	150.50	850.00	821.40			0.88	0.43	0.40			
HFM14	0.00	150.50	101.00	183.00		462.00	0.83	–5.50	0.53			
HFM14	0.00	150.50	150.00	224.80		172.00	0.68	–5.65	0.43			
HFM14	0.00	150.50	176.00	248.10		102.00	0.20	–6.21	–0.12			
HFM14	0.00	150.50	50.00	319.00		842.00	2.49	0.29	1.91			
HFM14	0.00	150.50	106.00	302.10		1,662.00	1.16	–3.57	0.91			
HFM14	0.00	150.50	162.00	296.60		342.00	0.34	–5.96	–0.03			
HFM14	0.00	150.50	38.00	367.50		782.00	0.08	–2.85	–0.13			
HFM14	0.00	150.50	85.00	350.00		642.00	0.02	–3.03	–0.22			
HFM14	0.00	150.50	436.00	403.90			0.23	–0.72	–1.01			
HFM14	0.00	150.50	16.00	375.70		3,602.00	0.36	–2.46	0.12			
HFM14	0.00	150.50	39.00	377.60		842.00	0.37	–2.42	0.14			
HFM14	0.00	150.50	64.00	380.90		842.00	0.36	–1.84	0.13			
HFM14	0.00	150.50	105.00	411.90		81,242.00	0.15	–2.07	–1.87			
HFM14	0.00	150.50	118.00	416.10		2,762.00	0.06	–2.04	–0.31			
HFM14	0.00	150.50	148.00	427.40		7,502.00	0.16	–1.90	–0.27			
HFM14	0.00	150.50	285.00	500.30			0.18	0.05	0.05			
HFM14	0.00	150.50	402.00	582.30			0.87	0.97	0.97			
HFM14	0.00	150.50	715.00	849.60			5.47	6.12	6.13			
HFM14	0.00	150.50	123.00	406.70		12,482.00	–0.07	–2.17	–0.37			

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_dis-tance_rs	(m) shortest_ distance_rt	(s) time_lag_ press_dtl	(m) initial_ head_hi	(m) head_at_ flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_ end_pp	(kPa) final_ press_pf
HFM14	0.00	150.50	163.00	418.90		7,022.00	–0.07	–1.45	–0.55			
HFM14	0.00	150.50	303.00	486.70			–0.46	–0.40	–0.48			
HFM14	0.00	150.50	316.00	494.60			–0.54	–0.47	–0.55			
HFM14	0.00	150.50	370.00	529.60			–0.72	–0.42	–0.48			
HFM14	0.00	150.50	434.00	575.10			–0.64	–0.36	–0.40			
HFM14	0.00	150.50	564.00	676.70			–0.88	–0.69	–0.68			
HFM14	0.00	150.50	54.00	415.90		1,172.00	0.38	–2.44	0.18			
HFM14	0.00	150.50	121.00	438.30		3,122.00	0.21	–2.00	–0.30			
HFM14	0.00	150.50	321.00	555.60		4,442.00	0.43	–1.66	–0.05			
HFM14	0.00	150.50	98.00	632.00		33,242.00	1.08	0.74	0.91			
HFM14	0.00	150.50	314.00	527.00		20,942.00	0.93	–4.40	–0.16			
HFM14	0.00	150.50	391.00	502.60		4,202.00	1.08	–4.66	0.61			
HFM14	0.00	150.50	432.00	493.30		442.00	0.69	–5.23	0.39			
HFM14	0.00	150.50	484.00	485.20		712.00	0.58	–5.42	0.19			
HFM14	0.00	150.50	19.00	511.10		23,642.00	–0.12	–0.24	–0.10			
HFM14	0.00	150.50	29.00	512.00		20,942.00	–0.11	–0.28	–0.11			
HFM14	0.00	150.50	64.00	517.80		13,262.00	–0.27	–2.24	–0.40			
HFM14	0.00	150.50	150.00	546.20		2,942.00	–0.29	–2.39	–0.48			
HFM14	0.00	150.50	15.00	532.10		1,742.00	0.48	–2.24	0.20			
HFM14	0.00	150.50	21.00	532.40		842.00	0.48	–2.36	0.25			
HFM14	0.00	150.50	31.00	535.70		842.00	0.39	–2.43	0.15			
HFM14	0.00	150.50	43.00	536.30		842.00	0.47	–2.38	0.25			
HFM14	0.00	150.50	74.00	539.00		842.00	0.48	–2.38	0.25			
HFM14	0.00	150.50	20.00	561.80		1,692.00	0.47	–2.15	0.24			
HFM14	0.00	150.50	28.00	564.20		832.00	0.45	–2.34	0.23			
HFM14	0.00	150.50	54.00	573.40		692.00	0.37	–2.46	0.17			
HFM14	0.00	150.50	119.00	602.10		3,602.00	0.42	–2.38	0.14			
HFM14	0.00	150.50	24.00	651.00		14,222.00	1.06	0.76	0.93			
HFM14	0.00	150.50	47.00	643.70		15,242.00	1.06	0.75	0.91			
HFM14	0.00	150.50	108.00	630.70		36,842.00	0.96	0.64	0.81			

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_distance_rs	(m) shortest_distance_rt	(s) time_lag_press_dtl	(m) initial_head_hi	(m) head_at_flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf
HFM14	0.00	150.50	114.00	803.80		46,442.00	1.96	1.74	2.00			
HFM14	0.00	150.50	165.00	772.90		47,642.00	2.10	1.71	1.97			
HFM14	0.00	150.50	206.00	776.30		38,042.00	2.09	1.63	1.94			
HFM14	0.00	150.50	233.00	769.80		38,642.00	1.98	1.57	1.87			
HFM14	0.00	150.50	360.00	748.50		35,642.00	1.53	0.76	1.51			
HFM14	0.00	150.50	419.00	743.90			1.70	1.18	1.33			
HFM14	0.00	150.50	749.00	778.30			2.17	1.86	1.94			
HFM14	0.00	150.50	130.00	797.50		58,442.00	0.18	–0.47	0.05			
HFM14	0.00	150.50	215.00	793.10		31,442.00	0.00	–0.74	–0.12			
HFM14	0.00	150.50	267.00	795.50		35,042.00	0.24	–0.56	0.17			
HFM14	0.00	150.50	357.00	810.30		76,442.00	0.23	–0.41	–0.09			
HFM14	0.00	150.50	392.00	816.10		76,442.00	–0.05	–0.68	–0.39			
HFM14	0.00	150.50	743.00	979.90			–0.32	–0.74	–0.68			
HFM14	0.00	150.50	775.00	1,001.40			0.14	–0.27	–0.21			
HFM14	0.00	150.50	913.00	1,103.20			–0.61	–0.47	–0.46			
HFM14	0.00	150.50	144.00	892.40		56,642.00	0.08	–0.63	–0.11			
HFM14	0.00	150.50	214.00	935.50		65,042.00	–0.03	–0.64	–0.10			
HFM14	0.00	150.50	316.00	1,007.40		141,242.00	–0.14	–0.78	–0.32			
HFM14	0.00	150.50	395.00	1,069.10		44,042.00	–0.22	–1.07	–0.36			
HFM14	0.00	150.50	422.00	1,091.20		72,842.00	0.02	–0.74	–0.15			
HFM14	0.00	150.50	536.00	1,188.30		135,842.00	0.07	–0.56	–0.08			
HFM14	0.00	150.50	593.00	1,238.40		19,442.00	–0.14	–0.76	–0.58			
HFM14	0.00	150.50	658.00	1,296.70			0.42	–0.10	0.07			
HFM14	0.00	150.50	770.00	1,398.50			–0.01	–0.44	–0.41			
HFM14	0.00	150.50	927.00	1,543.50			0.60	0.01	0.00			
HFM14	0.00	150.50	11.00	825.10		8,522.00	0.65	–0.60	0.52			
HFM14	0.00	150.50	45.00	823.50		6,002.00	0.59	–0.89	0.41			
HFM14	0.00	150.50	56.00	823.30		7,202.00	0.59	–0.80	0.43			
HFM14	0.00	150.50	50.00	836.10				1.79	1.95			
HFM14	0.00	150.50	118.00	830.80		43,442.00	2.13	1.77	2.02			
HFM14	0.00	150.50	41.00	837.50		2,402.00	0.55	–0.92	0.37			

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_dis-tance_rs	(m) shortest_ distance_rt	(s) time_lag_ press_dtl	(m) initial_ head_hi	(m) head_at_ flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_ end_pp	(kPa) final_ press_pf
HFM14	0.00	150.50	58.00	838.00		4,382.00	0.58	–0.78	0.41			
HFM14	0.00	150.50	69.00	838.50		5,882.00	0.53	–0.83	0.38			
HFM14	0.00	150.50	26.00	894.80		44,042.00	2.49	2.10	2.36			
HFM14	0.00	150.50	70.00	1,020.30			0.19	0.16	0.16			
HFM14	0.00	150.50	138.00	983.60		10,082.00	0.26	–1.19	0.11			
HFM14	0.00	150.50	236.00	937.10		1,982.00	–0.05	–2.41	–0.23			
HFM14	0.00	150.50	20.00	1,030.70		87,242.00	0.38	–0.11	0.02			
HFM14	0.00	150.50	27.00	1,028.30		41,642.00	0.38	–0.31	0.28			
HFM14	0.00	150.50	98.00	999.60		6,182.00	0.44	–1.00	0.30			
HFM14	0.00	150.50	160.00	967.40		2,402.00	0.19	–1.76	0.16			
HFM14	0.00	150.50	98.00	1,056.60		11,522.00	0.27	–1.11	0.19			
HFM14	0.00	150.50	157.00	1,056.60		2,162.00	0.07	–1.92	0.00			
HFM14	0.00	150.50	194.00	1,058.30		33,242.00	0.08	–1.53	–0.50			
HFM14	0.00	150.50	401.00	1,091.70			0.86	0.38	0.41			
HFM14	0.00	150.50	137.00	1,103.60		14,282.00	0.14	–1.28	0.03			
HFM14	0.00	150.50	178.00	1,124.20		6,722.00	–0.17	–1.67	–0.33			
HFM14	0.00	150.50	208.00	1,137.10		170,042.00	–0.20	–1.44	–1.09			
HFM14	0.00	150.50	261.00	1,162.30		62,042.00	–0.20	–1.35	–1.15			
HFM14	0.00	150.50	967.00	1,692.70			–4.39	–4.43	–4.39			
HFM14	0.00	150.50	987.00	1,711.40			–4.20	–4.25	–4.23			
HFM14	0.00	150.50	46.00	1,326.50		29,042.00	–0.10	–0.99	–0.30			
HFM14	0.00	150.50	254.00	1,222.10		73,442.00	0.03	–1.28	–0.42			
HFM14	0.00	150.50	564.00	1,101.20			–1.55	–0.45	–0.38			
HFM14	0.00	150.50	62.00	1,227.40		8,042.00	0.18	–1.13	0.03			
HFM14	0.00	150.50	25.00	1,289.00		51,842.00	0.66	0.16	0.48			
HFM14	0.00	150.50	77.00	1,292.40		27,242.00	0.62	–0.44	0.50			
HFM14	0.00	150.50	118.00	1,295.90		12,422.00	0.68	–0.64	0.56			
HFM14	0.00	150.50	215.00	1,308.50		14,582.00	0.77	–0.65	0.64			
HFM14	0.00	150.50	26.00	1,302.50		45,242.00	0.05	–0.31	0.03			
HFM14	0.00	150.50	92.00	1,320.50			0.28	0.25	0.10			

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_distance_rs	(m) shortest_distance_rt	(s) time_lag_press_dtl	(m) initial_head_hi	(m) head_at_flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf
HFM14	0.00	150.50	174.00	1,348.80			0.77	0.62	0.62			
HFM14	0.00	150.50	30.00	1,380.10				2.12	2.23			
HFM14	0.00	150.50	69.00	1,364.00				2.00	2.07			
HFM14	0.00	150.50	138.00	1,341.10			2.19	2.01	2.09			
HFM14	0.00	150.50	194.00	1,325.80			2.08	1.95	2.02			
HFM14	0.00	150.50	99.00	1,371.90		195,242.00	0.16	–0.05	0.09			
HFM14	0.00	150.50	160.00	1,341.50		30,242.00	1.45	1.12	1.29			
HFM14	0.00	150.50	436.00	1,375.30			1.39	1.03	1.00			
HFM14	0.00	150.50	685.00	1,493.90			–2.88	–3.07	–3.06			
HFM14	0.00	150.50	82.00	1,349.00		51,242.00	1.67	1.29	1.45			
HFM14	0.00	150.50	30.00	1,373.10		51,242.00	1.38	1.10	1.23			
HFM14	0.00	150.50	12.00	1,442.00			–0.04	–0.19	–0.08			
HFM14	0.00	150.50	29.00	1,438.90			–0.01	–0.18	0.00			
HFM14	0.00	150.50	188.00	1,390.70			–0.08	–0.16	–0.14			
HFM14	0.00	150.50	105.00	1,499.50		36,842.00	1.44	1.11	1.14			
HFM14	0.00	150.50	31.00	1,536.50		65,642.00	0.50	0.33	0.43			
HFM14	0.00	150.50	100.00	1,558.30				0.31	0.51			
HFM14	0.00	150.50	188.00					0.06	0.25			
HFM14	0.00	150.50	327.50					–0.90	0.16			
HFM14	0.00	150.50	420.50					–1.51	–0.30			
HFM14	0.00	150.50	461.00				–1.55	–1.48	–0.25			
HFM14	0.00	150.50	498.50					–1.54	–0.31			
HFM14	0.00	150.50	538.50					–1.05	–0.74			
HFM14	0.00	150.50	118.00	1,570.70		143,042.00	0.60	0.32	0.50			
HFM14	0.00	150.50	173.00	1,571.10		78,842.00	0.42	0.10	0.31			
HFM14	0.00	150.50	282.00	1,576.10		59,042.00	0.87	–0.25	0.68			
HFM14	0.00	150.50	428.00	1,593.70		6,842.00	–0.06	–1.40	–0.19			
HFM14	0.00	150.50	478.00	1,602.60		7,862.00	–0.12	–1.48	–0.25			

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_distance_rs	(m) shortest_distance_rt	(s) time_lag_press_dtl	(m) initial_head_hi	(m) head_at_flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf
HFM14	0.00	150.50	513.00	1,609.50		2,642.00	–0.12	–1.46	–0.22			
HFM14	0.00	150.50	558.00	1,619.20			0.23	–0.50	–0.27			
HFM14	0.00	150.50	945.00	1,739.80			0.86	0.07	0.06			
HFM14	0.00	150.50	75.00	1,698.50				0.40	0.55			
HFM14	0.00	150.50	153.00	1,712.10			0.31	0.24	0.42			
HFM14	0.00	150.50	136.00	1,728.80		51,242.00	–0.02	–0.21	0.10			
HFM14	0.00	150.50	35.00	1,746.50		71,642.00	0.96	0.54	0.62			
HFM14	0.00	150.50	62.00	1,746.80		139,442.00	0.49	0.25	0.42			
HFM14	0.00	150.50	145.00	1,758.60		161,042.00	0.43	0.22	0.36			
HFM14	0.00	150.50	22.00	1,881.90		72,242.00	6.09	6.05	6.08			
HFM14	0.00	150.50	117.00	1,911.80		76,442.00	6.17	6.05	6.09			
HFM14	0.00	150.50	100.00	2,376.00				–2.95	–2.95			
HFM14	0.00	150.50	245.50					–1.71	–1.70			
HFM14	0.00	150.50	403.00					–2.92	–2.99			
HFM14	0.00	150.50	451.00					–3.08	–3.14			
HFM14	0.00	150.50	573.00					–5.44	–5.45			
HFM14	0.00	150.50	700.00					–6.56	–6.60			
HFM14	0.00	150.50	780.50					–3.31	–3.31			
HFM14	0.00	150.50	43.00	2,027.60			6.10	6.06	6.20			
HFM14	0.00	150.50	125.00	2,007.80				5.59	5.61			
HFM14	0.00	150.50	19.00	2,506.20			0.11	0.19	0.28			
HFM14	0.00	150.50	35.00	2,495.50			0.30	0.35	0.39			
HFM14	0.00	150.50	111.00	2,455.60			0.28	0.34	0.39			

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(oC) fluid_temp_teo	(mS/m) fluid_elcond_eco	(mg/l) fluid_salinity_tdso	(mg/l) fluid_salinity_tdsom	(m) drawdown_sp	reference	comment
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fluid_temp_teo (oC)	fluid_elcond_eco (mS/m)	fluid_salinity_tdso (mg/l)	fluid_salinity_tdsom (mg/l)	drawdown_sp (m)	reference	comment
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(oC) fluid_temp_teo	(mS/m) fluid_elcond_eco	(mg/l) fluid_salinity_tdso	(mg/l) fluid_salinity_tdsom	(m) drawdown_sp	reference	comment
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(oC) fluid_temp_teo	(mS/m) fluid_elcond_eco	(mg/l) fluid_salinity_tdso	(mg/l) fluid_salinity_tdsom	(m) drawdown_sp	reference	comment
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Sicada – description of plu_inf_test_obs_d

PLU interference tests, Observation section data

Sicada Header	Header	Unit	Explanation
idcode	ID Obs Borehole		ID for observation borehole
secup	Borehole secup	(m)	Length coordinate along the borehole for the upper limit of observation section
seclow	Borehole seclow	(m)	Length coordinate along the borehole for the lower limit of observation section
start_date	Date for test start	YYYY-M M-DD hh:mm	Date for the start of the pumping/injection test (YYYY-MM-DD hh:mm)
stop_date	Date for test stop	YYYY-M M-DD hh:mm	Date for the stop of the pumping/injection test (YYYY-MM-DD hh:mm)
test_type	Test type (1– 7)	(–)	1A:Pumping test-wireline eq.,1B: Pumping test-submersible pump, 1C: Pumping test-airlift pumping. 2: Interference test.3: Injection test. 4: Slug test., 4B: Pulse test. 5A: Flowlogging-PFL-DIFF_sequential. 5B Flowlogging-PFL-DIFF_overlapping. 6: Flowlogging Impeller. 7: Grain size analysis
test_borehole	ID. pumped Borehole	(–)	ID for pumped or injected borehole
test_secup	Test secup	(m)	Length coordinate along the borehole for the upper limit of pumped or injected section
test_seclow	Test seclow	(m)	Length coordinate along the borehole for the lower limit of pumped or injected section
start_flow_period	Start flow	YYYY-MM-DD hh:mm:ss	Time for the start of the pumping/injection period (YYYY-MM-DD hh:mm:ss)
stop_flow_period	Stop flow	YYYY-MM-DD hh:mm:ss	Time for the stop of the pumping/injection period (YYYY-MM-DD hh:mm:ss)
lp	Lp	(m)	Hydraulic point of application for a test section, based on the geometric midpoint of test section or the main point of transmissivity distribution in test section
radial_distance_rs	rs	(m)	Geometrical distance from point of application in test section to point of application in observation section.
shortest_distance_rt	rt	(m)	Representative hydraulic distance from point of application in test section to point of application in observation section via inferred major conductive features. The actual structural model version shall be reported.
time_lag_press_dtl	dtL	(s)	Time lag for pressure response to reach observation section after start/stop of pumping or injection, based on the first significant response in the observation section.
initial_head_hi	hi	(m)	Hydraulic head in observation section at start of flow period
head_at_flow_end_hp	hp	(m)	Hydraulic head in observation section at stop of flow period
final_head_hf	hF	(m)	Hydraulic head in observation section at stop of recovery period
initial_press_pi	pi	(kPa)	Groundwater pressure in observation section at start of flow period
press_at_flow_end_pp	pp	(kPa)	Groundwater pressure in observation section at stop of flow period

Sicada Header	Header	Unit	Explanation
final_press_pf	pF	(kPa)	Groundwater pressure in observation section at stop of recovery period
fluid_temp_teo	Teo	(Co)	Measured borehole fluid temperature in the observation section (representative for evaluated parameters)
fluid_elcond_eco	ECo	(mS/m)	Measured electric conductivity of the borehole fluid in the observation section (representative for evaluated parameters)
fluid_salinity_tdso	TDSo	(mg/L)	Calculated total dissolved solids of the borehole fluid in the observation section, based on EC-measurement
fluid_salinity_tdso	TDSom	(mg/L)	Measured total dissolved solids of the borehole fluid in the observation section, based on water sampling and chemical analysis
reference	References		SKB report No for reports describing data and evaluation
comment	Comments		Short comment to the evaluated parameters (Optional)
Index o			Observation borehole or observation section (o short for observation)

plu_inf_test_obs_ed

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_borehole	(m) test_secup	(m) test_seclow
HFM01	2007-06-01 01:00	2007-10-20 00:00	33.50	45.50		HFM14	0.00	150.50
HFM13	2007-06-01 01:00	2007-10-20 00:00	159.00	173.00		HFM14	0.00	150.50
HFM15	2007-06-01 01:00	2007-10-20 00:00	85.00	95.00		HFM14	0.00	150.50
HFM19	2007-06-01 01:00	2007-10-20 00:00	168.00	182.00		HFM14	0.00	150.50
HFM32	2007-06-01 01:00	2007-10-20 00:00	26.00	31.00		HFM14	0.00	150.50
KFM10A	2007-06-01 01:00	2007-10-20 00:00	430.00	440.00		HFM14	0.00	150.50

cont.

(m) formation_width_b	(m) lp	(m) width_of_channel_b	(m**3/s) tbo	(m**3/s) l_measl_tbo	(m**3/s) u_measl_tbo	(m) sbo	(m) leakage_factor_lof	(m**2/s) transmissivity_to
12.00	39.00							5.90E–04
14.00	162.00							3.50E–04
10.00	89.00							3.90E–04
14.00	176.00							3.90E–04
5.00	29.00							1.50E–04
10.00	432.00							3.30E–04

cont.

value_type_to	(m**2/s) l_measl_to	(m**2/s) u_measl_to	storativity_so	(1/s) leakage_coeff_o	(m/s) hydr_cond_kosf	(m/s) l_measl_kosf	(m/s) u_measl_kosf	(1/m) spec_storage_sosf	(s) dt1	(s) dt2	(s) t1	(s) t2
			9.00E–05	1.70E–10								
			1.60E–05	4.80E–11								
			5.10E–05	1.60E–10								
			1.40E–05	3.90E–11								
			3.40E–04	5.40E–09								
			8.50E–06	2.90E–11								

cont.

(s) dte1	(s) dte2	(m**2/s) index_1	(s/m**2) index_2	(s/m**2) index_2_new	(m**2/s) diffusivity	(m**2/s) transmissiv-ity_to_nlr	value_type_ to_nlr	storativ-ity_so_nlr	(m**2/s) transmissiv-ity_to_grf	value_type_ to_grf	storativ-ity_so_grf	flow_dim_ grf_o	comments
		169.34	479.99	2,848.18	6.56E+00								dtl is for 0.01 m change
		257.23	1,083.85	6,169.67	2.19E+01								dtl is for 0.01 m change
		2,541.85	1,316.10	5,615.66	7.65E+00								dtl is for 0.01 m change
		603.47	1,102.77	6,080.49	2.79E+01								dtl is for 0.01 m change
		12.52	29.25	182.45	4.41E–01								dtl is for 0.01 m change
		550.55	1,019.42	6,321.55	3.88E+01								dtl is for 0.01 m change

Sicada – description of plu_inf_test_obs_ed

PLU interference test, evaluated data of observation sections

Sicada Header	Header	Unit	Explanation
idcode	ID Obs. Borehole		ID for obsevation borehole
secup	Borehole secup	m	Length coordinate along the borehole for the upper limit of the observation section
seclow	Borehole seclow	(m)	Length coordinate along the borehole for the lower limit of the observation section
start_date	Date for test start	YYYY-MM-DD hh:mm	Date for the start of the interference test (YYYY-MM-DD hh:mm)
stop_date	Date for test stop	YYYY-MM-DD hh:mm	Date for the stop of the interference test (YYYY-MM-DD hh:mm)
test_borehole	ID- Pumped borehole	(–)	ID for pumped or injected borehole
test_secup		(m)	Length coordinate along the borehole for the upper limit of pumped or injected section
test_seclow		(m)	Length coordinate along the borehole for the lower limit of pumped or injected section
formation_width_b	b	m	b:Representative aquifer thickness for inferred transmissivity, generally estimated as observation section length L_o
width_of_channel_b	B	m	B:Inferred width of formation for evaluated TB
lp	L_p		Hydraulic point of application for a test section, based on the geometric midpoint of test section or the main point of transmissivity distribution in test section
tbo	TB_o	m^3/s	Flow capacity in 1D formation of width B and transmissivity T based on transient evaluation in observation section. Considered best estimate from transient evaluation of flow period or recovery period.
l_meas_limit_tbo	TB-measl-L	m^3/s	Estimated lower measurement limit for evaluated TB in observation section.
u_meas_limit_tbo	TB-measl-U	m^3/s	Estimated upper measurement limit for evaluated TB in observation section.
sbo	SB_o	m	SB_o: Storage capacity of 1D formation of width B and storativity S based on transient evaluation in observation section. Considered best estimate from transient evaluation of flow period or recovery period.
leakage_factor_lof	L_{of}	m	Leakage coefficient in observation section evaluated from 2D radial flow model. K´ = hydraulic conductivity across the aquitard, b´ = water saturated thickness of aquitard (leaky formation). Considered best estimate from transient evaluation of flow period or recovery period.
transmissivity_to	T_o	m^2/s	Transmissivity of formation in observation section, based on 2D radial flow model. Considered best estimate from transient evaluation of flow period or recovery period.
l_measl_to	$T_{o\text{-}measl\text{-}L}$	m^2/s	Estimated lower measurement limit for evaluated T_o in observation section
u_measl_to	$T_{o\text{-}measl\text{-}U}$	m^2/s	Estimated upper measurement limit for evaluated T_o in observation section
storativity_so	S_o	(–)	Storativity (Storage coefficient) of formation in observation section based on 2D radial flow model. Considered best estimate from transient evaluation of flow period or recovery period.

Sicada Header	Header	Unit	Explanation
leakage_coeff_o	$(K'/b')_o$	(l/s)	Leakage coefficient in observation section evaluated from 2D radial flow model. K´ = hydraulic conductivity across the aquitard, b´ = water saturated thickness of aquitard (leaky formation). Considered best estimate from transient evaluation of flow period or recovery period.
hydr_kond_kosf	K_{osf}	m/s	Hydraulic conductivity of formation in observation section, based on 3D spherical flow model. Considered best estimate from transient evaluation of flow period or recovery period.
l_measl_kosf	$K_{osf\text{-}measl\text{-}L}$	m/s	Estimated lower measurement limit for evaluated K_{osf} in observation section.
u_measl_kosf	$K_{osf\text{-}measl\text{-}U}$	m/s	Estimated upper measurement limit for evaluated K_{osf} in observation section.
spec_storage_sosf	S_{osf}	1/m	Specific Storage of formation in observation section, based on 3D spherical flow. Considered best estimate from transient evaluation of flow period or recovery period.
dt1	dt_1	s	Estimated start time after pump/injection start or recovery start, for the period used for the evaluated parameter
dt2	dt_2	s	Estimated stop time after pump/injection start or recovery start, for the period used for the evaluated parameter
t1	t_1	s	Start time for evaluated parameter from start of flow period.
t2	t_2	s	Stop time for evaluated parameter from start of flow period.
dte1	dt_{e1}	s	Start time for evaluated parameter from start of recovery period.
dte2	dt_{e2}	s	Stop time for evaluated parameter from start of recovery period.
transmissivity_to_nlr	T_{oNLR}	m^2/s	Transmissivity in observation section, based on Non Linear Regression of the entire test sequence.
storativity_so_nlr	S_{oNLR}	(–)	Storativity in observation section, based on Non Linear Regression of the entire test sequence.
transmissivity_to_grf	T_{oGRF}	m^2/s	Transmissivity in observation section, based on the Generalised Radial Flow model (Baker, 1988). Considered best estimate from transient evaluation of flow period or recovery period.
storativity_so_grf	S_{oGRF}	(–)	Storativity in observation section, based on Generalised Radial Flow model. Considered best estimate from transient evaluation of flow period or recovery period.
flow_dim_grf_o	D_{oGRF}	(–)	Inferred flow dimension in observation section, based on the Generalised Radial Flow model (Barker, 1988). Considered best estimate from transient evaluation of flow period or recovery period.
Comments	Comments		Short comment to the evaluated parameters (Optional)

Result tables to Sicada – Test 2

Result tables to Sicada from the second single-hole test in HFM14

plu_s_hole_test_d

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
HFM14	2007-11-27 08:45	2007-12-20 06:00	6.00	150.50		1B	1	2007-11-27 09:20:19	2007-12-13 09:08:10

cont.

(m**3/s) flow_rate_end_qp	value_type_qp	(m**3/s) mean_flow_rate_qm	(m**3/s) q_measl__l	(m**3/s) q_measl__u	(m**3) tot_volume_vp	(s) dur_flow_phase_tp	(s) dur_rec_phase_tf	(m) initial_head_hi	(m) head_at_flow_end_hp
5.8250E–03	0	5.7628E–03			7.9623E+03	1,381,671.00	593,510.00	17.39	5.99

cont.

(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf	(oC) fluid_temp_tew	(mS/m) fluid_elcond_ecw	(mg/l) fluid_salinity_tdsw	(mg/l) fluid_salinity_tdswm	reference	(no_unit) comments	(m) lp
17.53										

For description of table components see Appendix 3.

plu_s_hole_test_ed1

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(m) lp	(m) seclen_class
HFM14	2007-11-27 08:45	2007-12-20 06:00	6.00	150.50		1B	1	20.00	

cont.

(m**2/s) spec_capacity_q_s	value_type_q_s	(m**2/s) transmissivity_tq	value_type_tq	bc_tq	(m**2/s) transmissivity_moye	value_type_tm	bc_tm	(m/s) hydr_cond_moye	(m) formation_width_b
5.11E–04	0				6.47E–04	0	1	4.48E–06	144.50

cont.

(m) width_of_channel_b	(m**3/s) tb	(m**3/s) l_measl_tb	(m**3/s) u_measl_tb	(m) sb	(m) assumed_sb	(m) leakage_factor_lf	(m**2/s) transmissivity_tt	value_type_tt	bc_tt

cont.

(m**2/s) l_measl_q_s	(m**2/s) u_measl_q_s	storativity_s	assumed_s	s_bc	(m) ri	ri_index	(1/s) leakage_coeff	(m/s) hydr_cond_ksf	value_type_ksf
2.00E–06	2.00E–02								

cont.

(m/s) l_measl_ksf	(m/s) u_measl_ksf	(1/m) spec_storage_ssf	(1/m) assumed_ssf	(m**3/pa) c	cd	skin	(s) dt1	(s) dt2	(s) t1

cont.

(s) t2	(s) dte1	(s) dte2	(kPa) p_horner	(m**2/s) transmissivity_t_nlr	storativity_s_nlr	value_type_t_nlr	bc_t_nlr	(m**3/pa) c_nlr	cd_nlr

cont.

skin_nlr	(m**2/s) transmissivity_t_grf	value_type_t_grf	bc_t_grf	storativity_s_grf	flow_dim_grf	comment

For description of table components see Appendix 3.

Result table to Sicada from the second interference test in HFM14

plu_inf_test_obs_d

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	test_type	formation_type	(YYYY-MM-DD hh:mm:ss) start_flow_period	(YYYY-MM-DD hh:mm:ss) stop_flow_period
KFM08D	2007-11-01 00:00	2007-12-20 06:00	0.00	160.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08D	2007-11-01 00:00	2007-12-20 06:00	161.00	330.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08D	2007-11-01 00:00	2007-12-20 06:00	331.00	659.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08D	2007-11-01 00:00	2007-12-20 06:00	660.00	680.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08D	2007-11-01 00:00	2007-12-20 06:00	681.00	824.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08D	2007-11-01 00:00	2007-12-20 06:00	825.00	835.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08D	2007-11-01 00:00	2007-12-20 06:00	836.00	950.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	0.00	161.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	162.00	215.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	216.00	264.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	265.00	280.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	281.00	473.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	474.00	503.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	504.00	683.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	684.00	694.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10
KFM08A	2007-11-01 00:00	2007-12-20 06:00	695.00	1001.00	2	1		2007-11-27 09:20:19	2007-12-13 09:08:10

cont.

test_borehole	(m) test_secup	(m) test_seclow	(m) lp	(m) radial_distance_rs	(m) shortest_distance_rt	(s) time_lag_press_dtl	(m) initial_head_hi	(m) head_at_flow_end_hp	(m) final_head_hf	(kPa) initial_press_pi	(kPa) press_at_flow_end_pp	(kPa) final_press_pf
HFM14	0.00	150.50	130.00	1,259.50		11,921.00	0.30	–0.68	0.32			
HFM14	0.00	150.50	245.50	1,219.70			–0.07	–0.15	0.00			
HFM14	0.00	150.50	495.00	1,207.40			–0.62	–0.58	–0.54			
HFM14	0.00	150.50	670.00	1,228.10			0.00	–0.24	–0.03			
HFM14	0.00	150.50	752.50	1,245.40			–0.11	–0.23	–0.13			
HFM14	0.00	150.50	830.00	1,265.40			–1.74	–1.84	–1.71			
HFM14	0.00	150.50	893.00	1,284.70			–2.01	–2.07	–2.00			
HFM14	0.00	150.50	80.50	1,328.30			–0.02	0.01	–0.09			
HFM14	0.00	150.50	188.50	1,390.10			0.24	0.20	0.14			
HFM14	0.00	150.50	240.00	1,422.30			0.38	0.39	0.31			
HFM14	0.00	150.50	272.50	1,444.20			–0.64	–0.63	–0.70			
HFM14	0.00	150.50	377.00	1,517.50			–0.68	–0.74	–0.73			
HFM14	0.00	150.50	488.50	1,603.00			–0.54	–0.59	–0.55			
HFM14	0.00	150.50	593.50	1,689.30			–1.86	–1.86	–3.61			
HFM14	0.00	150.50	689.00	1,771.30			0.19	0.19	0.23			
HFM14	0.00	150.50	848.00	1,914.30			0.51	0.49	0.55			

cont.

(oC) fluid_temp_teo	(mS/m) fluid_elcond_eco	(mg/l) fluid_salinity_tdso	(mg/l) fluid_salinity_tdsom	(m) drawdown_sp	reference	comment
						dtl is for 0.01 m change
						dtl is for 0.01 m change
						dtl is for 0.01 m change
						dtl is for 0.01 m change
						dtl is for 0.01 m change
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For description of table components see Appendix 3.