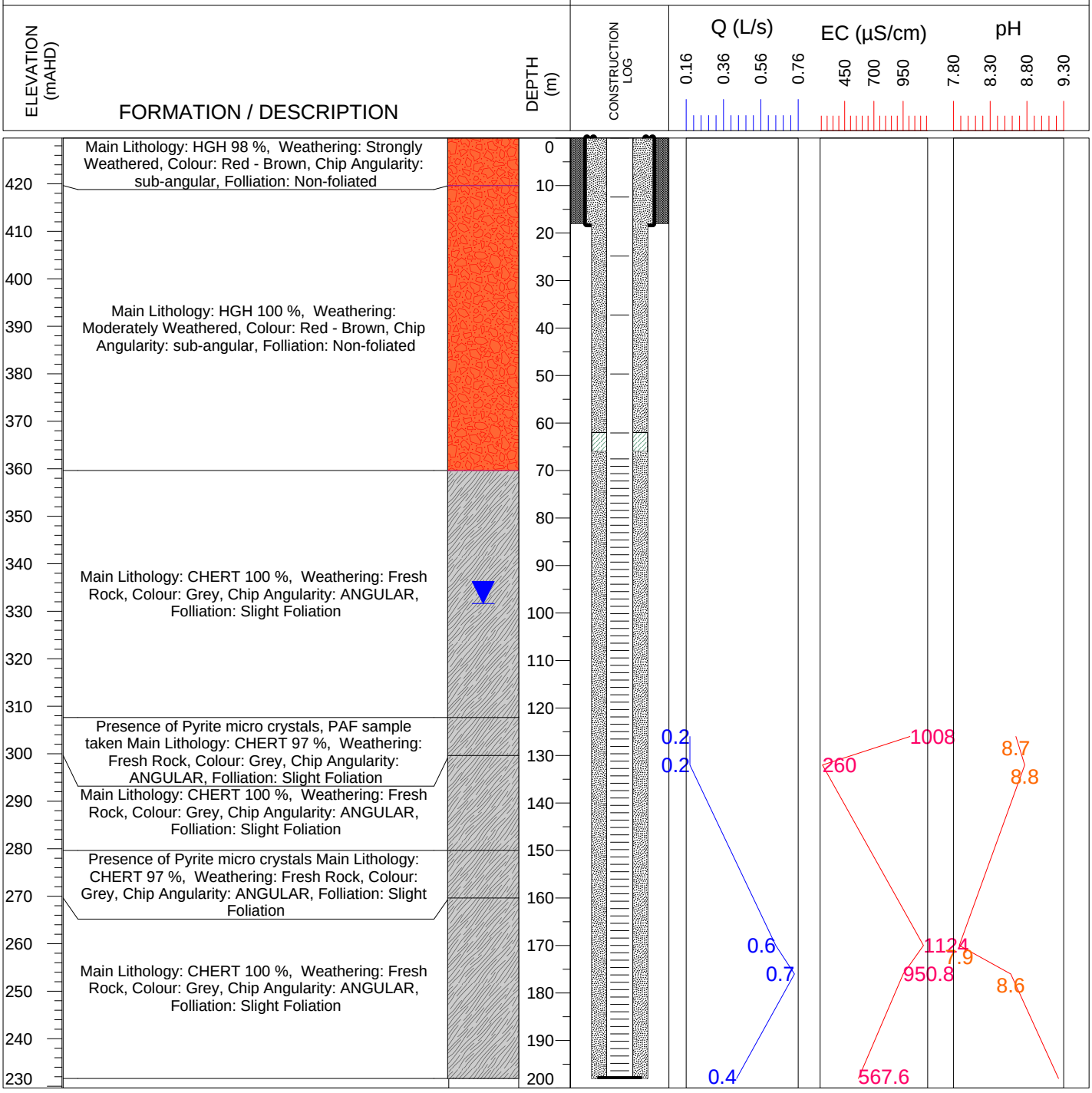
HOLE NO.: **CRD0142**		CLIENT: ATLAS	srk consulting
LOCATION: Sparrow Lake / Razorback	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,397.37	TOTAL DEPTH (m): 198
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,623,833.44	GROUND ELEVATION (mAHD): 429.6
START DATE: 17/03/2024	FINISH DATE: 20/03/2024	TOP OF INNER CASING (mAHD): 430.24	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): 429.78	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian Monitoring Bore



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

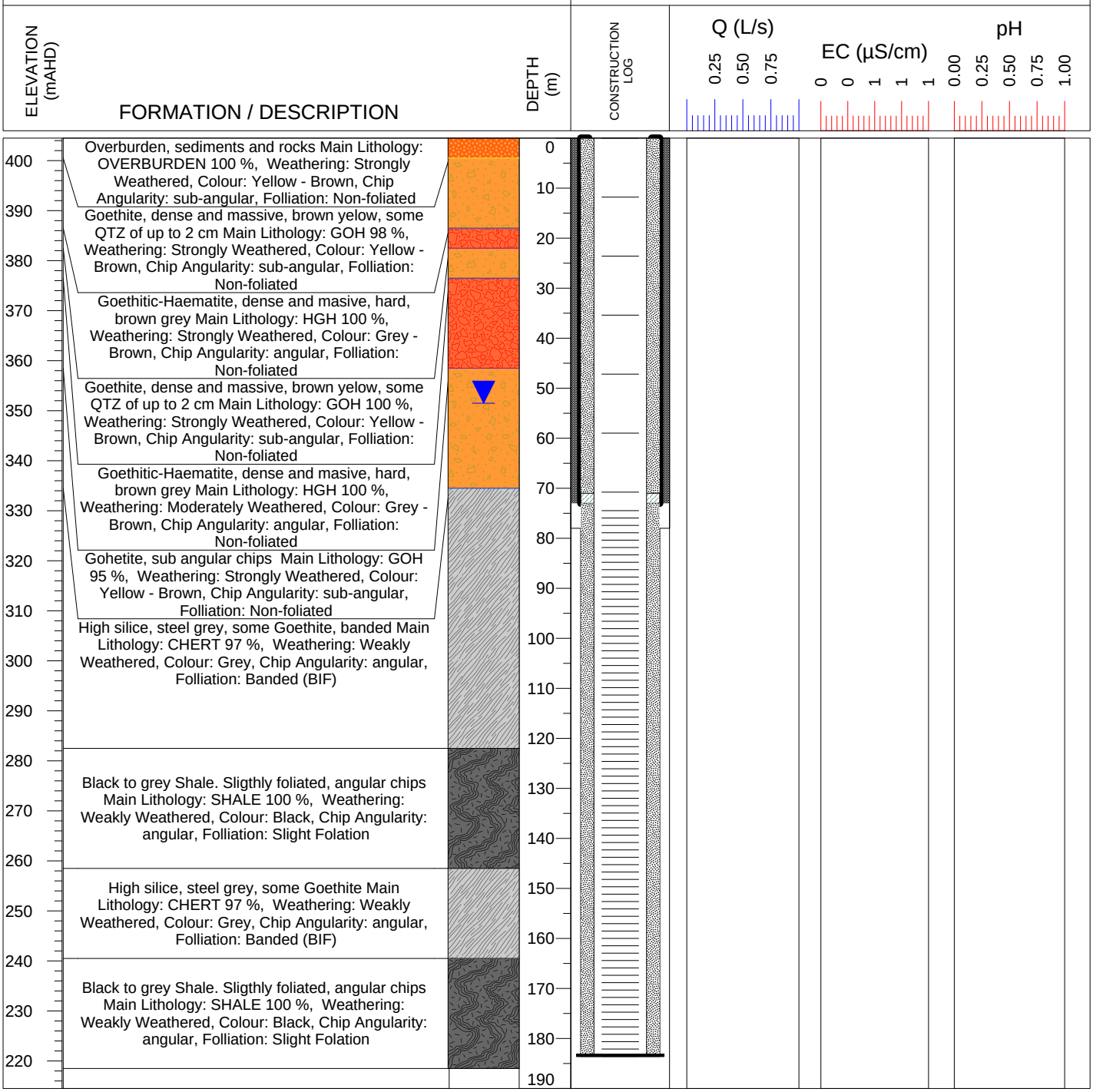
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0143**		CLIENT: ATLAS	srk consulting
LOCATION: Sparrow Lake	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,061.94	TOTAL DEPTH (m): 186
DRILLING METHOD: Mud/Air rotatory	DRILLING EQUIPMENT: RIG15	NORTHING: 7,622,901.20	GROUND ELEVATION (mAHD): 404.5
START DATE: 16/02/2024	FINISH DATE: 07/03/2024	TOP OF INNER CASING (mAHD): 405.62	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): n/a	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH). Use of Mud for drilling until ~72 m

CONSTRUCTION LOG DETAILS:
Non-Artesian Production Bore (20 l/s)



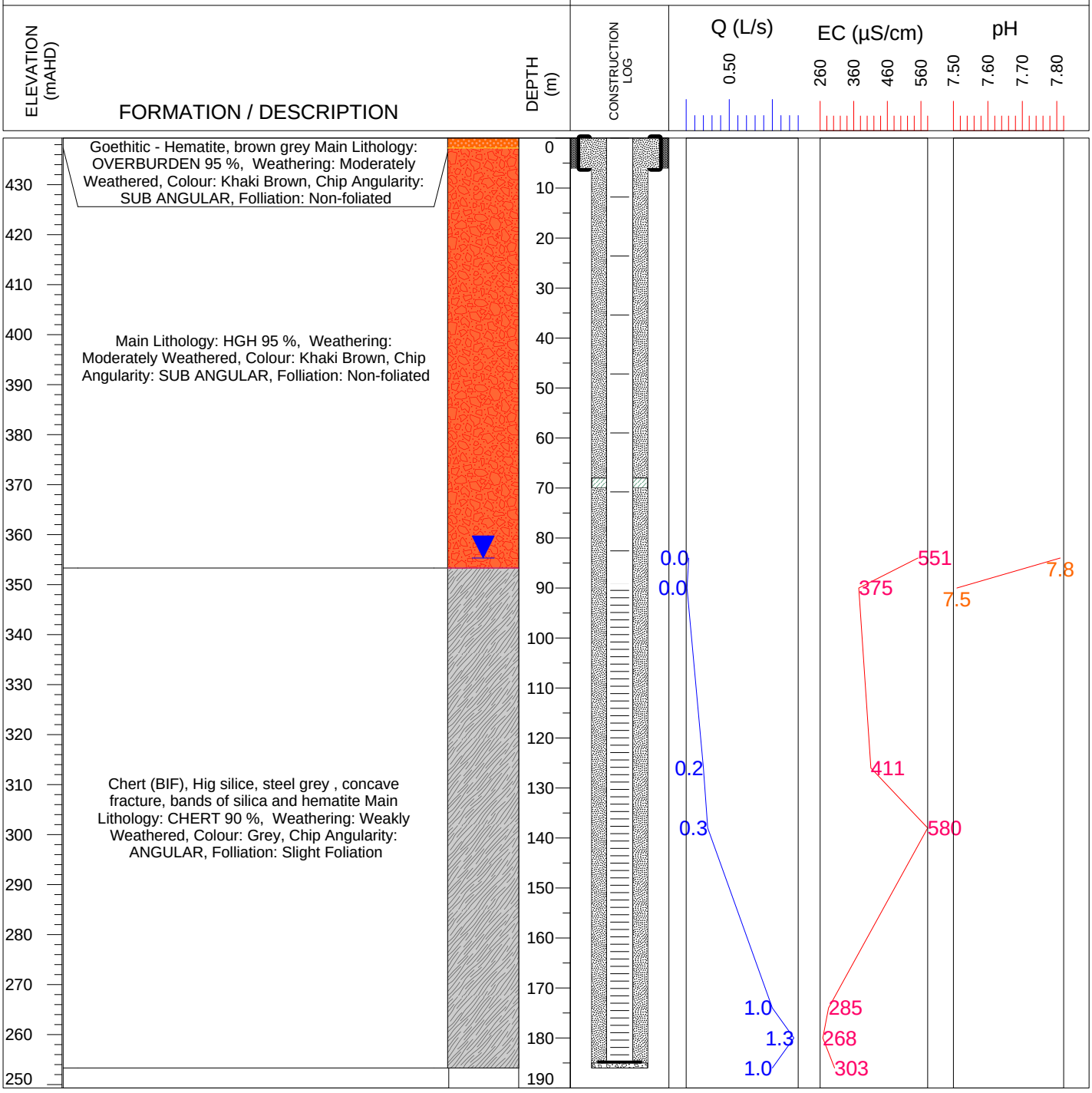
Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0144**		CLIENT: ATLAS	srk consulting
LOCATION:Sparrow Lake	PROJECT. NO.:ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,183.85	TOTAL DEPTH (m):186
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING:7,622,692.43	GROUND ELEVATION (mAHD):439.3
START DATE: 14/01/2024	FINISH DATE:18/01/2024	TOP OF INNER CASING (mAHD):440.02	
PROJECT:Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD):439.44	
NOTE: Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)		CONSTRUCTION LOG DETAILS: Non-Artesian Monitoring Bore	



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

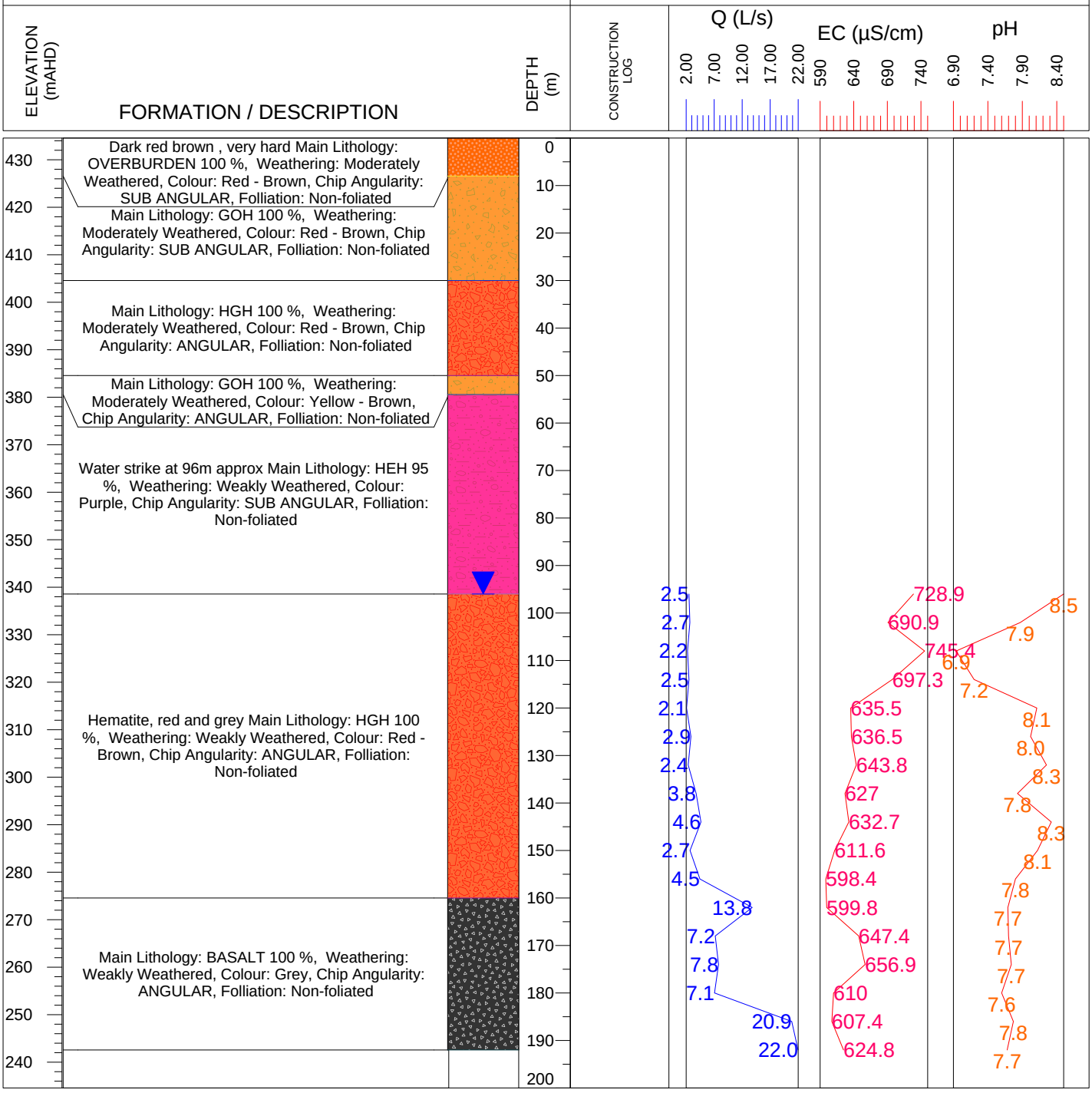
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0145**		CLIENT: ATLAS	srk consulting
LOCATION: Sparrow Lake	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,372.49	TOTAL DEPTH (m): 192
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,622,713.33	GROUND ELEVATION (mAHD): 434.6
START DATE: 18/01/2024	FINISH DATE: 22/01/2024	TOP OF INNER CASING (mAHD): n/a	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): n/a	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Bore collapsed and abandoned (Still open), decomission pendent



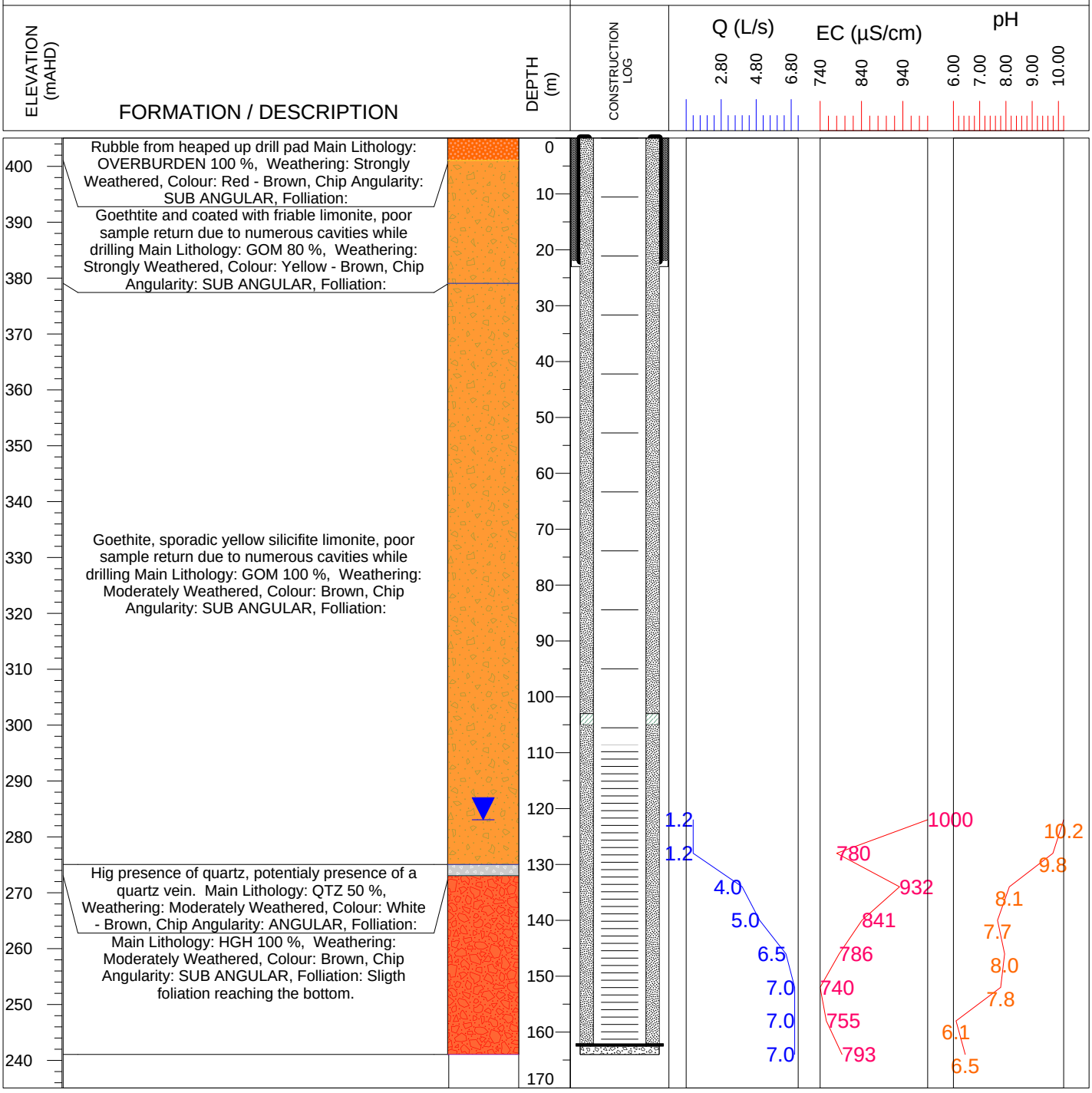
Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0146**		CLIENT: ATLAS	srk consulting
LOCATION:Glen Herring	PROJECT. NO.:ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 775,113.00	TOTAL DEPTH (m):164
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING:7,632,005.23	GROUND ELEVATION (mAHD):405.1
START DATE: 24/05/2024	FINISH DATE:31/05/2024	TOP OF INNER CASING (mAHD):405.63	
PROJECT:Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD):405.39	
NOTE: Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)		CONSTRUCTION LOG DETAILS: Non-Artesian Production Bore (7 l/s)	



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

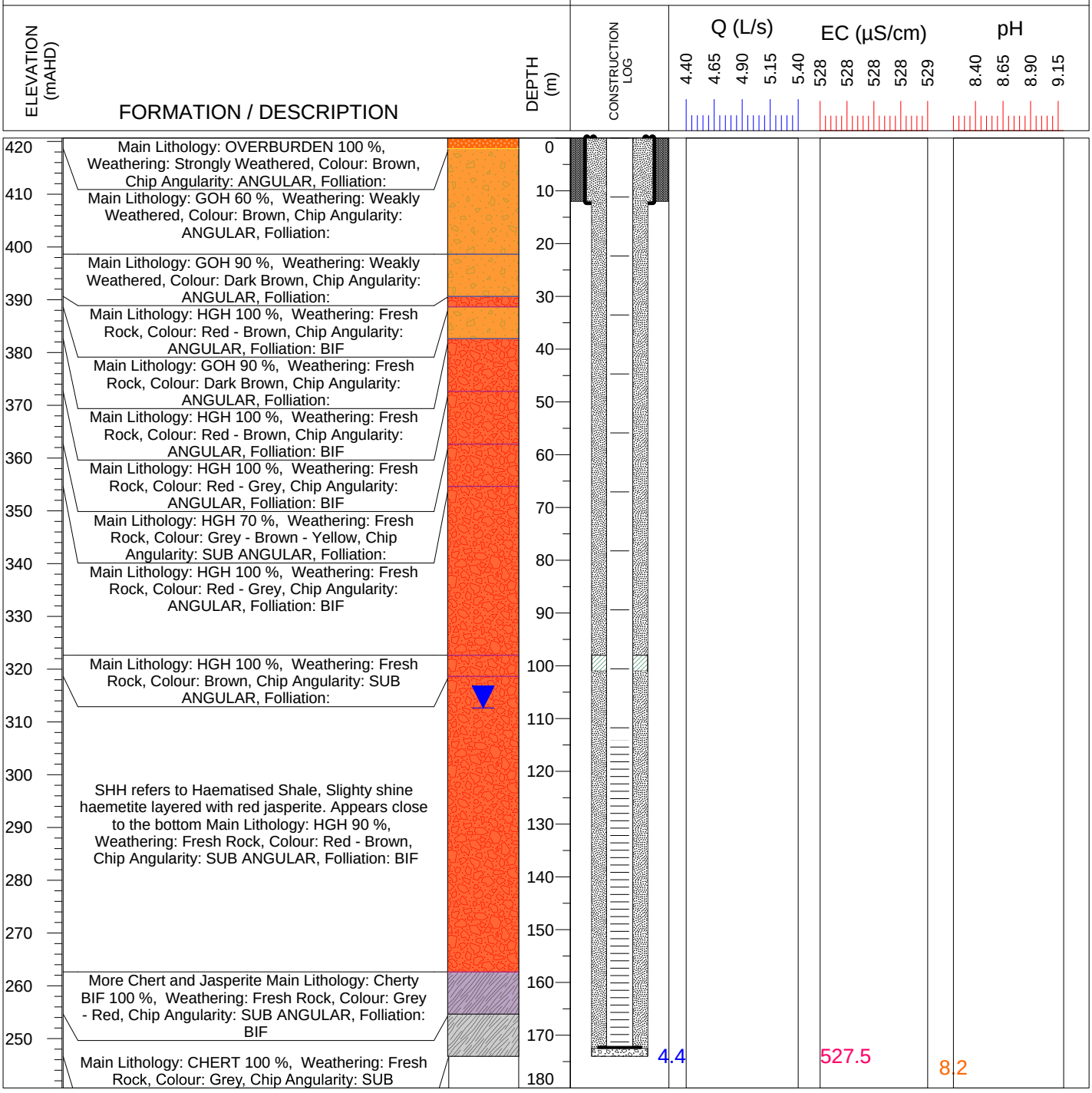
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0147**		CLIENT: ATLAS	srk consulting
LOCATION:Glen Herring	PROJECT. NO.:ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 775,353.86	TOTAL DEPTH (m):174
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING:7,631,706.62	GROUND ELEVATION (mAHD):420.6
START DATE: 22/06/2024	FINISH DATE:24/06/2024	TOP OF INNER CASING (mAHD):421.35	
PROJECT:Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD):420.84	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian, monitoring bore next to production bore CRD0133



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

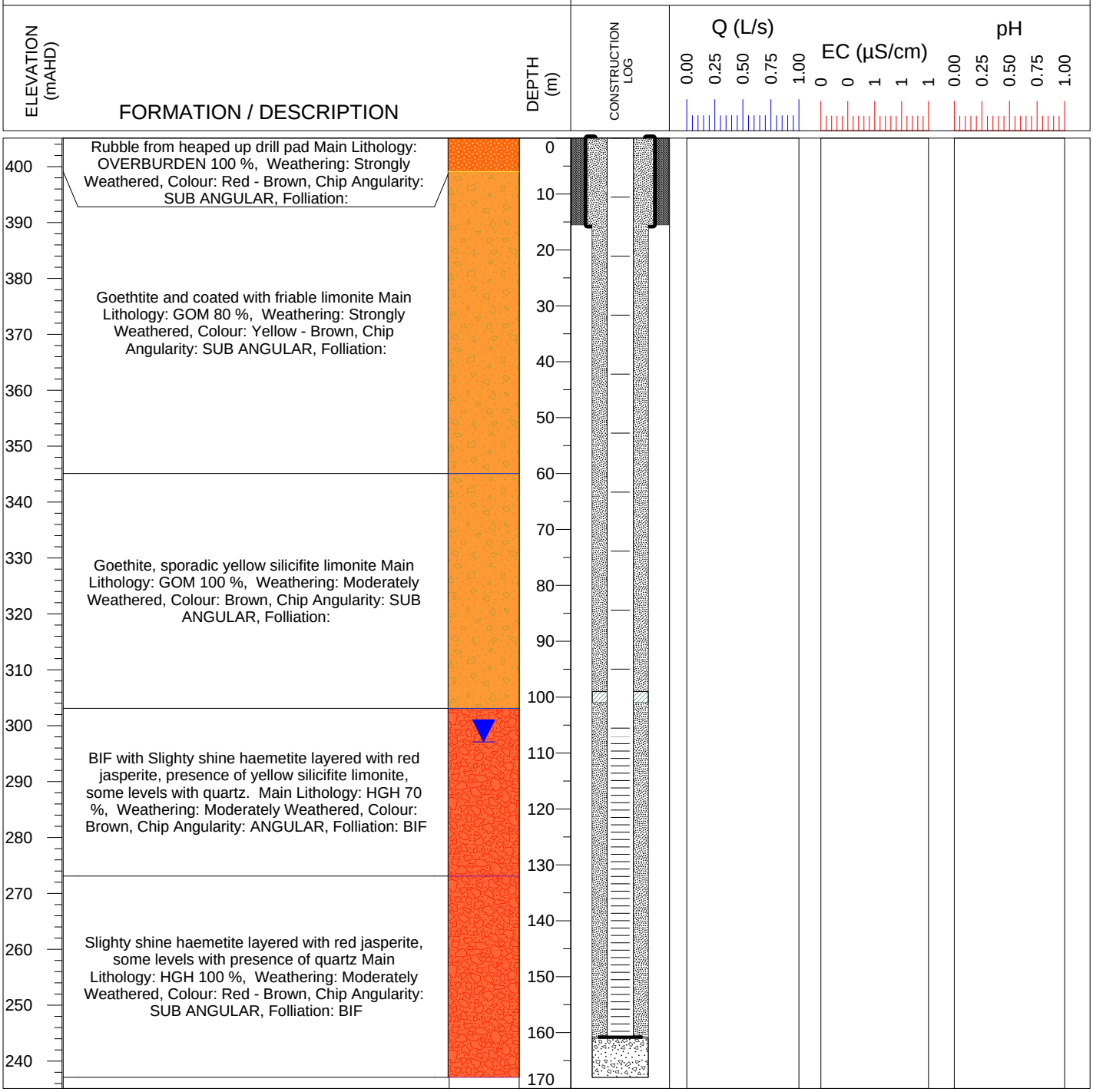
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0148**		CLIENT: ATLAS	srk consulting
LOCATION: Glen Herring	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 775,117.36	TOTAL DEPTH (m): 164
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,632,009.52	GROUND ELEVATION (mAHD): 405.1
START DATE: 04/07/2024	FINISH DATE: 06/07/2024	TOP OF INNER CASING (mAHD): 405.82	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): 405.30	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian, monitoring bore next to production bore CRD0146



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

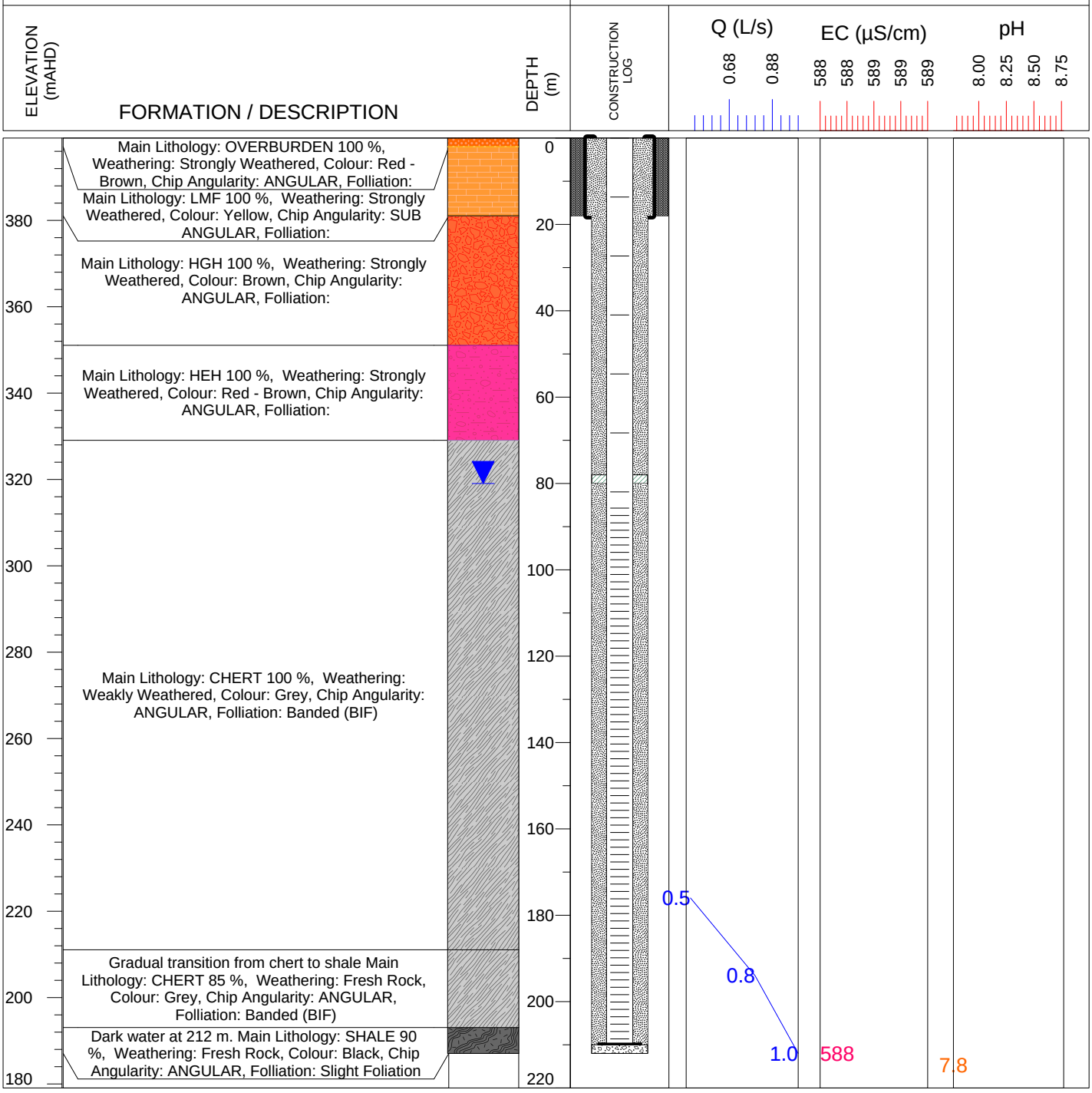
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0149**		CLIENT: ATLAS	srk consulting
LOCATION:Runway	PROJECT. NO.:ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: AL/CFK	EASTING: 777,696.99	TOTAL DEPTH (m):212
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING:7,628,315.43	GROUND ELEVATION (mAHD):399.1
START DATE: 02/05/2024	FINISH DATE:08/05/2024	TOP OF INNER CASING (mAHD):399.82	
PROJECT:Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD):399.34	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian, monitoring bore next to production bore CRD0137



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

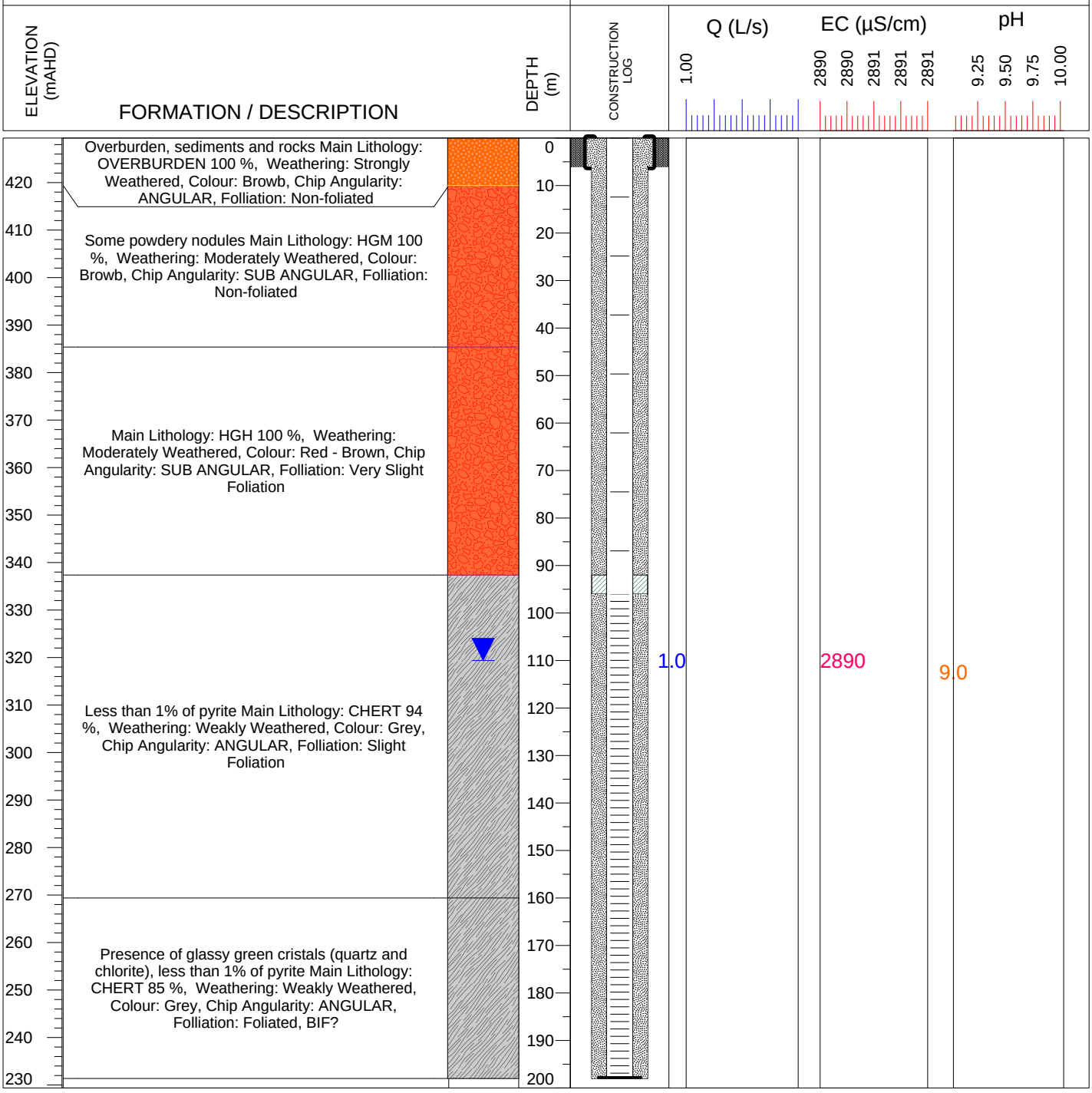
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0150**		CLIENT: ATLAS	srk consulting
LOCATION: Sparrow Lake / Razorback	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,604.67	TOTAL DEPTH (m): 198
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,623,368.06	GROUND ELEVATION (mAHD): 429.4
START DATE: 31/03/2024	FINISH DATE: 03/04/2024	TOP OF INNER CASING (mAHD): 429.84	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): 429.48	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian, monitoring bore next to production bore CRD0141



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

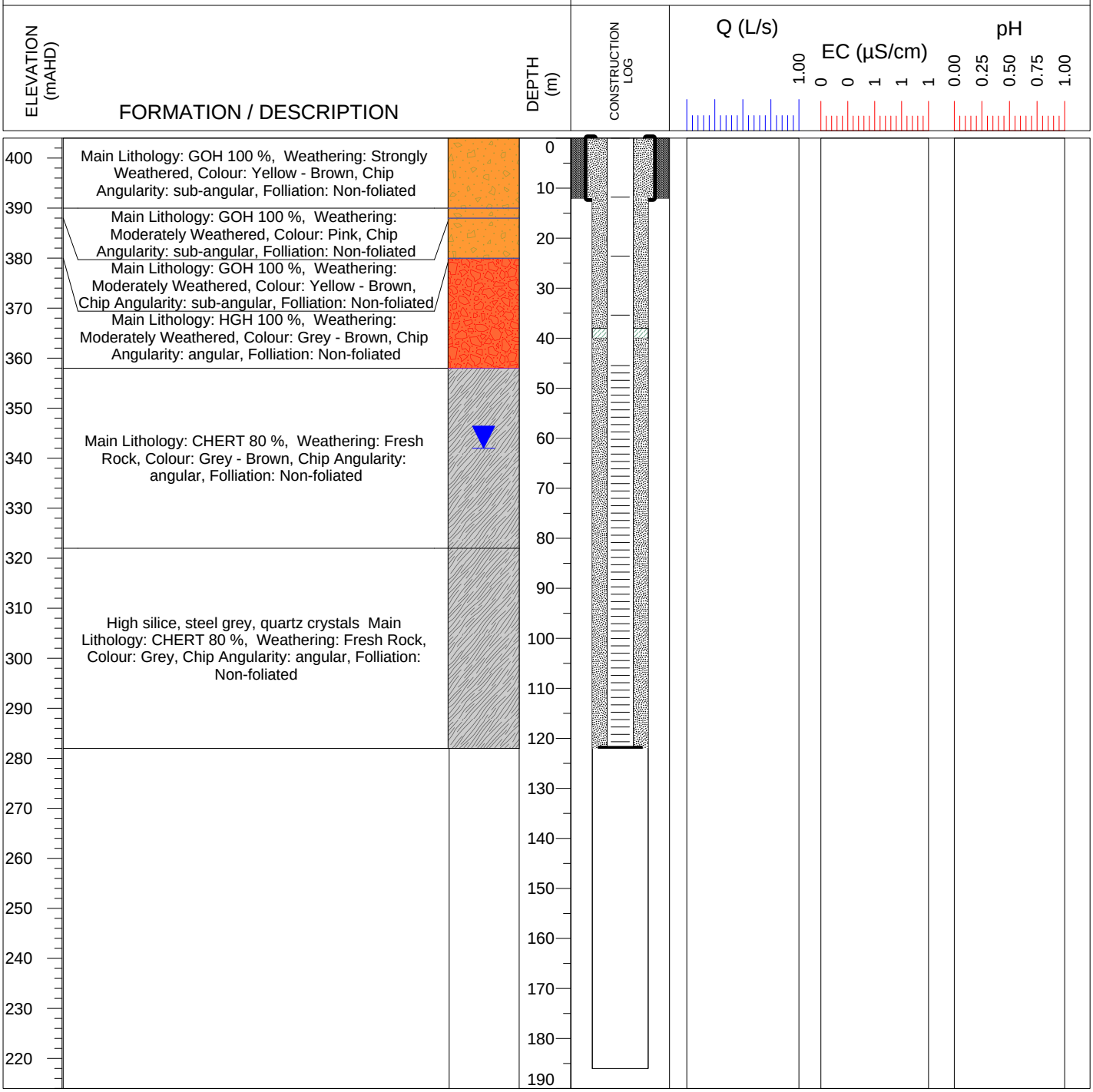
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0151**		CLIENT: ATLAS	srk consulting
LOCATION: Sparrow Lake	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,078.55	TOTAL DEPTH (m): 122
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,622,920.93	GROUND ELEVATION (mAHD): 404.0
START DATE: 08/03/2024	FINISH DATE: 10/03/2024	TOP OF INNER CASING (mAHD): 405.22	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): n/a	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian, monitoring bore next to production bore CRD0143



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

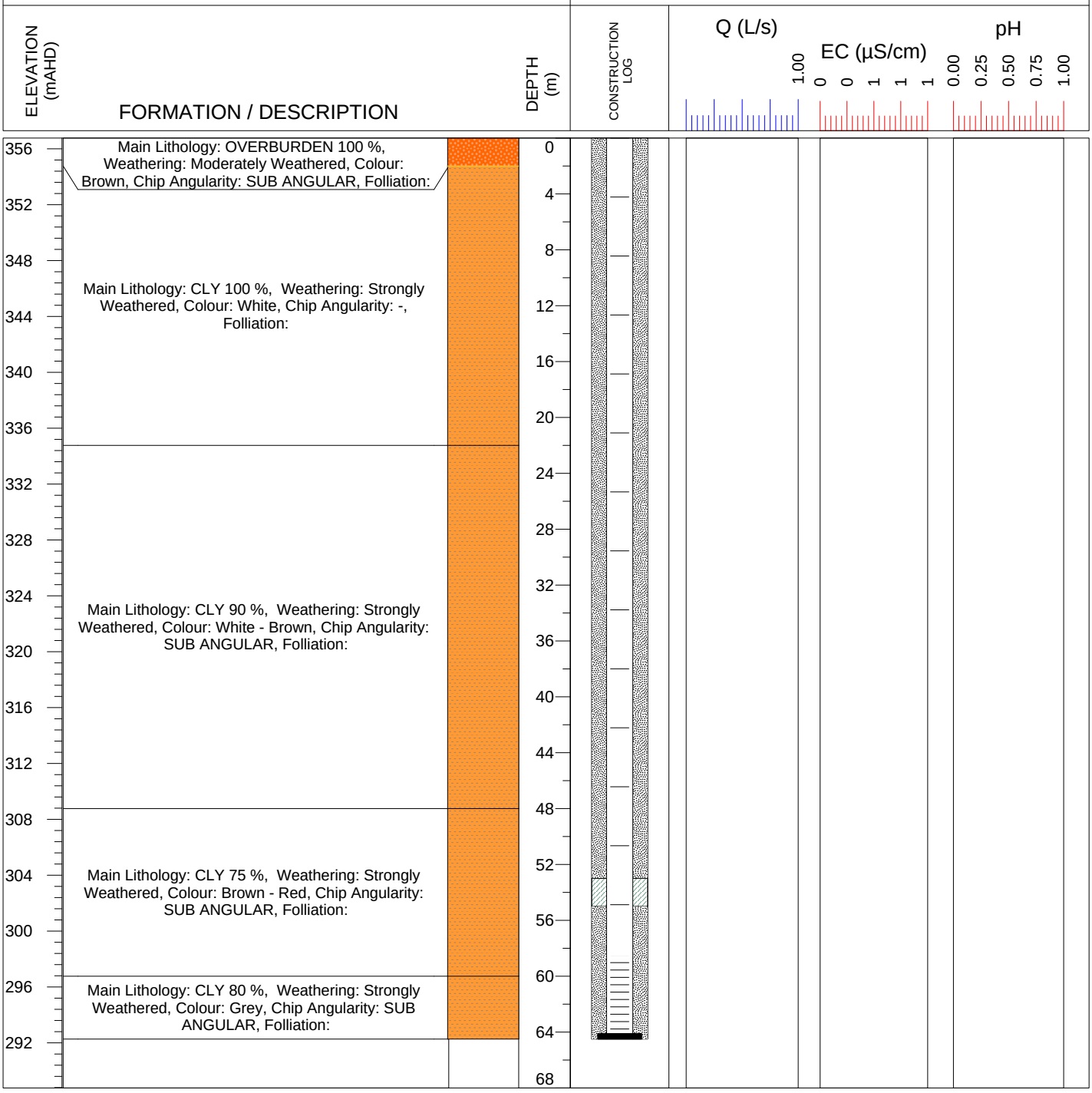
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRD0154**		CLIENT: ATLAS	srk consulting
LOCATION: Glen Herring	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 774,810.24	TOTAL DEPTH (m): 64.5
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,632,594.40	GROUND ELEVATION (mAHD): 356.8
START DATE: 08/06/2024	FINISH DATE: 08/06/2024	TOP OF INNER CASING (mAHD): 357.47	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): 357.01	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Non-Artesian Monitoring Bore, same pad than CRD0131, shalow monitoring bore



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

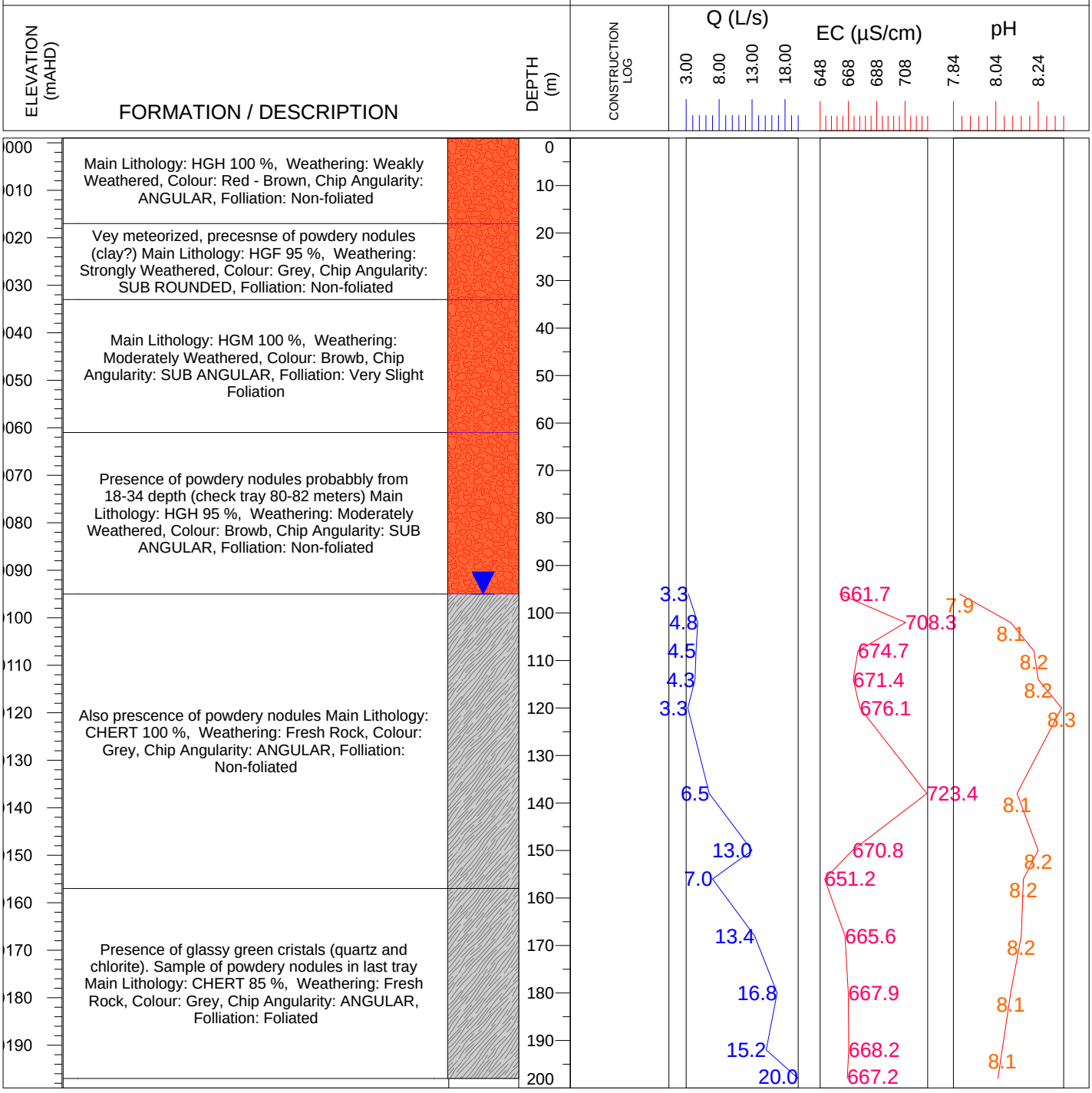
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRDTA0141**		CLIENT: ATLAS	srk consulting
LOCATION: Sparrow Lake / Razorback	PROJECT. NO.: ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,587.00	TOTAL DEPTH (m): 198
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING: 7,623,373.00	GROUND ELEVATION (mAHD): n/a
START DATE: 04/02/2024	FINISH DATE: 10/02/2024	TOP OF INNER CASING (mAHD): n/a	
PROJECT: Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): n/a	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Bore collapsed, abandoned and decomissioned. Pilot bore at the same pad of CRD0141 and CRD0151



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

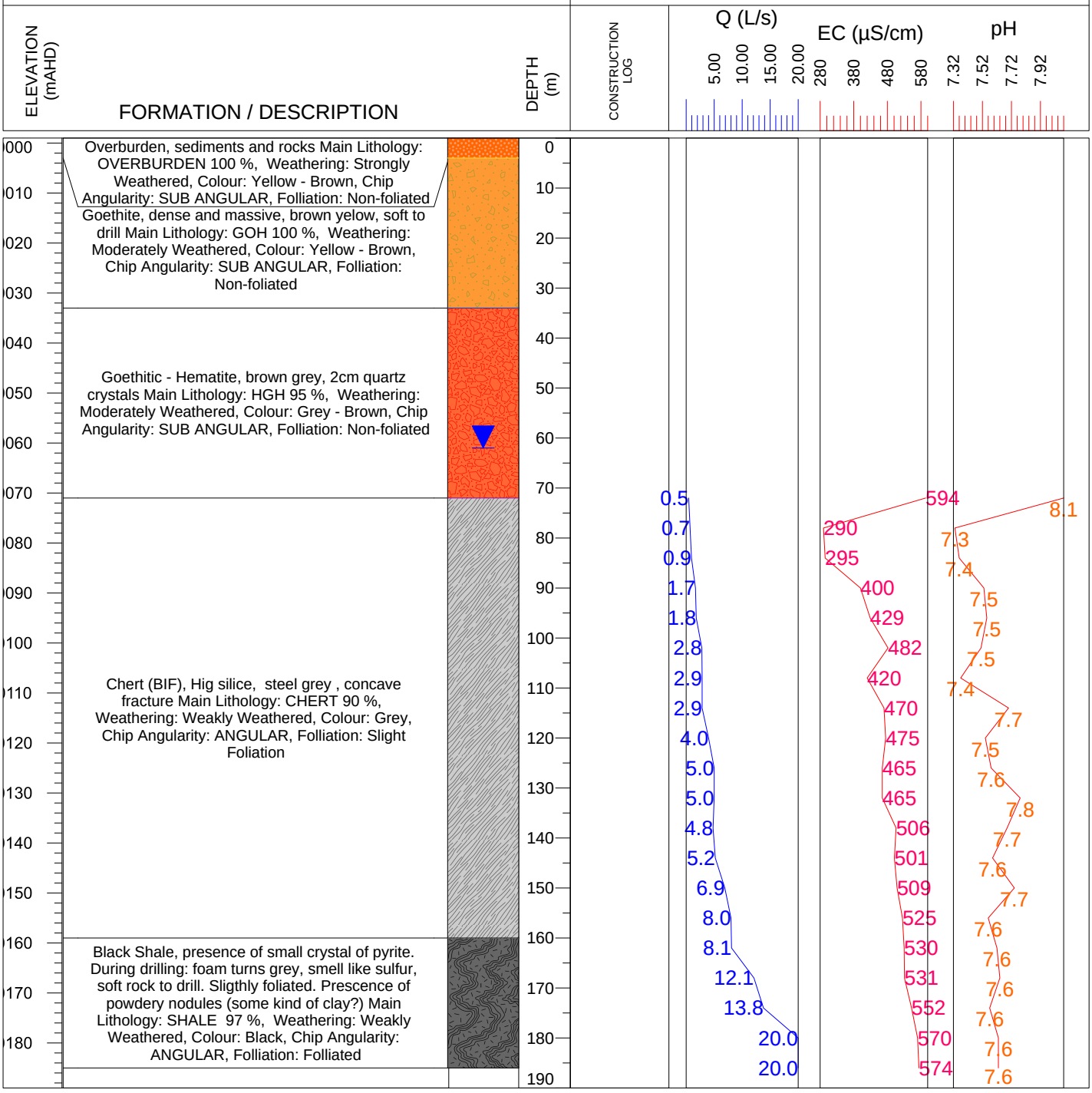
Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

HOLE NO.: **CRDTA0143**		CLIENT: ATLAS	srk consulting
LOCATION:Sparrow Lake	PROJECT. NO.:ATL009		
DRILLING CONTRACTOR: FORACO	LOGGED BY: PDL/CFK	EASTING: 776,068.00	TOTAL DEPTH (m):186
DRILLING METHOD: Air Hammer	DRILLING EQUIPMENT: RIG15	NORTHING:7,622,893.00	GROUND ELEVATION (mAHD): n/a
START DATE: 11/01/2024	FINISH DATE:13/01/2024	TOP OF INNER CASING (mAHD): n/a	
PROJECT:Sanjiv Ridge - BWT Hydro Drilling 2024		TOP OF CONCRETE PLINTH (mAHD): n/a	

NOTE:
Data collected during pilot hole (8") drilling (Q (L/s), EC (µS/cm), pH)

CONSTRUCTION LOG DETAILS:
Bore collapsed, abandoned (now under haul road). Pilot bore at the same pad of CRD0143 and CRD0150



Geology Key

BASALT	GOM	HGH	LMM
CHERT	HEH	HGM	OVERBURDEN
Cherty BIF	HEM	LMF	QTZ
CLY	HES	LMH	SHALE
GOH	HGF		

Well Construction Key

Open Hole	PVC Casing
Steel Casing	PVC Screen
Grout	End Cap
Gravel Pack	Fall Back
Bentonite	

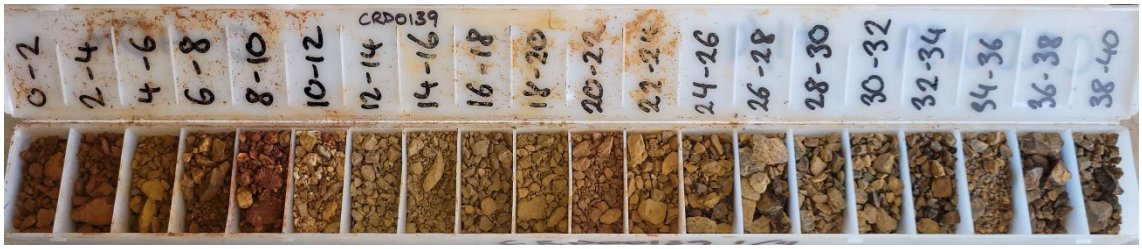
Appendix B Chip tray photographs

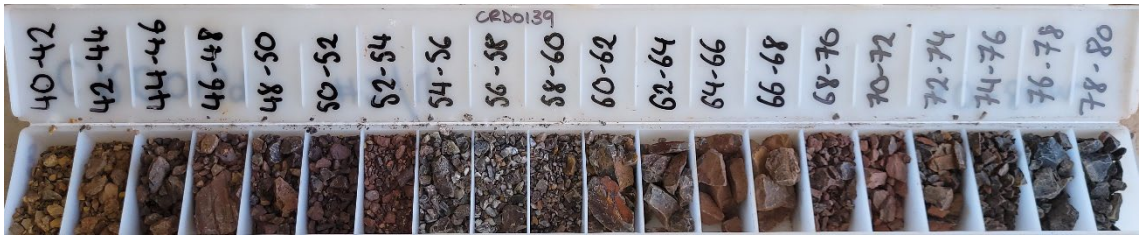
1 Chip Trays Photos

1.1 Sparrow Lake Pit

1.1.1 CRD139

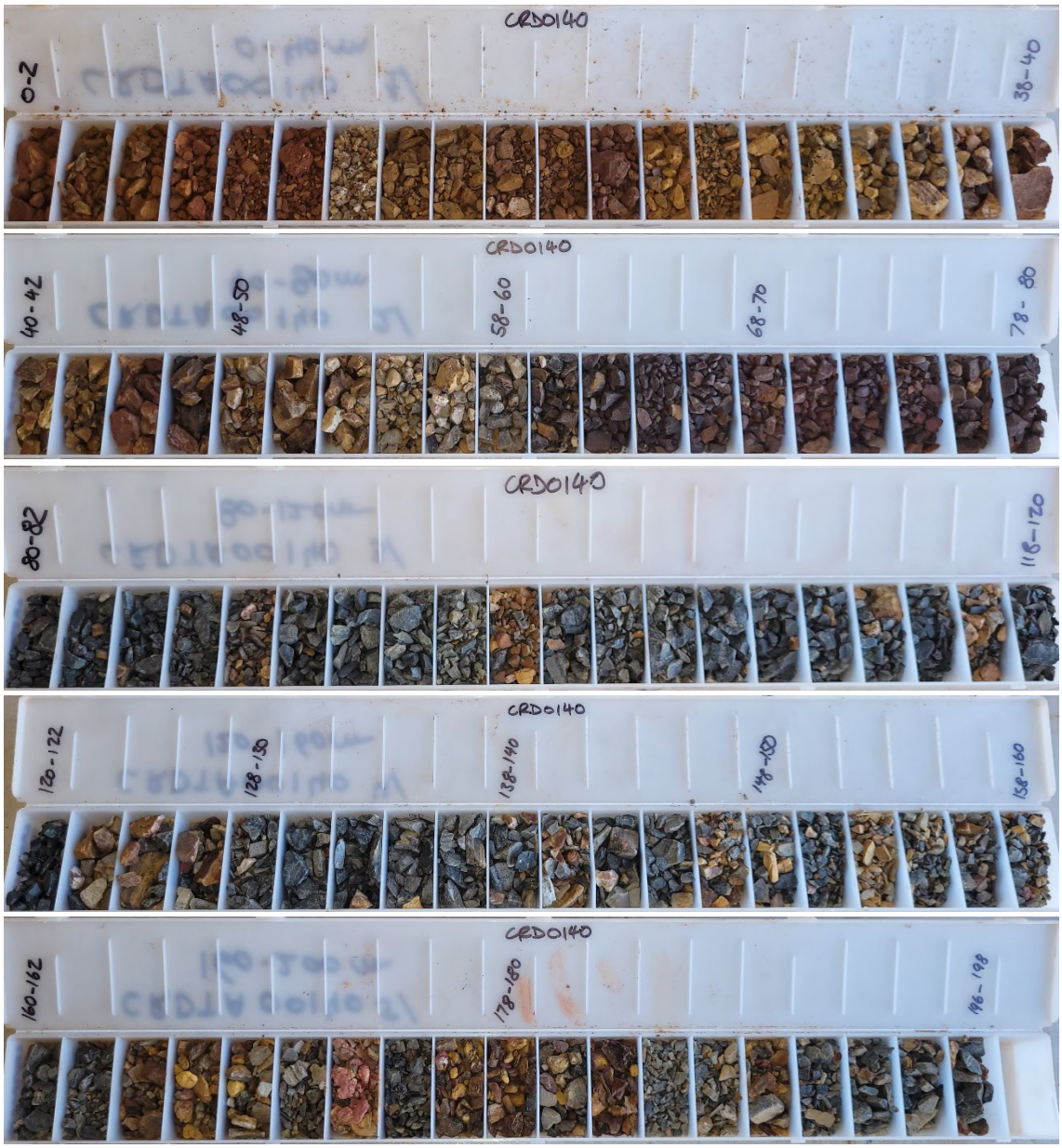
From 0 to 126 m. Chips collected every 2 meters.





1.1.2 CRD0140

From 0 to 198 m. Chips collected every 2 meters.



1.1.3 CRD0141

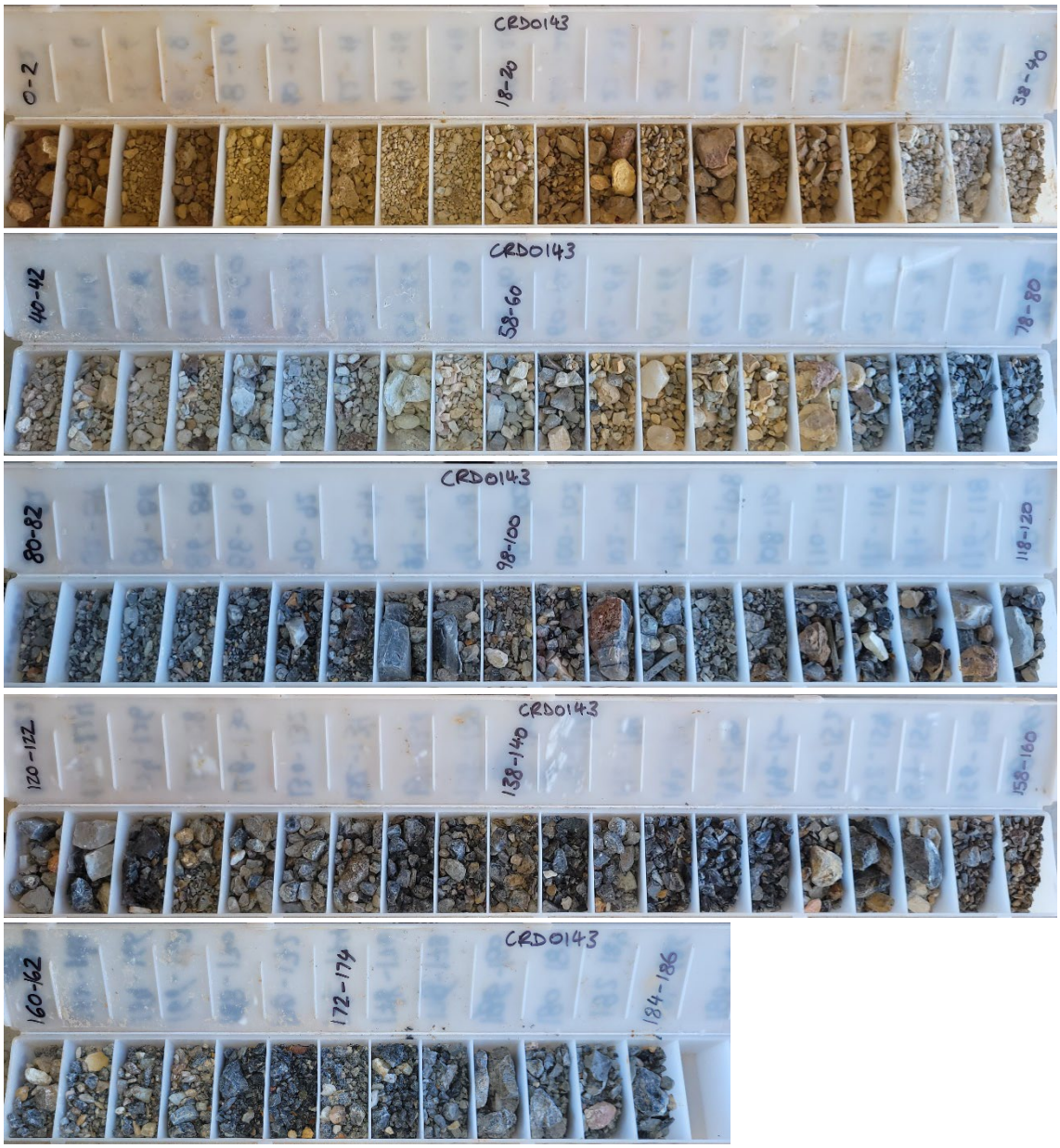
From 0 to 198 m. Chips collected every 2 meters.

1.1.4 CRD0142

From 0 to 198 m. Chips collected every 2 meters.

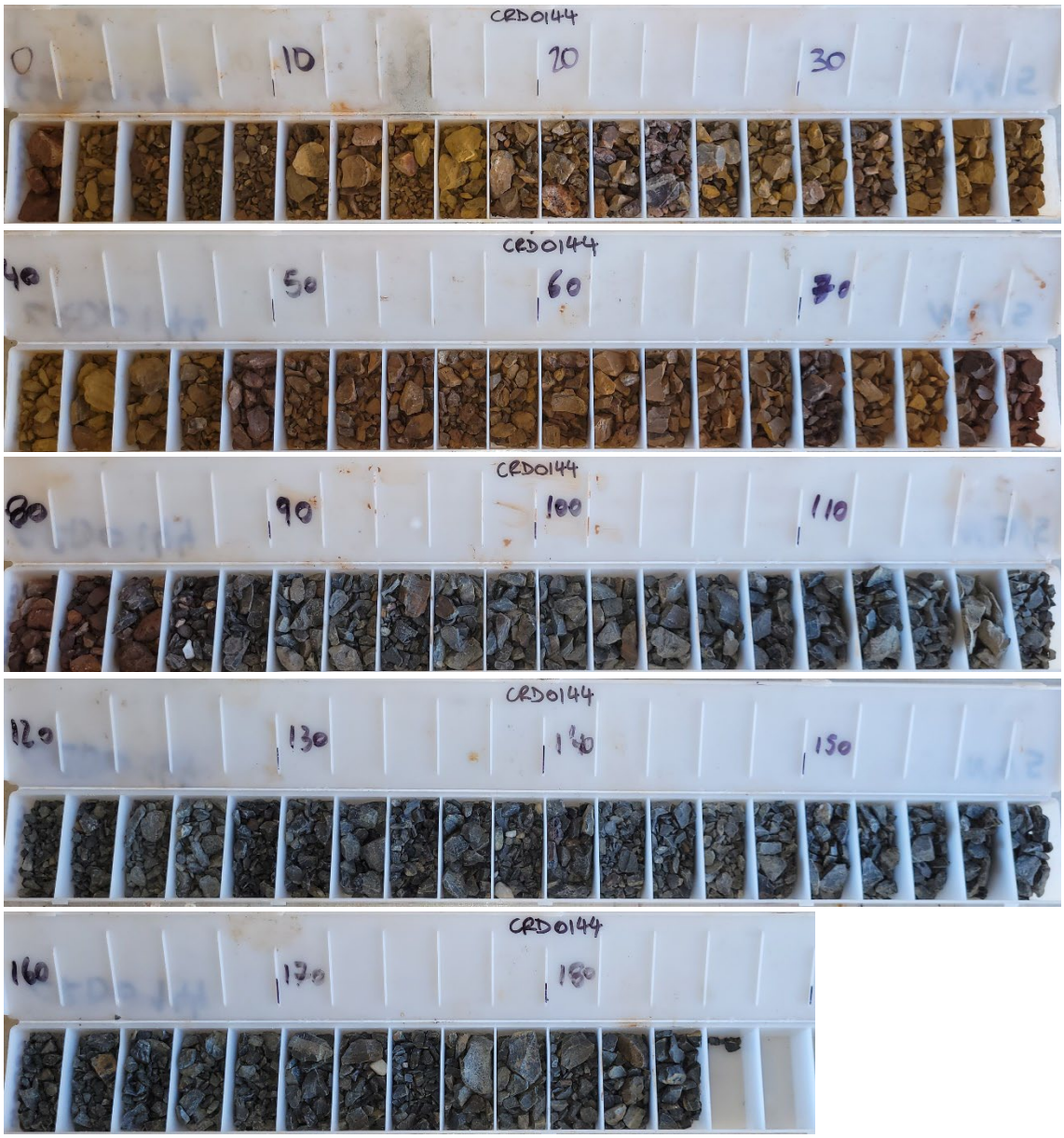
1.1.5 CRD0143

From 0 to 186 m. Chips collected every 2 meters.



1.1.6 CRD0144

From 0 to 186 m. Chips collected every 2 meters.



1.1.7 CRD0150

From 0 to 198 m. Chips collected every 2 meters.

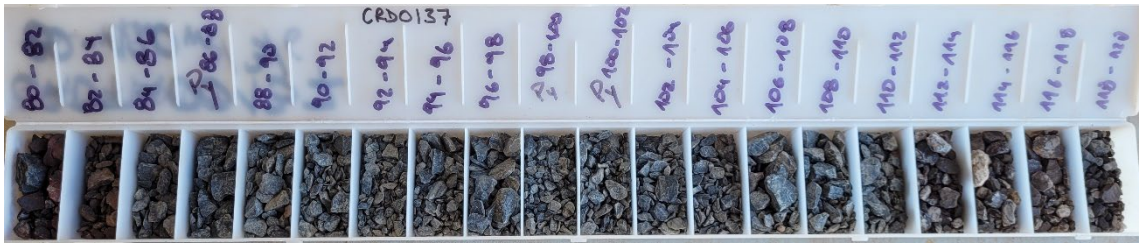
1.1.8 CRD0151

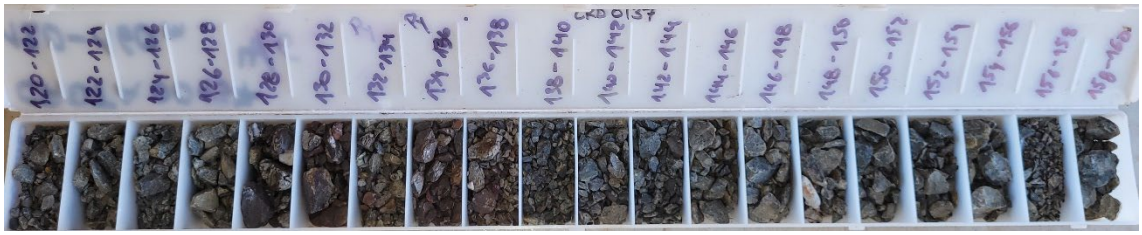
From 0 to 122 m. Chips collected every 2 meters.

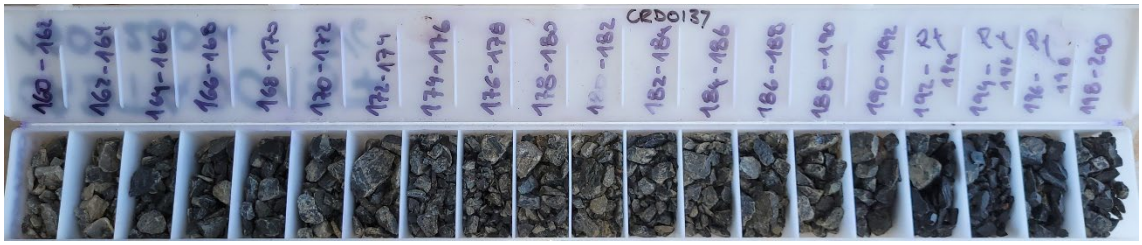
1.2 Runway Pit

1.2.1 CRD0137

From 0 to 208 m. Chips collected every 2 meters.

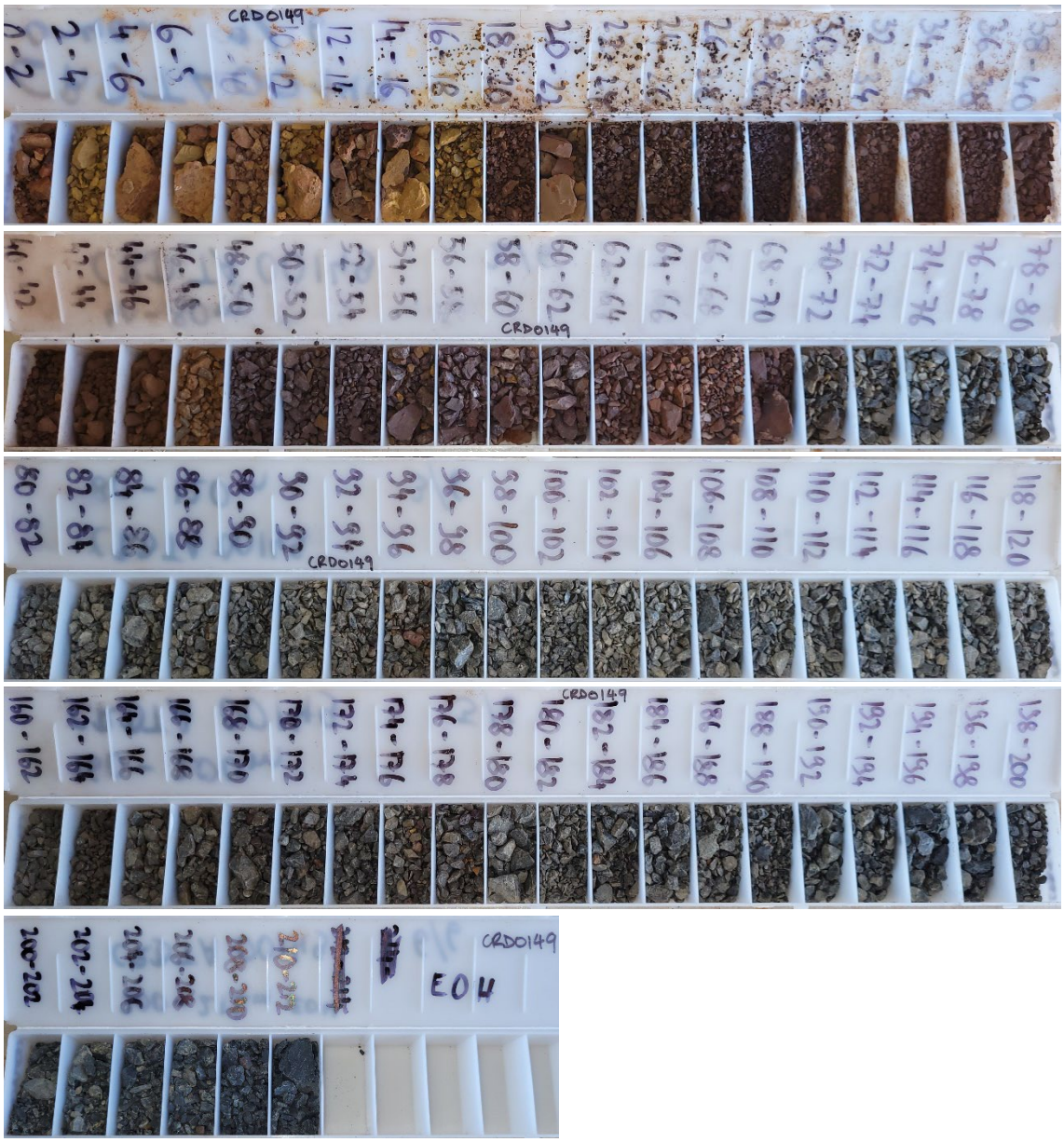






1.2.2 CRD0149

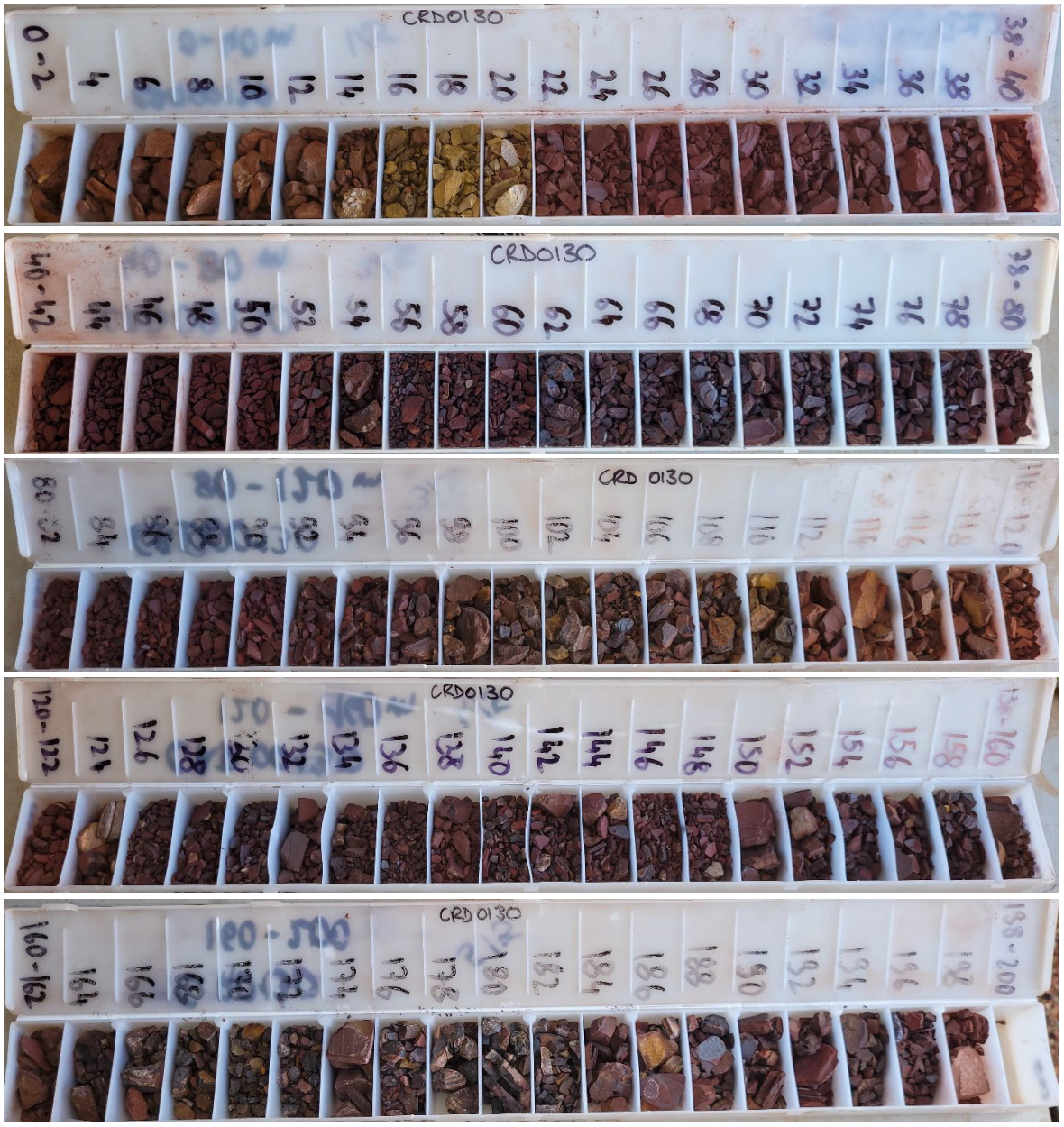
From 0 to 212 m. Chips collected every 2 meters.



1.3 Glen Herring

1.3.1 CRD0130

From 0 to 198 m. Chips collected every 2 meters.



1.3.2 CRD0131

From 0 to 186 m. Chips collected every 2 meters.

1.3.3 CRD0132

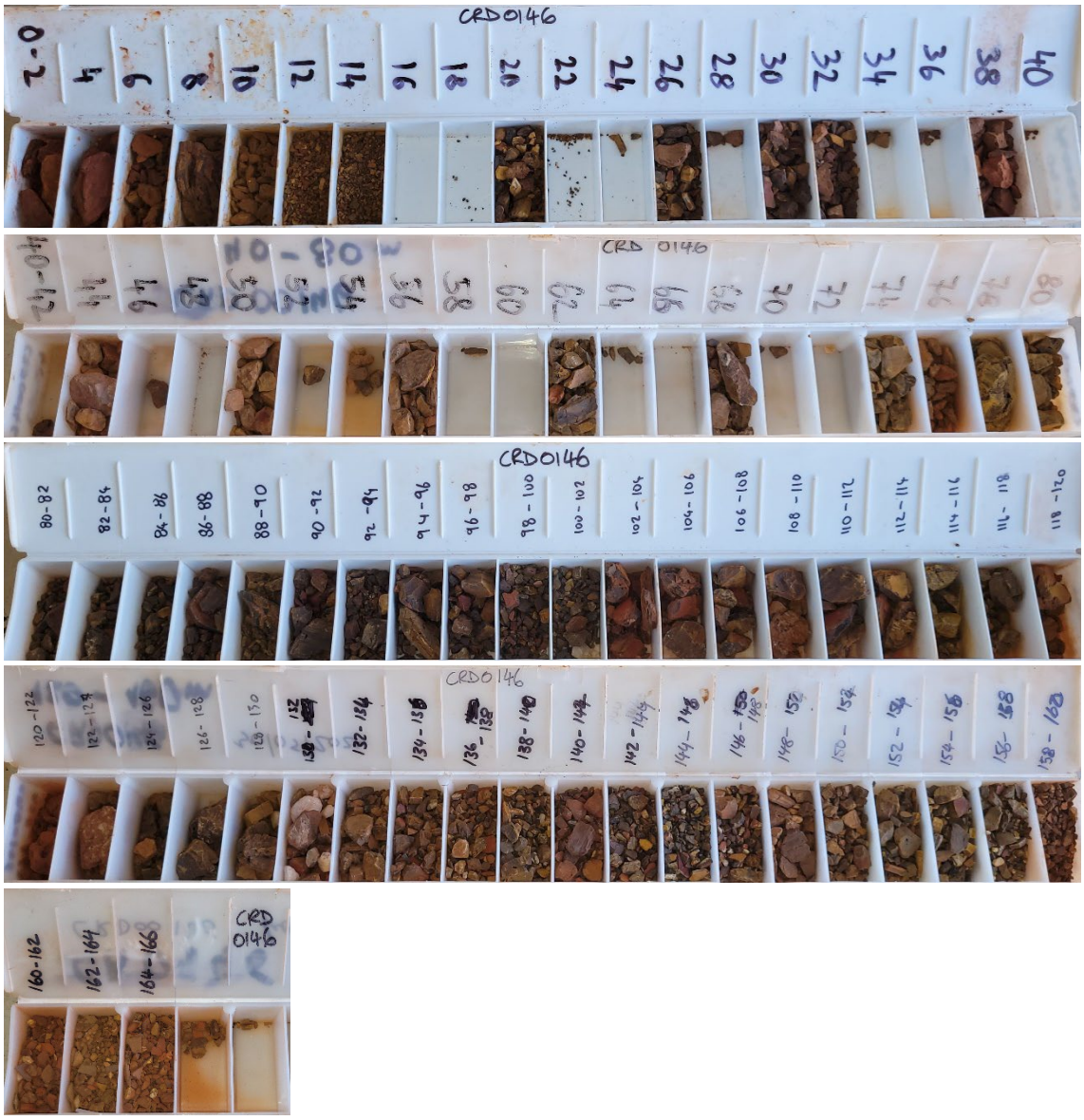
From 0 to 158 m. Chips collected every 2 meters.

1.3.4 CRD0133

From 0 to 176 m. Chips collected every 2 meters.

1.3.5 CRD0146

From 0 to 166 m. Chips collected every 2 meters.



1.3.6 CRD0147

From 0 to 174 m. Chips collected every 2 meters.

1.3.7 CRD0148

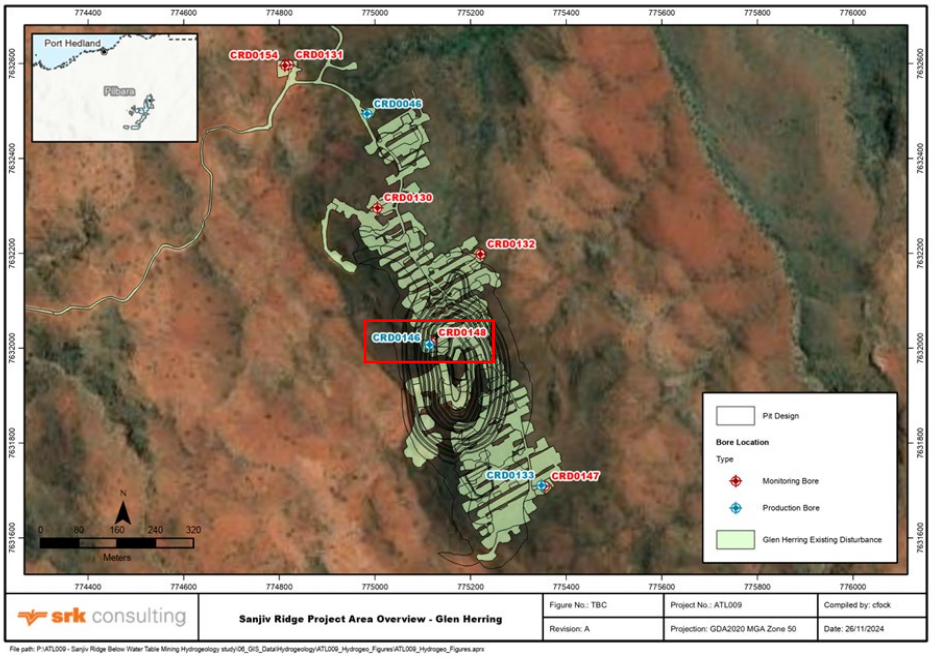
From 0 to 168 m. Chips collected every 2 meters.

1.3.8 CRD0154

From 0 to 64 m. Chips collected every 2 meters.

Appendix C Pumping test analytical report

Pumping Bore ID:	CRD0146
Date:	22 September - 25 September 2024
Pump Test Contractor:	Flow Water Services



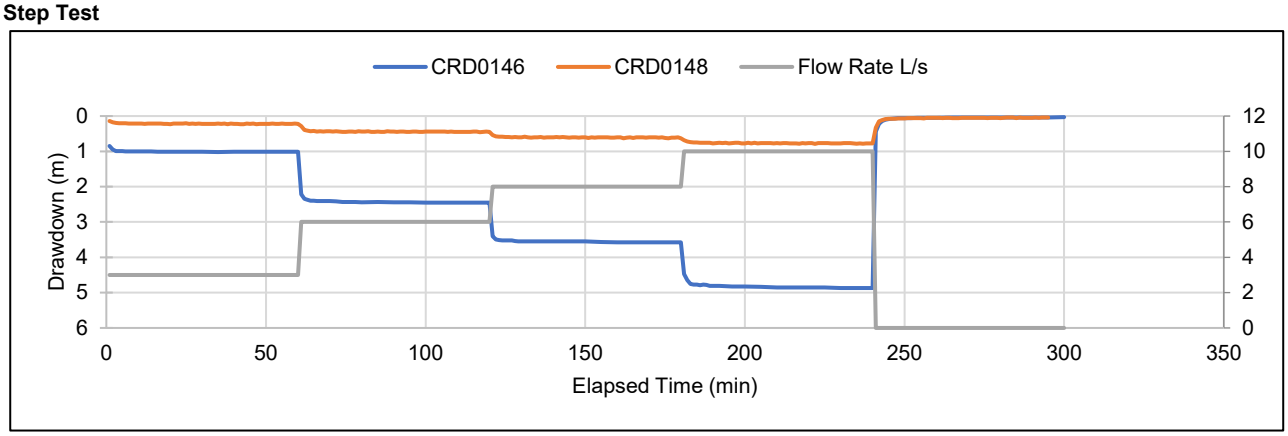
Bore Details	Production Bore	Observation Bore 1	Observation Bore 2
Bore ID	CRD0146	CRD0148	-
Easting	775113.003	775117.362	
Northing	7632005.231	7632009.521	
Elevation (mASL)	405.065	405.101	
Bore Hole Depth (m)	164	164	
Slotted Interval (m)	108.5-162.5	107-161	
Bore Hole Diameter (m)	0.3048	0.2032	
Casing Diameter (m)	0.2032	0.1016	
Well Configuration	Full	Full	
Aquifer Unit	Fractured Goethite and Hemaetite	Fractured Goethite and Hemaetite	
Confined, Unconfined, Leaky	Confined	Confined	
Aquifer Thickness (b) (m)	54	54	

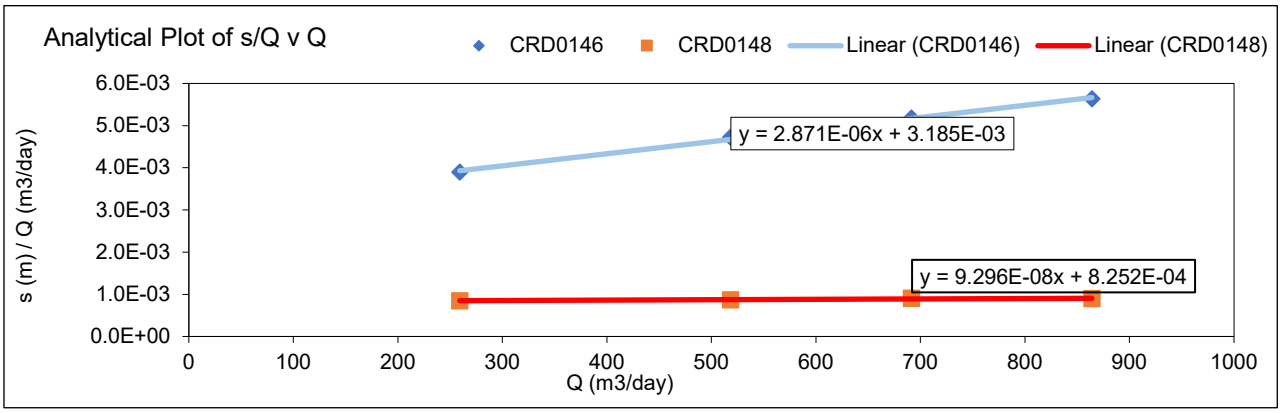
Groundwater Levels	Production Bore	Observation Bore 1	Observation Bore 2
SWL (mbTOC)	103.85	103.75	-
TOC (m)	0.56	0.71	
Date/Time	22/09/2024 9:55	22/09/2024 9:30	

Test Program	Date/Time	Duration (mins)	Rates (L/s)	Starting WL (mbTOC)
Calibration	-	-	- -	- -
Recovery	-	- -	- -	- -
Step Test	22/09/2024 9:55	240	3, 6, 8, 10	103.85
Recovery	22/09/2024 13:55	60	-	104.29
CRT	22/09/2024 15:30	4320	10	103.88
Recovery	25/09/2024 15:30	80	-	109.1

Groundwater Samples	10 mins	27-hours	48-hours	72-hours
CRT	X			X

Step Test





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole

P = Value determined using Rorabaugh's method of superposition

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

From plot of s/Q v Q (trend line equation) for CRD0146:

Intercept (B) 3.185E-03
Gradient (C) 2.871E-06

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	3.0	259	1.01	1.02	3.90E-03	81%
2	6.0	518	2.45	2.42	4.73E-03	68%
3	8.0	691	3.58	3.57	5.18E-03	62%
4	10.0	864	4.87	4.90	5.64E-03	56%

From plot of s/Q v Q (trend line equation) for CRD0148:

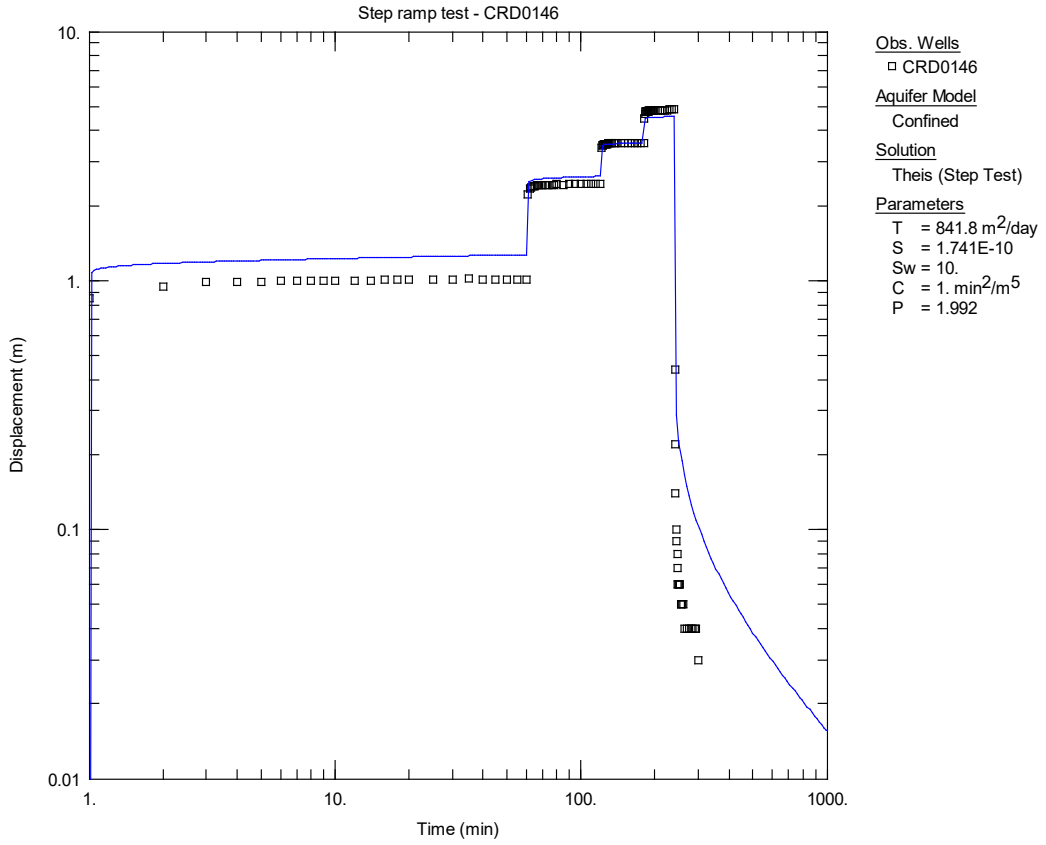
Intercept (B) 8.252E-04
Gradient (C) 9.296E-08

ANALYSIS TABLE

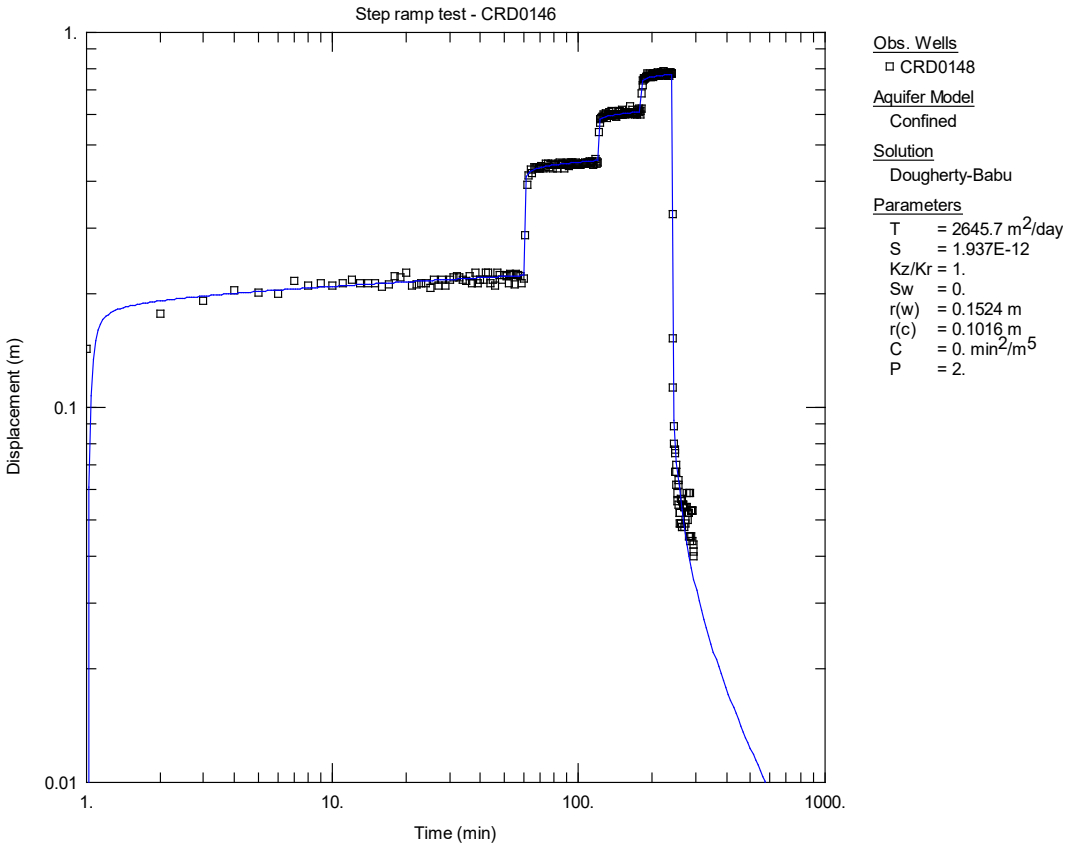
Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	3.0	259	0.22	0.22	8.49E-04	97%
2	6.0	518	0.45	0.45	8.66E-04	94%
3	8.0	691	0.63	0.61	9.06E-04	93%
4	10.0	864	0.78	0.78	8.97E-04	91%

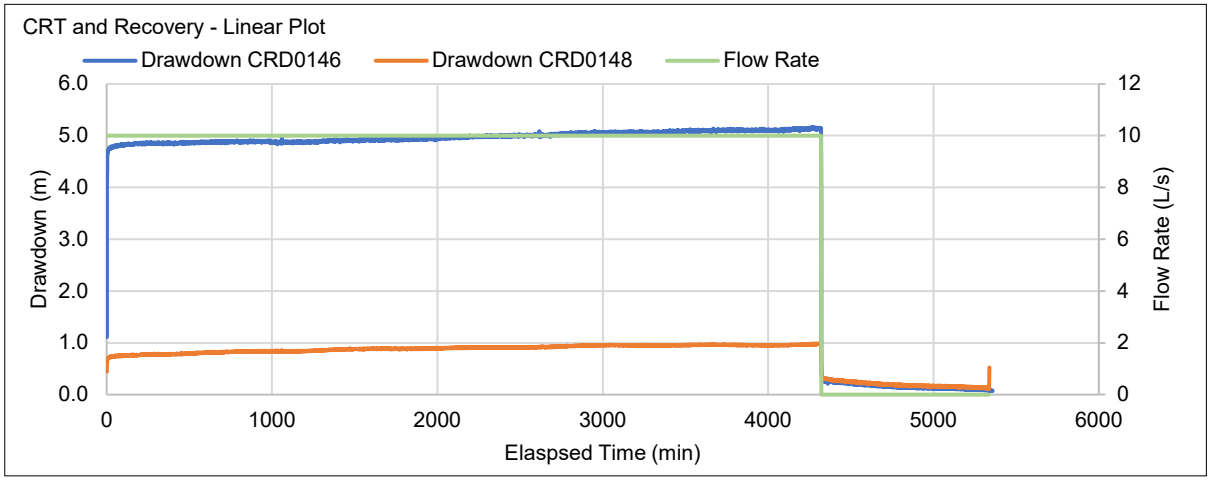
AQTESOLV Analytical Solutions - Pumped Well



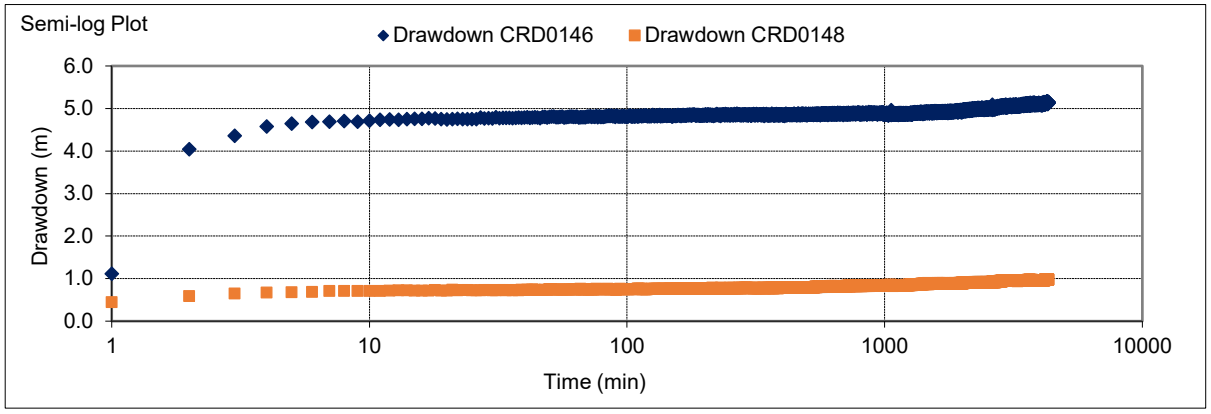
AQTESOLV Analytical Solutions - Monitoring Well

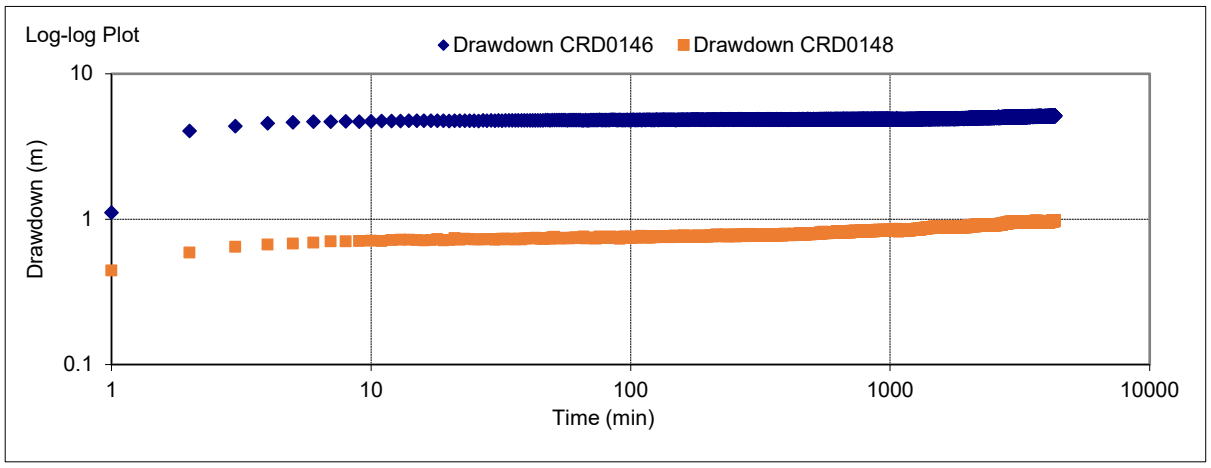


CRT

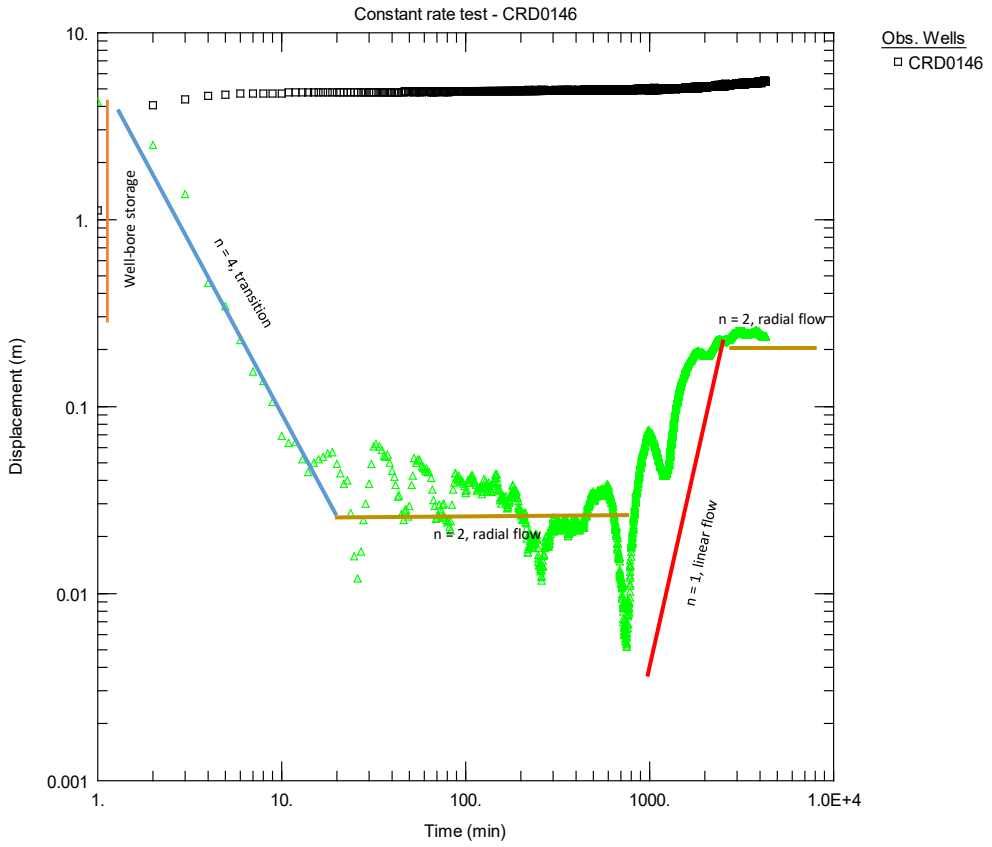


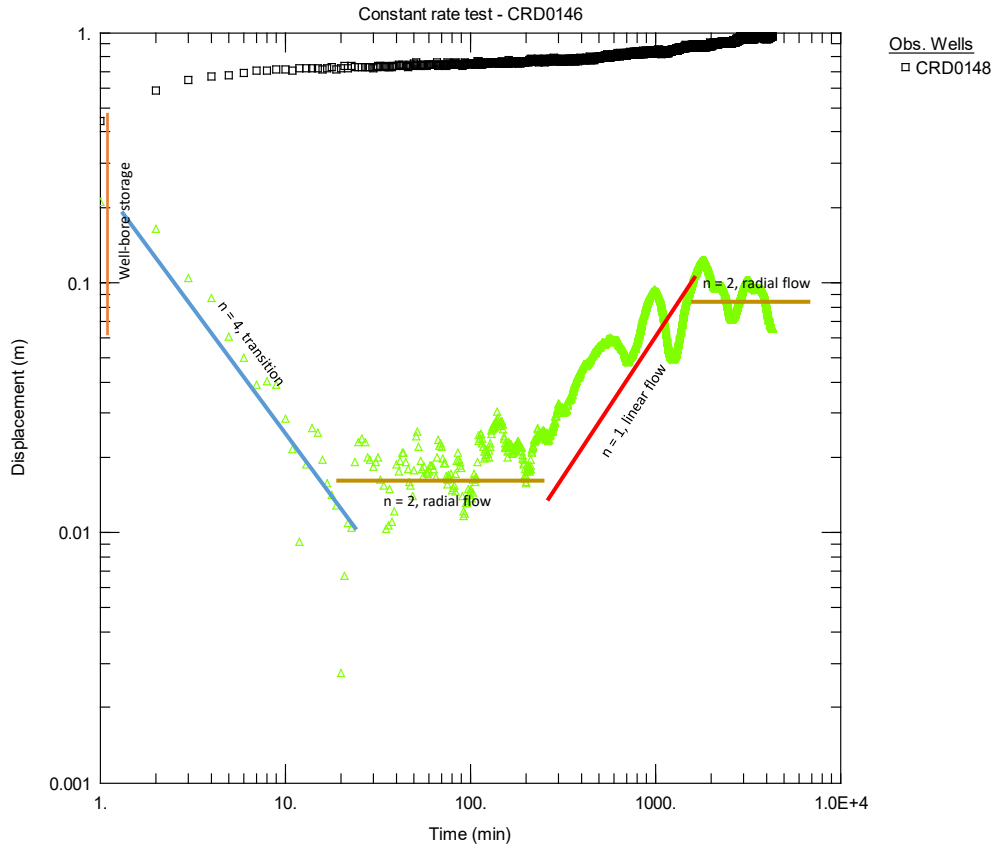
Diagnostic plots of drawdown data versus time for production bore and observation bore are shown below:



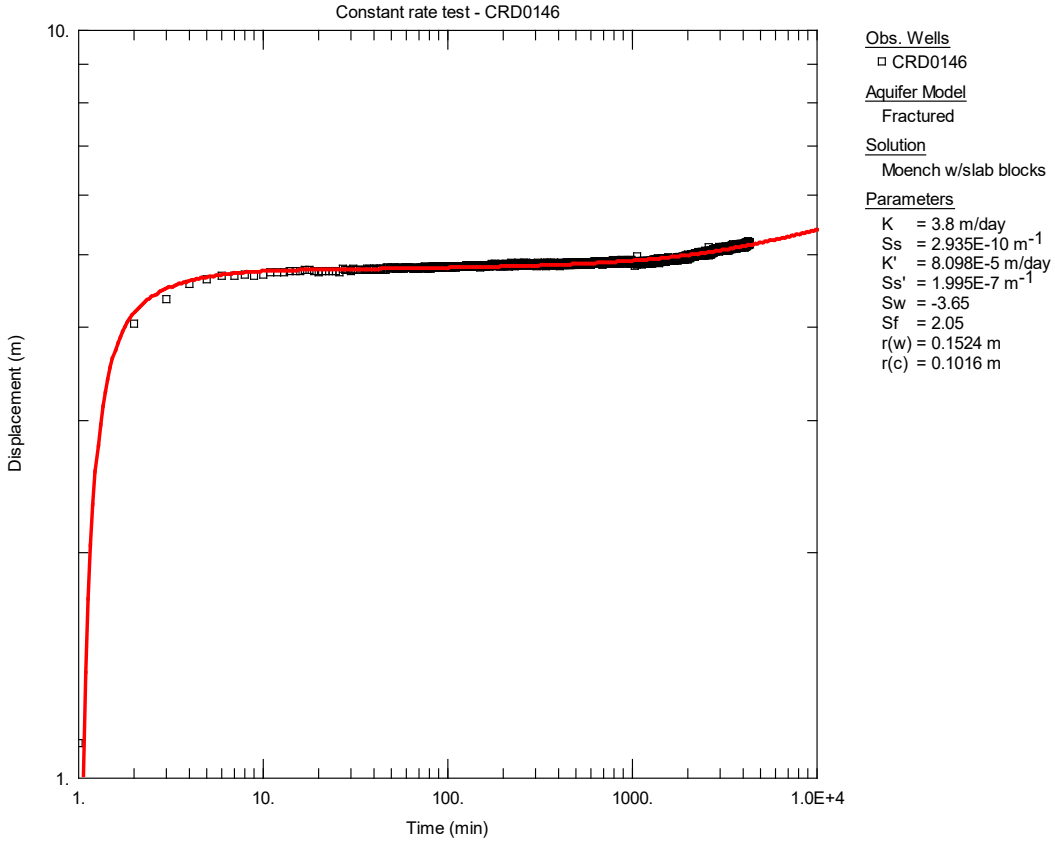


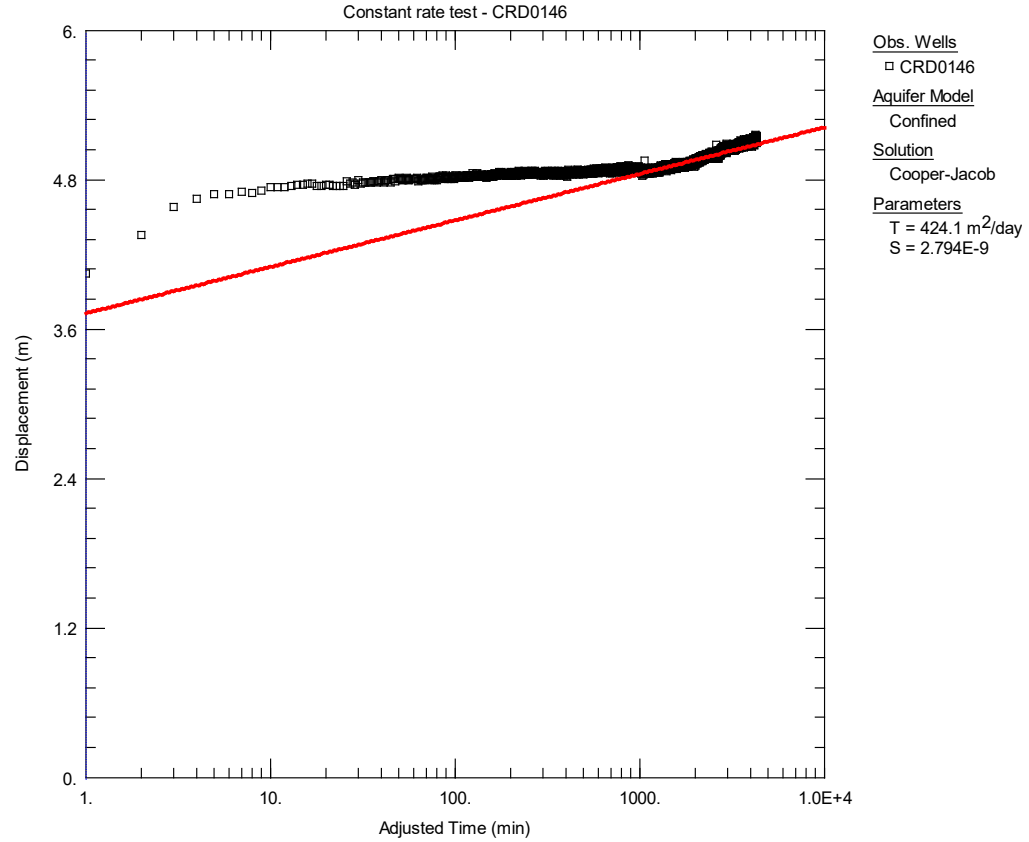
Derivative Plots



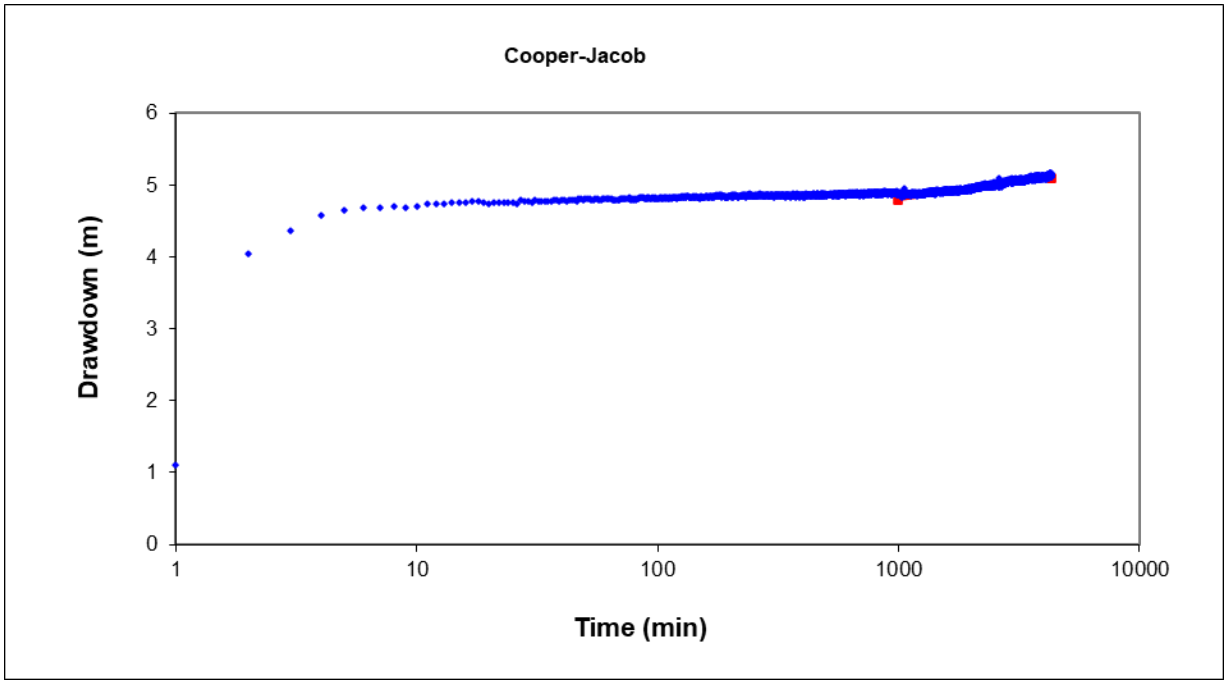


AQTESOLV Analytical Solutions - Pumped Well



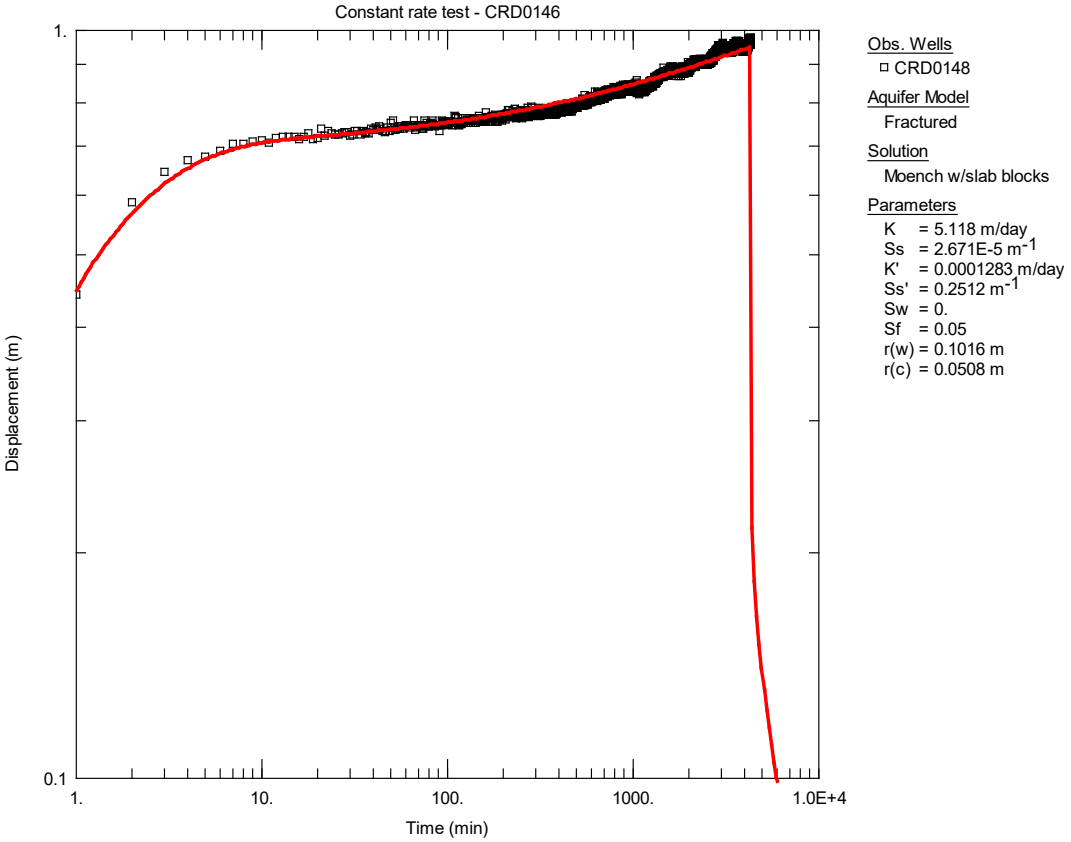


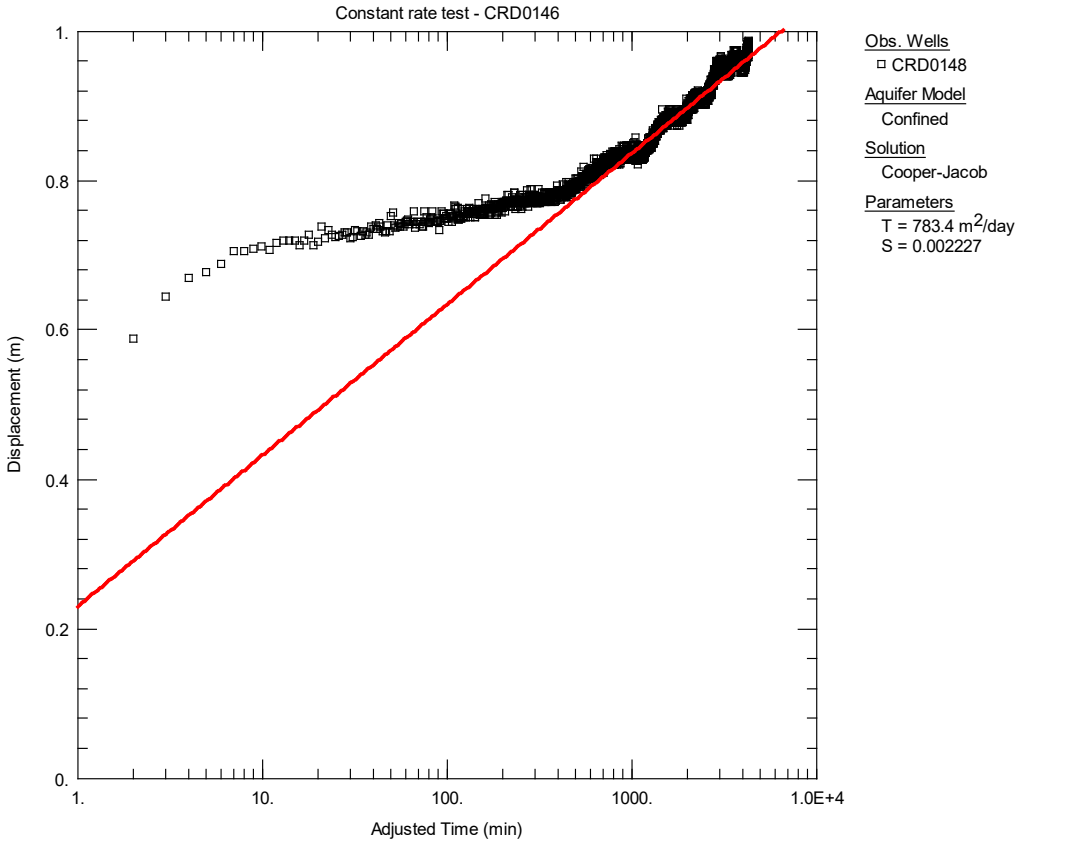
FC Analytical Solutions - Pumped Well



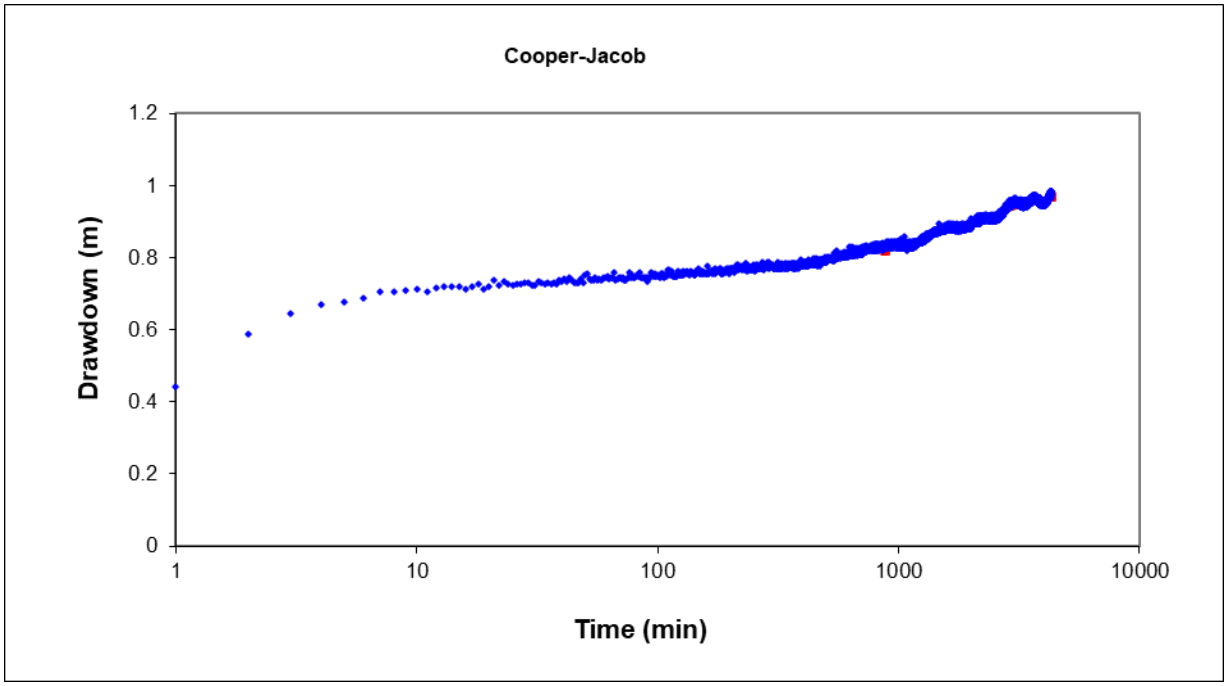
x0	y0	T(m2/d) =	335.10
1000	4.8		
x1	**y1**		
4320	5.1		

AQTESOLV Analytical Solutions - Monitoring Well



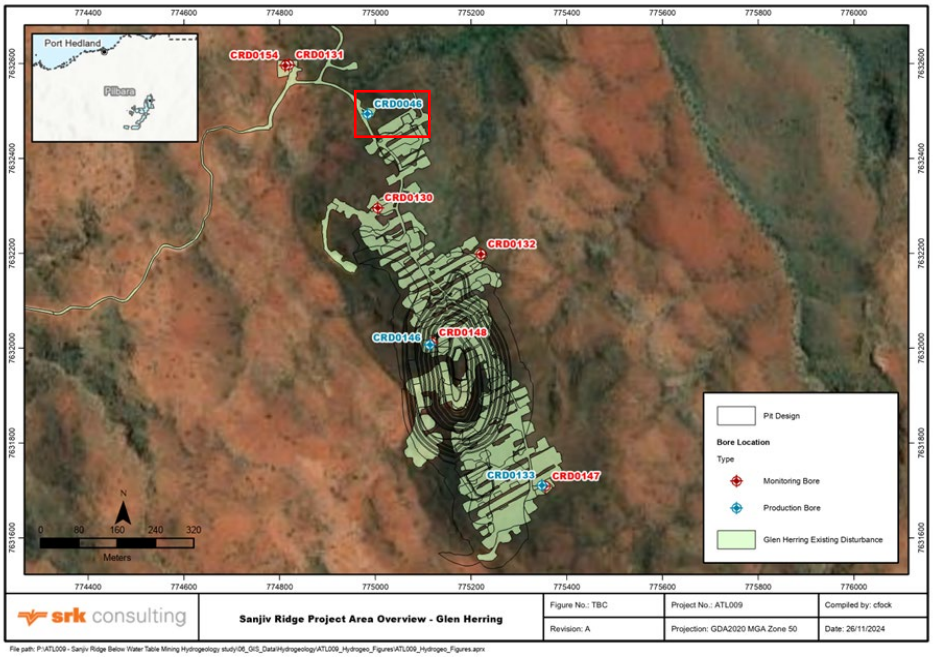


FC Analytical Solutions - Monitoring Well



x0	**y0**	**T(m2/d) =**	729.90
878	0.82	**S =**	4.41E-03
x1	**y1**		
4320	0.97		

Pumping Bore ID:	CRD0046
Date:	29 September - 02 October 2024
Pump Test Contractor:	Flow Water Services



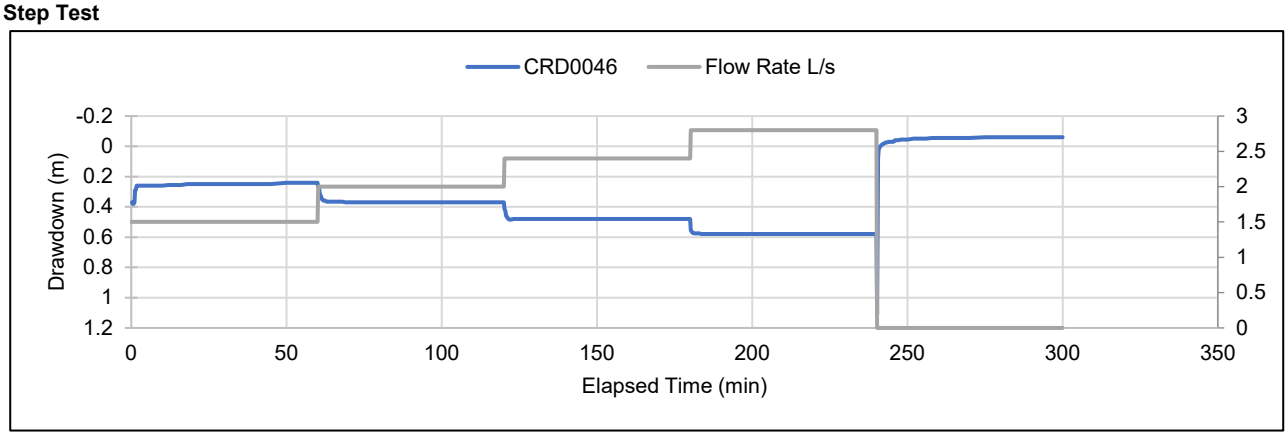
Bore Details	Production Bore	Observation Bore 1	Observation Bore 2
Bore ID	CRD0046		-
Easting	774938		
Northing	7632495		
Elevation (mASL)	-		
Bore Hole Depth (m)	105		
Slotted Interval (m)	83.85 - 105		
Bore Hole Diameter (m)	0.2032		
Casing Diameter (m)	0.1016		
Well Configuration	Full		
Aquifer Unit	-		
Confined, Unconfined, Leaky	Confined		
Aquifer Thickness (b) (m)	21.2		

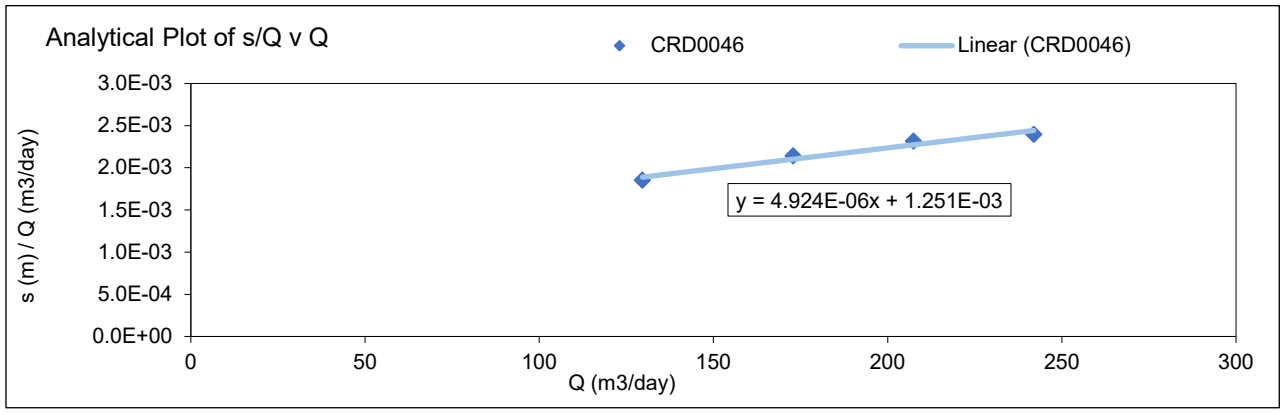
Groundwater Levels	Production Bore	Observation Bore 1	Observation Bore 2
SWL (mbTOC)	58.7		-
TOC (m)	-		
Date/Time	29/09/2024 10:41		

Test Program	Date/Time	Duration (mins)	Rates (L/s)	Starting WL (mbTOC)
Calibration	-	-	- -	- -
Recovery	-	- -	- -	- -
Step Test	29/09/2024 10:51	240	1.5, 2.0, 2.4, 2.8	58.71
Recovery	29/09/2024 14:51	60	-	-
CRT	29/09/2024 15:43	4324	2.8	58.65
Recovery	2/10/2024 15:48	60	-	59.365

Groundwater Samples	10 mins	27-hours	48-hours	72-hours
CRT	X			X

Step Test





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole
P = Value determined using Rorabaugh's method of superposition

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

From plot of s/Q v Q (trend line equation) for CRD0046:

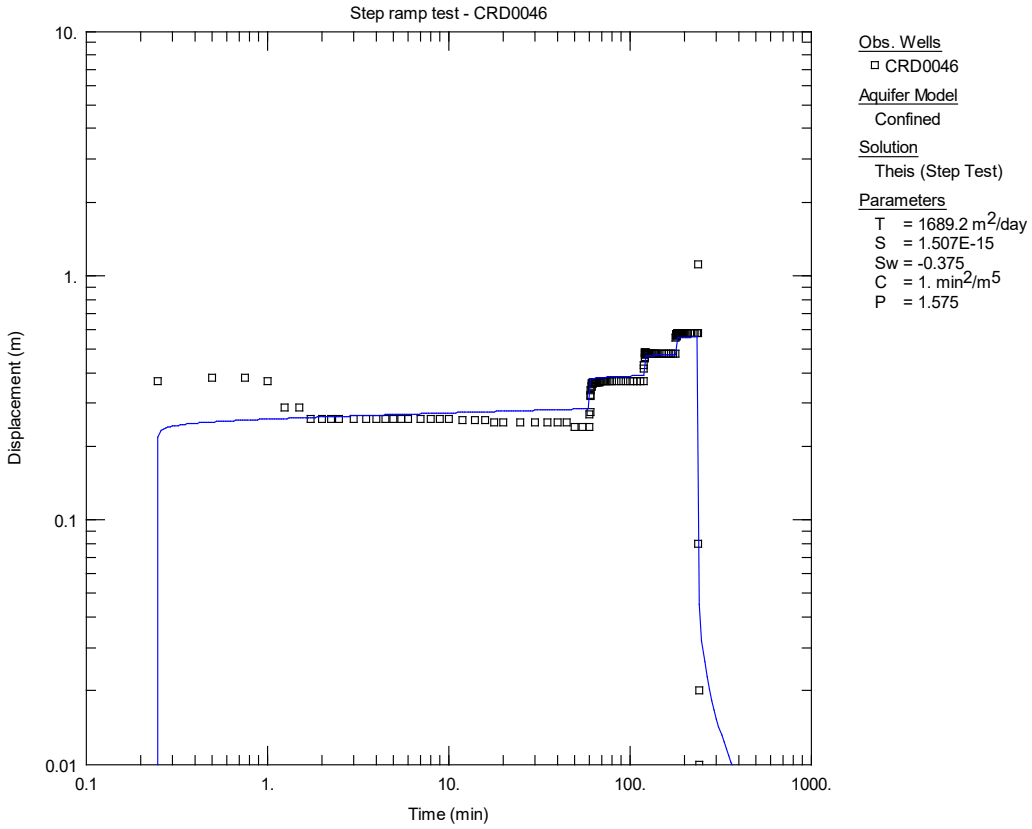
Intercept (B) 1.251E-03
Gradient (C) 4.924E-06

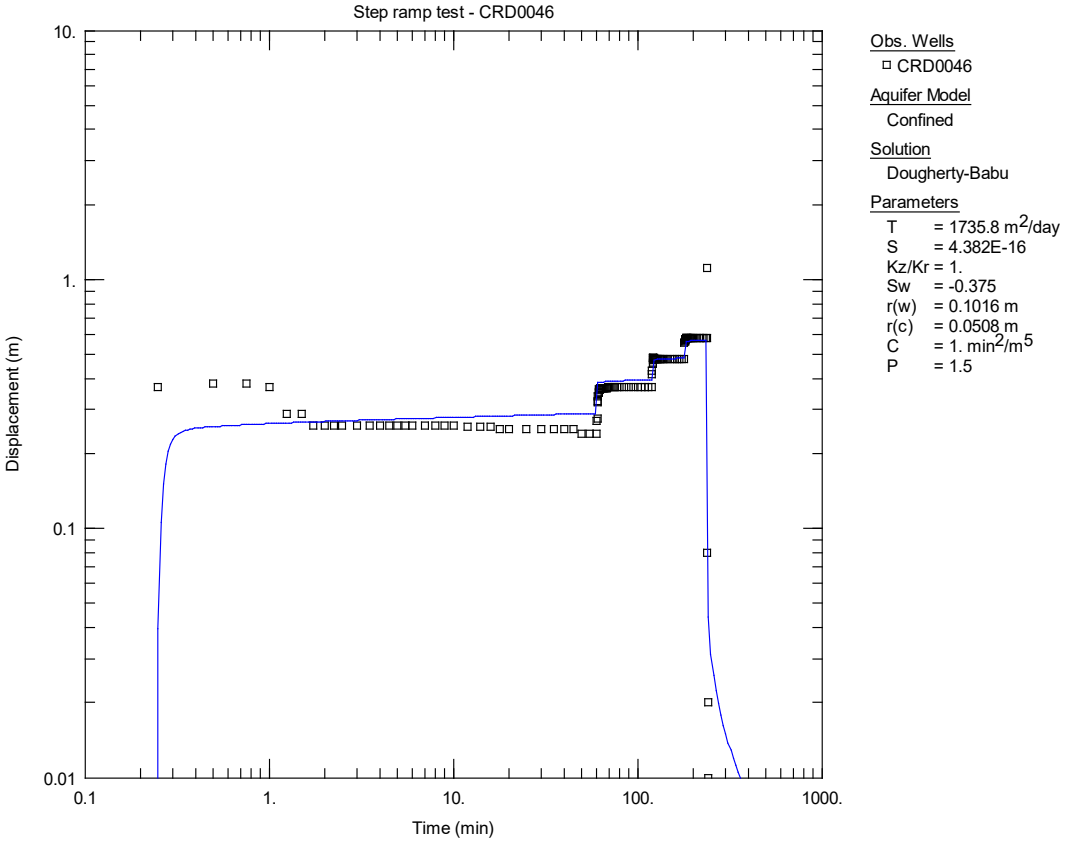
ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

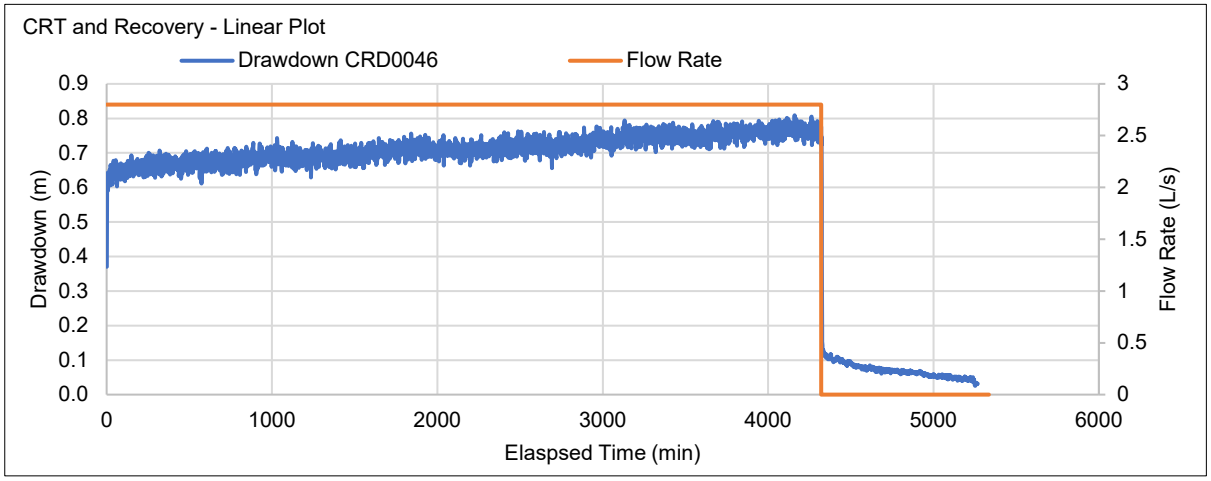
Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	1.5	130	0.24	0.17	1.85E-03	66%
2	2.0	173	0.37	0.36	2.14E-03	60%
3	2.4	207	0.48	0.47	2.31E-03	55%
4	2.8	242	0.58	0.59	2.40E-03	51%

AQTESOLV Analytical Solutions - Pumped Well

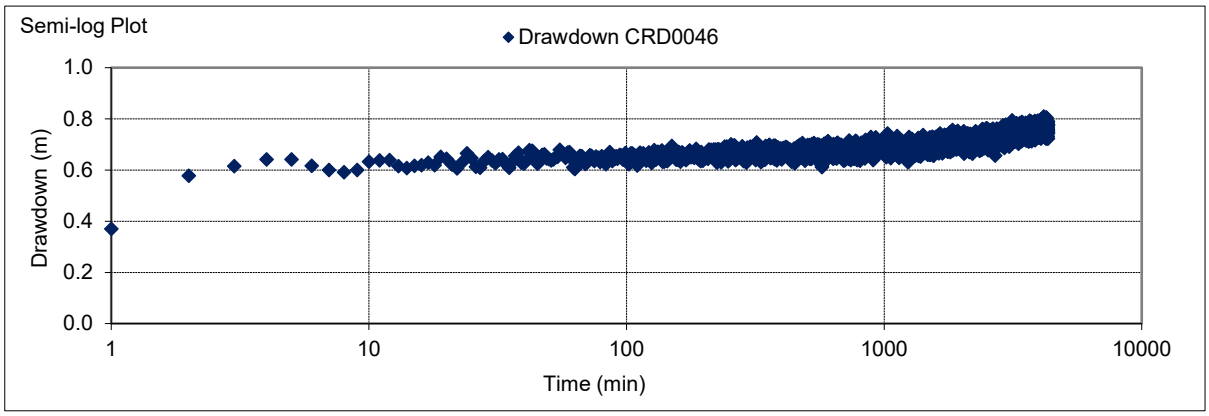


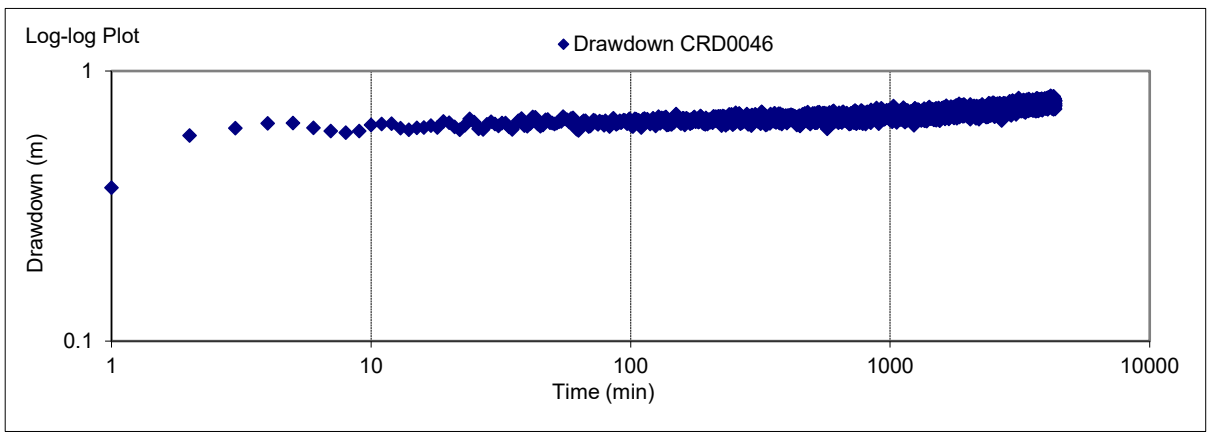


CRT

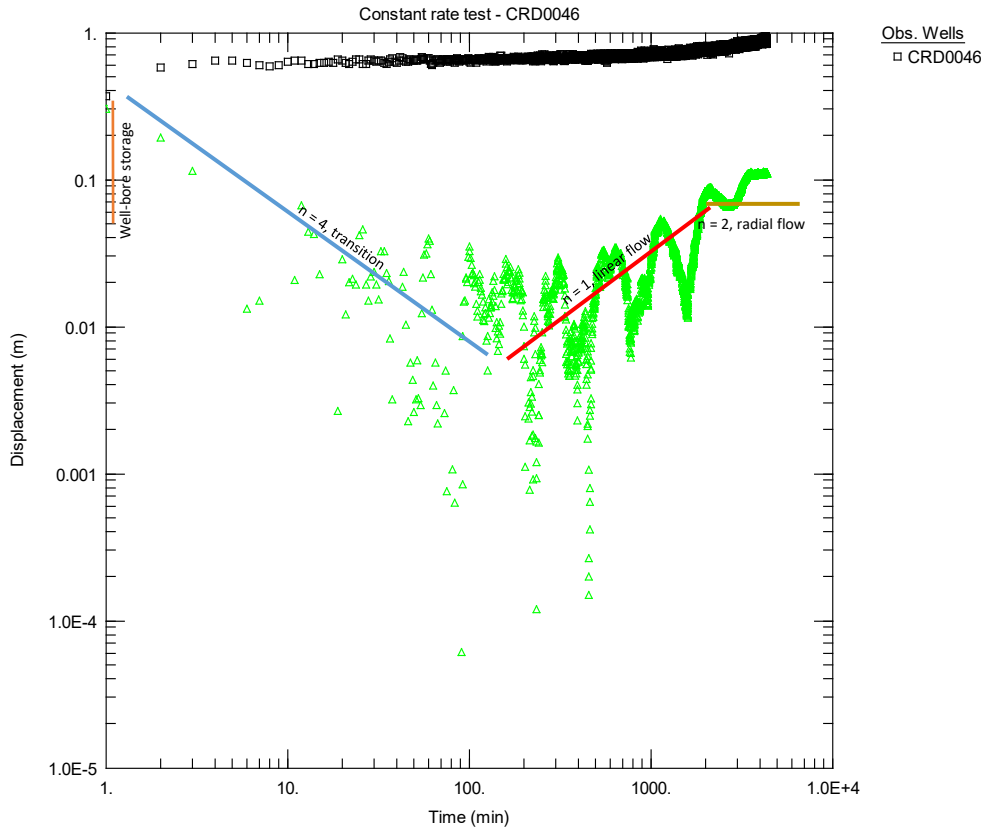


Diagnostic plots of drawdown data versus time for production bore and observation bore are shown below:

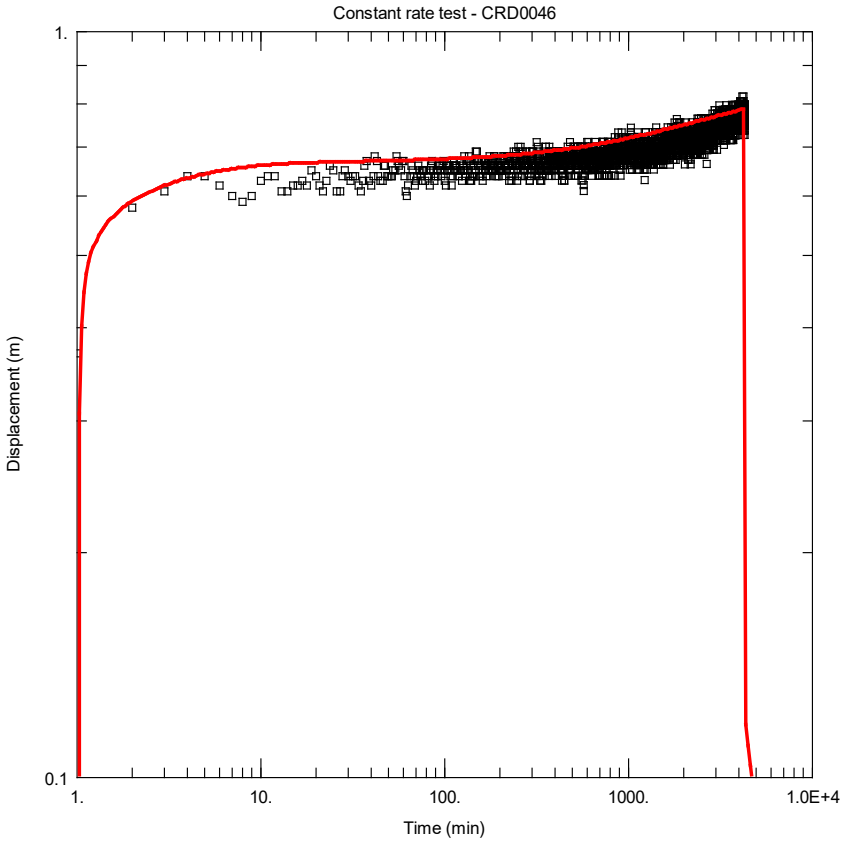


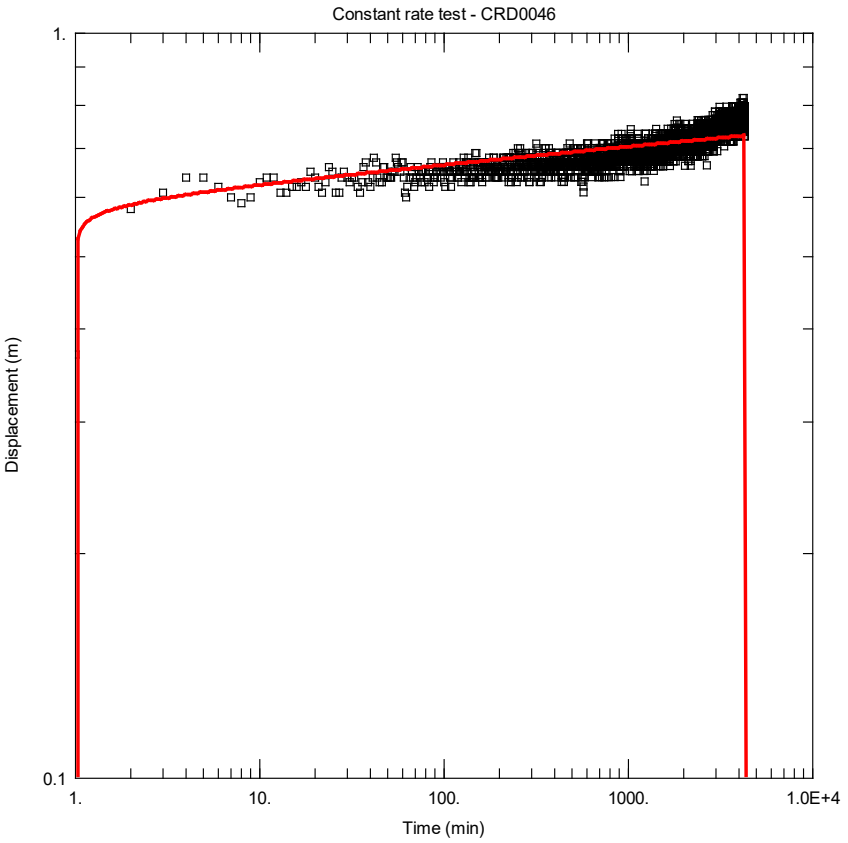


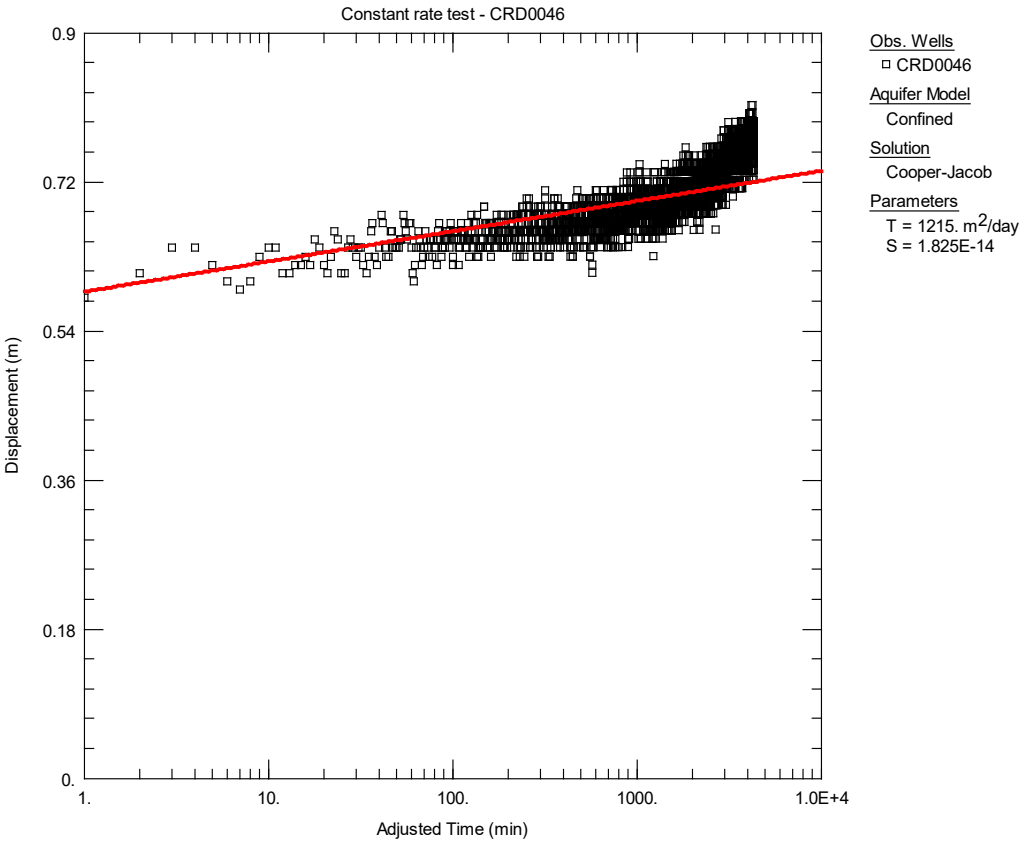
Derivative Plots



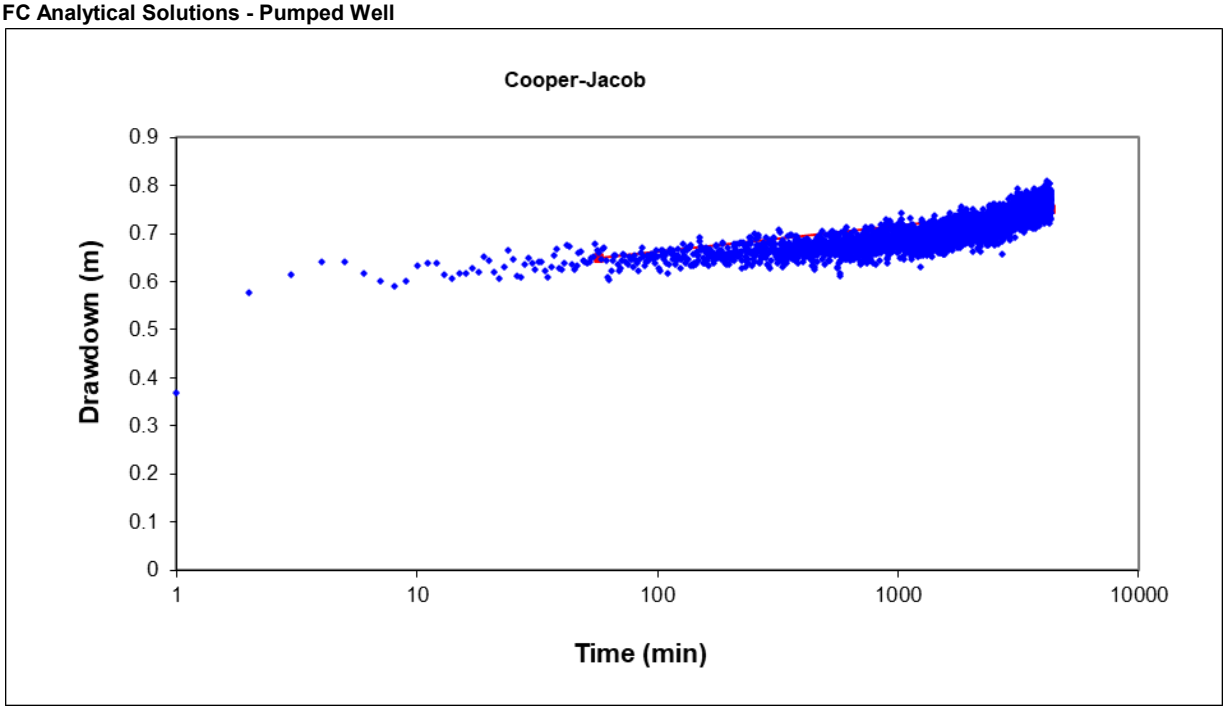
AQTESOLV Analytical Solutions - Pumped Well





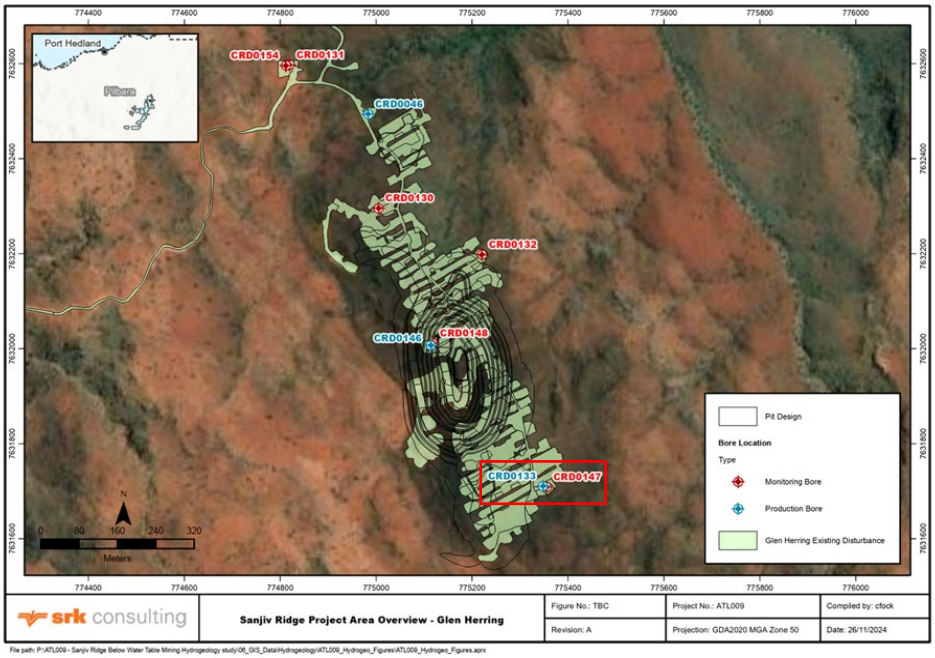


FC Analytical Solutions - Pumped Well



x0	y0		
57.1	0.65	**T(m2/d) =**	831.90
x1	**y1**		
4310	0.75		

Pumping Bore ID:	CRD0133
Date:	04 October - 08 October 2024
Pump Test Contractor:	Flow Water Services



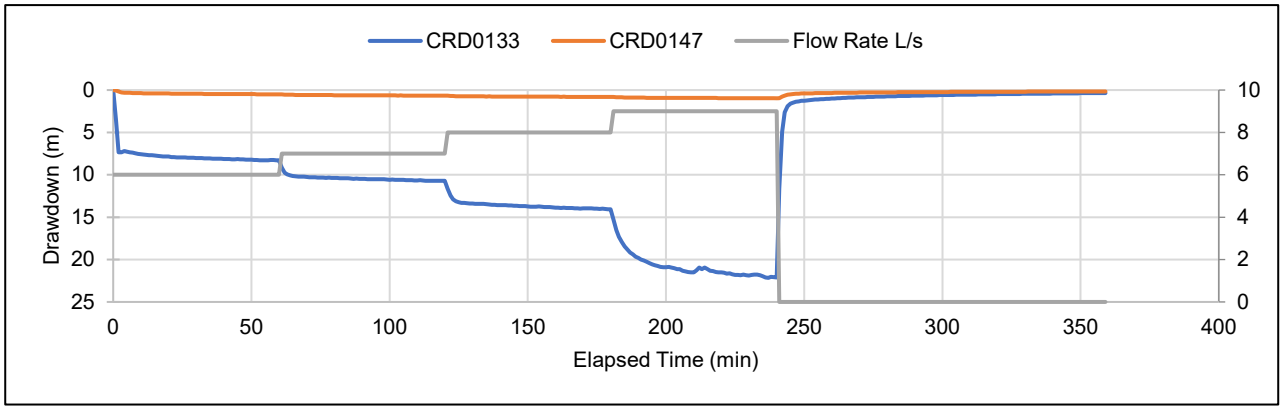
Bore Details	Production Bore	Observation Bore 1	Observation Bore 2
Bore ID	CRD0133	CRD0147	-
Easting	775346.969	775353.861	
Northing	7631708.676	7631706.619	
Elevation (mASL)	420.766	420.642	
Bore Hole Depth (m)	176	174	
Slotted Interval (m)	116 - 176	114 - 172.5	
Bore Hole Diameter (m)	0.3048	0.2032	
Casing Diameter (m)	0.2032	0.1016	
Well Configuration	Full	Full	
Aquifer Unit	Fractured Hemaetite and Chert	Fractured Hemaetite and Chert	
Confined, Unconfined, Leaky	Confined	Confined	
Aquifer Thickness (b) (m)	60	60	

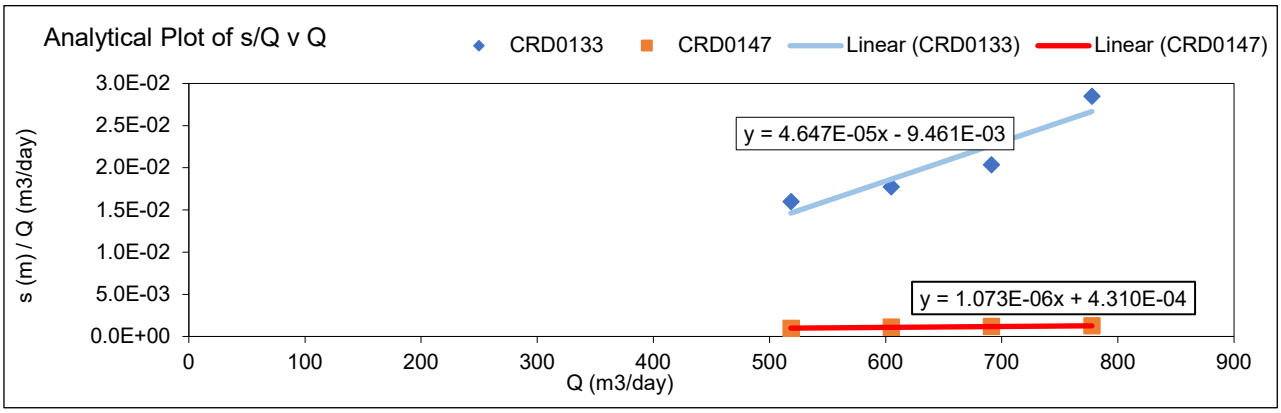
Groundwater Levels	Production Bore	Observation Bore 1	Observation Bore 2
SWL (mbTOC)	119.56	119.32	-
TOC (m)	0.63	0.70	
Date/Time	3/10/2024 12:10	2/10/2024 7:30	

Test Program	Date/Time	Duration (mins)	Rates (L/s)	Starting WL (mbTOC)
Calibration	-	-	- -	- -
Recovery	-	- -	- -	- -
Step Test	4/10/2024 7:30	240	6, 7, 8, 9	119.48
Recovery	4/10/2024 11:30	120	-	140.00
CRT	4/10/2024 13:30	4320	8	119.87
Recovery	7/10/2024 13:30	160	-	138.3

Groundwater Samples	10 mins	27-hours	48-hours	72-hours
CRT	X			X

Step Test





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole

P = Value determined using Rorabaugh's method of superposition

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

From plot of s/Q v Q (trend line equation) for CRD0133:

Intercept (B) -9.461E-03
Gradient (C) 4.647E-05

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	6.0	518	8.29	7.58	1.60E-02	-65%
2	7.0	605	10.73	11.28	1.77E-02	-51%
3	8.0	691	14.08	15.66	2.04E-02	-42%
4	9.0	778	22.16	20.74	2.85E-02	-35%

From plot of s/Q v Q (trend line equation) for CRD0147:

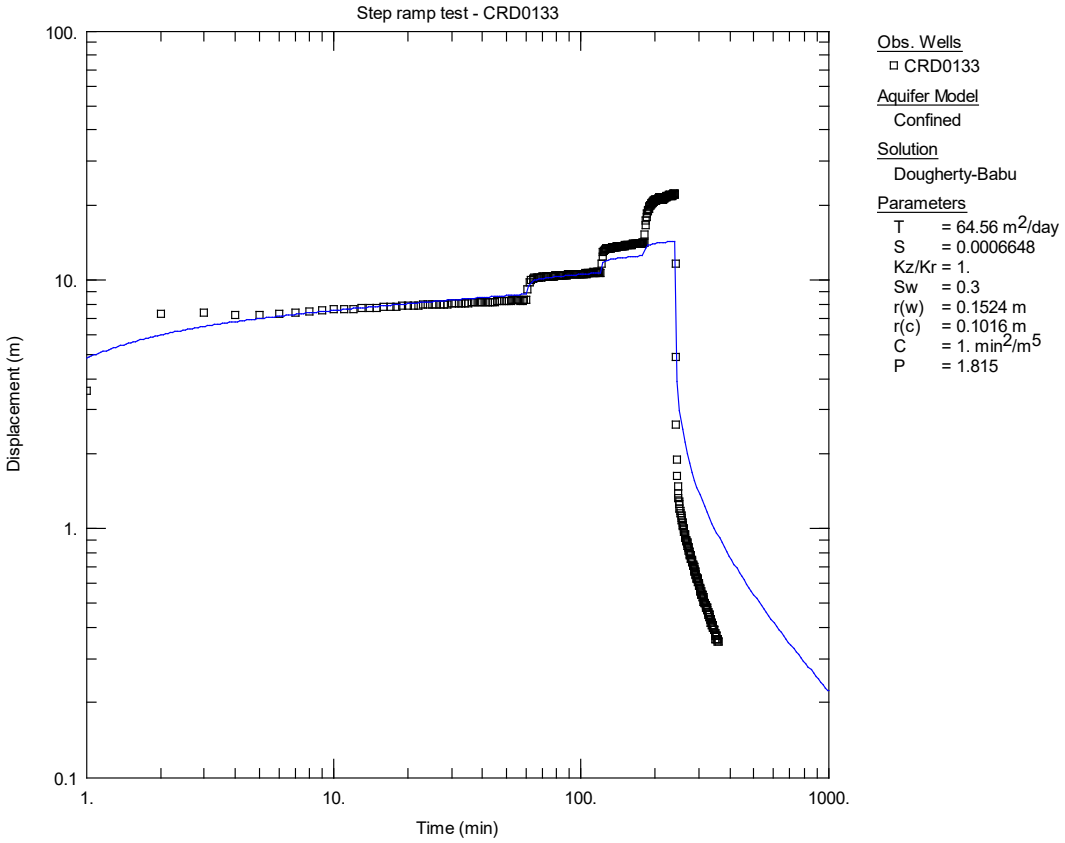
Intercept (B) 4.310E-04
Gradient (C) 1.073E-06

ANALYSIS TABLE

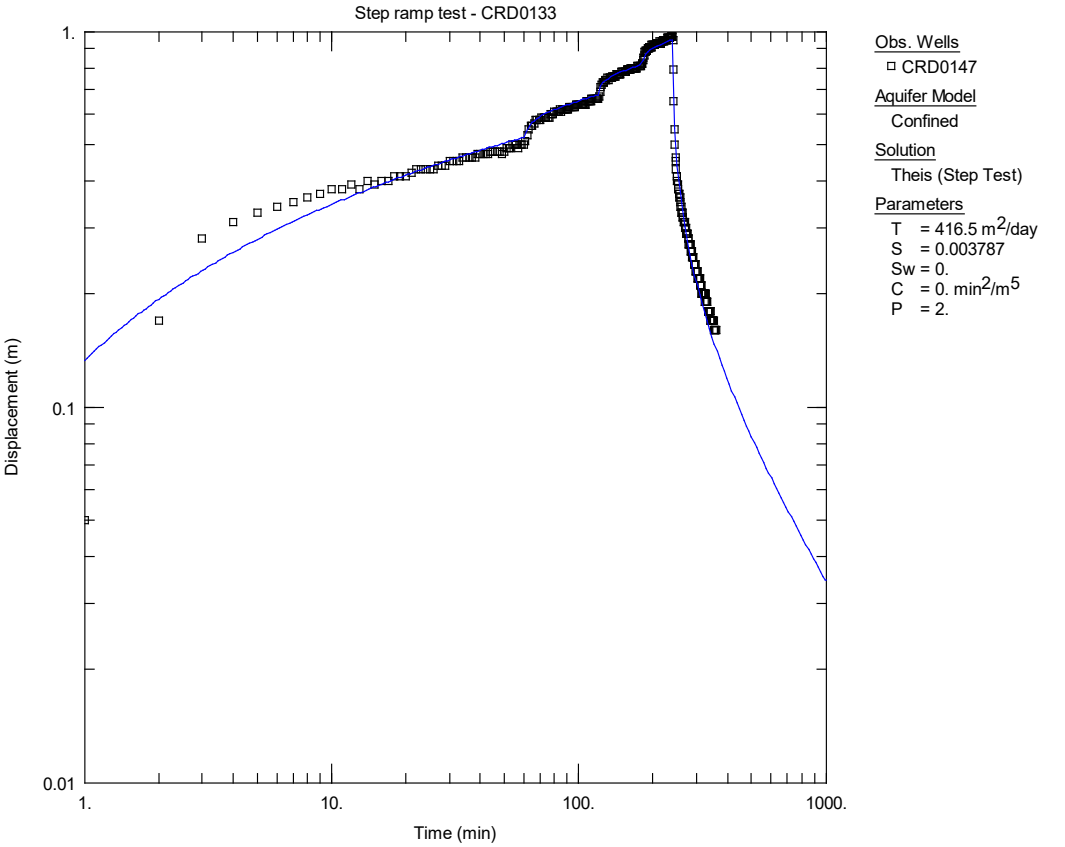
Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	6.0	518	0.50	0.51	9.65E-04	44%
2	7.0	605	0.67	0.65	1.11E-03	40%
3	8.0	691	0.82	0.81	1.19E-03	37%
4	9.0	778	0.97	0.98	1.25E-03	34%

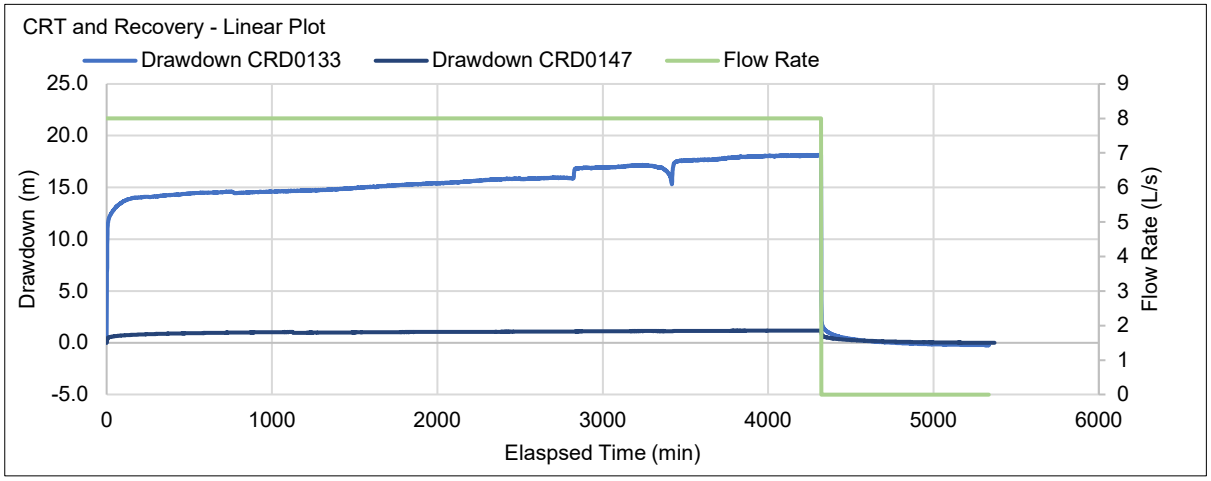
AQTESOLV Analytical Solutions - Pumped Well



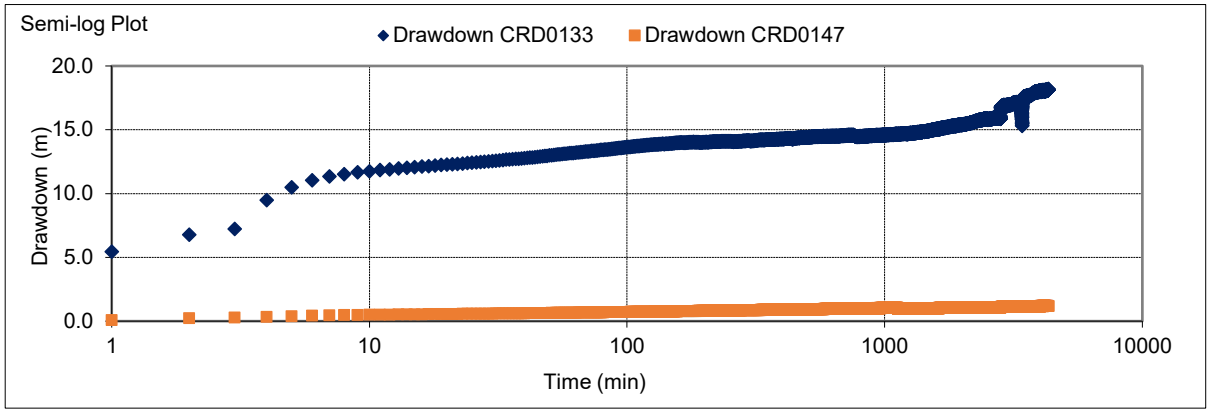
AQTESOLV Analytical Solutions - Monitoring Well

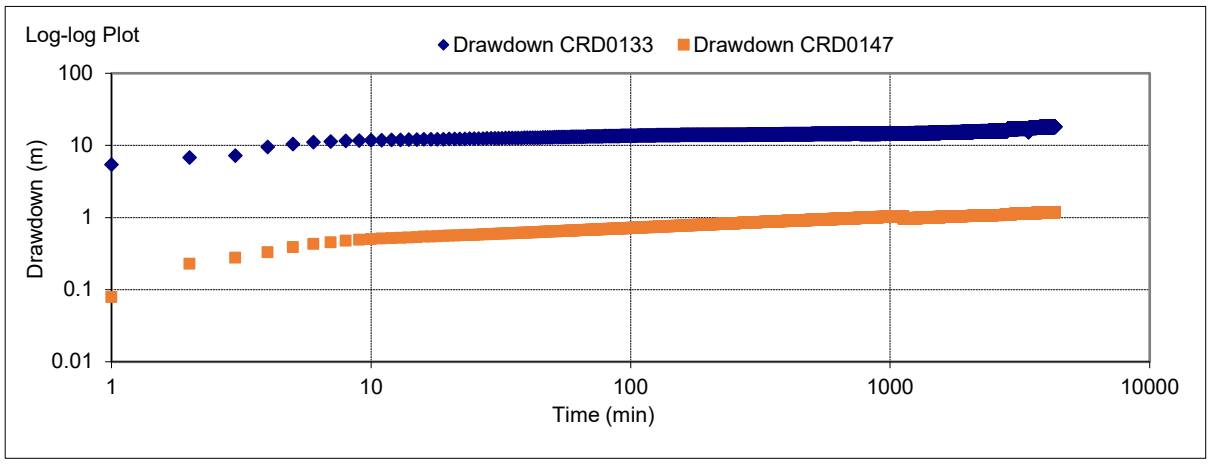


CRT

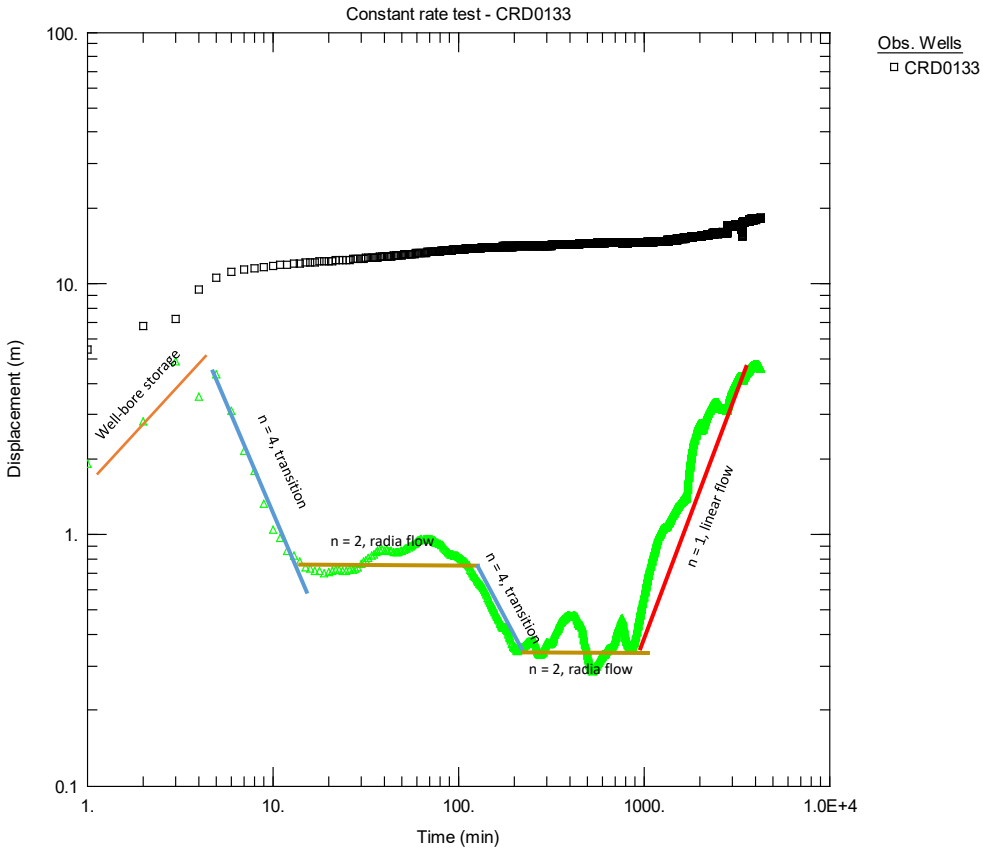


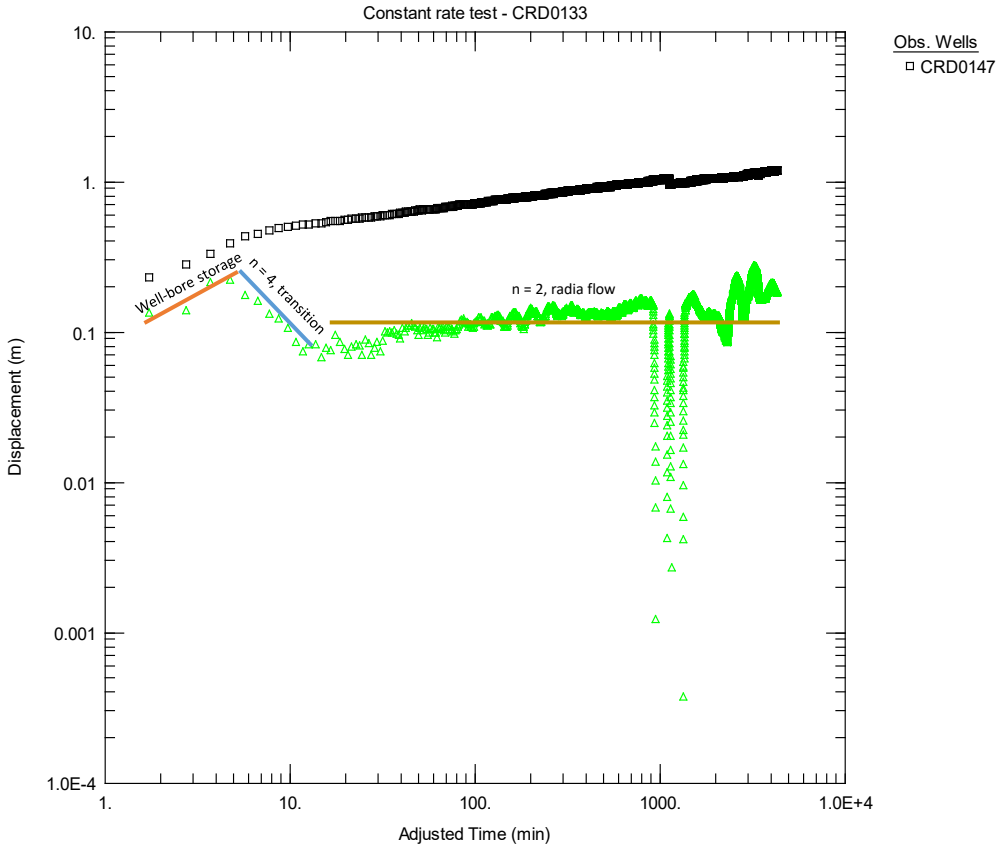
Diagnostic plots of drawdown data versus time for production bore and observation bore are shown below:



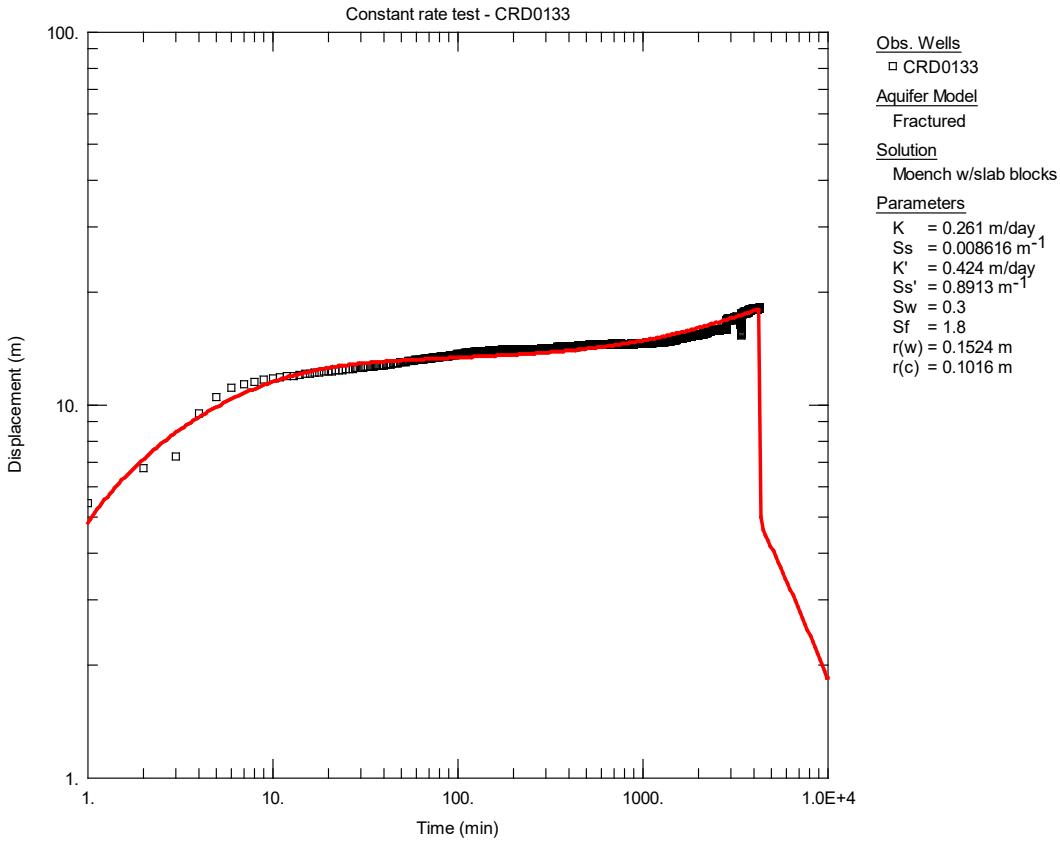


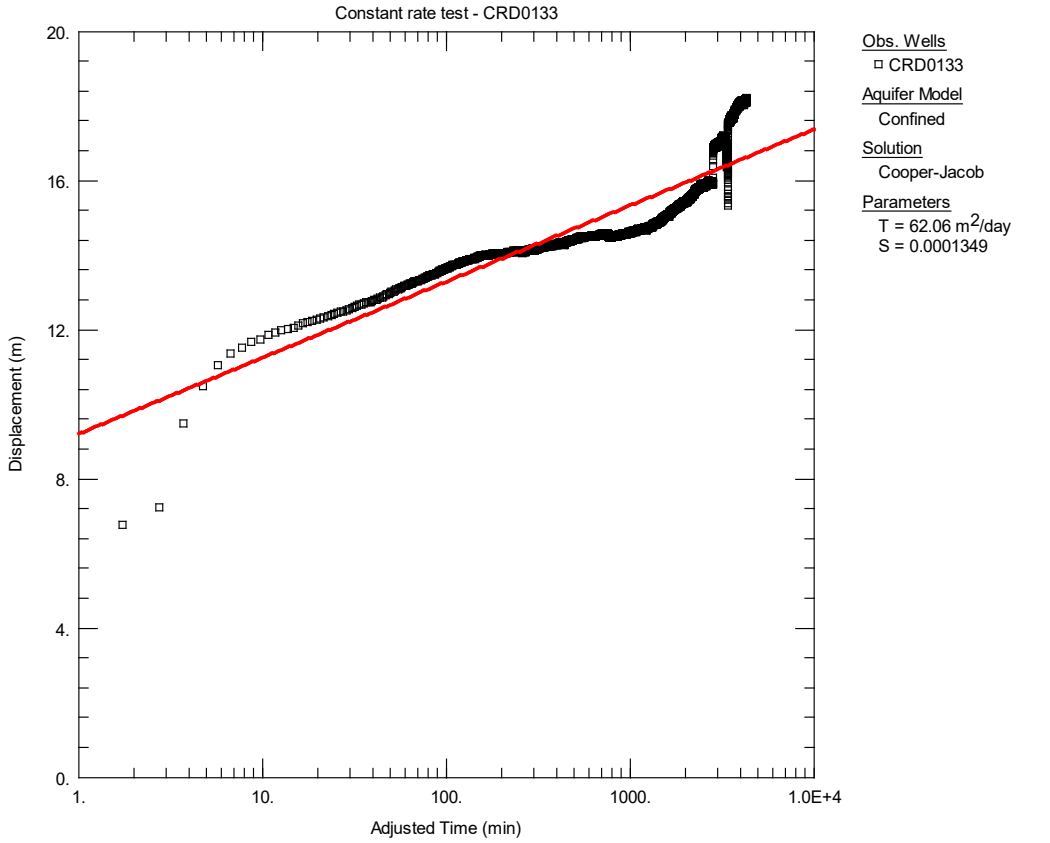
Derivative Plots

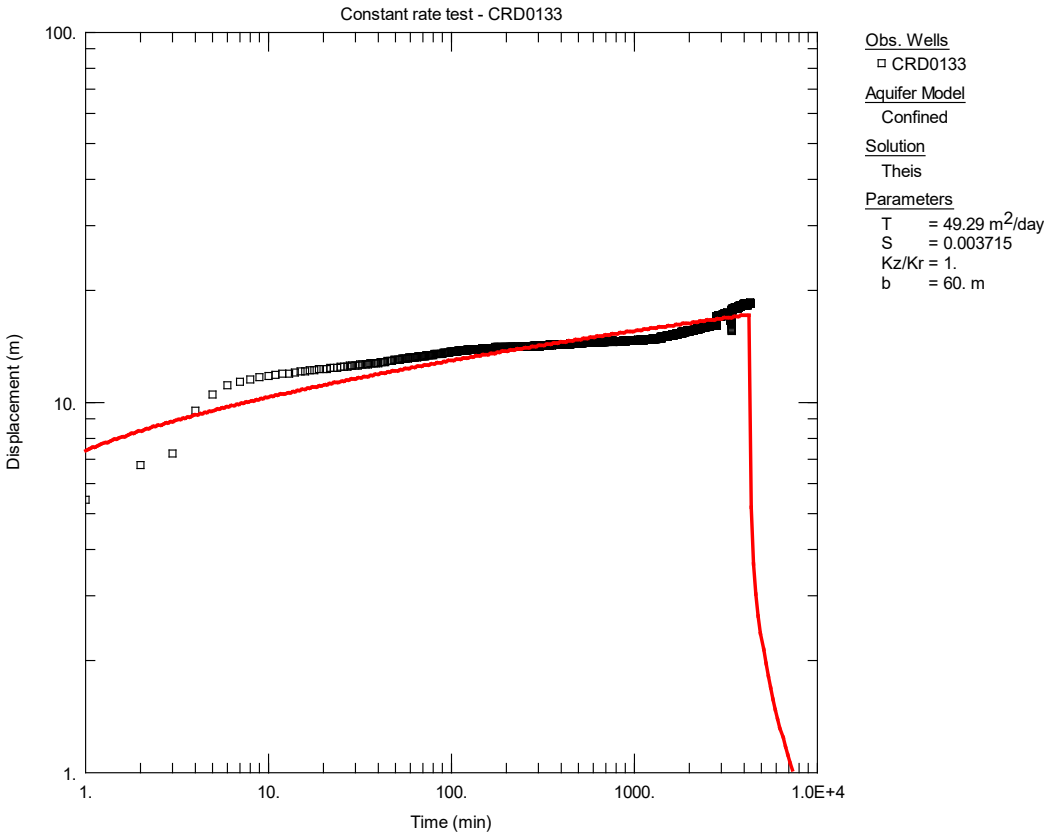




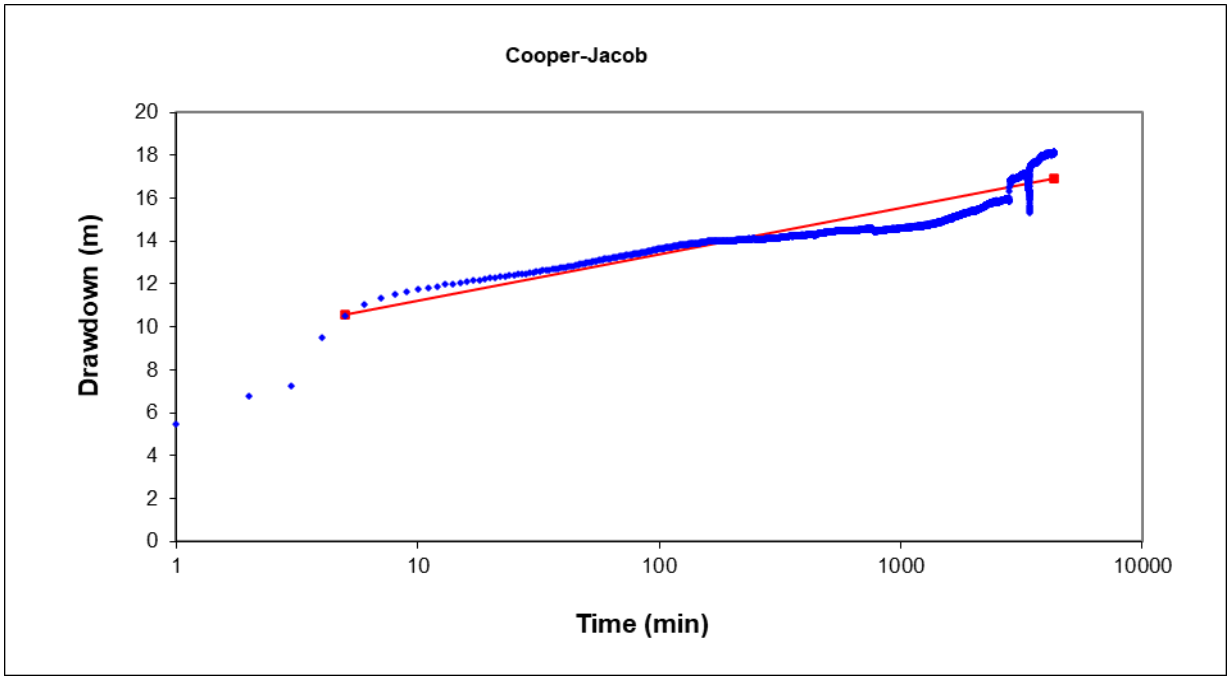
AQTESOLV Analytical Solutions - Pumped Well







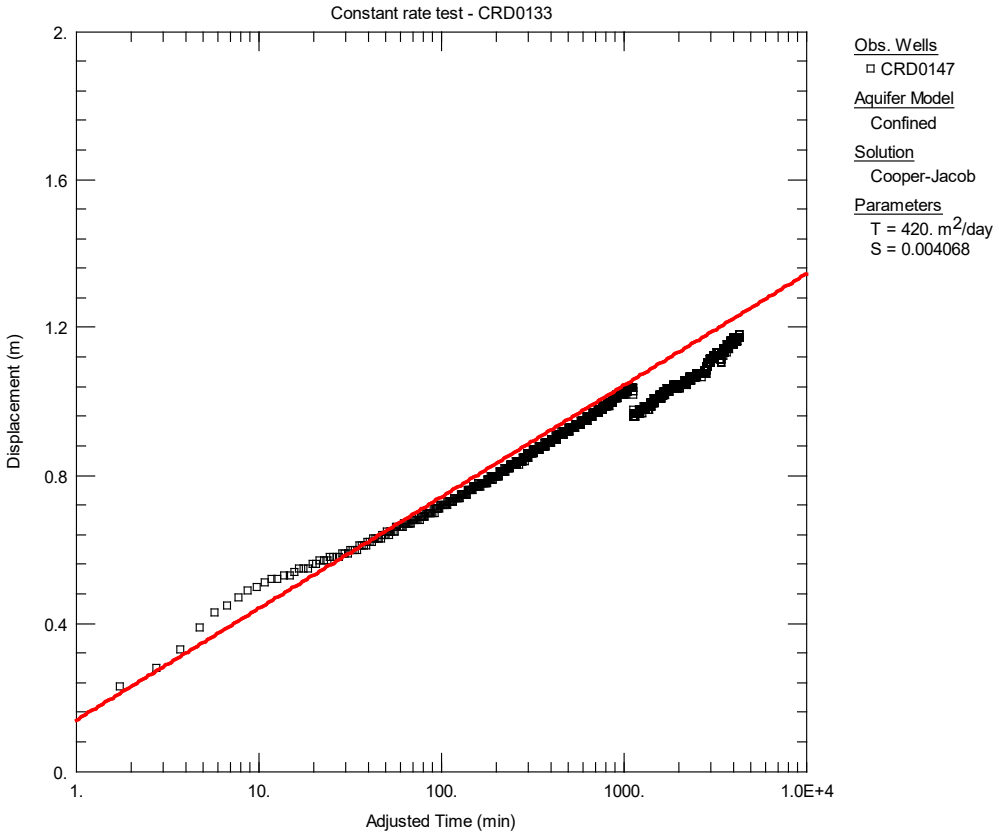
FC Analytical Solutions - Pumped Well

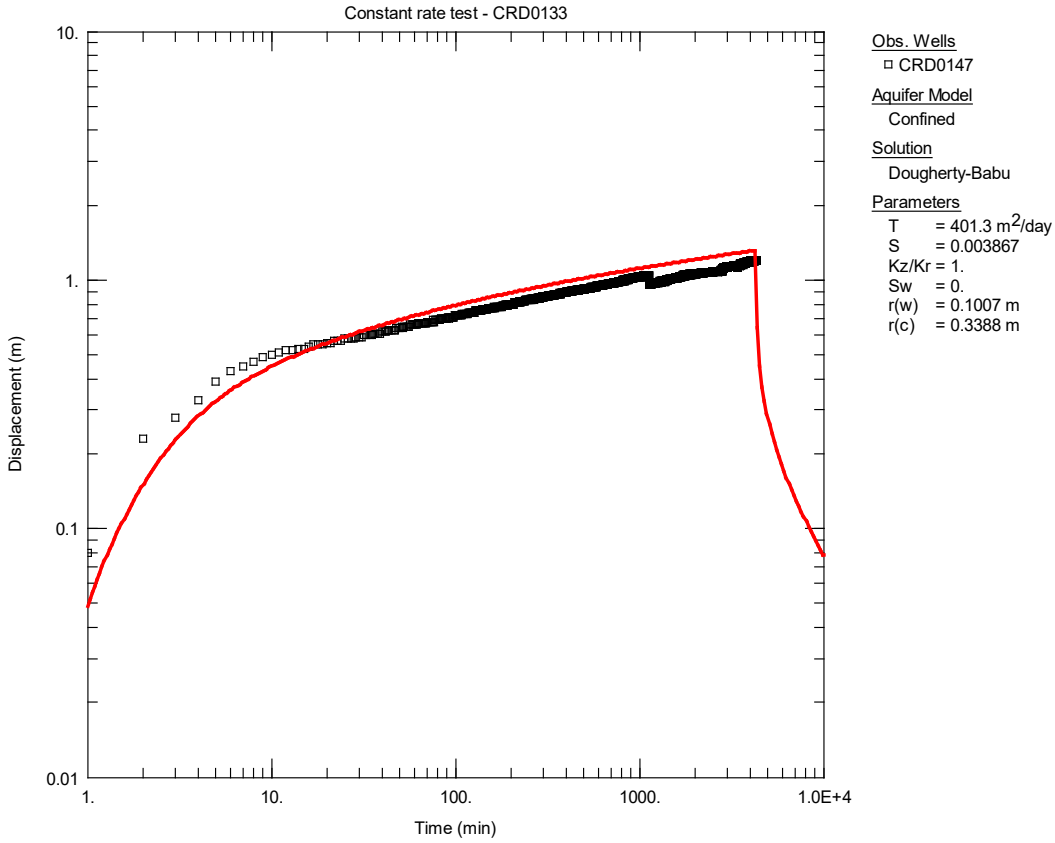


x0	y0		
5	10.6		
x1	**y1**		
4310	16.9		

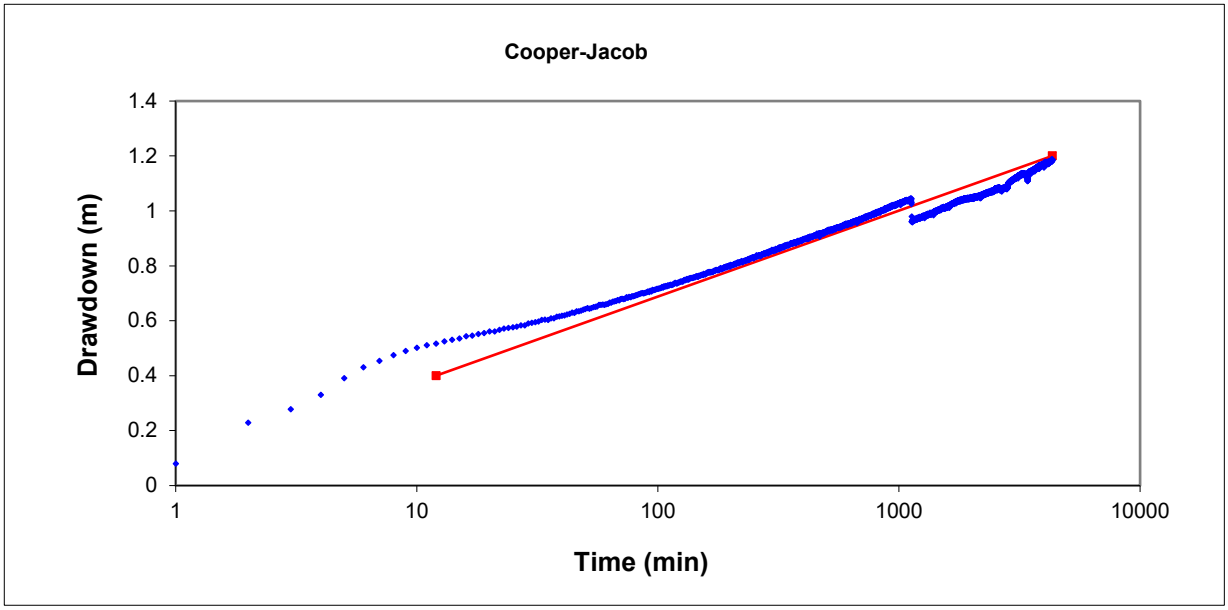
T(m2/d) = 59.00

AQTESOLV Analytical Solutions - Monitoring Well



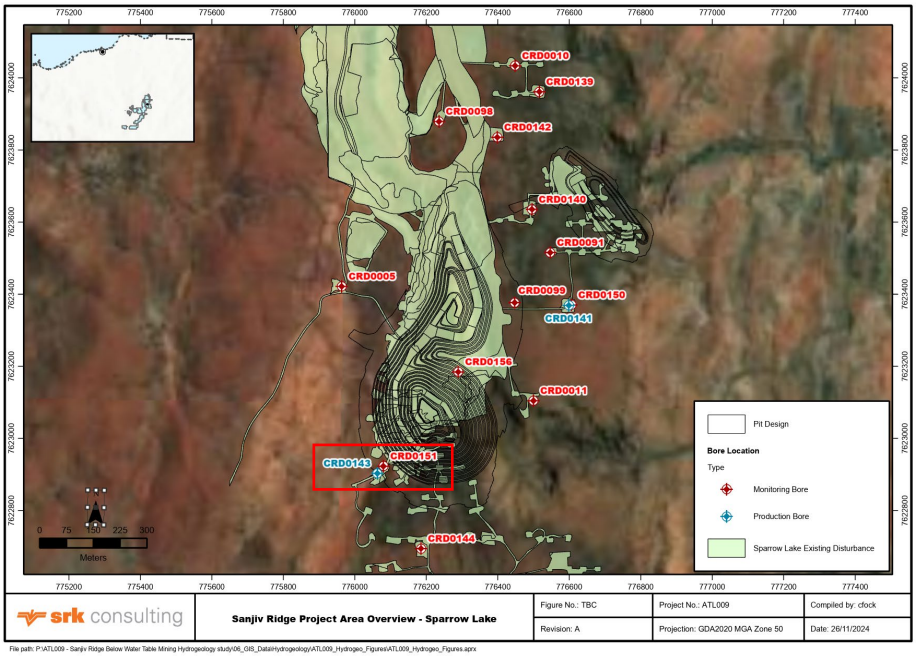


FC Analytical Solutions - Monitoring Well



x0	y0	T(m2/d) =	404.40
12	0.4	S =	0.00773
x1	y1		
4320	1.2		

Pumping Bore ID:	**CRD0143**
Date:	**28 October - 31 October 2024**
Pump Test Contractor:	**Airwell Group**



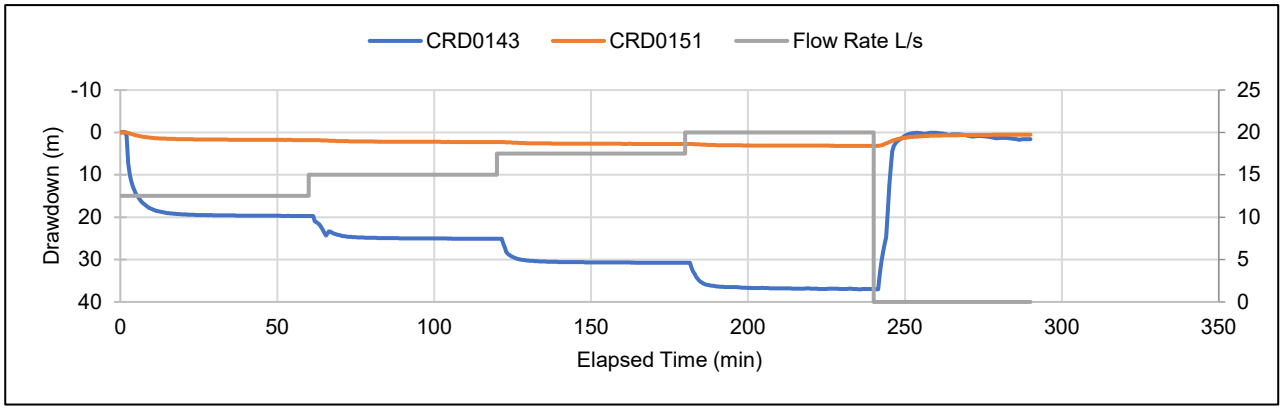
Bore Details	Production Bore	Observation Bore 1	Observation Bore 2	Observation Bore 3	Observation Bore 4	Observation Bore 5	Observation Bore 6
Bore ID	CRD0143	CRD0151	CRD0156	CRD0099	CRD0150	CRD0091	CRD0140
Easting	776061.94	776078.55	776287.99	776446.10	776604.67	776545.54	776494.53
Northing	7622901.20	7622920.93	7623182.45	7623374.92	7623368.06	7623513.80	7623633.61
Elevation (mASL)	404.496	403.988	-	-	429.376	-	423.289
Bore Hole Depth (m)	186	122	-	120	198	90	198
Slotted Interval (m)	73-183.6	44-122			96-198		66-198
Bore Hole Diameter (m)	0.3048	0.2032	0.2032	0.2032	0.2032	0.2032	0.2032
Casing Diameter (m)	0.2032	0.1016	0.0508	0.0508	0.1016	0.0508	0.1016
Well Configuration	Full	Full	Full	Full	Full	Full	Full
Aquifer Unit	Fracture Chert and Shale	Fracture Chert	-	-	Fracture Chert	-	Fracture Chert
Type of Aquifer	Confined	Confined	Confined	Confined	Confined	Confined	Confined
Aquifer Thickness (b) (m)	110.6	110.6	110.6	110.6	110.6	110.6	110.6

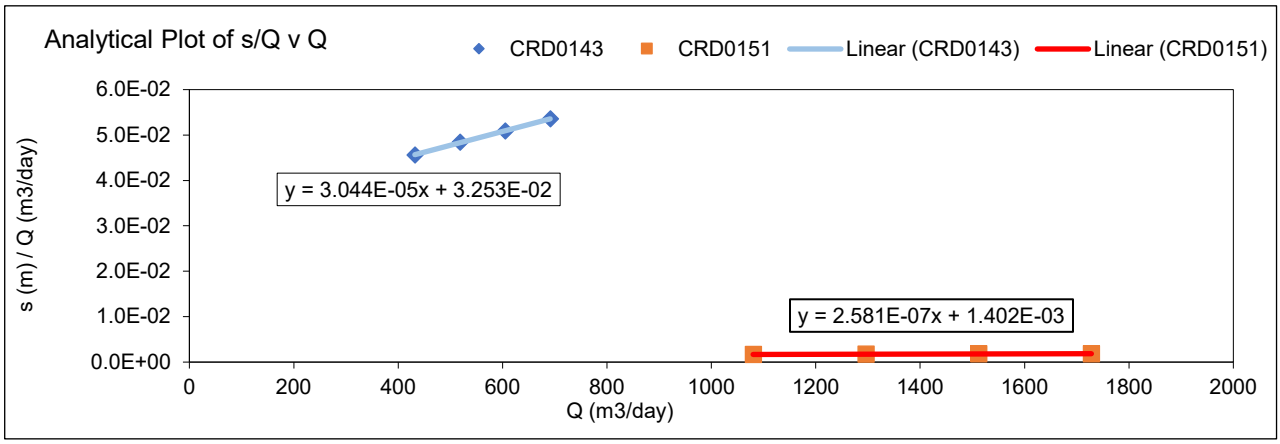
Groundwater Levels	Production Bore	Observation Bore 1	Observation Bore 2	Observation Bore 3	Observation Bore 4	Observation Bore 5	Observation Bore 6
SWL (mbTOC)	53.52	52.94	20.15	77.5	78.99	71.77	73.11
TOC (m)	1.12	1.23	-	-	0.47	-	0.68
Date	28/10/2024	27/10/2024	27/10/2024	29/10/2024	25/10/2024	29/10/2024	25/10/2024
Time	7:28:00 AM	10:00:00 AM	8:00:00 AM	10:15:00 AM	2:00:00 PM	10:30:00 AM	2:00:00 PM

Test Program	Date/Time	Duration (mins)	Rates (L/s)	Starting WL (mbTOC)	
Calibration	27/10/2024 14:00	29/02/1900 0:00	10,15, 22	-	-
Recovery	-	- -	- -	-	-
Step Test	28/10/2024 7:28	240	12.5, 15, 17.5, 20	53.52	
Recovery	28/10/2024 11:28	60	-	93.55	
CRT	28/10/2024 14:00	4320	20	53.73	
Recovery	31/10/2024 14:00	60	-	93.35	

Groundwater Samples	10 mins	27-hours	48-hours	72-hours
CRT	X			X

Step Test





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)

C = Gradient (coefficient of turbulent flow loss or apparent well loss)

s = Drawdown in the borehole

P = Value determined using Rorabaugh's method of superposition

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

From plot of s/Q v Q (trend line equation) for CRD0143: **Intercept (B)** 3.253E-02

ANALYSIS TABLE **Gradient (C)** 3.044E-05

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	5.0	432	19.71	19.73	4.56E-02	71%
2	6.0	518	25.09	25.04	4.84E-02	67%
3	7.0	605	30.78	30.80	5.09E-02	64%
4	8.0	691	37.02	37.02	5.36E-02	61%

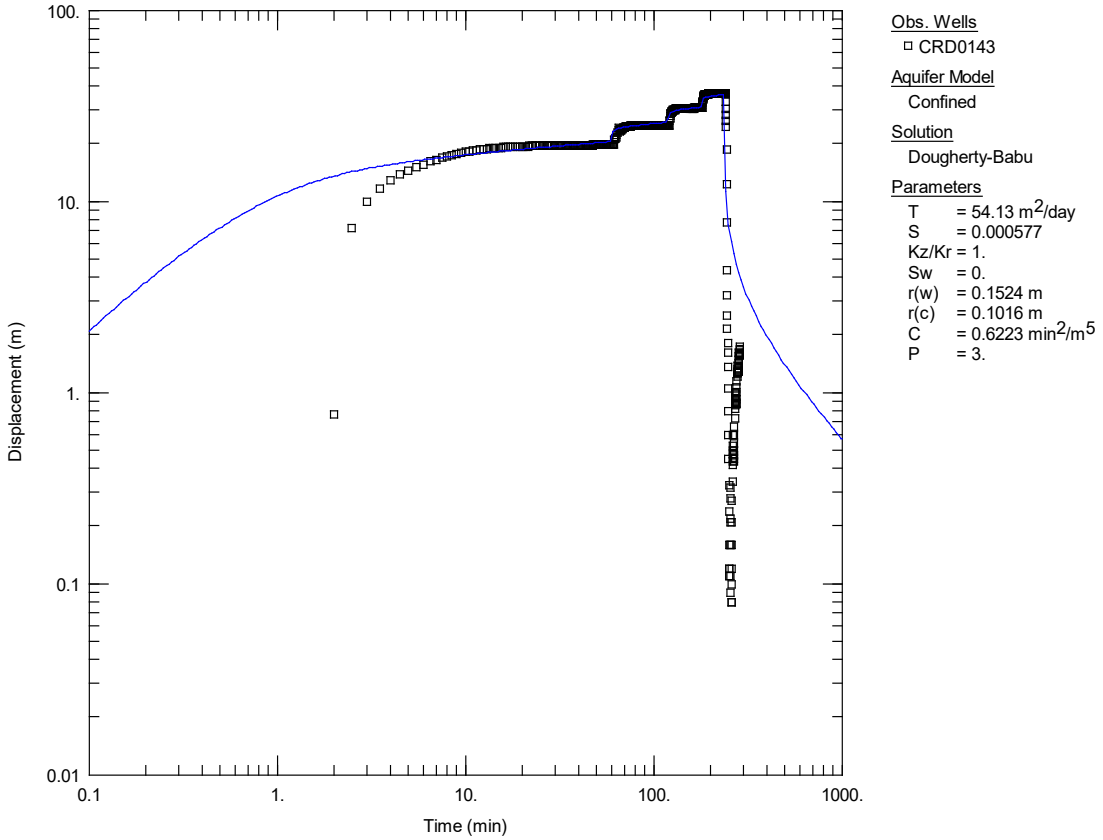
From plot of s/Q v Q (trend line equation) for CRD0151: **Intercept (B)** 1.402E-03

ANALYSIS TABLE **Gradient (C)** 2.581E-07

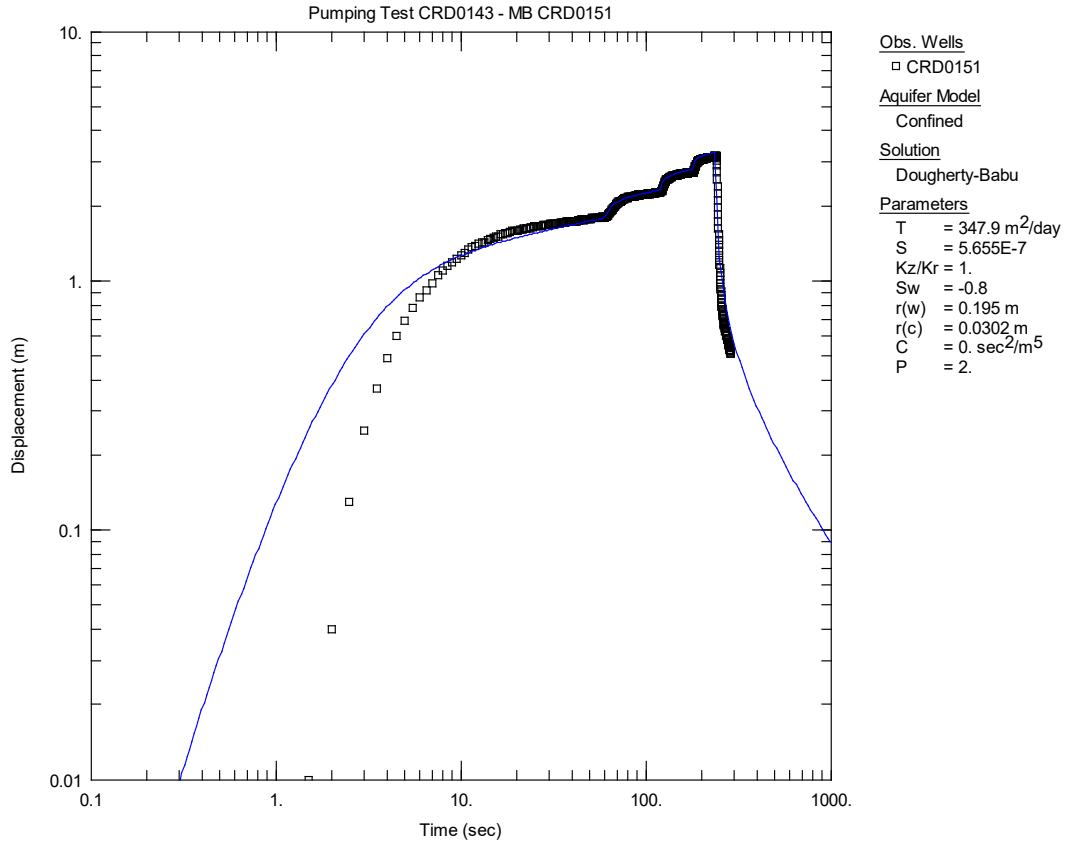
Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	12.5	1080	1.80	1.82	1.67E-03	83%
2	15.0	1296	2.27	2.25	1.75E-03	81%
3	17.5	1512	2.73	2.71	1.81E-03	78%
4	20.0	1728	3.17	3.19	1.83E-03	76%

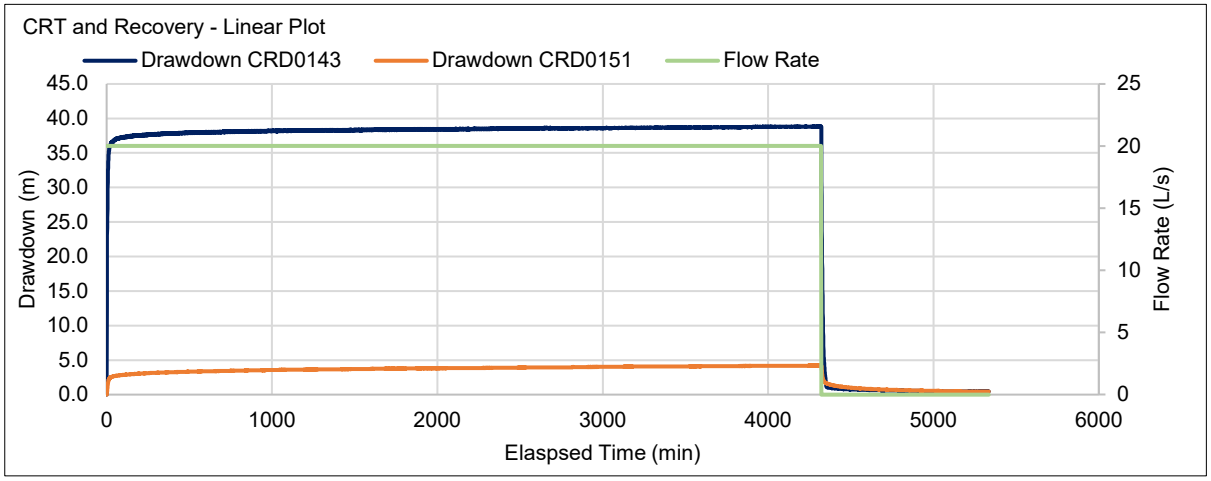
AQTESOLV Analytical Solutions - Pumped Well



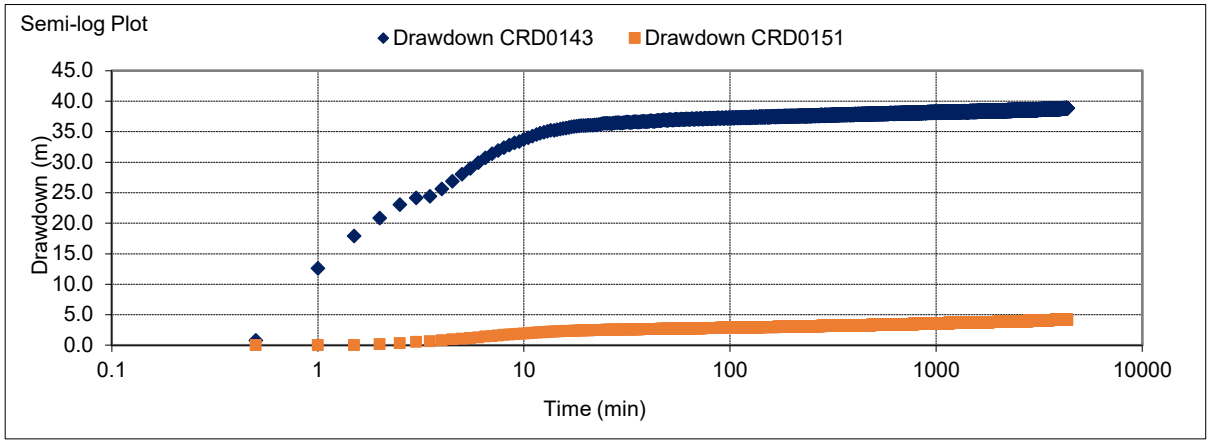
AQTESOLV Analytical Solutions - Monitoring Well

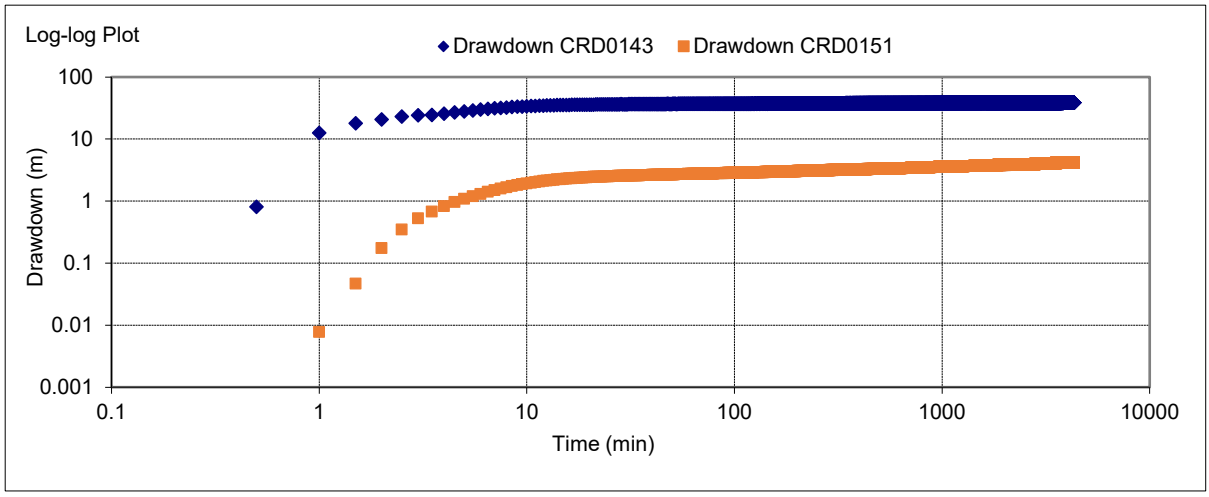


CRT

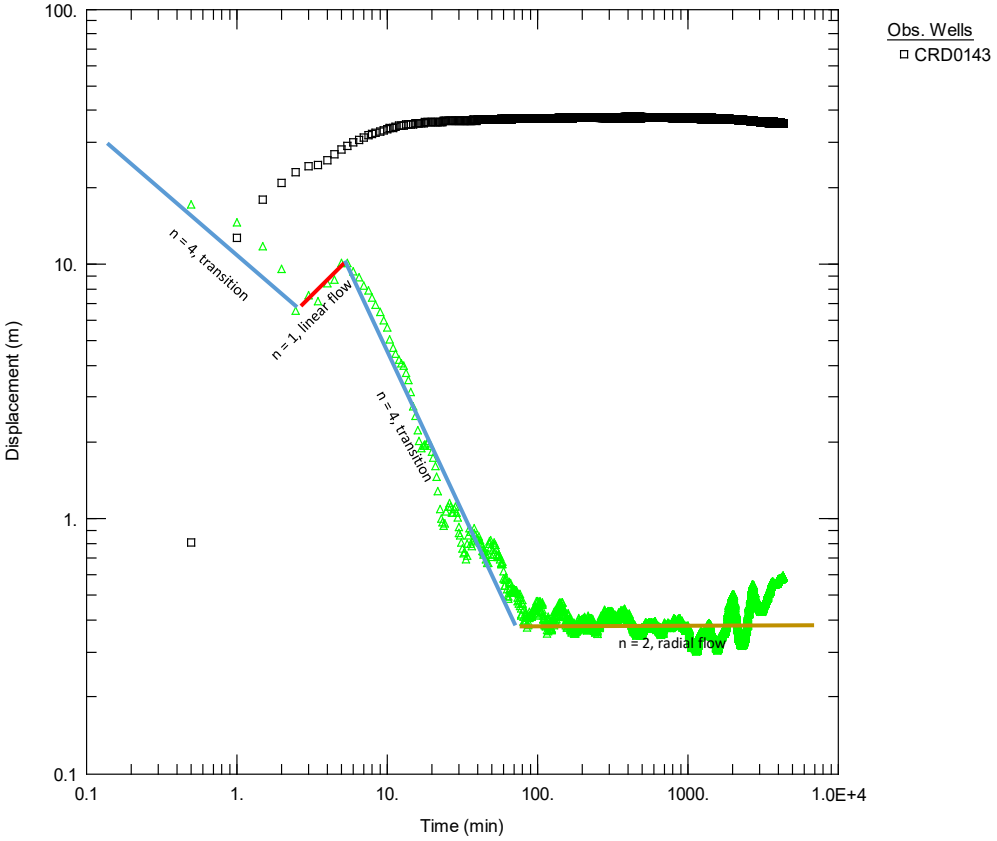


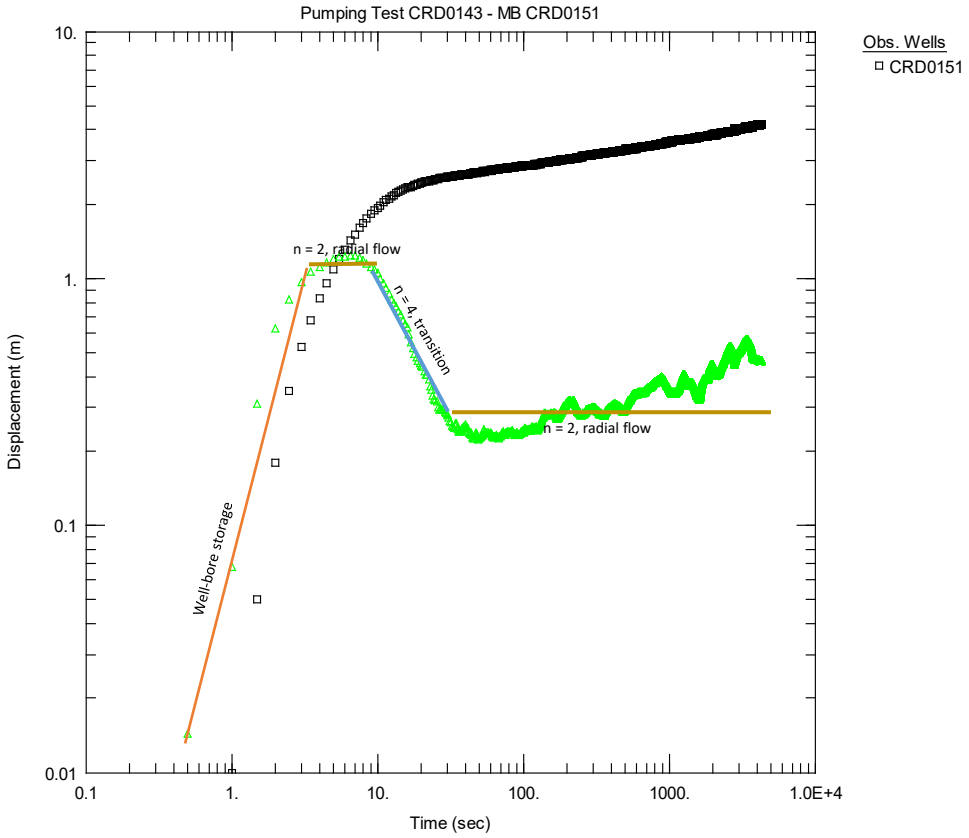
Diagnostic plots of drawdown data versus time for production bore and observation bore are shown below:



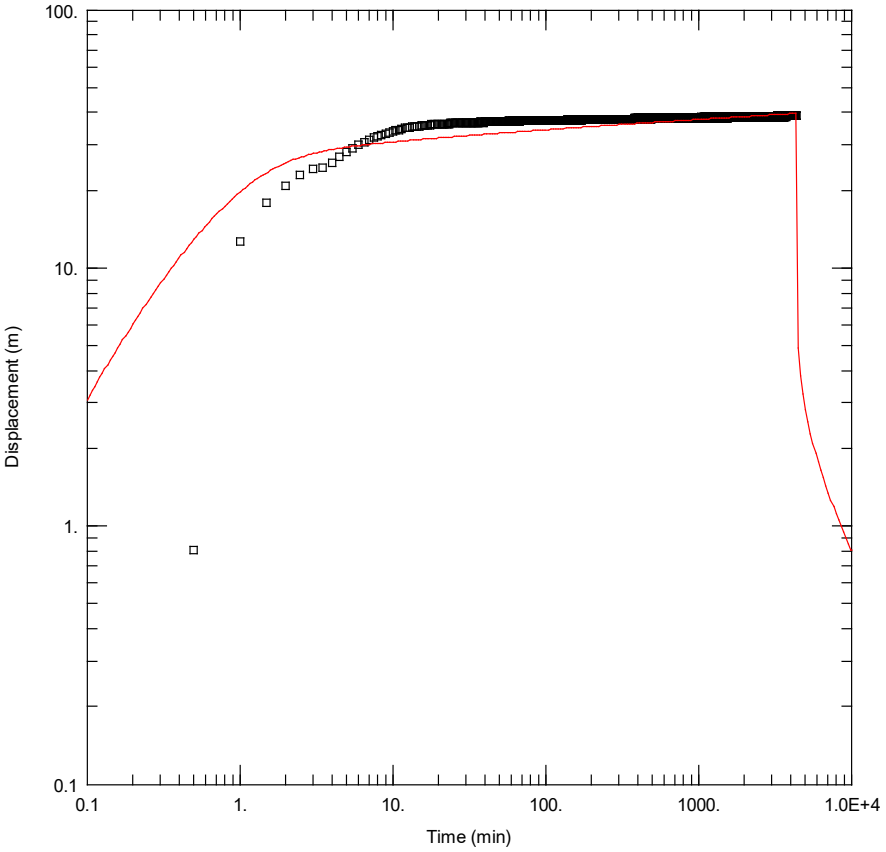


Derivative Plots





AQTESOLV Analytical Solutions - Pumped Well

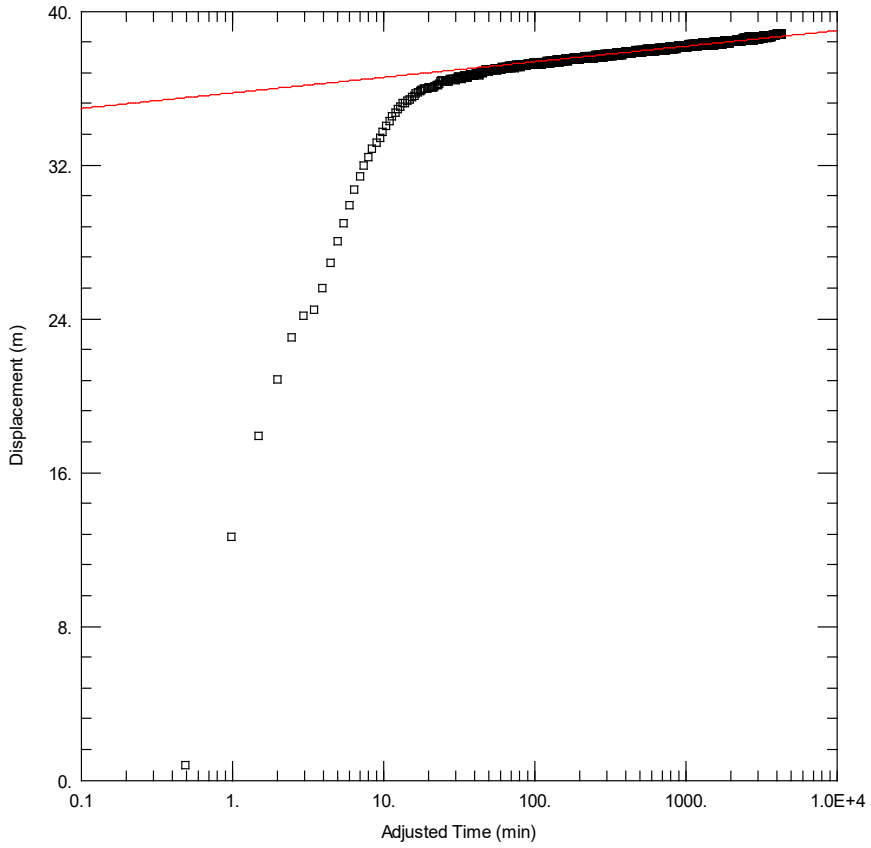


Obs. Wells
□ CRD0143

Aquifer Model
Fractured

Solution
Moench w/slab blocks

Parameters
K = 0.8726 m/day
Ss = 1.049E-10 m^{-1}
K' = 1440. m/day
Ss' = 1.0E-10 m^{-1}
Sw = 0.
Sf = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m



Obs. Wells
□ CRD0143

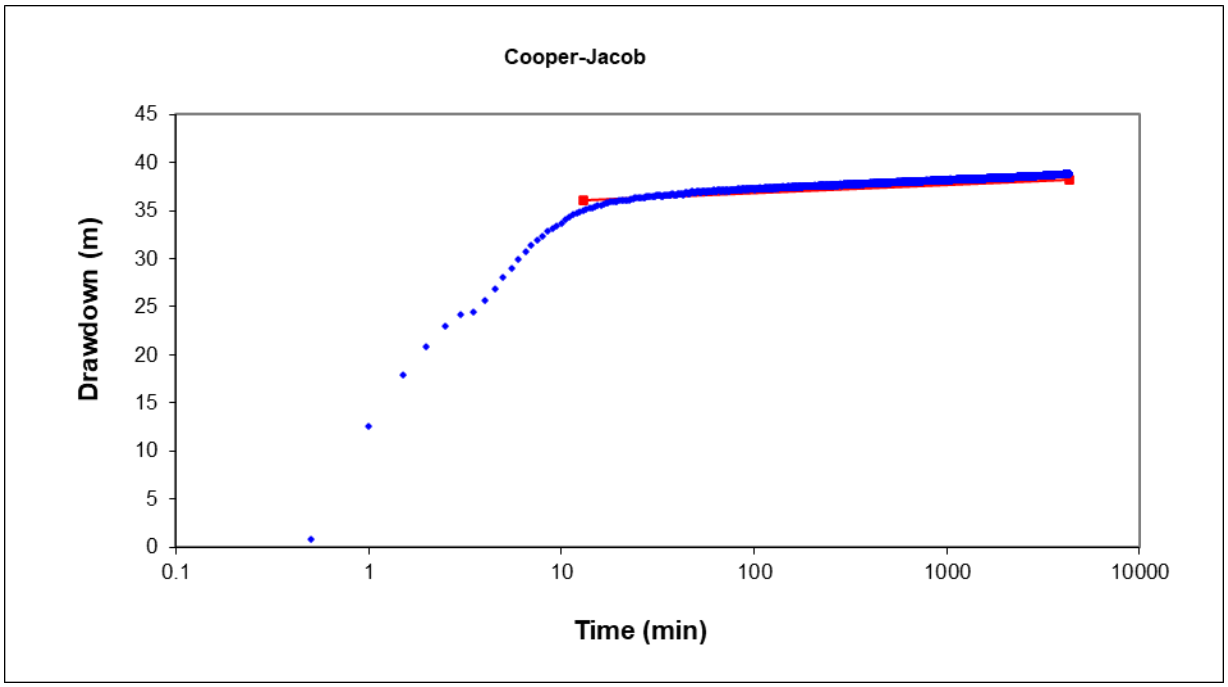
Aquifer Model
Confined

Solution
Cooper-Jacob

Parameters
T = 391.5 m^2/day
S = 1.69E-43

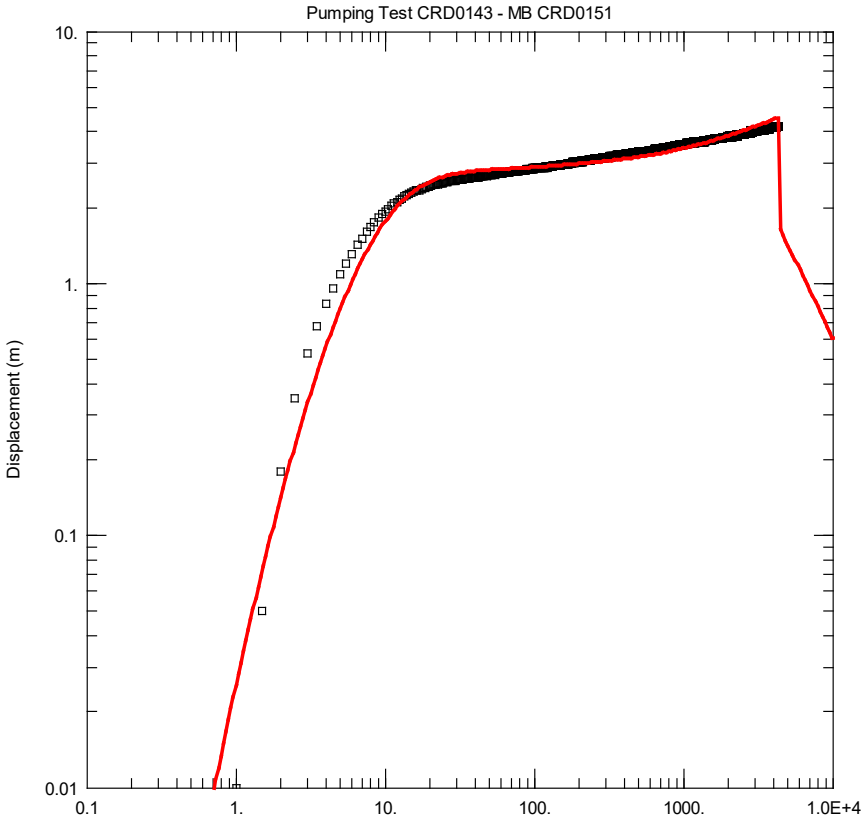
Storativity cannot be accurately calculated directly from data collected only from a pumping bore due to influence of well effects which can obscure aquifer response.

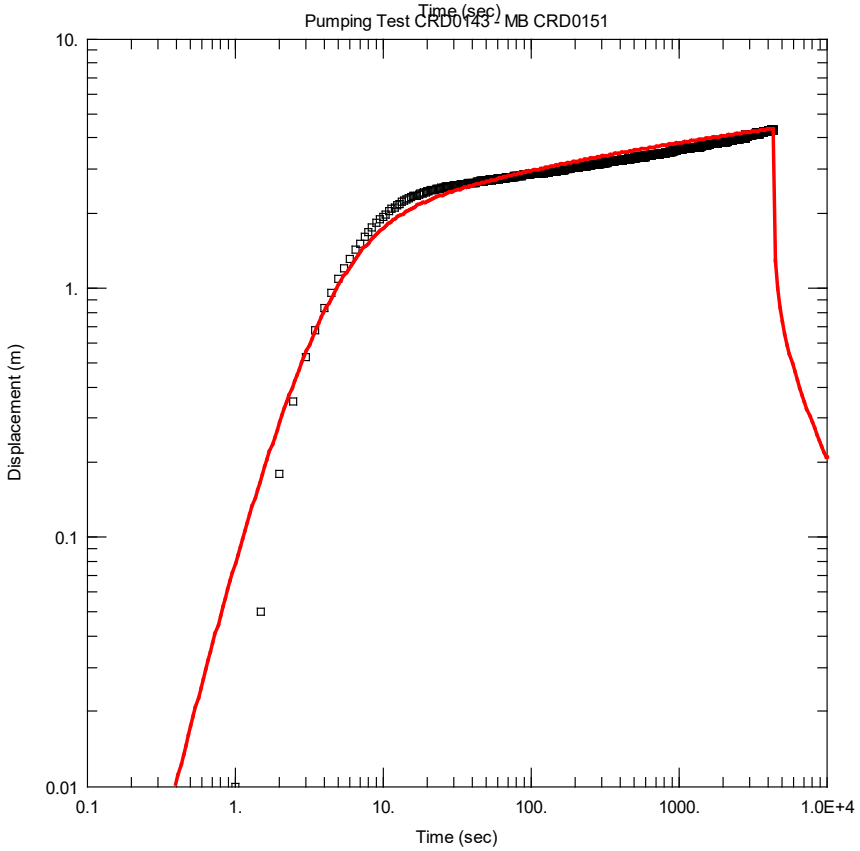
FC Analytical Solutions - Pumped Well

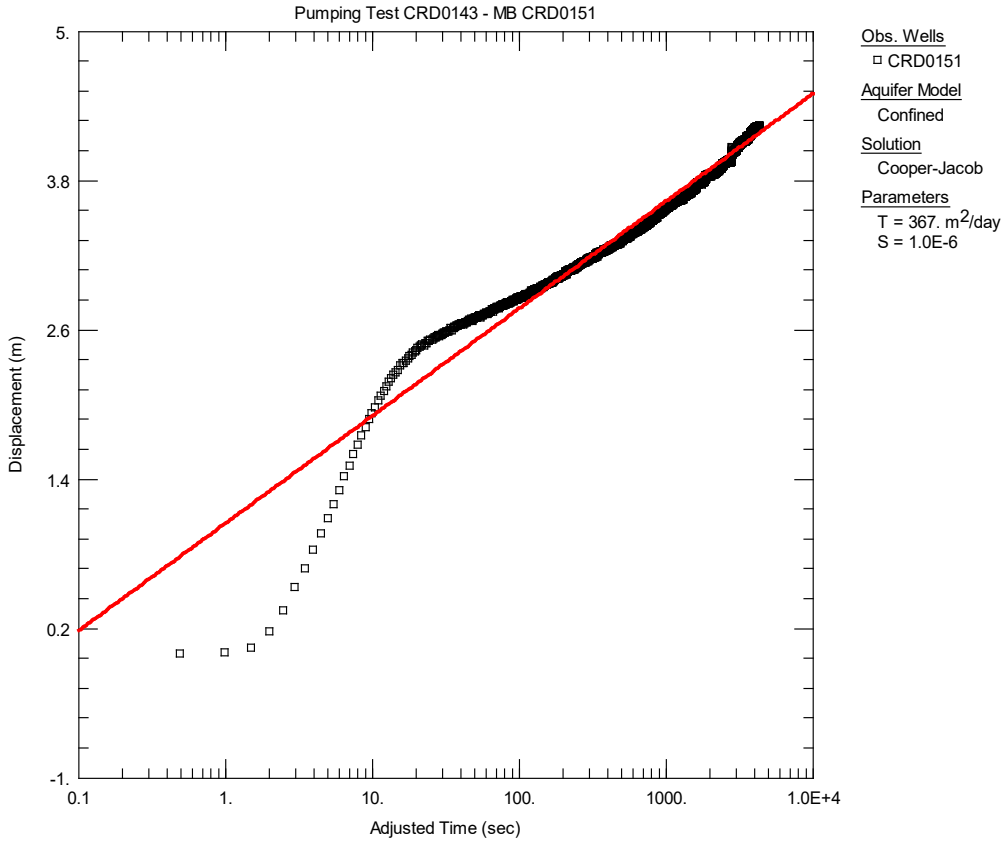


x0	y0	T(m2/d) =	338.70
13	36.1		
x1	**y1**		
4320	38.2		

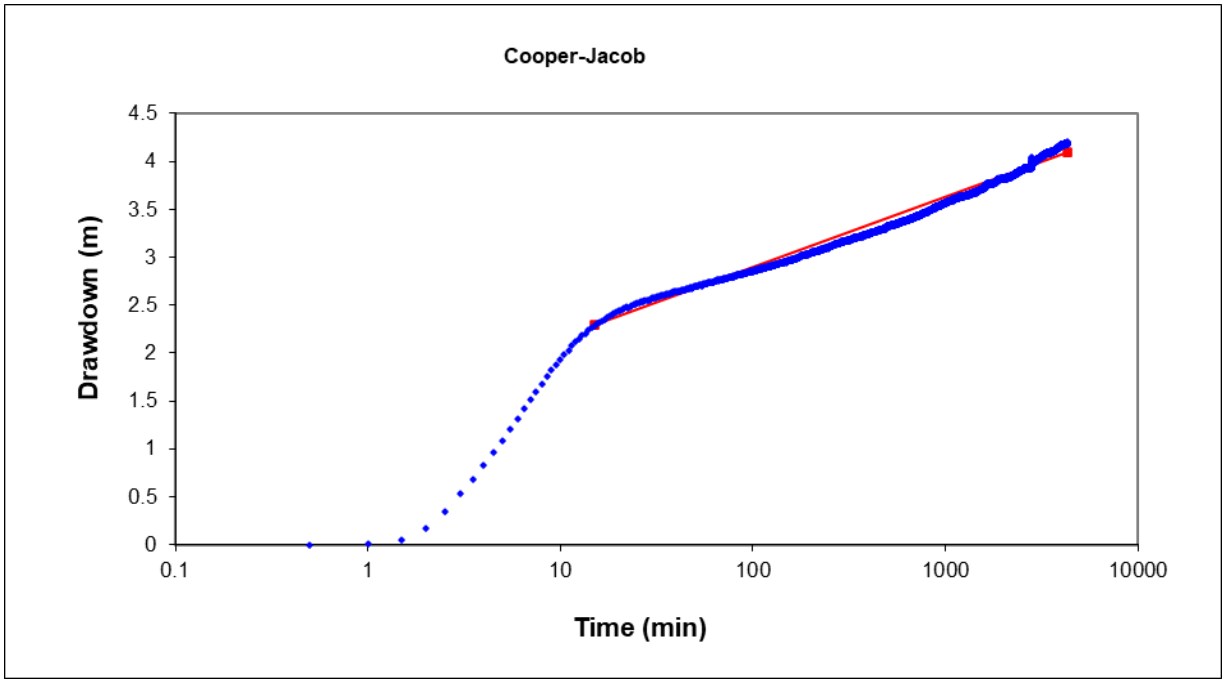
AQTESOLV Analytical Solutions - Monitoring Well CRD0151





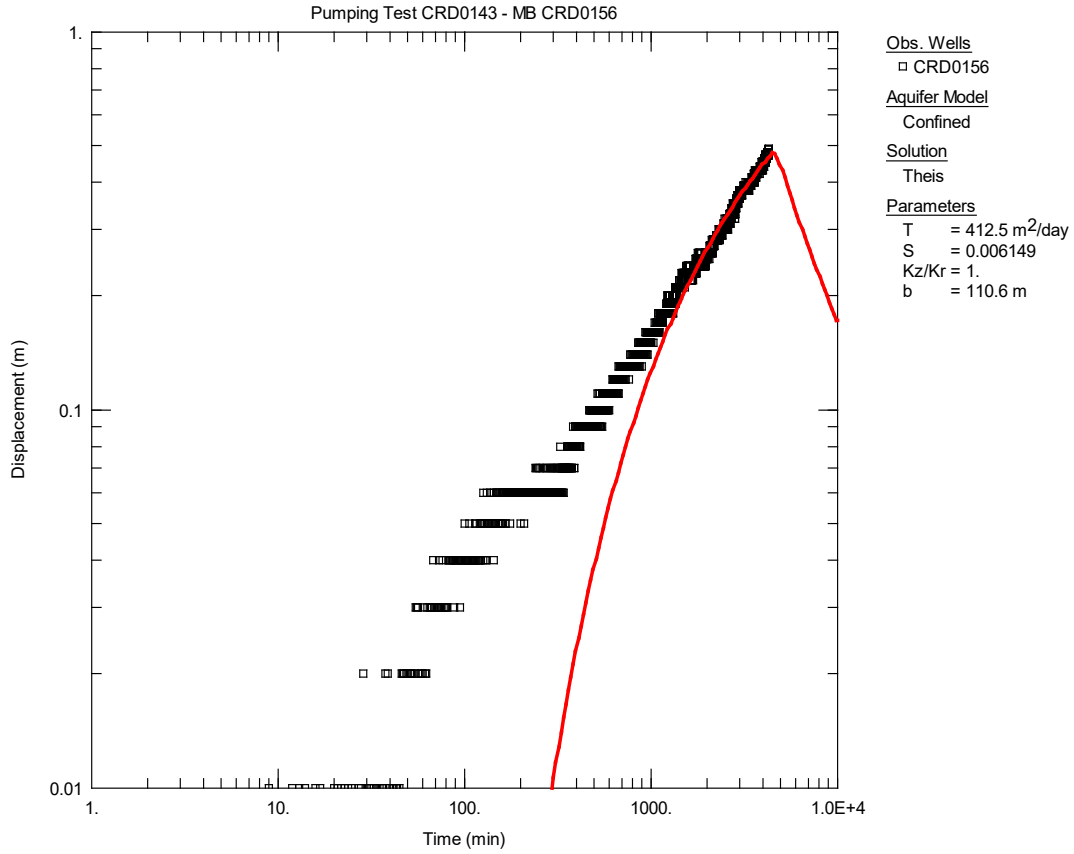


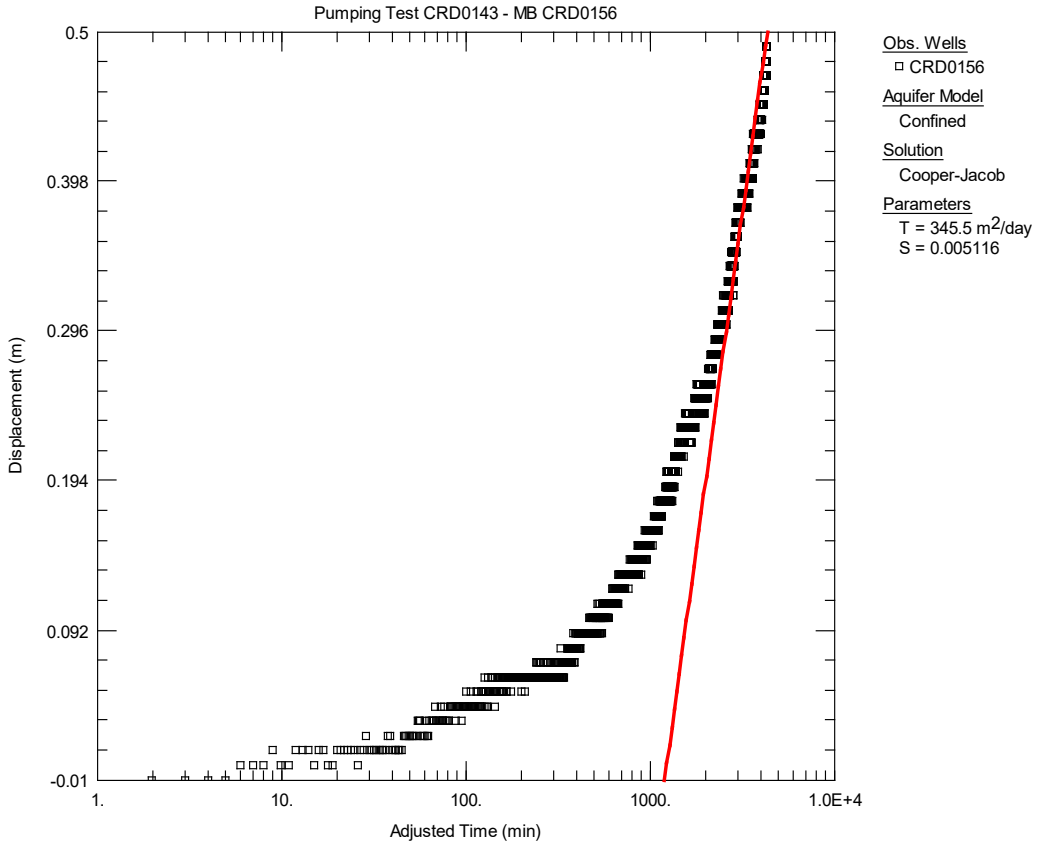
FC Analytical Solutions - Monitoring Well CRD0151

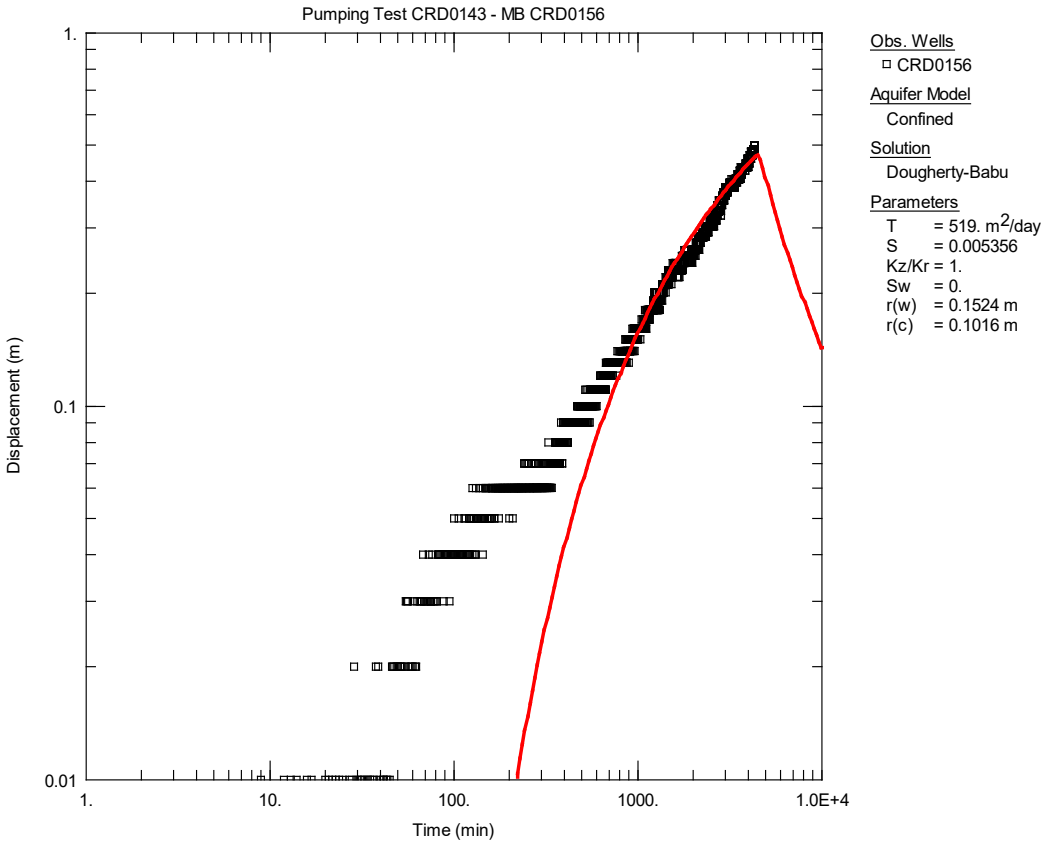


x0	y0		
15.1	2.3	**T(m2/d) =**	431.80
		S =	2.96E-04
x1	**y1**		
4320	4.1		

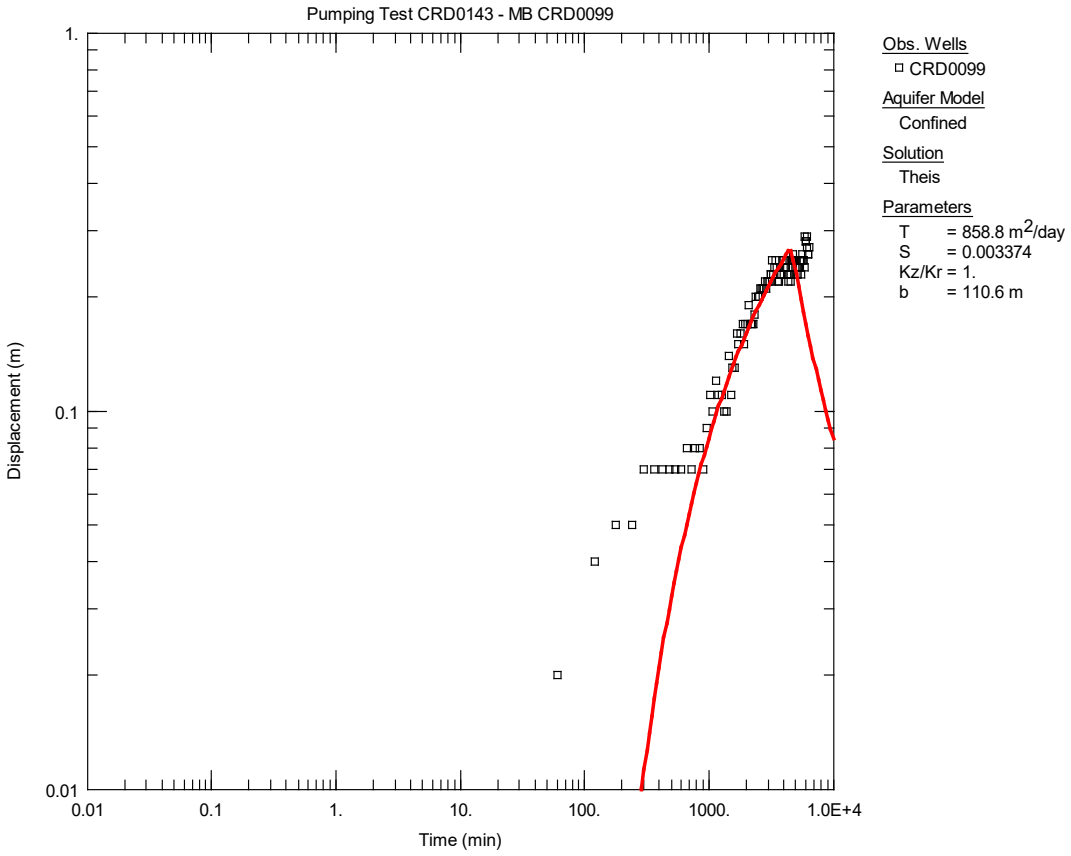
AQTESOLV Analytical Solutions - Monitoring Well CRD0156

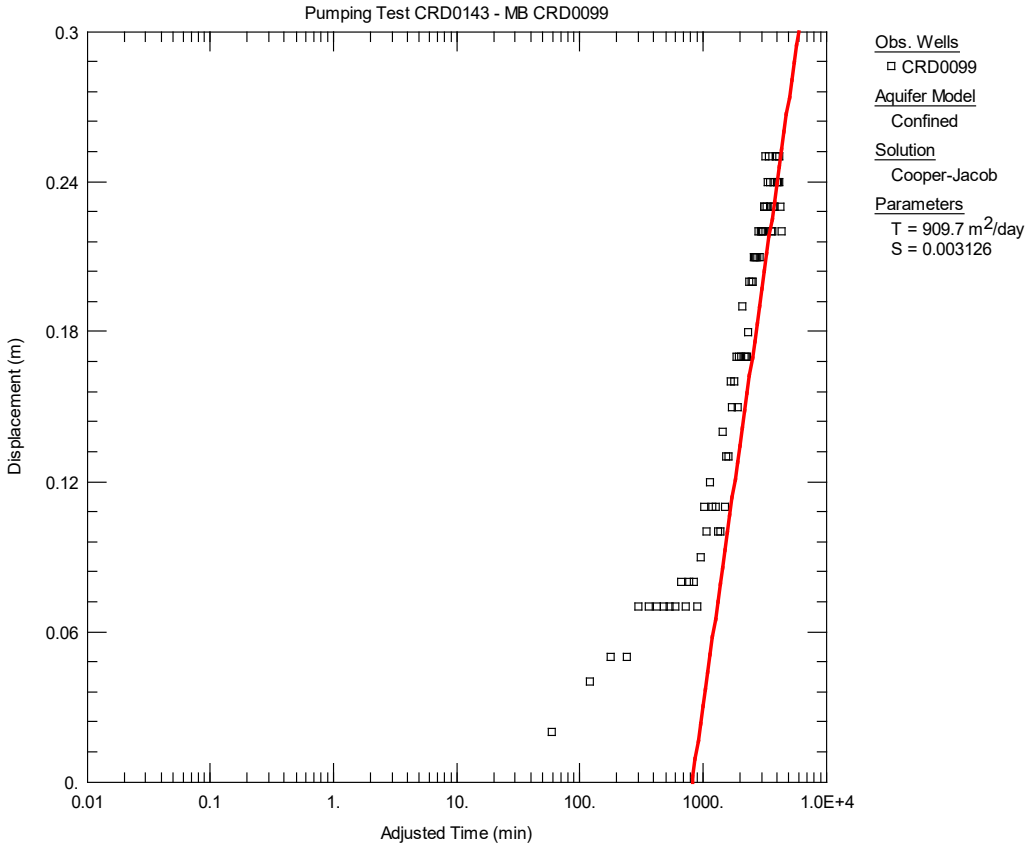


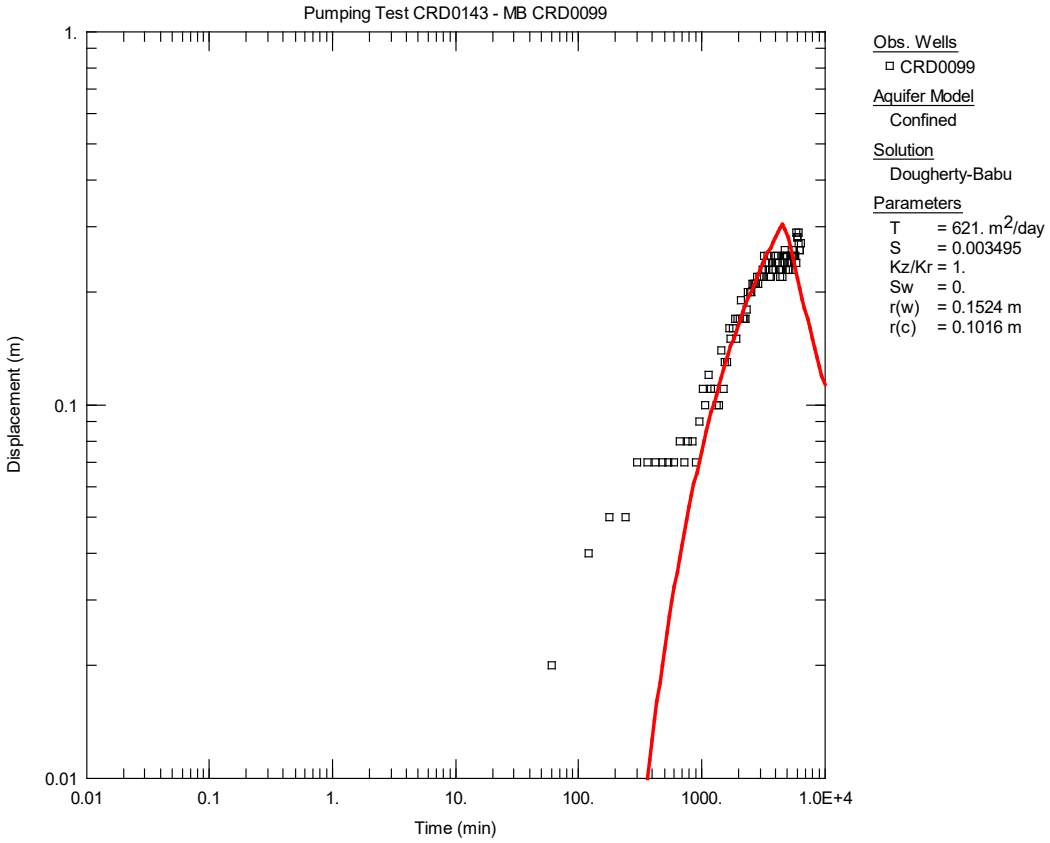



Pumping Test CRD0143 - MB CRD0156
Displacement (m)
1.
0.1
0.01
1.
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0156
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 519. m2/day
S = 0.005356
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

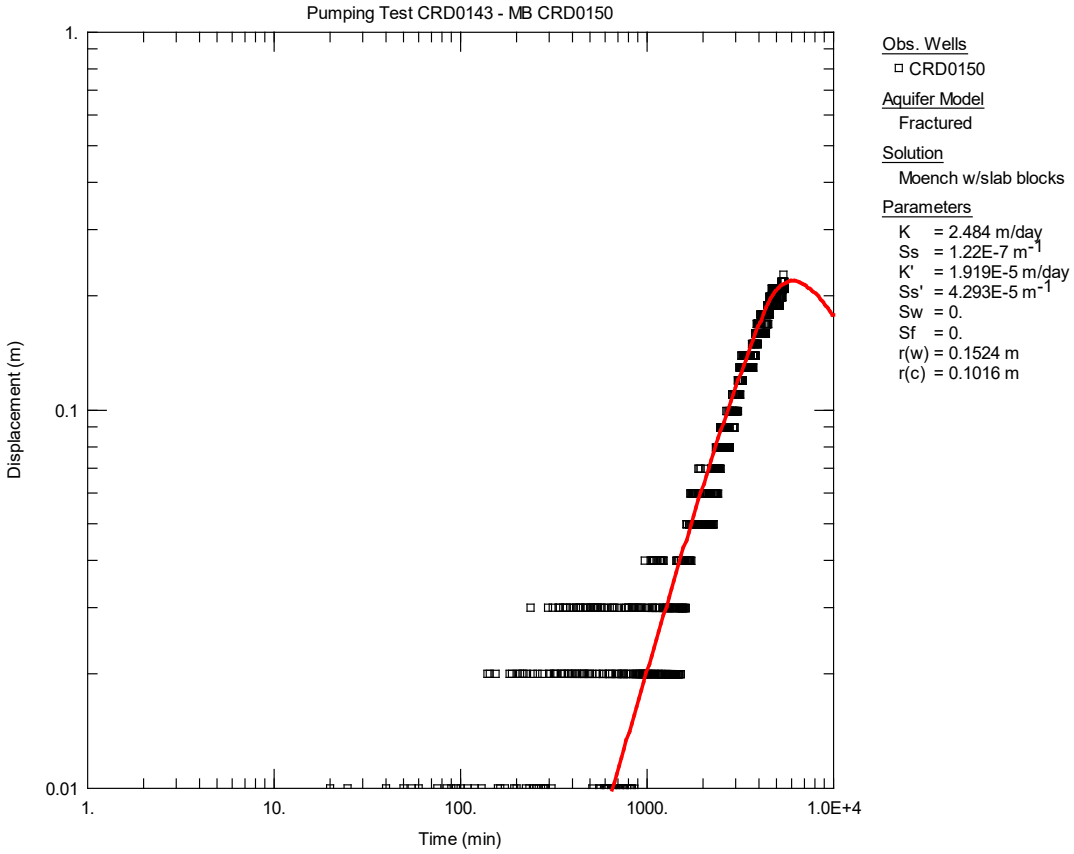
AQTESOLV Analytical Solutions - Monitoring Well CRD0099

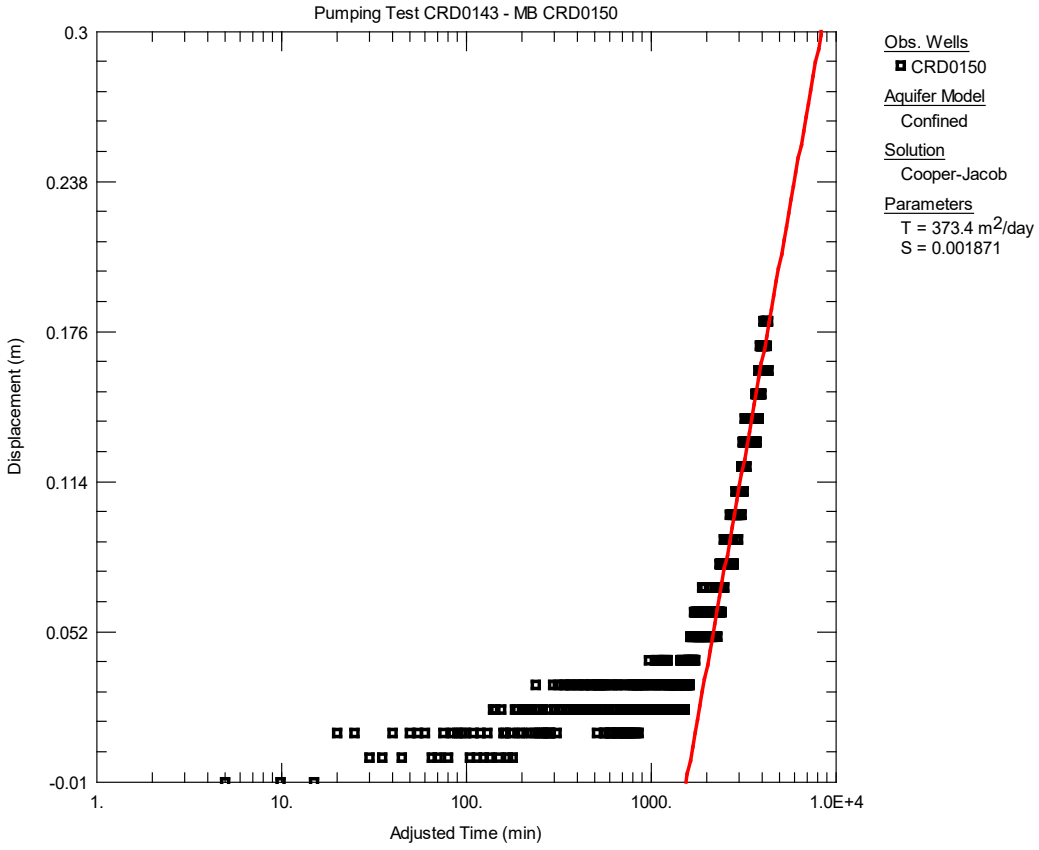


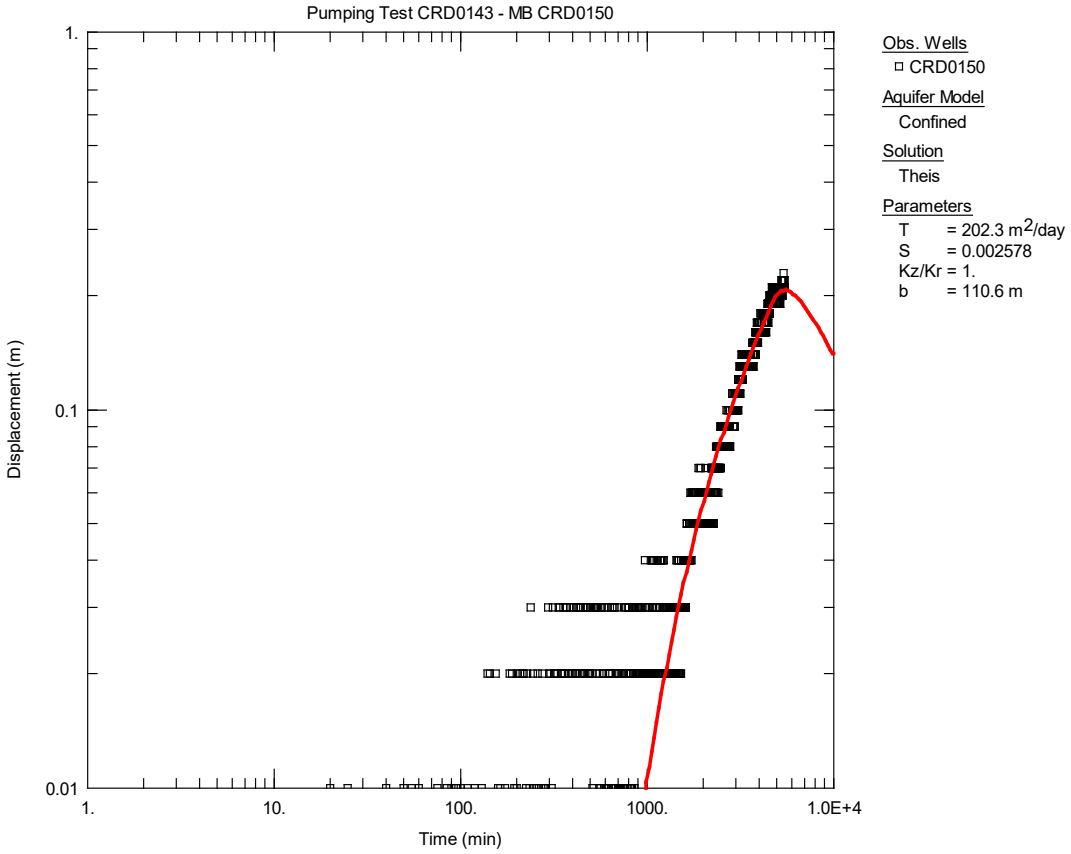



Pumping Test CRD0143 - MB CRD0099
Displacement (m)
1.
0.1
0.01
0.01
0.1
1.
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0099
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 621. m2/day
S = 0.003495
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

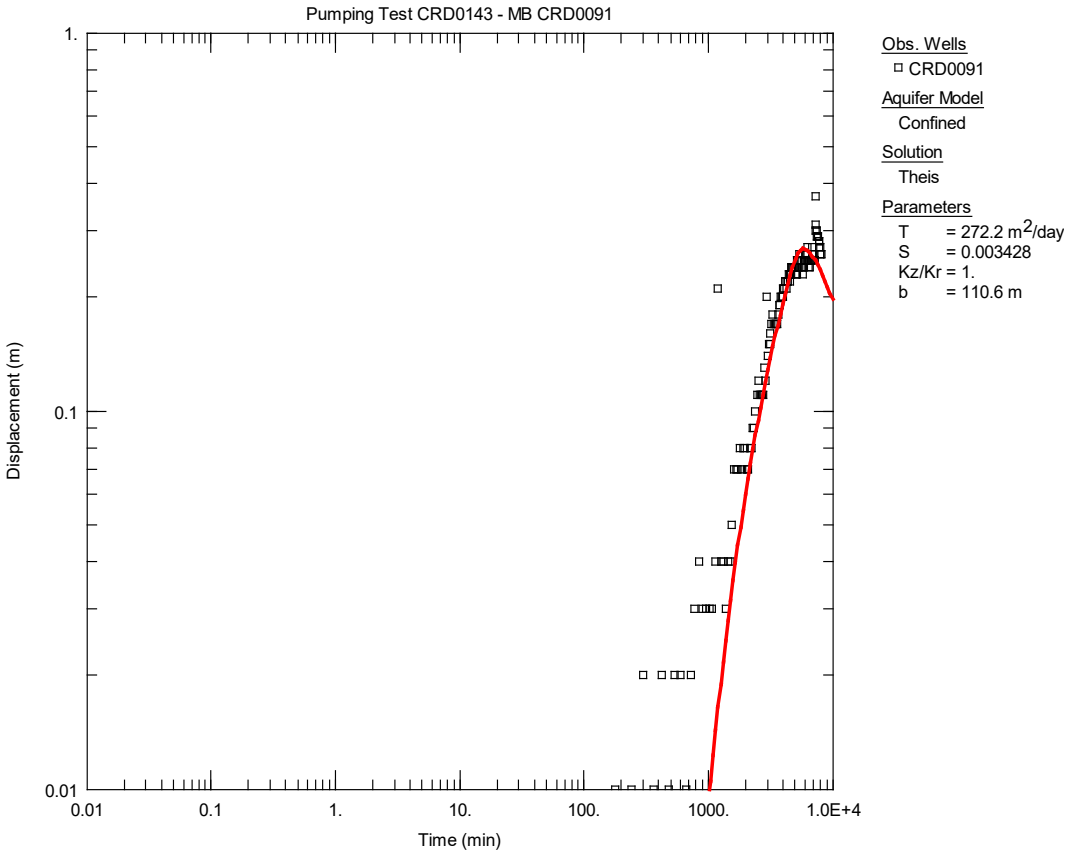
AQTESOLV Analytical Solutions - Monitoring Well CRD0150

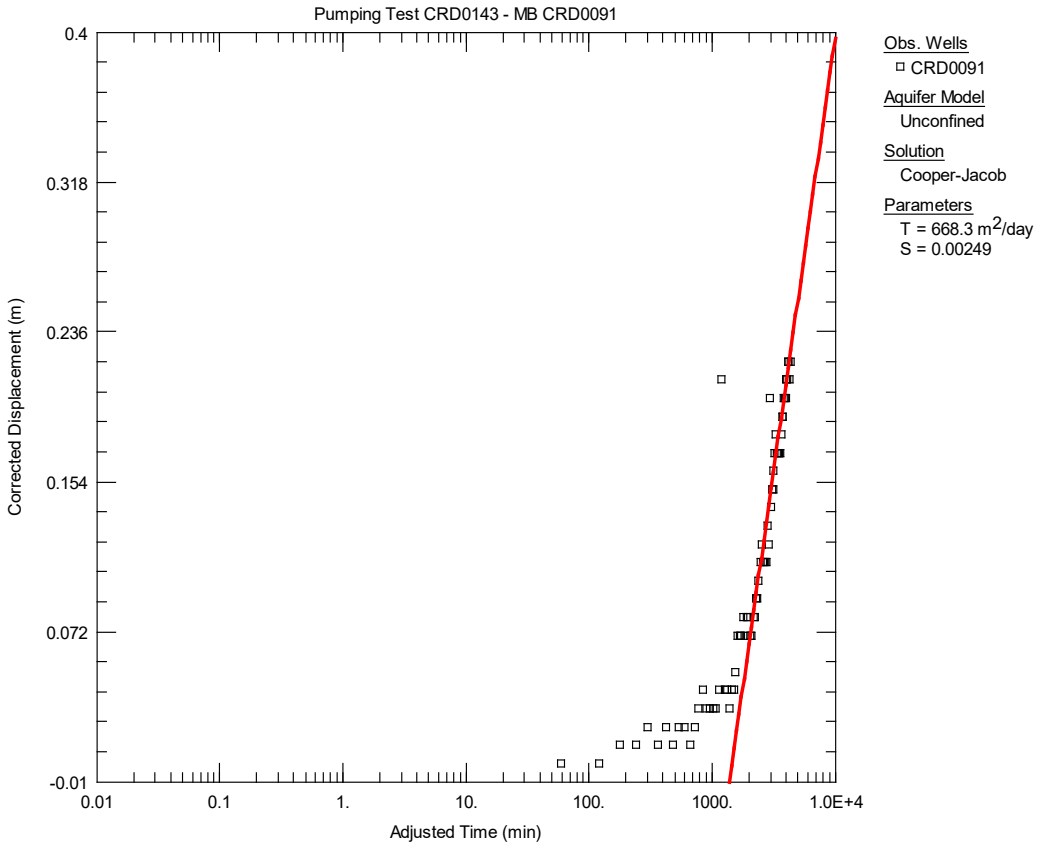


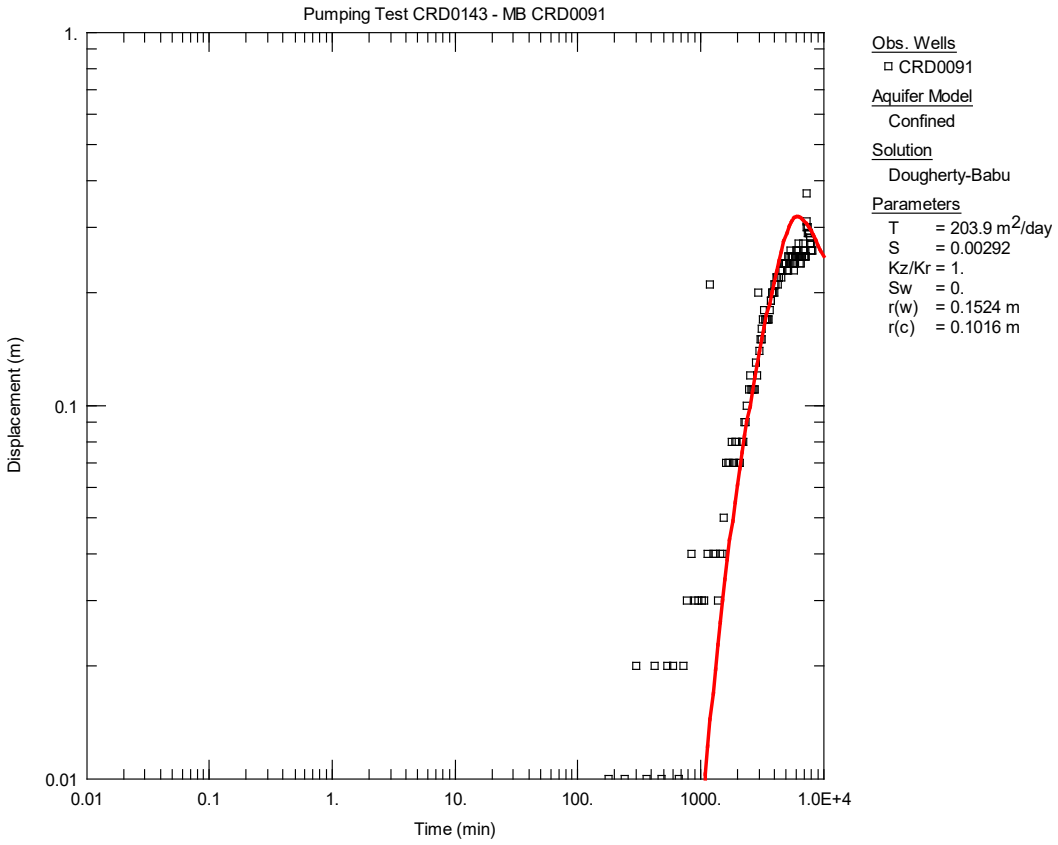



Pumping Test CRD0143 - MB CRD0150
Displacement (m)
1.
0.1
0.01
1.
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0150
Aquifer Model
Confined
Solution
Theis
Parameters
T = 202.3 m2/day
S = 0.002578
Kz/Kr = 1.
b = 110.6 m

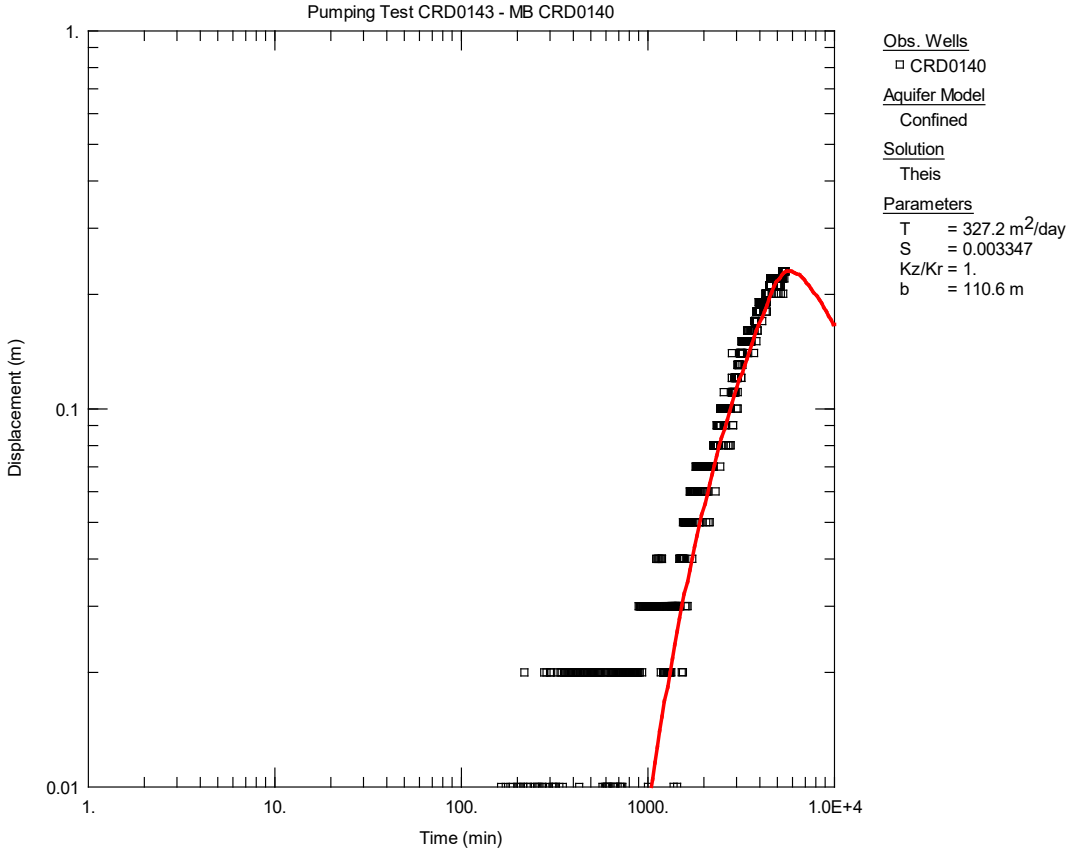
AQTESOLV Analytical Solutions - Monitoring Well CRD0091

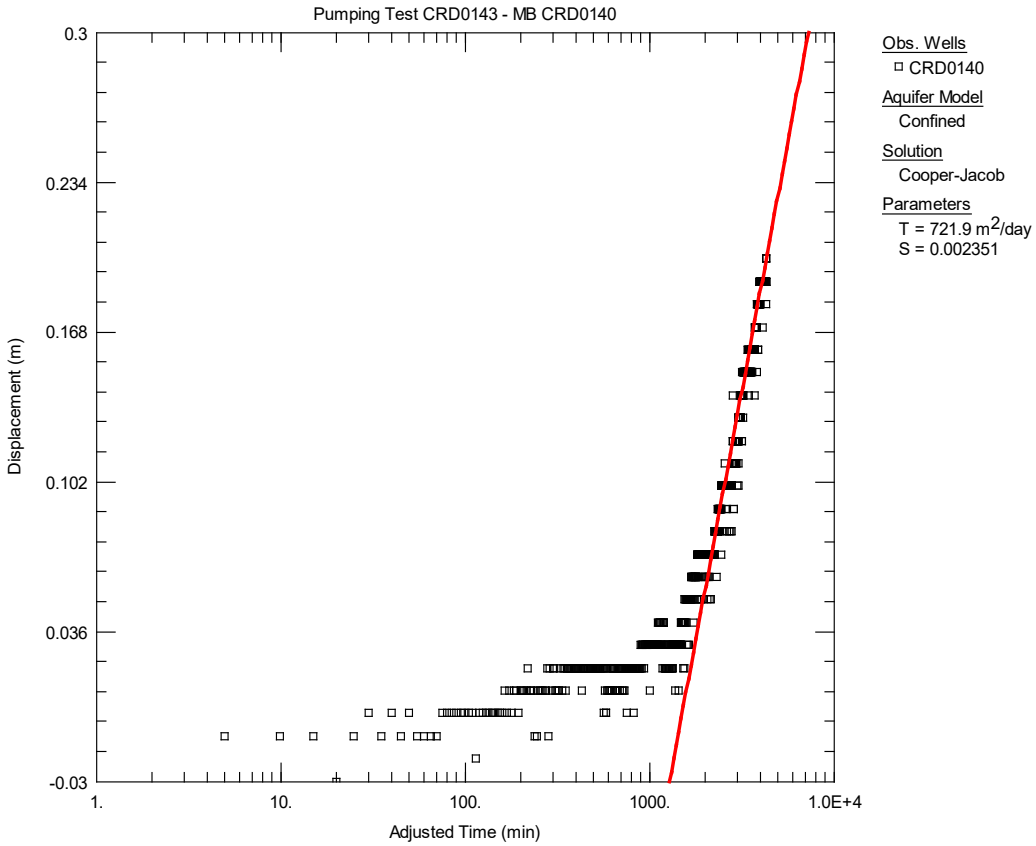


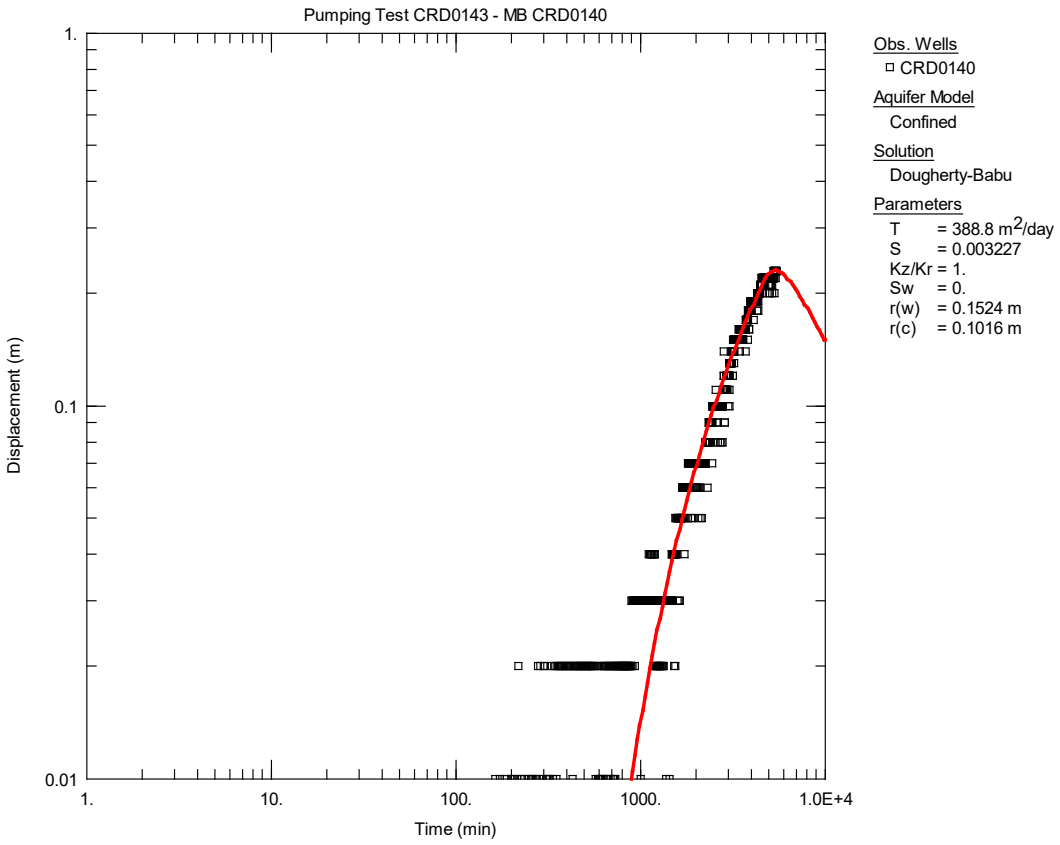



Pumping Test CRD0143 - MB CRD0091
Displacement (m)
1.
0.1
0.01
0.01
0.1
1.
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0091
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 203.9 m2/day
S = 0.00292
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

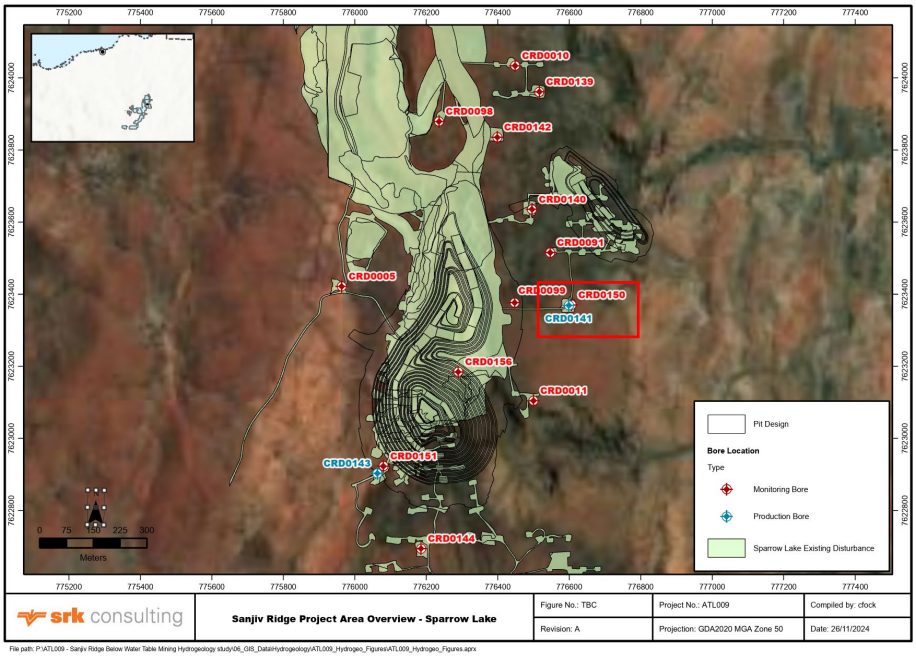
AQTESOLV Analytical Solutions - Monitoring Well CRD0140






Pumping Test CRD0143 - MB CRD0140
Displacement (m)
1.
0.1
0.01
1.
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0140
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 388.8 m2/day
S = 0.003227
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

Pumping Bore ID:	**CRD0141**
Date:	**3 November - 6 November 2024**
Pump Test Contractor:	**Airwell Group**



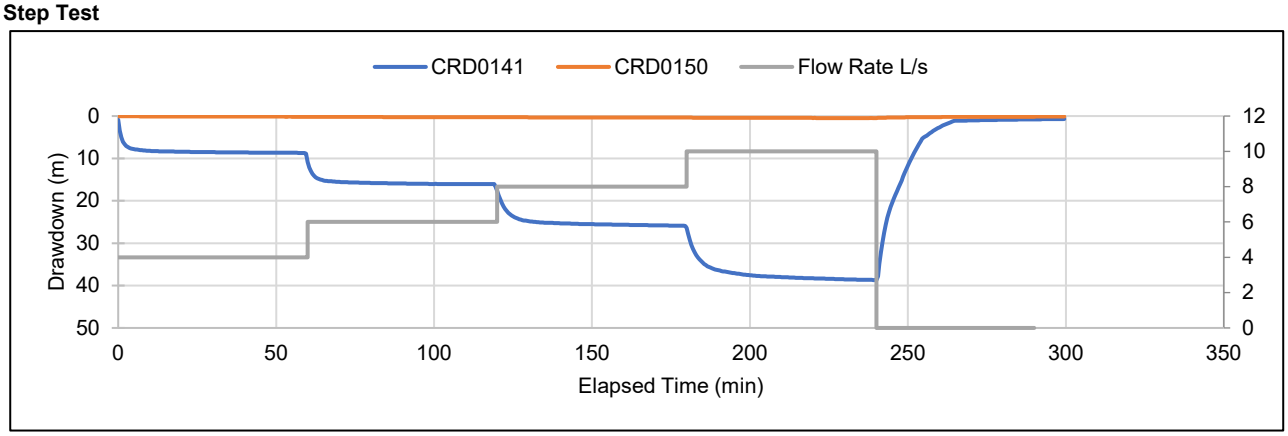
Bore Details	Production Bore	Observation Bore 1	Observation Bore 2	Observation Bore 3	Observation Bore 4	Observation Bore 5	Observation Bore 6
Bore ID	CRD0141	CRD0150	CRD0099	CRD0091	CRD0140	-	-
Easting	776597.37	776604.67	776446.10	776545.54	776494.53	-	-
Northing	7623367.13	7623368.06	7623374.92	7623513.80	7623633.61	-	-
Elevation (mASL)	429.59	429.376	-	-	423.289	-	-
Bore Hole Depth (m)	198	198	120	90	198	-	-
Slotted Interval (m)	84-198	96-198			66-198	-	-
Bore Hole Diameter (m)	0.3048	0.2032	0.2032	0.2032	0.2032	-	-
Casing Diameter (m)	0.2032	0.1016	0.0508	0.0508	0.1016	-	-
Well Configuration	Full	Full	Full	Full	Full	-	-
Aquifer Unit	Fracture Chert	Fracture Chert	-	-	Fracture Chert	-	-
Type of Aquifer	Confined	Confined	Confined	Confined	Confined	-	-
Aquifer Thickness (b) (m)	114	114	114	114	114	-	-

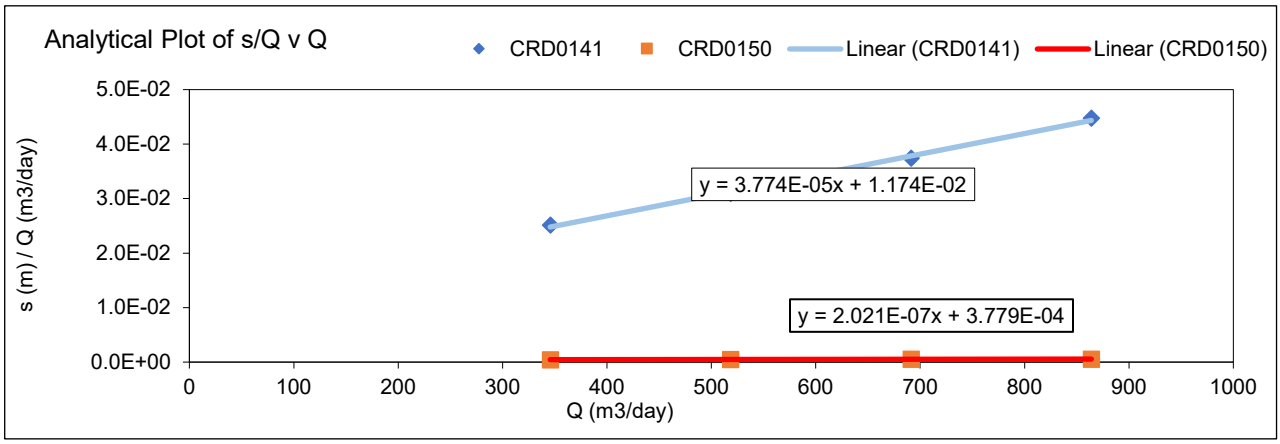
Groundwater Levels	Production Bore	Observation Bore 1	Observation Bore 2	Observation Bore 3	Observation Bore 4	Observation Bore 5	Observation Bore 6
SWL (mbTOC)	79.51	79.28	77.69	71.96	73.42		
TOC (m)	0.39	0.47	-	-	0.68		
Date	3/11/2024	3/11/2024	3/11/2024	3/11/2024	3/11/2024		
Time	8:00:00 AM	7:30:00 AM	7:20:00 AM	7:10:00 AM	8:00:00 AM		

Test Program	Date/Time	Duration (mins)	Rates (L/s)	Starting WL (mbTOC)
Calibration	2/11/2024 15:00	60	2, 4, 6, 8	- -
Recovery	-	- -	- -	- -
Step Test	3/11/2024 8:00	240	4, 6, 8, 10	79.51
Recovery	3/11/2024 12:00	60	-	111.11
CRT	3/11/2024 14:00	4320	8	79.51
Recovery	6/11/2024 14:00	1020	-	109.91

Groundwater Samples	10 mins	27-hours	48-hours	72-hours
CRT	X			X

Step Test





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)

C = Gradient (coefficient of turbulent flow loss or apparent well loss)

s = Drawdown in the borehole

P = Value determined using Rorabaugh's method of superposition

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

From plot of s/Q v Q (trend line equation) for CRD0141: **Intercept (B)** 1.174E-02

ANALYSIS TABLE **Gradient (C)** 3.774E-05

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	4.0	346	8.69	8.57	2.51E-02	47%
2	6.0	518	16.06	16.23	3.10E-02	38%
3	8.0	691	25.85	26.15	3.74E-02	31%
4	10.0	864	38.66	38.32	4.47E-02	26%

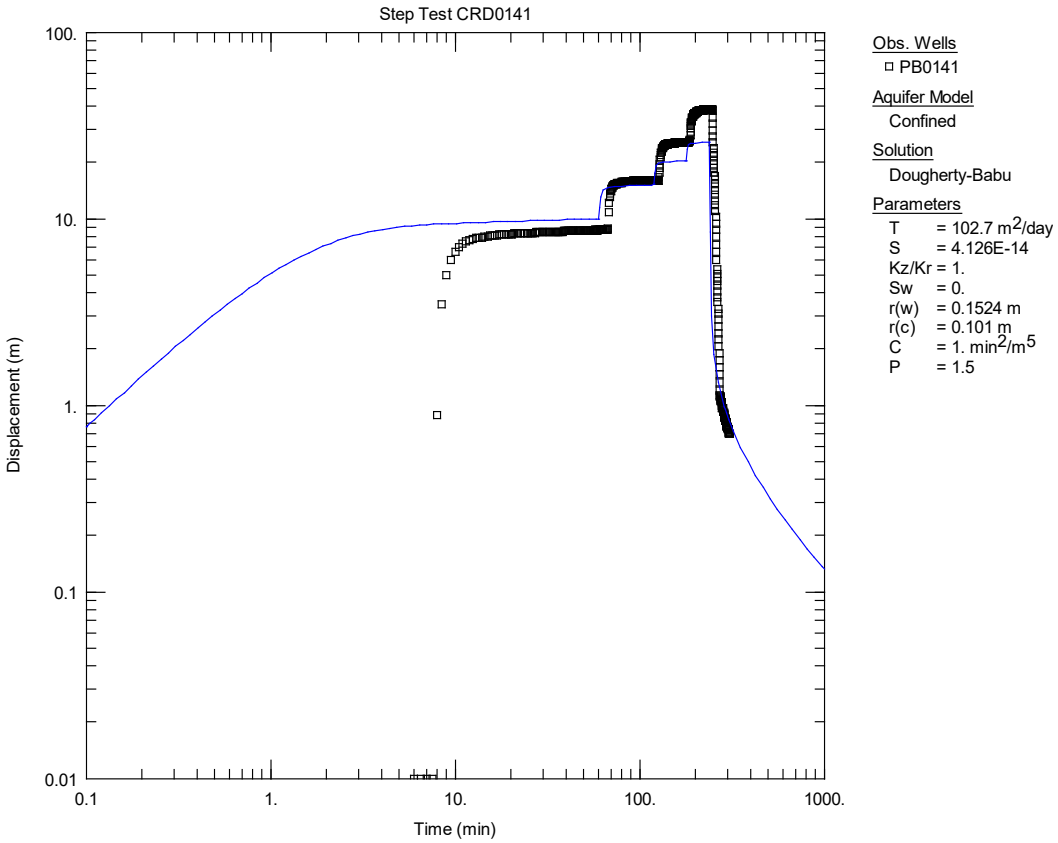
From plot of s/Q v Q (trend line equation) for CRD0150: **Intercept (B)** 3.779E-04

ANALYSIS TABLE **Gradient (C)** 2.021E-07

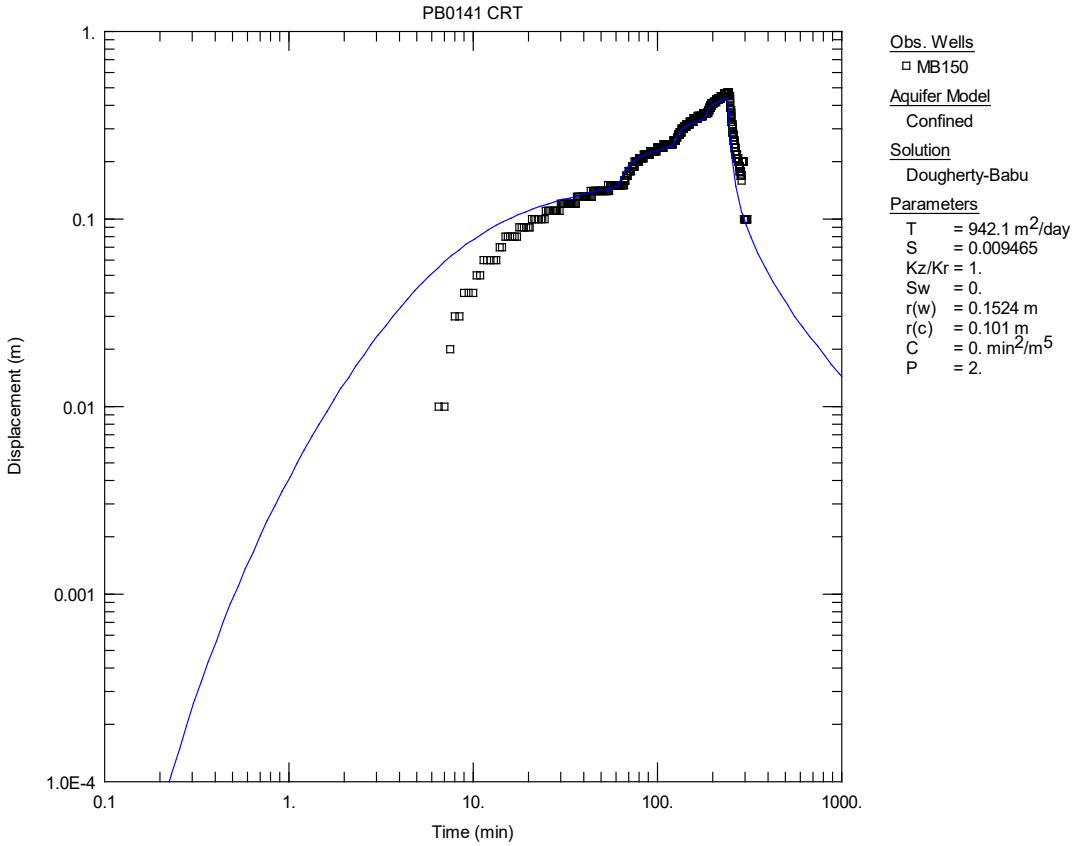
Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	4.0	346	0.15	0.15	4.34E-04	84%
2	6.0	518	0.26	0.25	5.02E-04	78%
3	8.0	691	0.36	0.36	5.21E-04	73%
4	10.0	864	0.47	0.48	5.44E-04	68%

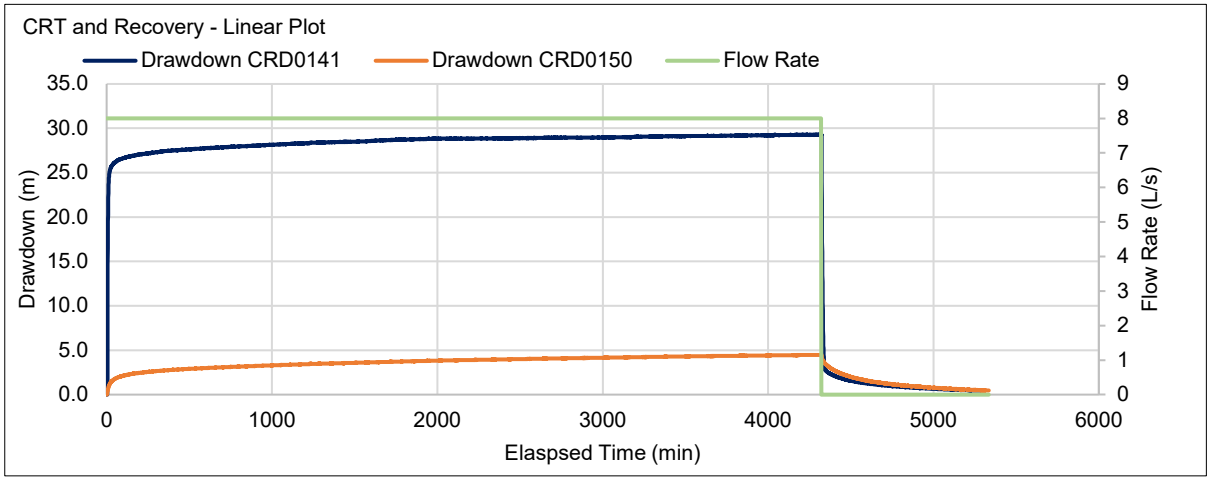
AQTESOLV Analytical Solutions - Pumped Well



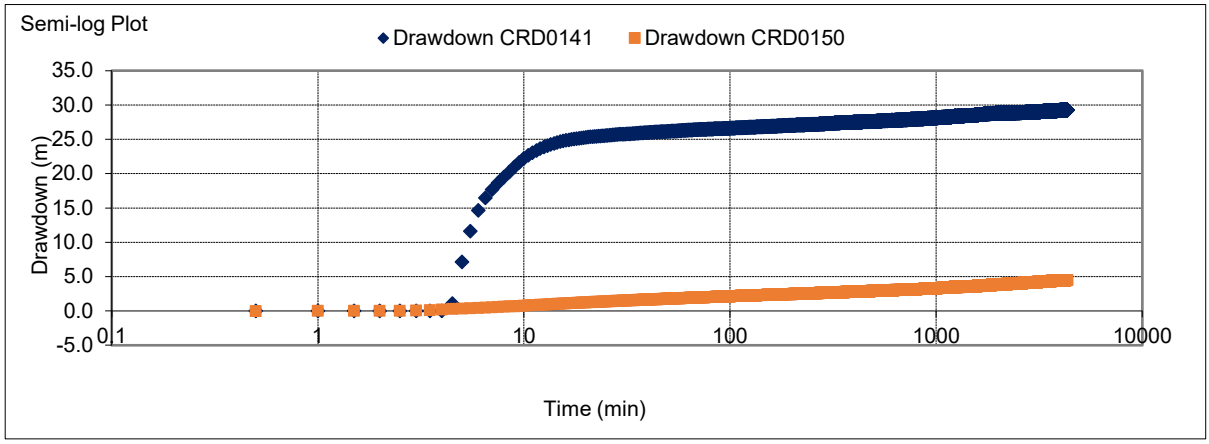
AQTESOLV Analytical Solutions - Monitoring Well

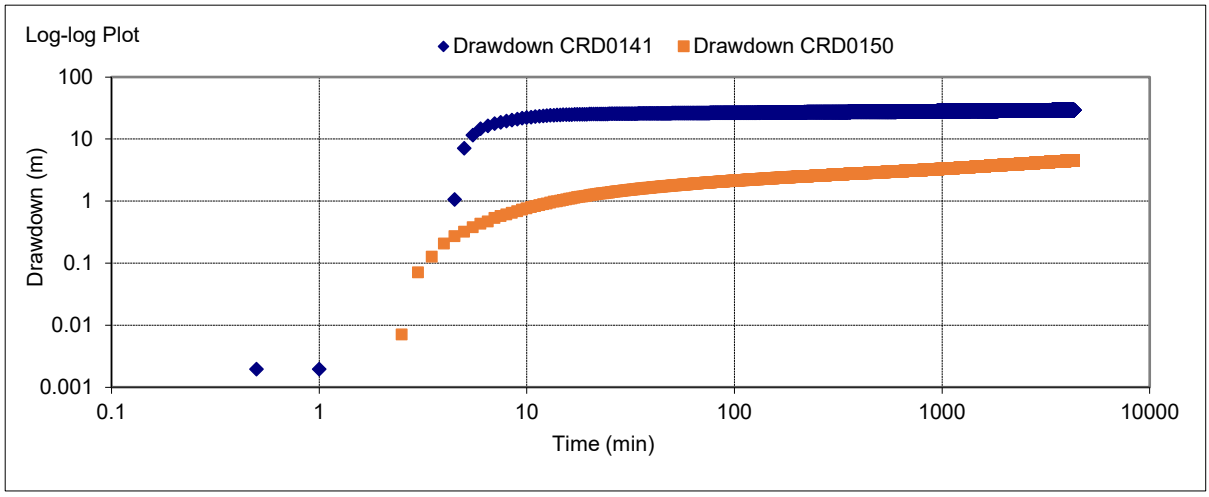


CRT

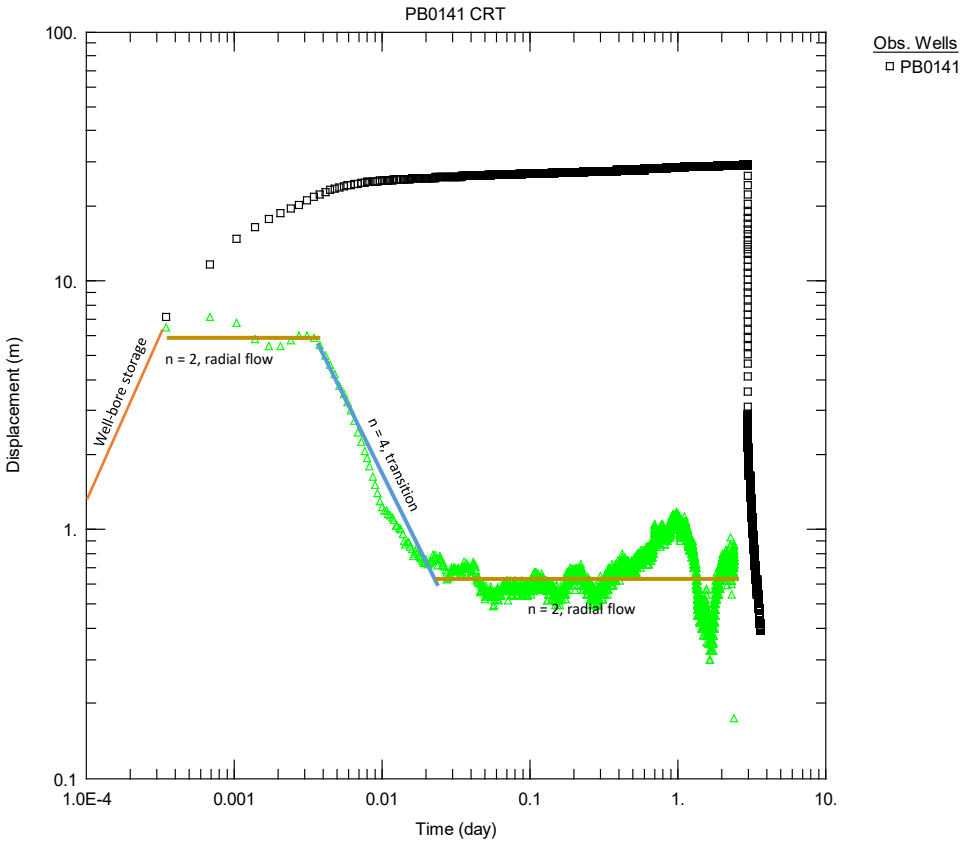


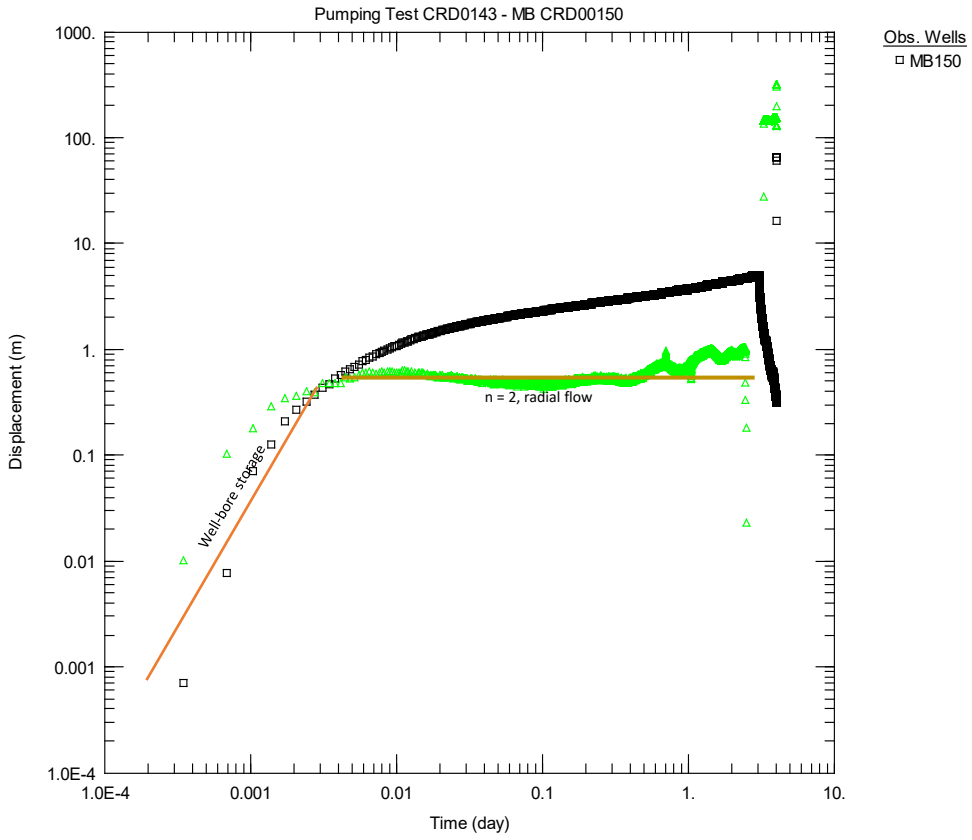
Diagnostic plots of drawdown data versus time for production bore and observation bore are shown below:



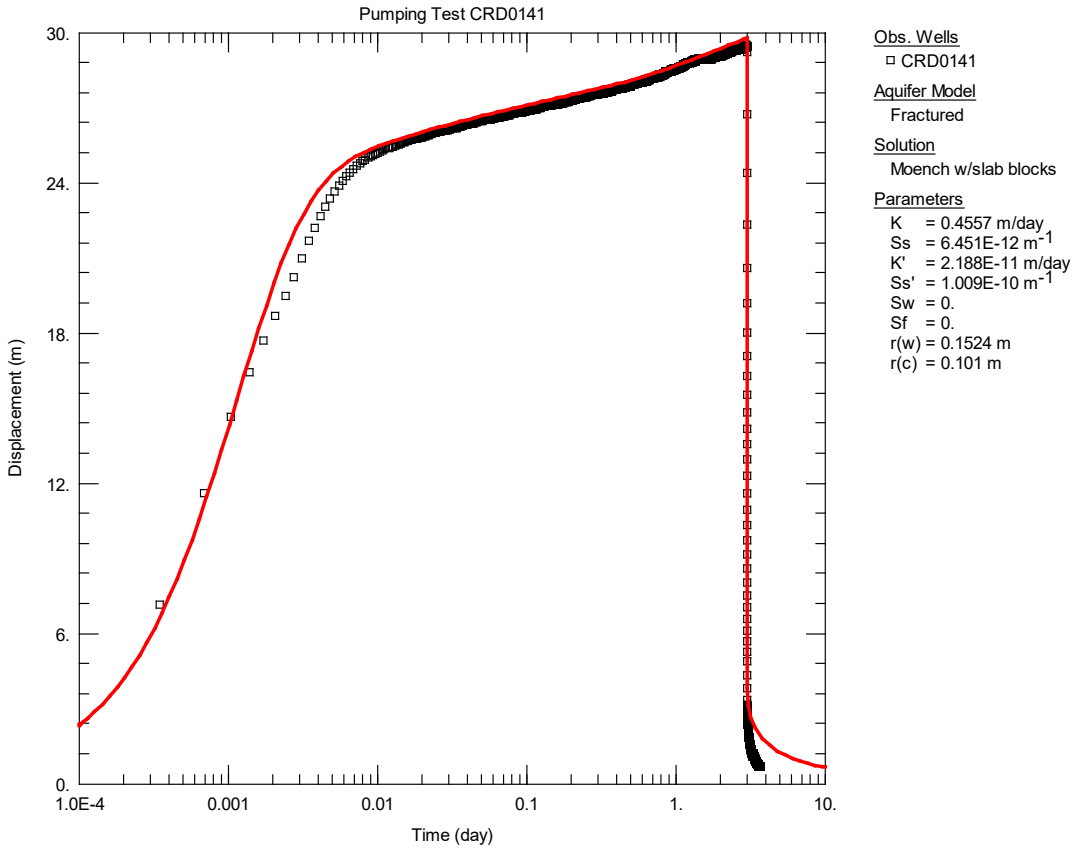


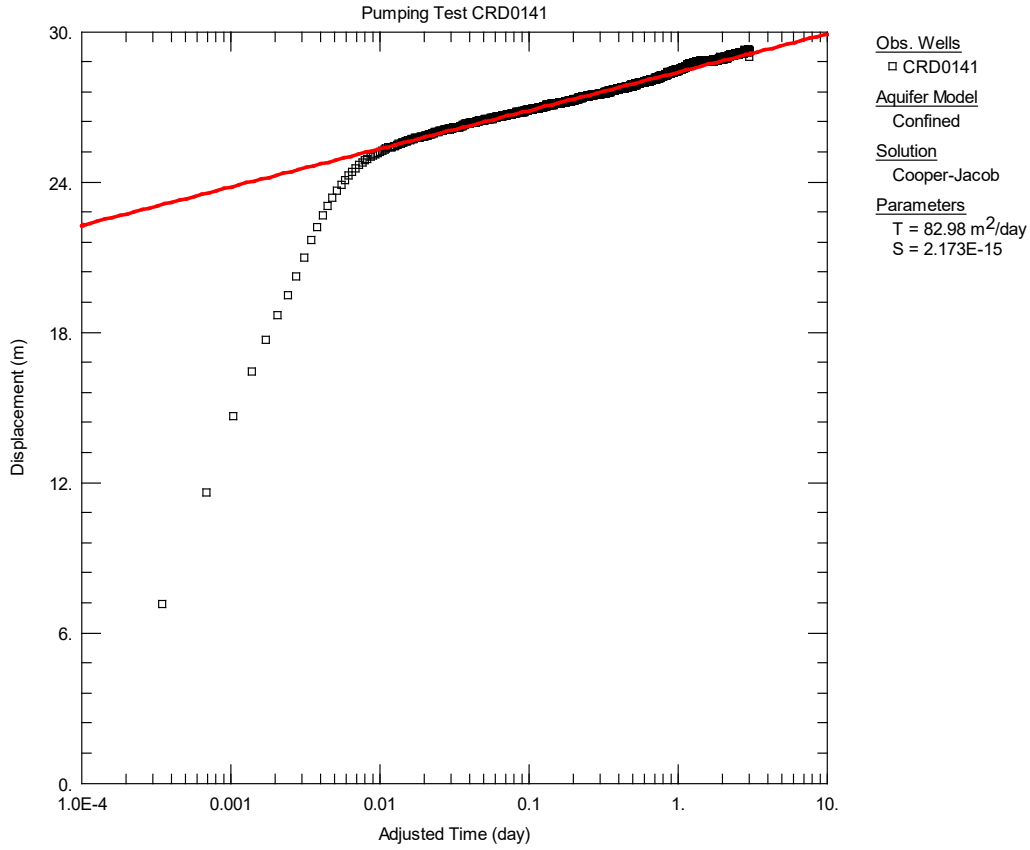
Derivative Plots



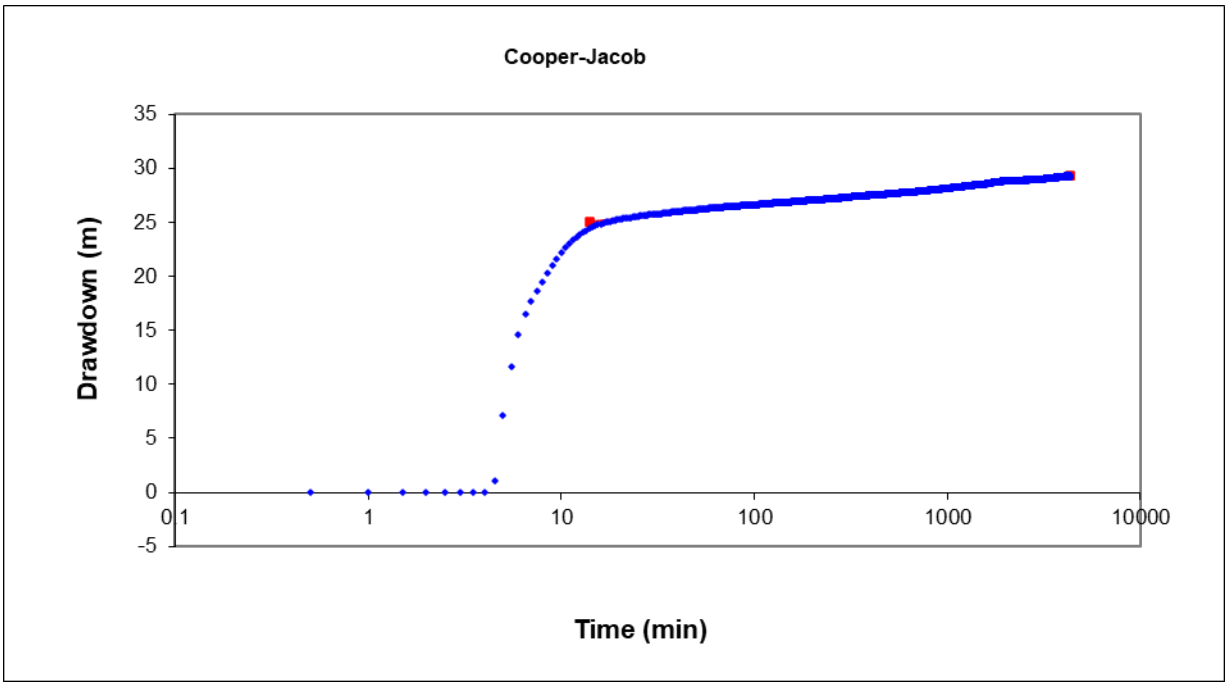


AQTESOLV Analytical Solutions - Pumped Well



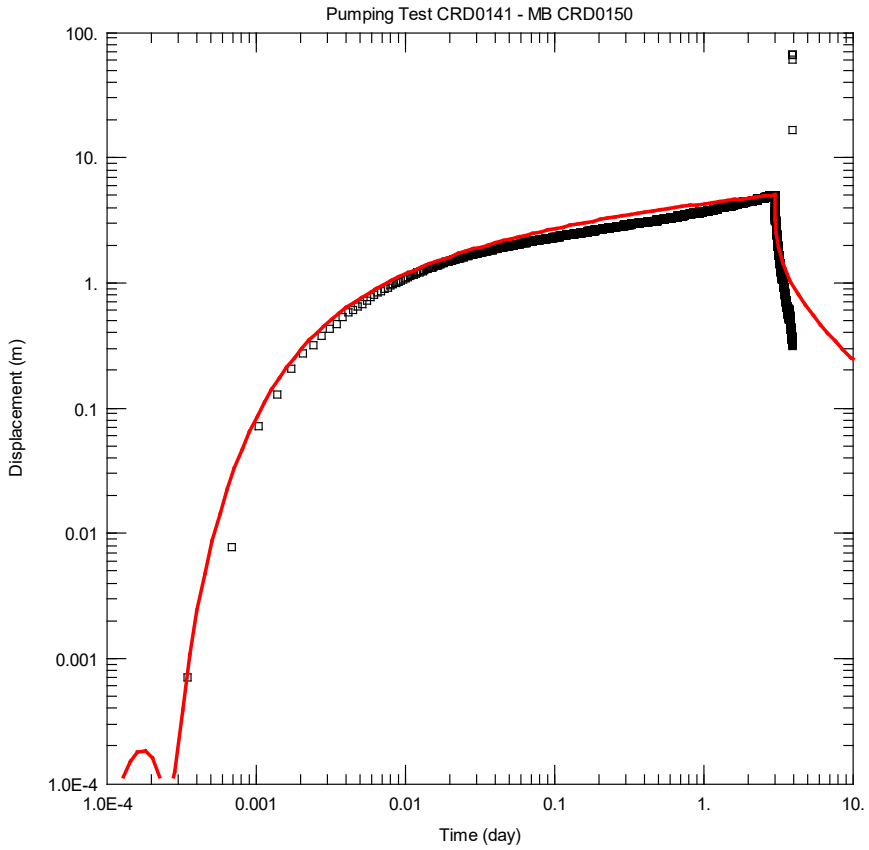


FC Analytical Solutions - Pumped Well



x0	y0	T(m2/d) =	91.60
14	25		
x1	**y1**		
4320	29.3		

AQTESOLV Analytical Solutions - Monitoring Well CRD0150

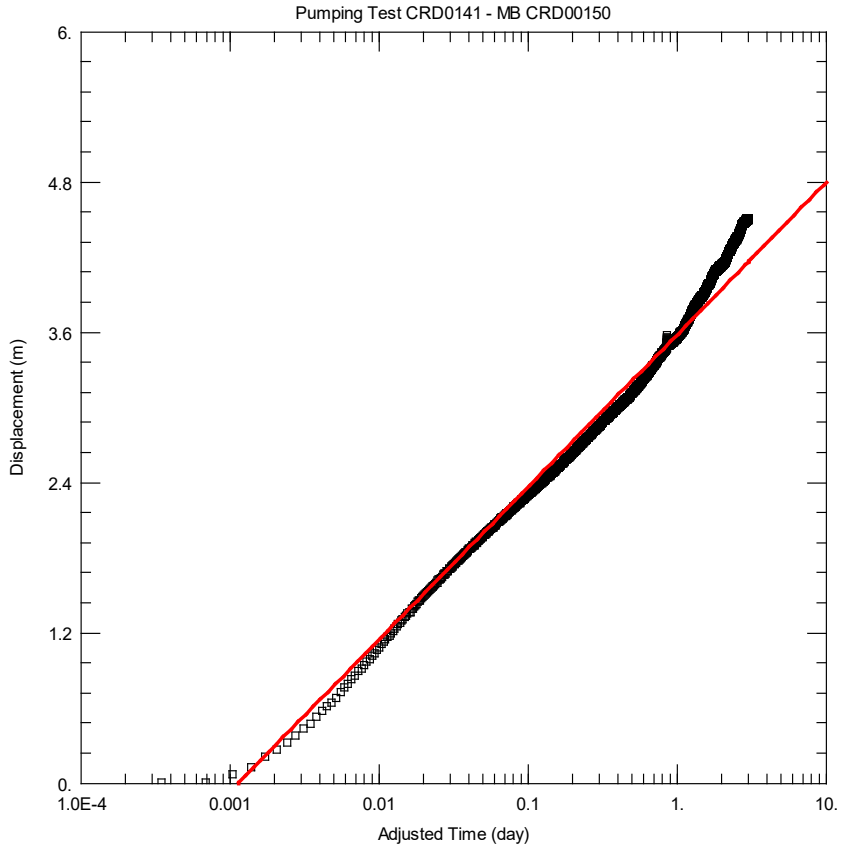


Obs. Wells
□ CRD0150

Aquifer Model
Fractured

Solution
Moench w/slab blocks

Parameters
K = 0.9024 m/day
Ss = 7.313E-5 m^{-1}
K' = 0.01 m/day
Ss' = 1.145E-7 m^{-1}
Sw = -0.15
Sf = 0.05
r(w) = 0.1524 m
r(c) = 0.101 m

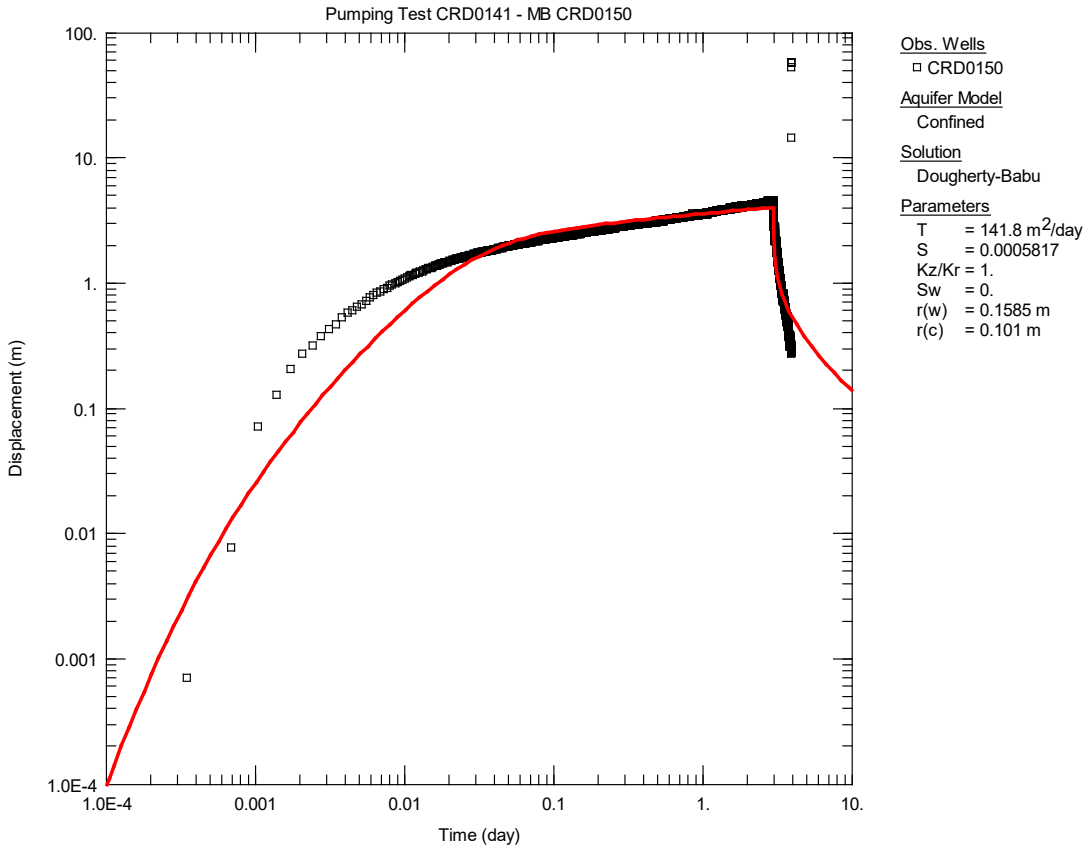


Obs. Wells
□ CRD0150

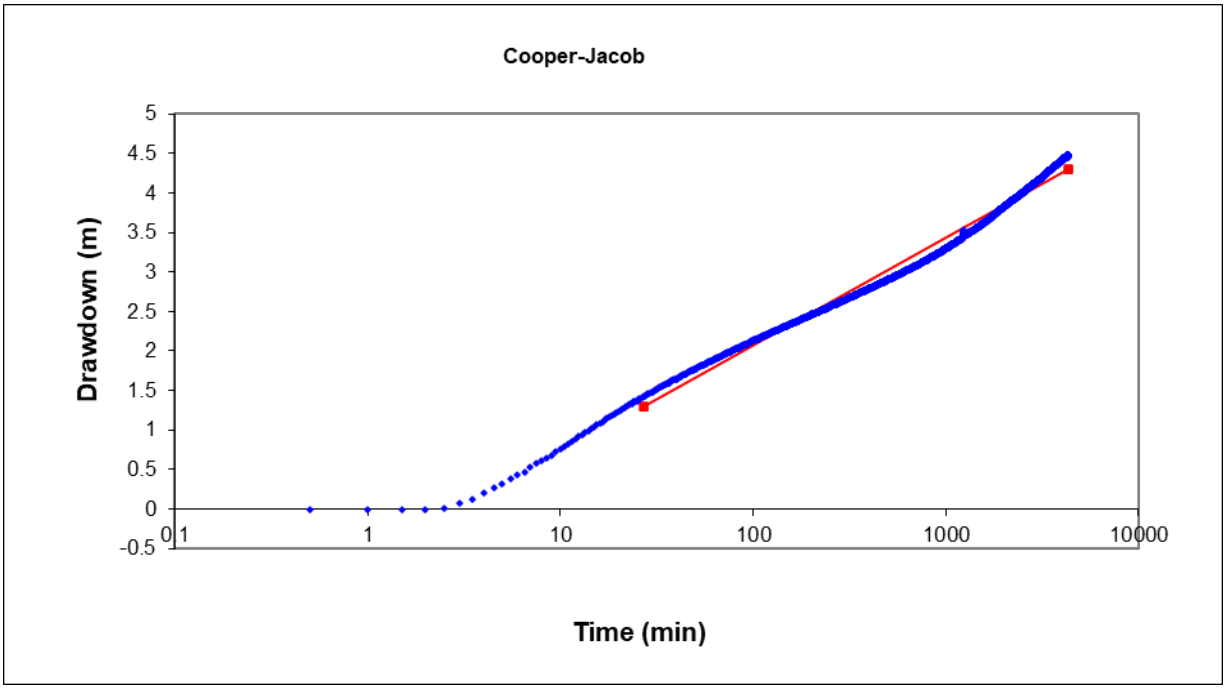
Aquifer Model
Confined

Solution
Cooper-Jacob

Parameters
T = 104.2 m^2/day
S = 0.00494

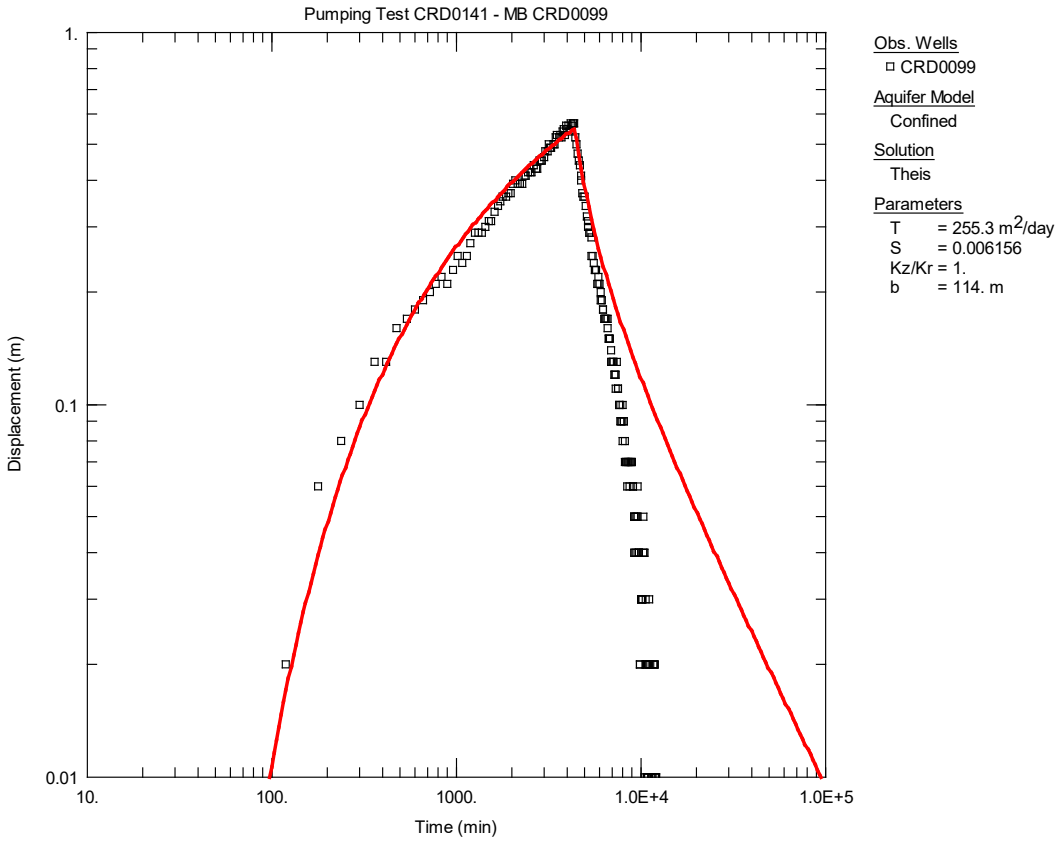


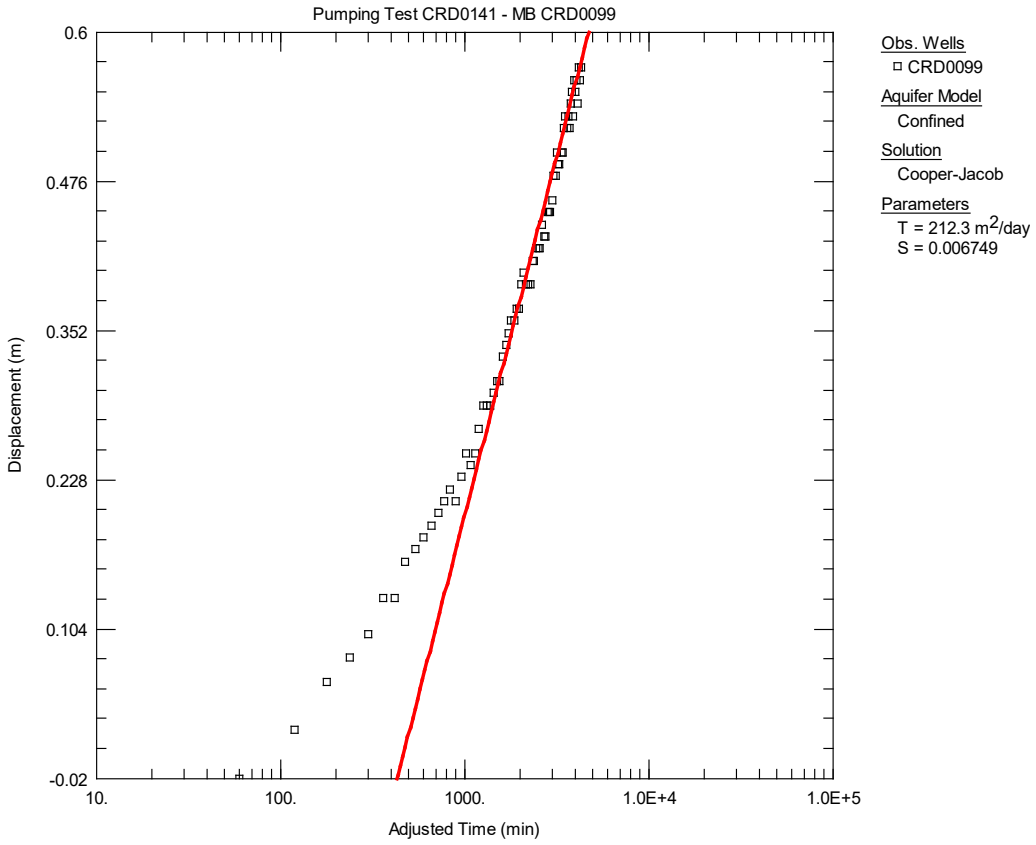
FC Analytical Solutions - Monitoring Well CRD0150

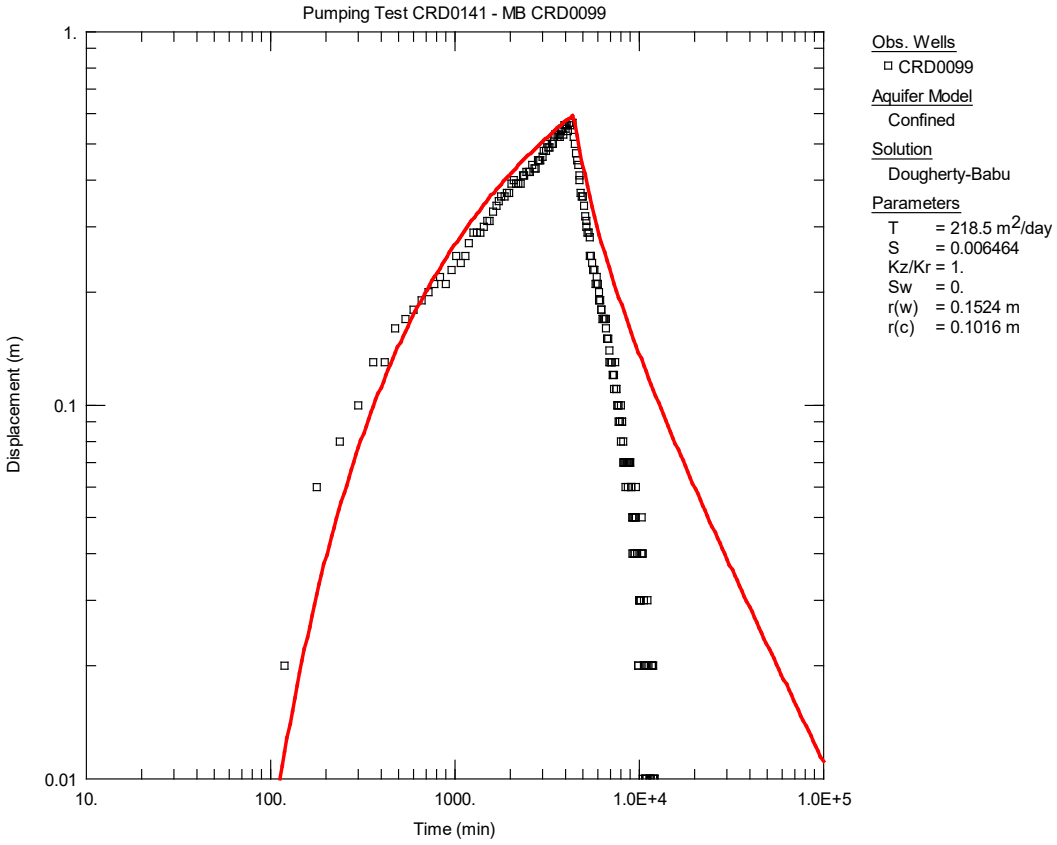


x0	y0	T(m2/d) =	116.20
27.1	1.3	S =	2.19E-02
x1	y1		
4320	4.3		

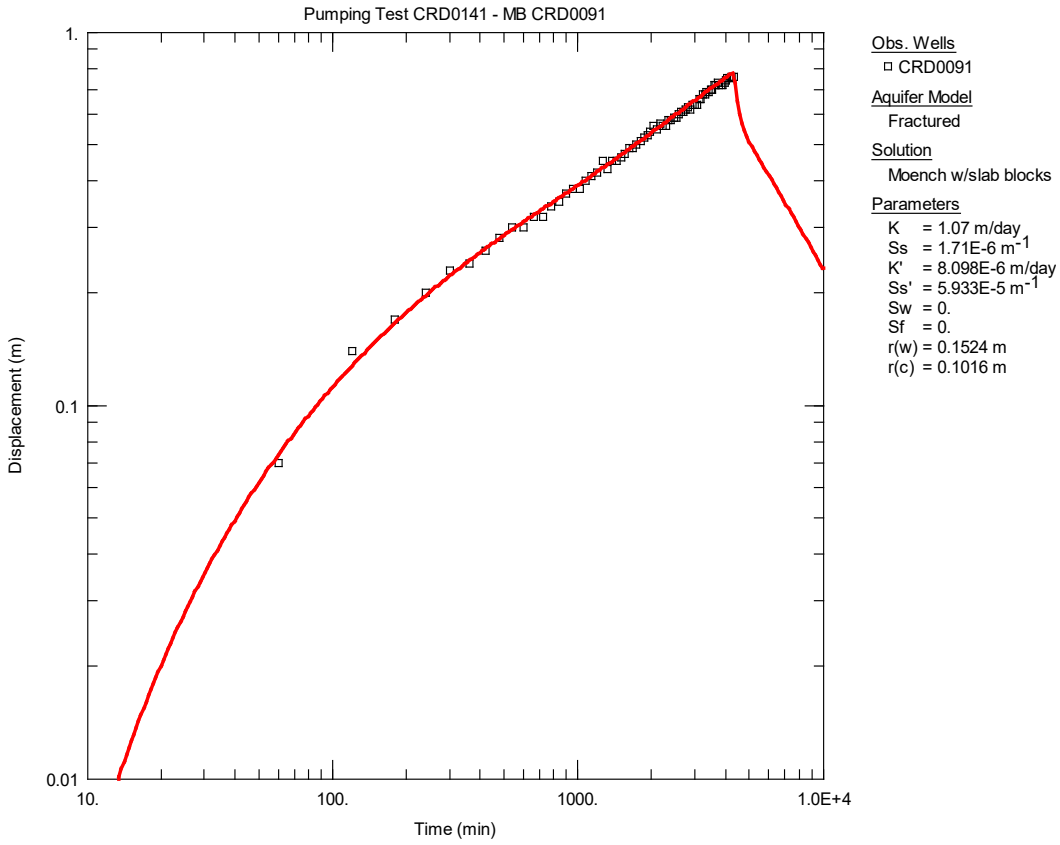
AQTESOLV Analytical Solutions - Monitoring Well CRD0099

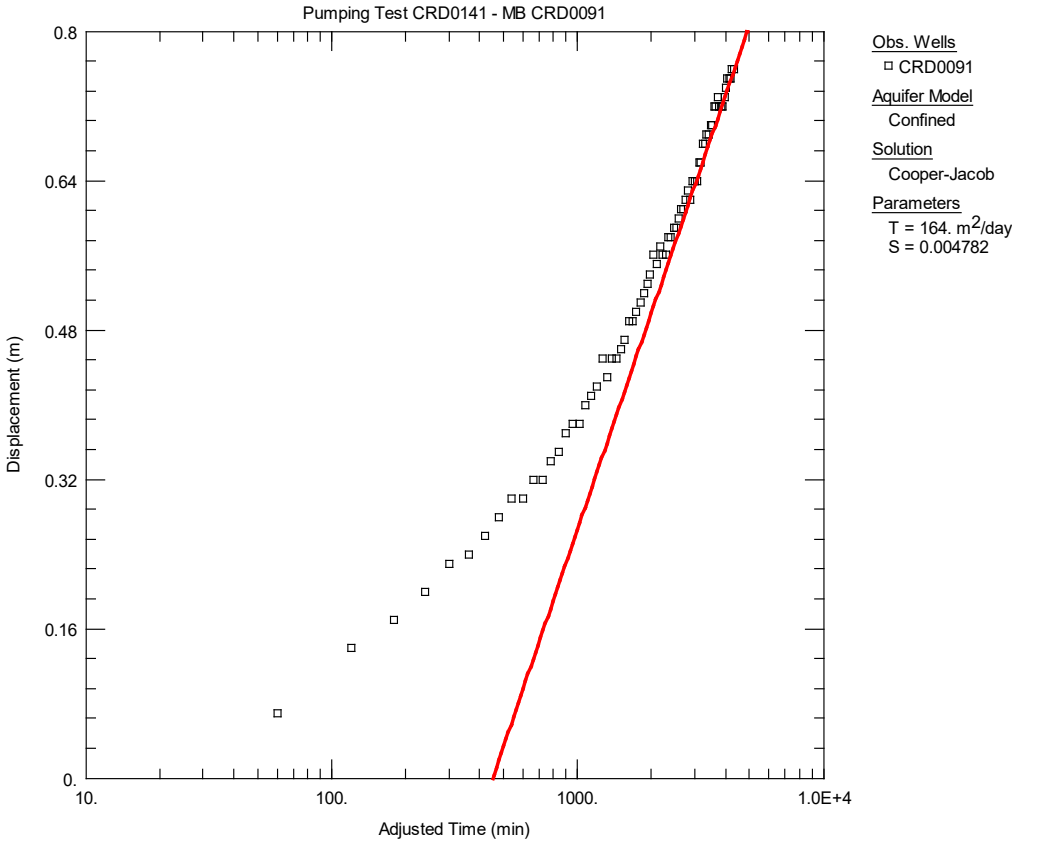


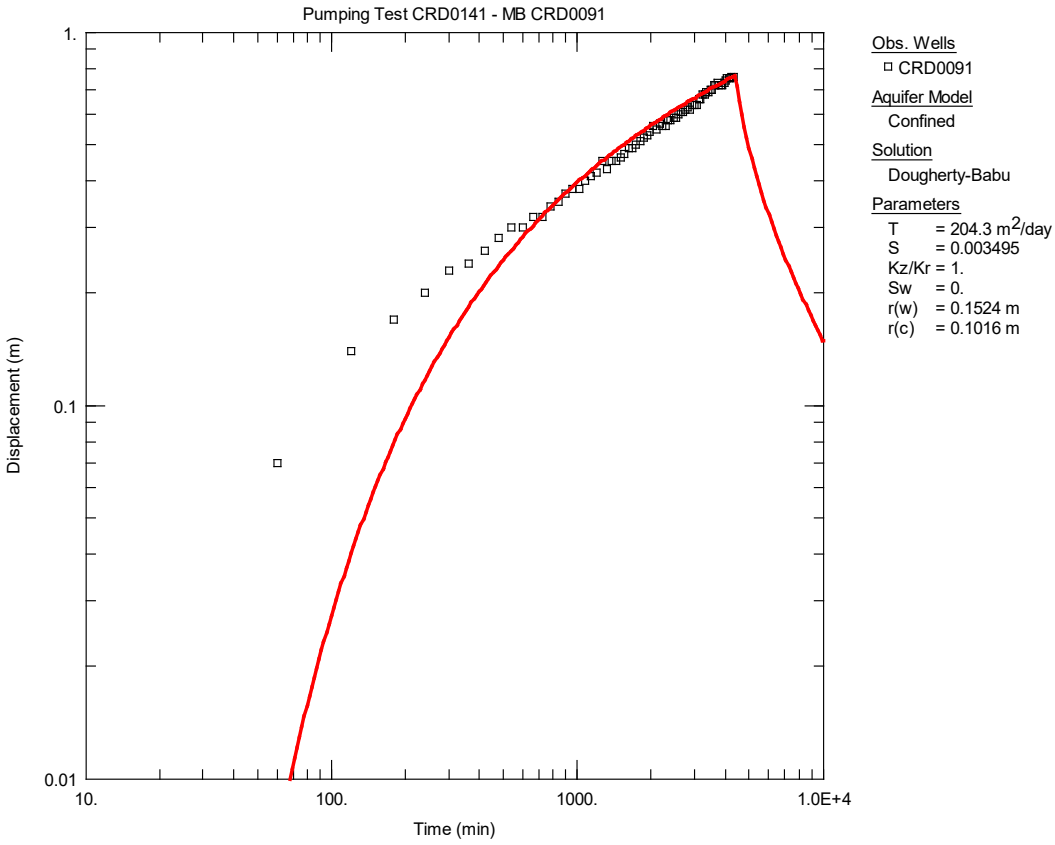



Pumping Test CRD0141 - MB CRD0099
Displacement (m)
1.
0.1
0.01
10.
100.
1000.
1.0E+4
1.0E+5
Time (min)
Obs. Wells
CRD0099
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 218.5 m2/day
S = 0.006464
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

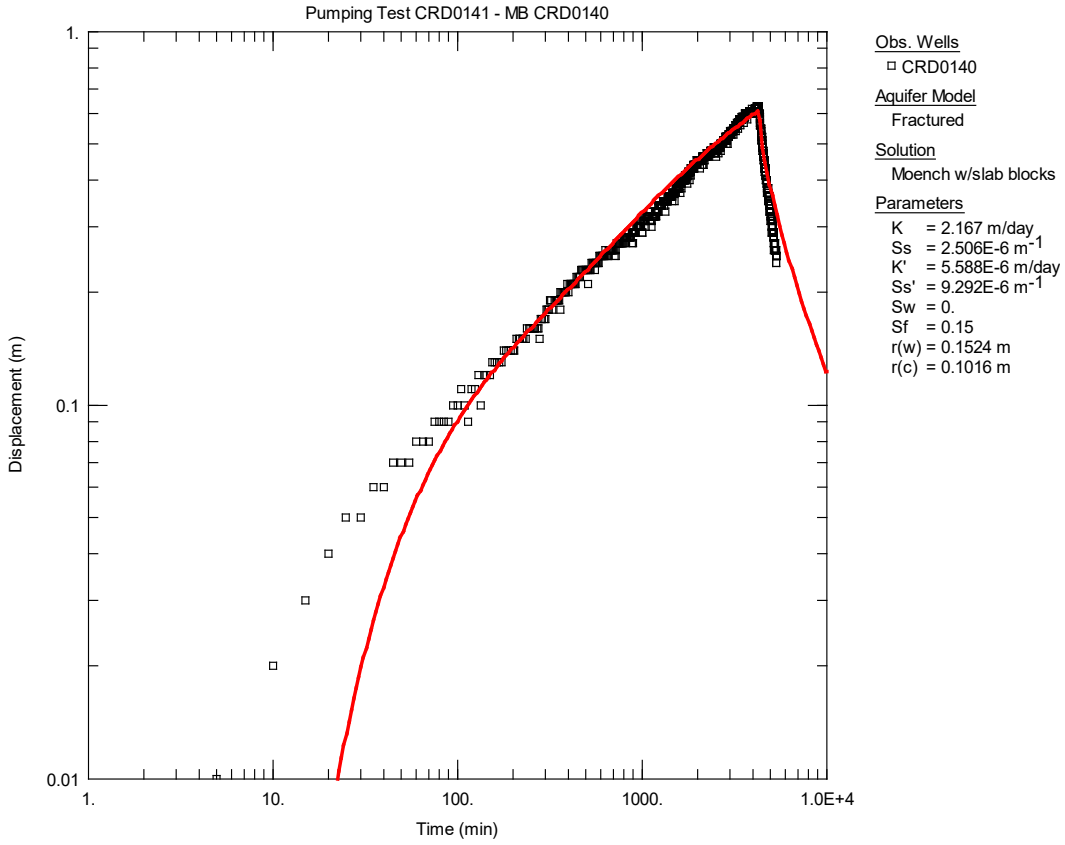
AQTESOLV Analytical Solutions - Monitoring Well CRD0091

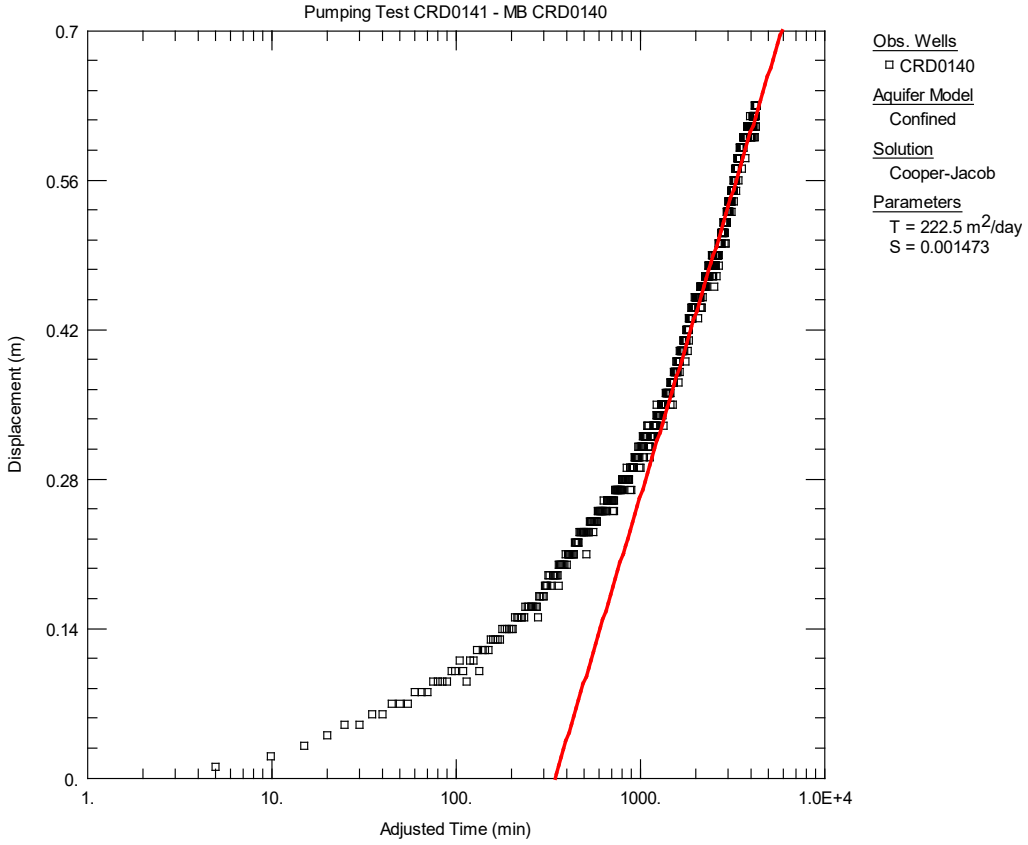


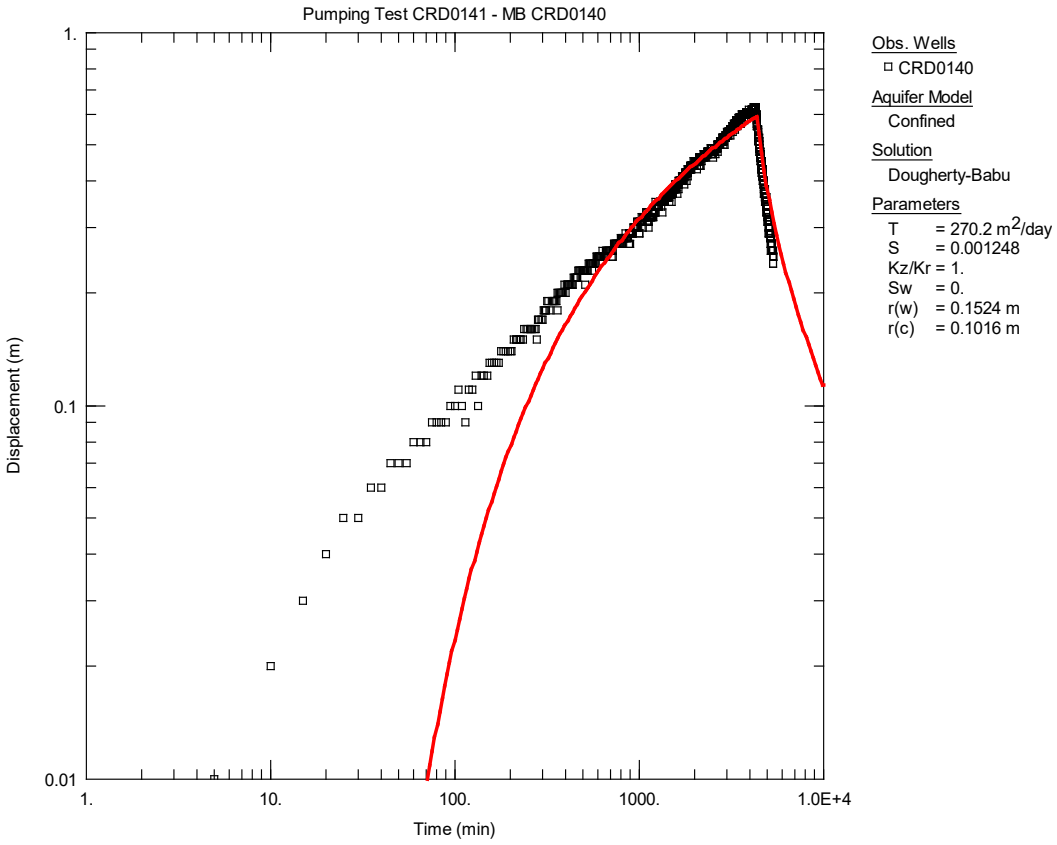



Pumping Test CRD0141 - MB CRD0091
Displacement (m)
1.
0.1
0.01
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0091
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 204.3 m2/day
S = 0.003495
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

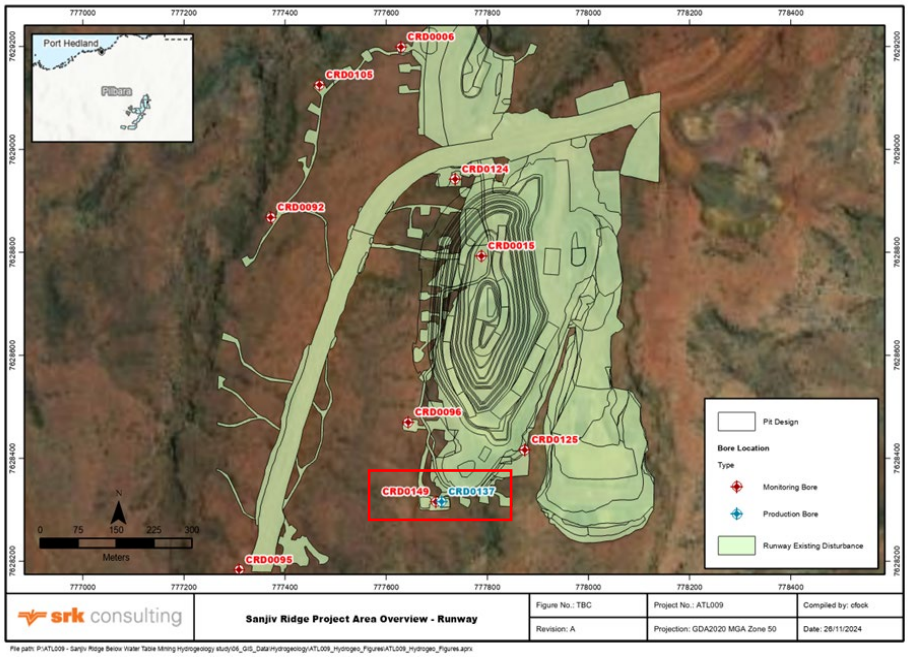
AQTESOLV Analytical Solutions - Monitoring Well CRD0140






Pumping Test CRD0141 - MB CRD0140
Displacement (m)
1.
0.1
0.01
1.
10.
100.
1000.
1.0E+4
Time (min)
Obs. Wells
CRD0140
Aquifer Model
Confined
Solution
Dougherty-Babu
Parameters
T = 270.2 m2/day
S = 0.001248
Kz/Kr = 1.
Sw = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m

Pumping Bore ID:	CRD0137
Date:	11 November - 14 November 2024
Pump Test Contractor:	Airwell Group



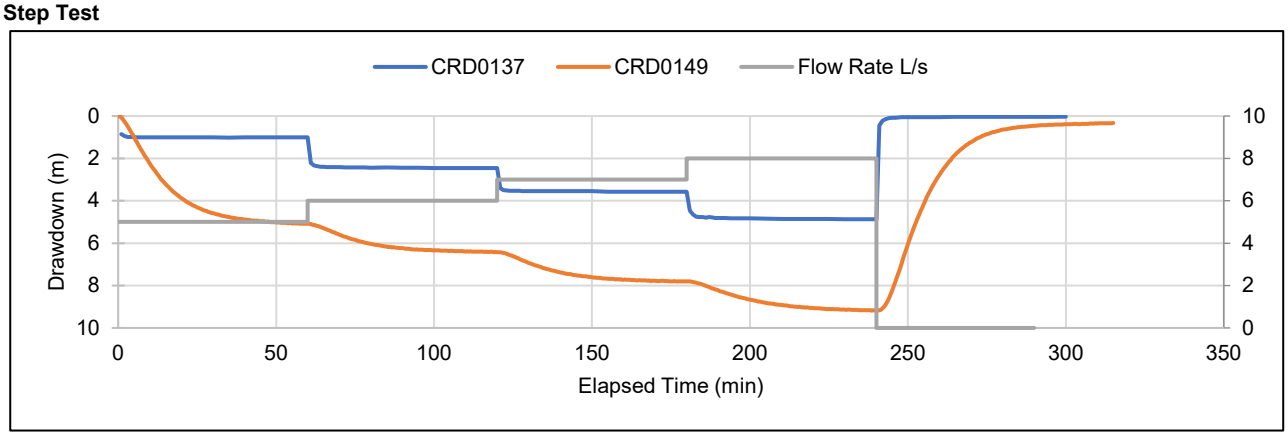
Bore Details	Production Bore	Observation Bore 1	Observation Bore 2
Bore ID	CRD0137	CRD0149	-
Easting	777708.453	777696.993	-
Northing	7628315.525	7628315.426	-
Elevation (mASL)	398.81	399.071	-
Bore Hole Depth (m)	208	212	-
Slotted Interval (m)	82-208	84-210	-
Bore Hole Diameter (m)	0.3048	0.2032	-
Casing Diameter (m)	0.2032	0.1016	-
Well Configuration	Full	Full	-
Aquifer Unit	Fractured Chert	Fractured Chert	-
Confined, Unconfined, Leaky	Confined	Confined	-
Aquifer Thickness (b) (m)	126	126	-

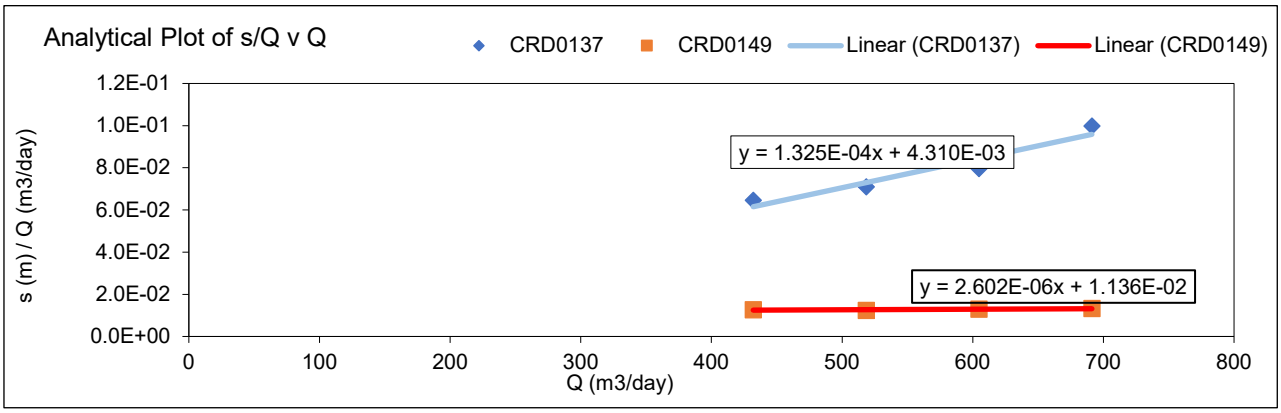
Groundwater Levels	Production Bore	Observation Bore 1	Observation Bore 2
SWL (mbTOC)	75.96	76.5	-
TOC (m)	0.523	0.752	
Date/Time	8/11/2024 14:55	8/11/2024 15:00	

Test Program	Date/Time	Duration (mins)	Rates (L/s)	Starting WL (mbTOC)	
Calibration	10/11/2024 14:00	60	3, 4.5, 5.5, 6.5, 7.5	-	-
Recovery	-	- -	- -	-	-
Step Test	11/11/2024 7:30	240	5, 6, 7, 8	76.13	
Recovery	11/11/2024 11:30	60	-	137.12	
CRT	11/11/2024 13:00	4320	6.5	76.39	
Recovery	14/11/2024 13:00	90	-	122.09	

Groundwater Samples	10 mins	27-hours	48-hours	72-hours
CRT	X			X

Step Test





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole

P = Value determined using Rorabaugh's method of superposition

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

From plot of s/Q v Q (trend line equation) for CRD0137:

Intercept (B) 4.310E-03
Gradient (C) 1.325E-04

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	5.0	432	27.87	26.58	6.45E-02	7%
2	6.0	518	36.78	37.83	7.09E-02	6%
3	7.0	605	48.11	51.06	7.95E-02	5%
4	8.0	691	68.98	66.26	9.98E-02	4%

From plot of s/Q v Q (trend line equation) for CRD0149:

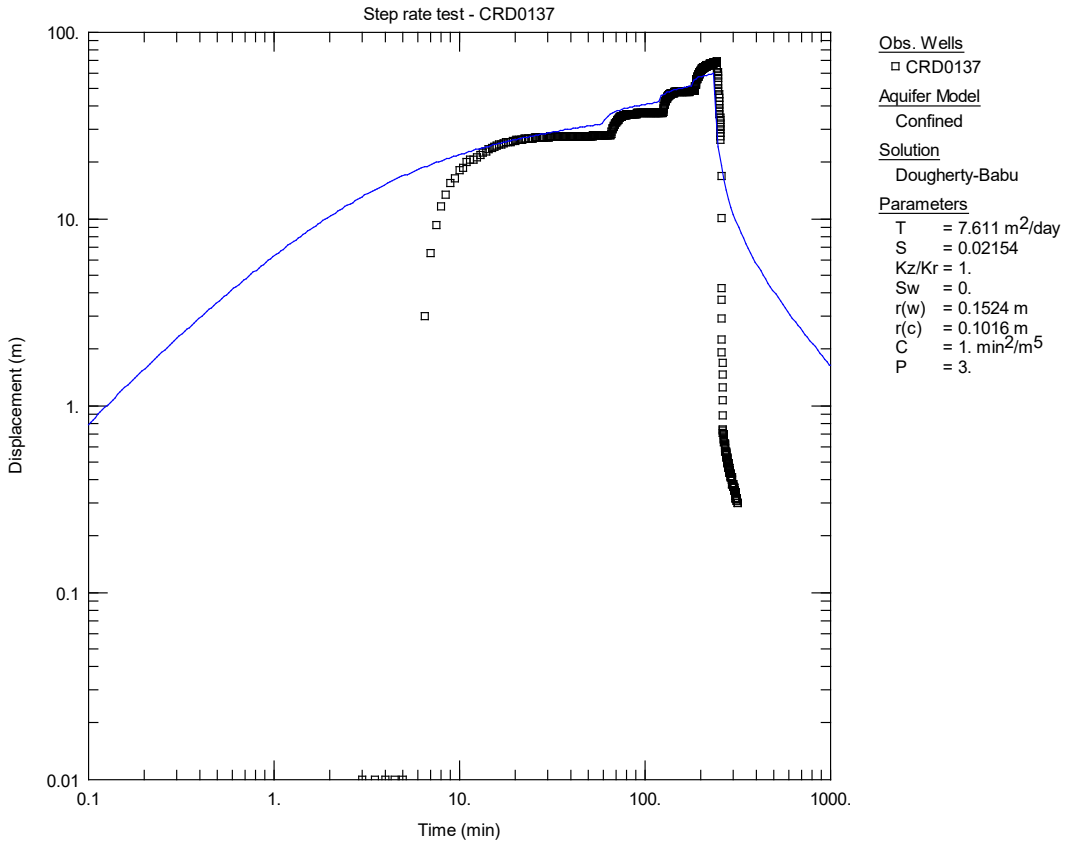
Intercept (B) 1.136E-02
Gradient (C) 2.602E-06

ANALYSIS TABLE

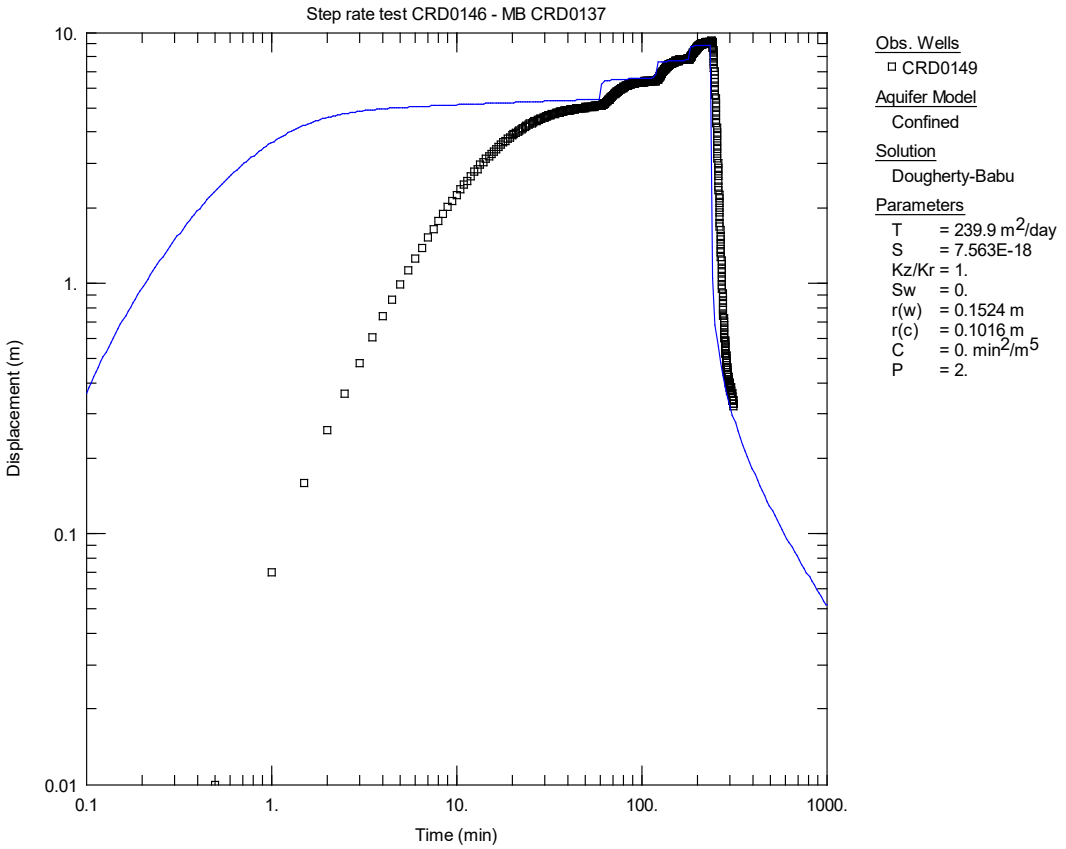
Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Drawdown (s) (m)	Predicted Drawdown (m)	s/Q	Apparent Efficiency (Ew) %
1	5.0	432	5.49	5.39	1.27E-02	91%
2	6.0	518	6.42	6.59	1.24E-02	89%
3	7.0	605	7.81	7.82	1.29E-02	88%
4	8.0	691	9.18	9.10	1.33E-02	86%

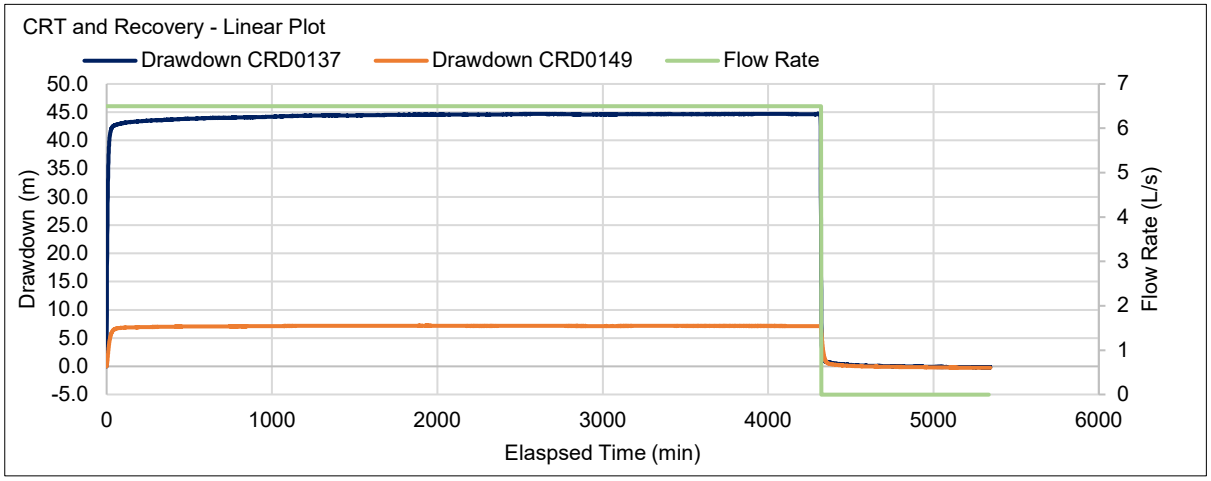
AQTESOLV Analytical Solutions - Pumped Well



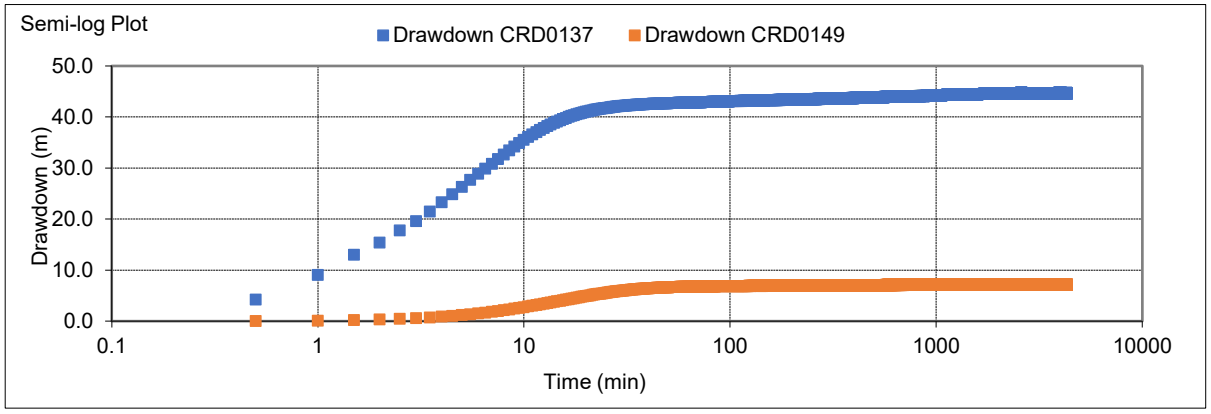
AQTESOLV Analytical Solutions - Monitoring Well

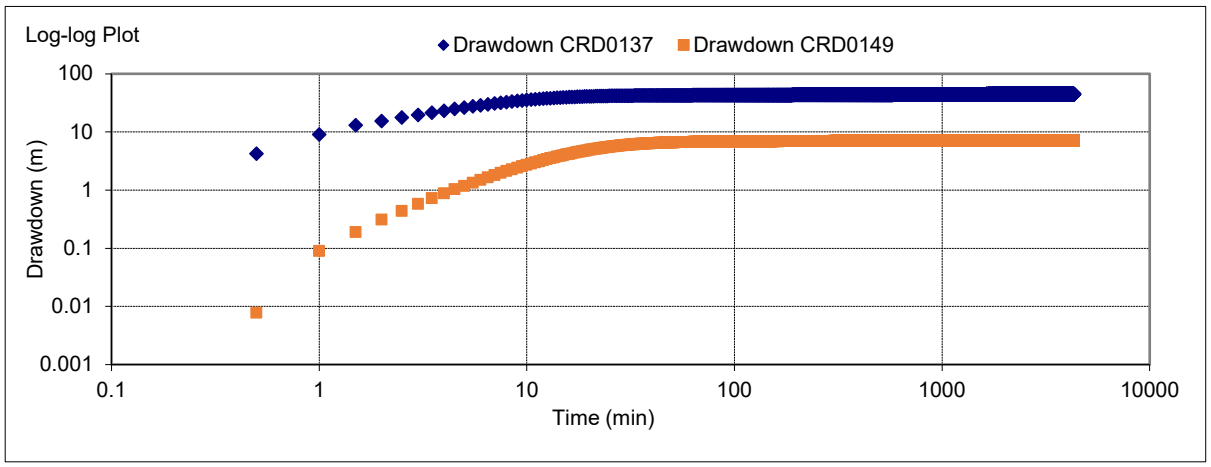


CRT

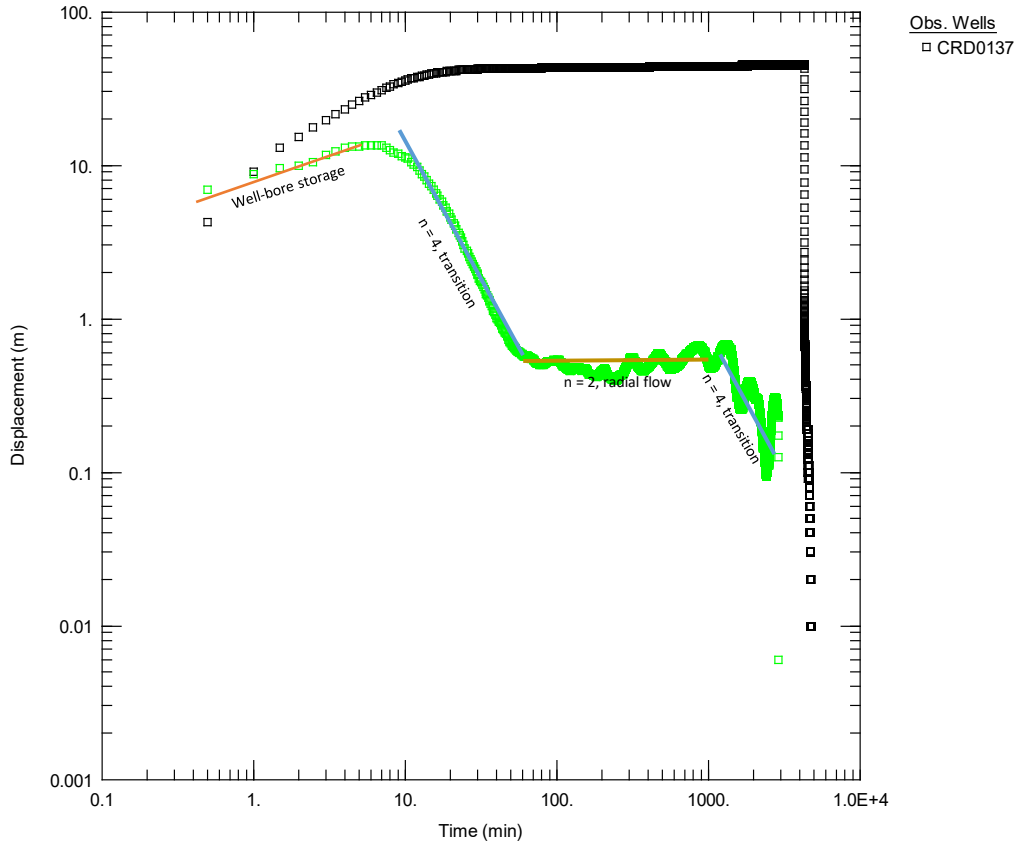


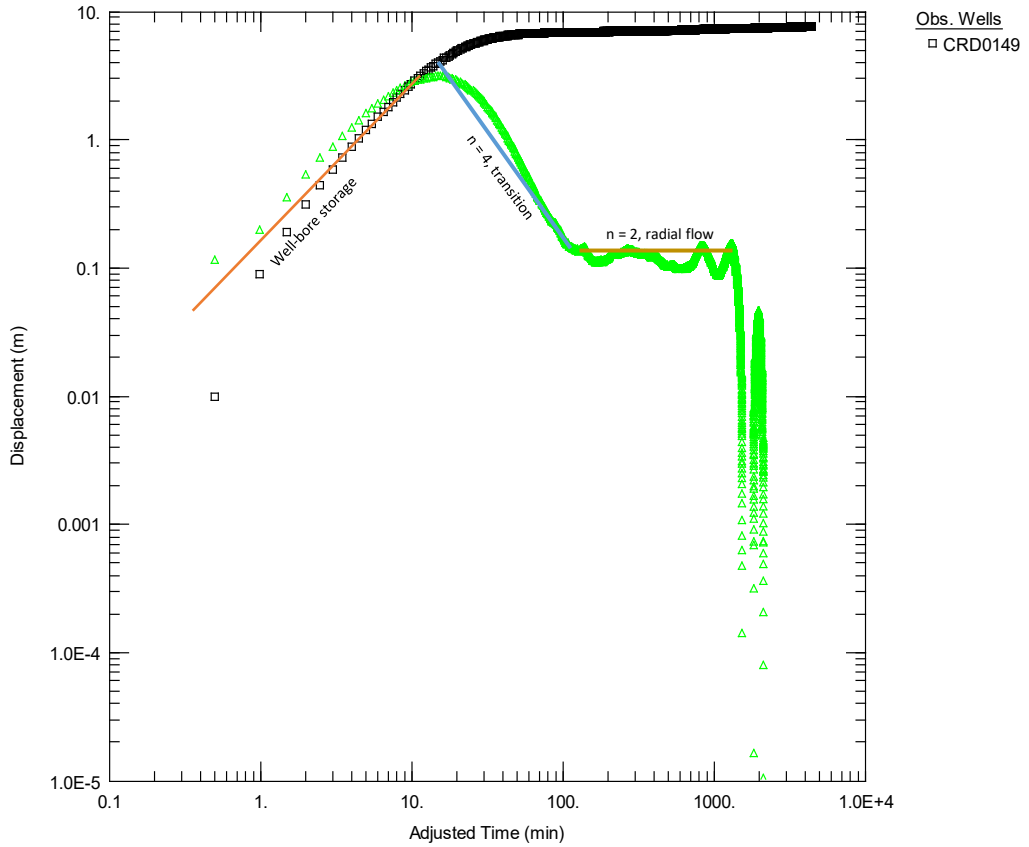
Diagnostic plots of drawdown data versus time for production bore and observation bore are shown below:



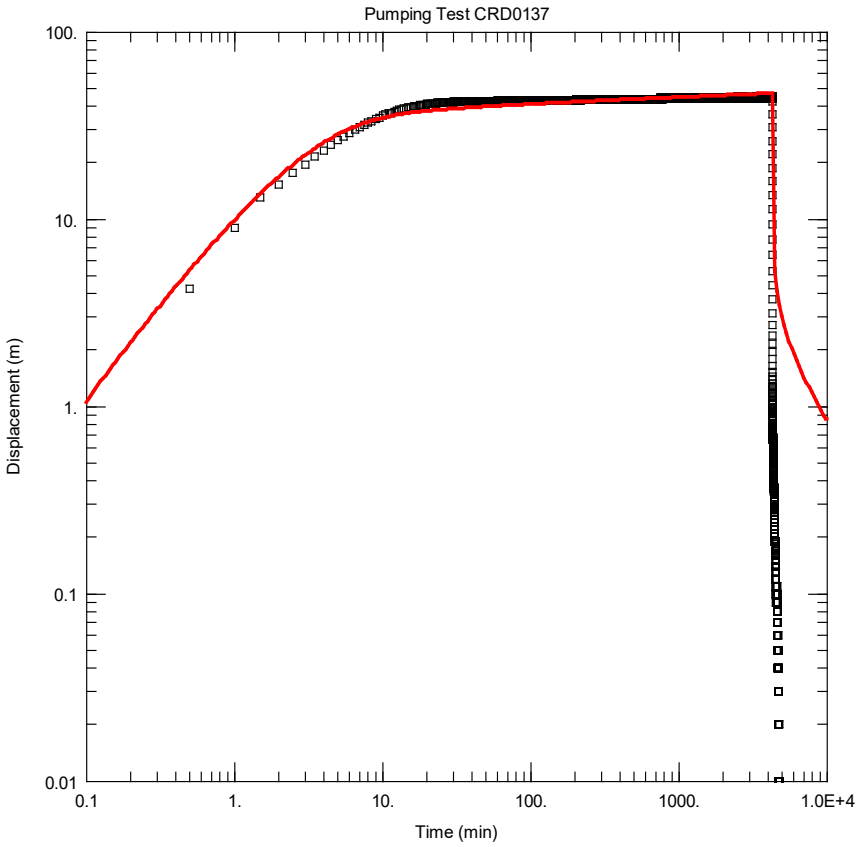


Derivative Plots





AQTESOLV Analytical Solutions - Pumped Well

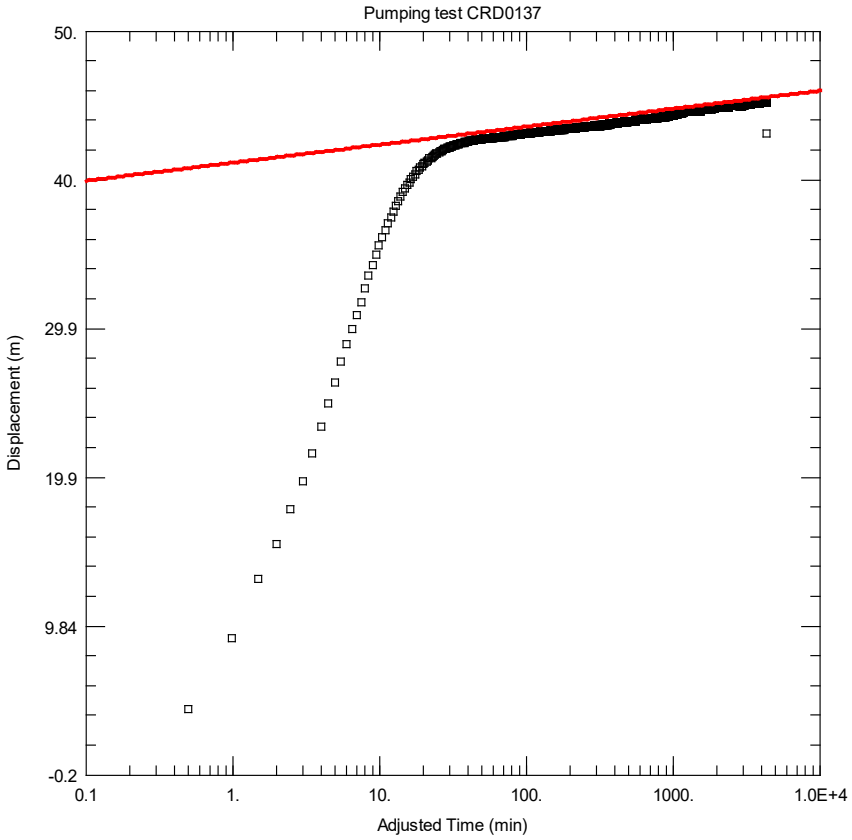


Obs. Wells
□ CRD0137

Aquifer Model
Fractured

Solution
Moench w/slab blocks

Parameters
K = 0.1176 m/day
Ss = 5.75E-8 m^{-1}
K' = 3.773E-10 m/day
Ss' = 0.003981 m^{-1}
Sw = 0.
Sf = 0.
r(w) = 0.1524 m
r(c) = 0.1016 m



Obs. Wells
□ CRD0137

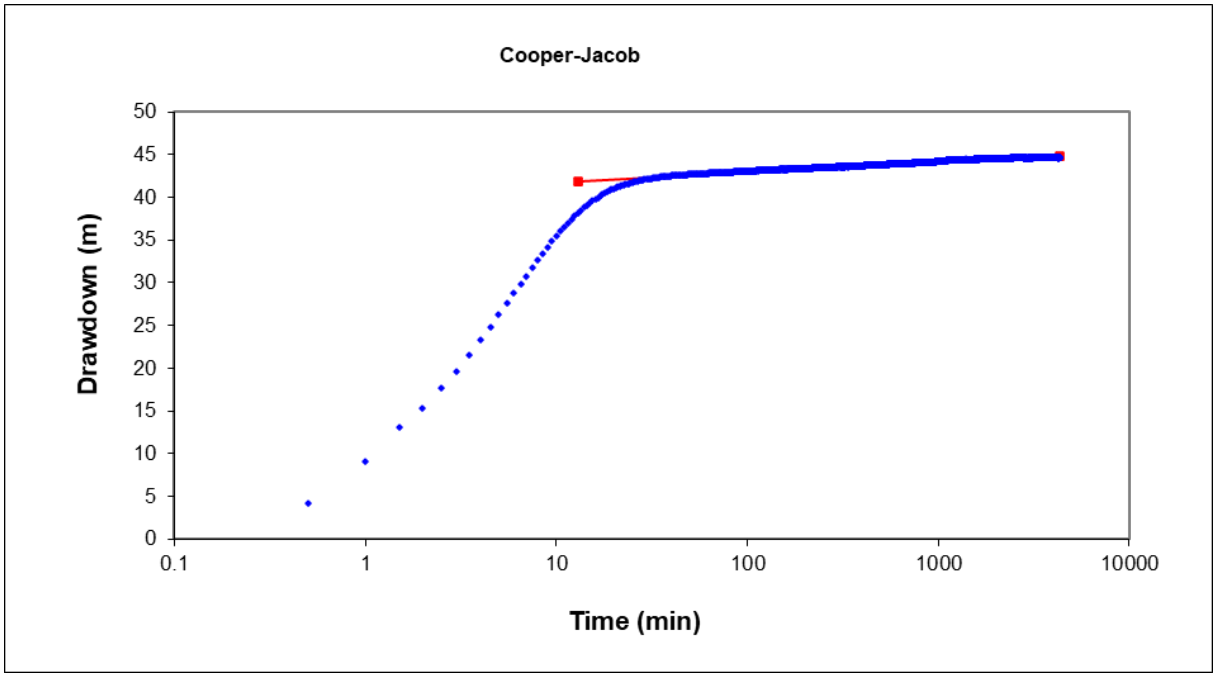
Aquifer Model
Confined

Solution
Cooper-Jacob

Parameters
T = 84.81 m^2/day
S = 2.224E-33

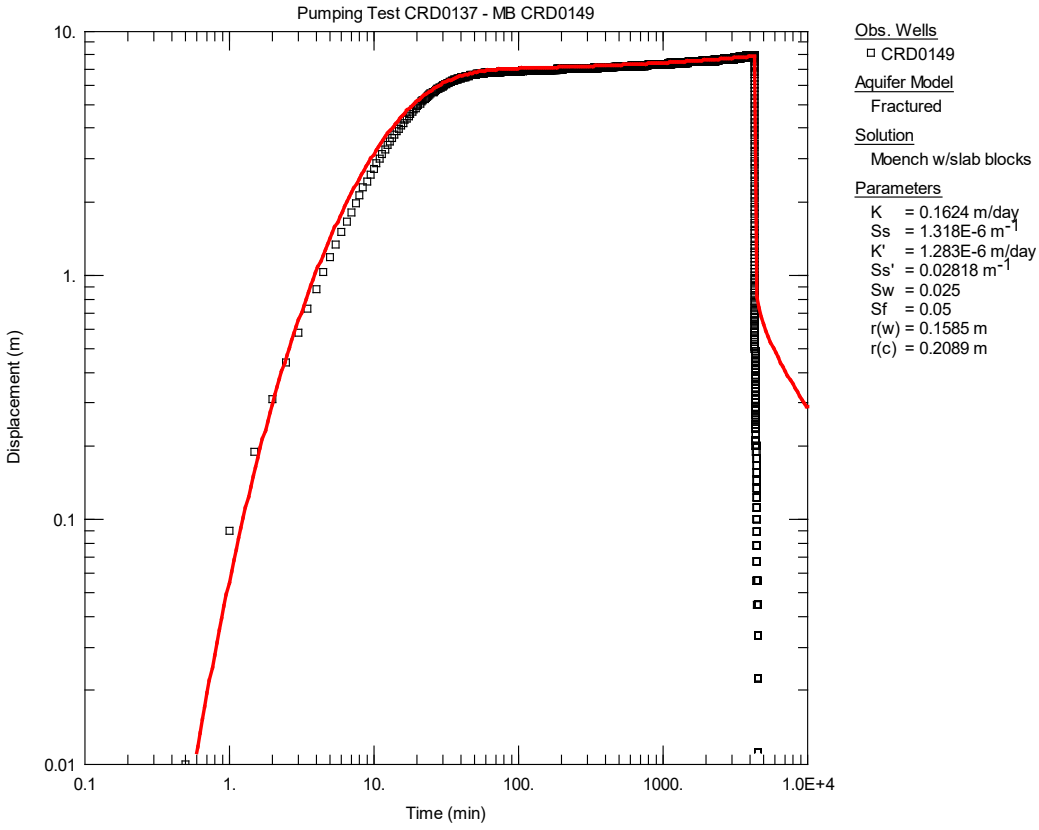
Storativity cannot be accurately calculated directly from data collected only from a pumping bore due to influence of well effects which can obscure aquifer response.

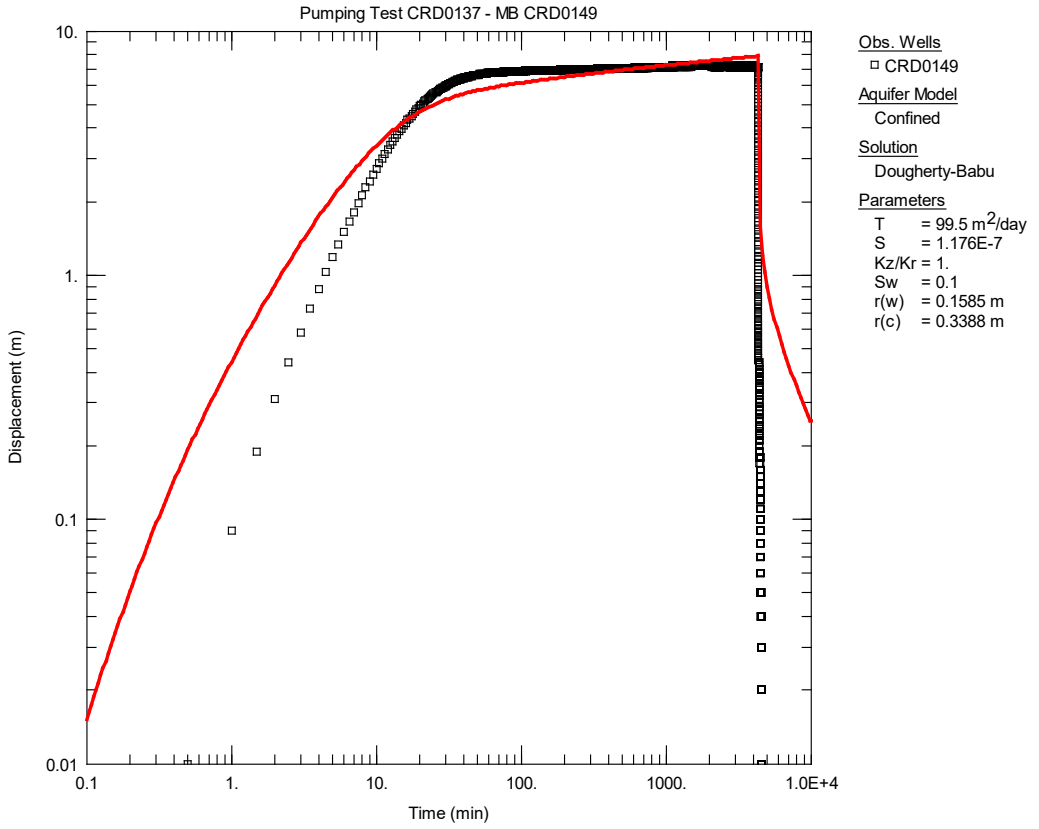
FC Analytical Solutions - Pumped Well

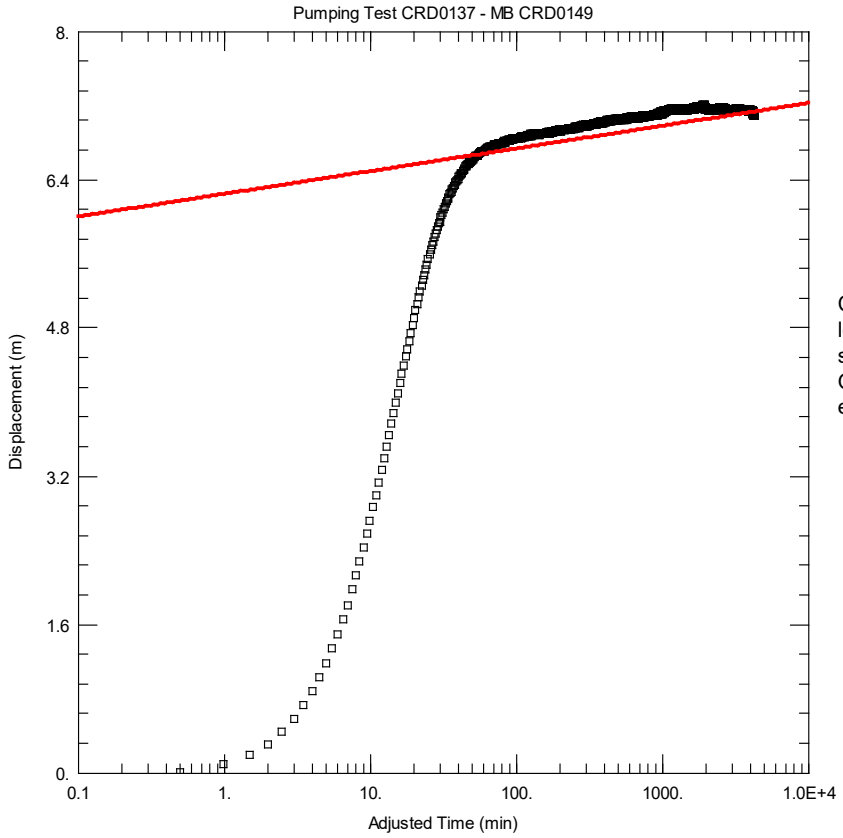


x0	y0	T(m2/d) =	133.00
13	41.9		
x1	**y1**		
4320	44.9		

AQTESOLV Analytical Solutions - Monitoring Well



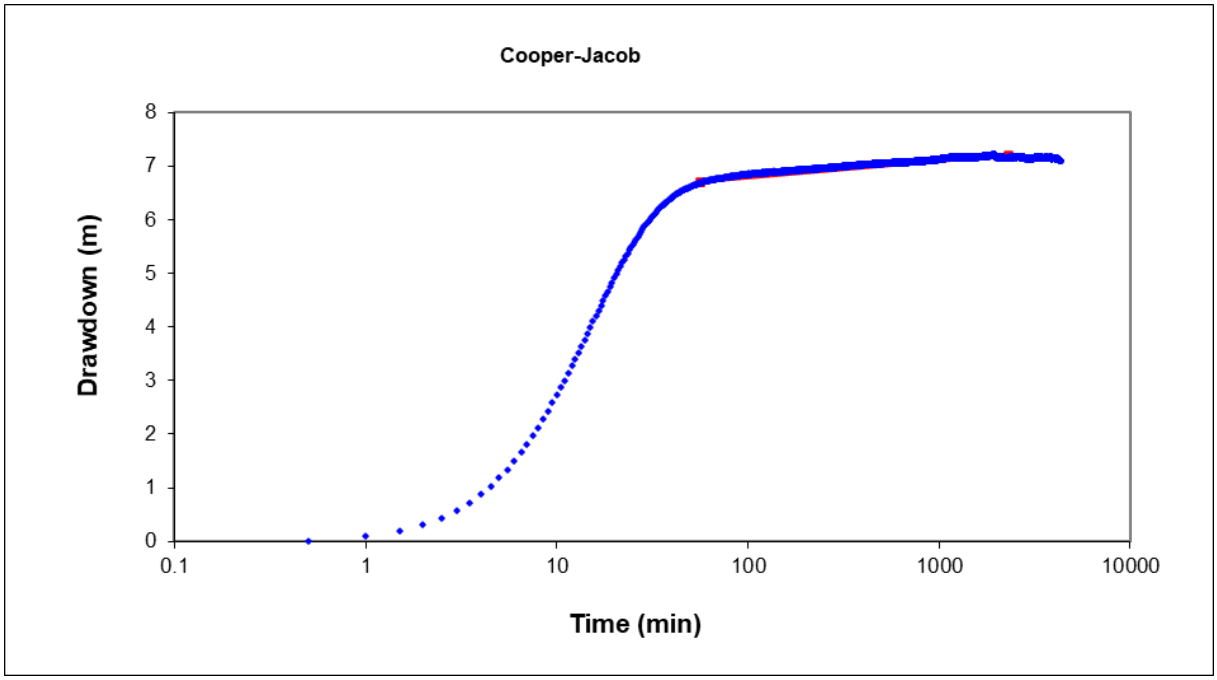




Obs. Wells
□ CRD0149
Aquifer Model
Confined
Solution
Cooper-Jacob
Parameters
T = 420.6 m^2/day
S = 1.473E-28

Cooper-Jacob method yielded an unusually low S values, potentially due to wellbore storage or non-ideal aquifer conditions. Other methods produced more reasonable estimates, we have prioritized those results.

FC Analytical Solutions - Monitoring Well



x0	y0	T(m2/d) =	510.30
56.1	6.7	S =	4.60E-22
x1	y1		
2300	7.2		

Cooper-Jacob method yielded an unusually low S values, potentially due to wellbore storage or non-ideal aquifer conditions. Other methods produced more reasonable estimates, we have prioritized those results.

Appendix D Borehole completion photographs

1 Completed Bores Photos

1.1 Sparrow Lake Pit

1.1.1 CRD139

No photo available

1.1.2 CRD0140

1.1.3 CRD0141

1.1.4 CRD0142

1.1.5 CRD0143

1.1.6 CRD0144

1.1.7 CRD0150

1.1.8 CRD0151

No photo available

1.2 Runway Pit

1.2.1 CRD0137

No photo available

1.2.2 CRD0149

No photo available

1.3 Glen Herring

1.3.1 CRD0130

1.3.2 CRD0131

1.3.3 CRD0132


ATL009 - CRD0132
-21.391519,+119.654430
61° NE
12/7/2024, 8:48
WATER BORE DETAILS

1.3.4 CRD0133

1.3.5 CRD0146

1.3.6 CRD0147

1.3.7 CRD0148

1.3.8 CRD0154

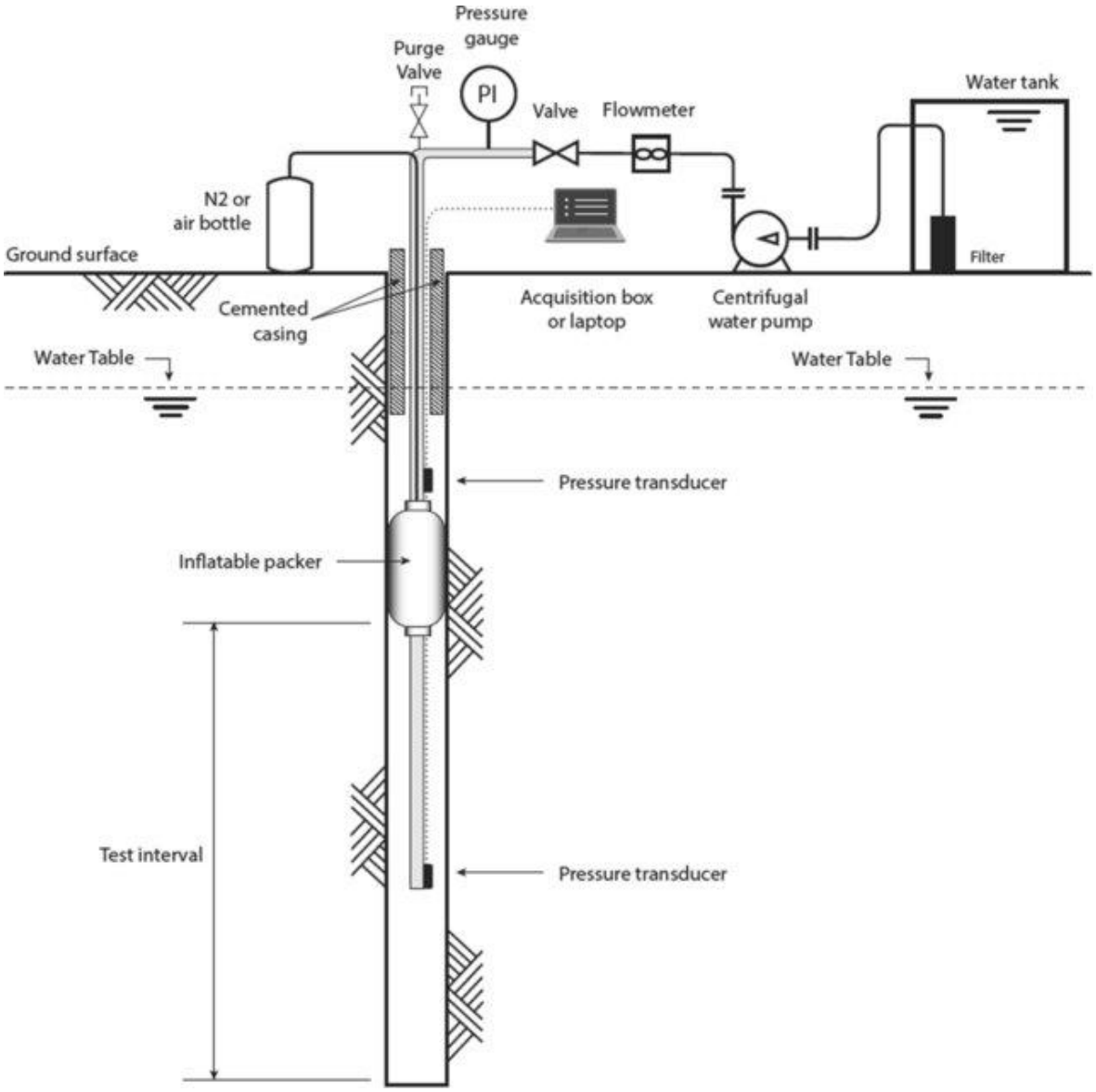

N
W
E
S
ATL009 - CRD0154
-21.387961,+119.650472
354° N
12/7/2024, 9:09
WATER BORE DETAILS

Appendix E Packer Test data

1.1 Packer test operations and set up

A single-packer testing approach was utilized for the tests conducted at the Runway Pit. The schematic configuration is illustrated in Figure E.1.

Figure E.1: Schematic single-packer test



Sources: Vaskou et al. (2019)

The procedure for each test interval was as follows:

1. The packer was placed in the indicated depth and posteriorly inflated to achieve a seal against the borehole wall.
2. Water was injected into the isolated interval at a controlled pressure, while flow rates and pressure were continuously monitored.

3. The test was conducted in a series of steady-state pressure steps.
4. Measurements of injected volume and corresponding pressures were recorded for each step.
5. After completion of testing, the packer was deflated and moved to the next test interval or removed.

1.2 Analysis using Lugeon method

The test results were analysed using the Lugeon approach, which calculates the hydraulic conductivity of the rock mass, expressed in Lugeon Units. This method relies on the average water pressure and flow rate measured during each pressure step. The Lugeon Unit is defined as the volume of water injected per unit length of borehole, per unit time, under a pressure of 1 MPa.

The Lugeon value is calculated as follows:

$$Lugeon\ Value = \frac{q}{L}\frac{P_0}{P}$$

Where:

Lugeon Value = reflects hydraulic conductivity of 1.3 x 10^{-5} cm/s when determined under homogenous, isotropic conditions.

q = average flow rate from a single step (in liters per minute)

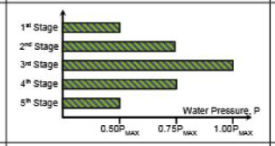
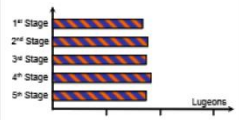
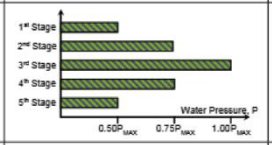
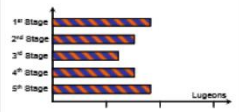
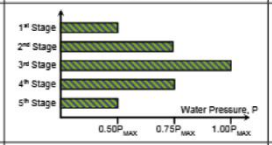
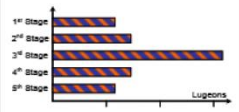
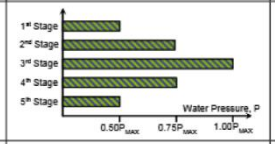
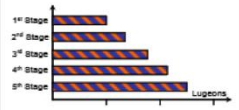
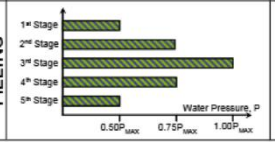
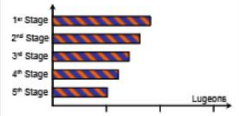
L = length of test interval (in meters)

P_0 = reference pressure, which is defined as 1 MPa.

P = total pressure head above static pressure.

Houlsby (1976) developed a method to select a representative Lugeon value or equivalent hydraulic conductivity to represent the test interval using the observed patterns of Lugeon values. His method uses a bar graph of Lugeon values calculated for each step. The test values are matched to a pattern, and a method to generate a representative hydraulic conductivity value is selected. The patterns are labelled as representing flow regimes that include laminar flow, turbulent flow, dilation, wash-out, or void filling. Each regime is described in the caption of Figure E.2.

Figure E.2: Lugeon-test patterns and flow regime interpretation

BEHAVIOR	PRESSURE STAGES	LUGEON PATTERN	DESCRIPTION	REPRESENTATIVE LUGEON VALUE
LAMINAR			All Lugeon values about equal regardless of the water pressure	Average of Lugeon values for all stages
TURBULENT			Lugeon values decrease as the water pressures increase. The minimum Lugeon value is observed at the stage with the maximum water pressure	Lugeon value corresponding to the highest water pressure (3rd stage)
DILATION			Lugeon values vary proportionally to the water pressures. The maximum Lugeon value is observed at the stage with the maximum water pressure	Lowest Lugeon value recorded, corresponding either to low or medium water pressures (1st, 2nd, 4th, 5th stage)
WASH-OUT			Lugeon values increase as the test proceeds. Discontinuities' infillings are progressively washed-out by the water	Highest Lugeon value recorded (5th stage)
VOID FILLING			Lugeon values decrease as the test proceeds. Either non-persistent discontinuities are progressively being filled or swelling is taking place	Final Lugeon value (5th stage)

Sources: Houlsby (1976)

Using the calculated Lugeon values, the condition of rock mass discontinuities can be estimated based on the classifications provided in Table E-1.

Table E-1: Estimated hydraulic conductivities and condition of rock mass discontinuities by Lugeon Range

Lugeon Range	Classification	Hydraulic Conductivity Range (cm/s)	Condition of Rock Mass Discontinuities	Reporting precision (Lugeons)
< 1	Very Low	$< 1 \times 10^{-5}$	Very tight	< 1
1 -5	Low	$1 \times 10^{-5} – 6 \times 10^{-5}$	Tight	± 0
5 -15	Moderate	$6 \times 10^{-5} – 2 \times 10^{-4}$	Few partly open	± 1
15 – 50	Medium	$2 \times 10^{-4} – 6 \times 10^{-4}$	Some open	± 5
50 - 100	High	$6 \times 10^{-4} – 1 \times 10^{-3}$	Many open	± 1
> 100	Very High	$> 1 \times 10^{-3}$	Open closely spaced or void	> 100

Sources: Quinones-Rozo (2010)

1.3 Packer test analysis

1.3.1 Runway

Two locations were packer tested in runway: holes RS03 and RS04 shown in Figure E.3. Hole RS03 was tested successfully between 76.1 and 80 m. The raw data obtained from bore RS03 is summarised in Table E-2.

Hole RS04 was tested at two different depths (63.2m and 45.7m). Both tests failed due to high flows.

Figure E.3 Location of Runway pit geotechnical bores used for packer test holes relative to production bores and monitoring bores used in the 2024 pumping test results

Notes: Geotechnical bores are red diamonds; Production bores are green circles. Runway pit shell in beige.

Table E-2: Raw results obtained in bore RS03

Interval (min)	Pressure Steps (kPa)				
Steps	P1 150	P2 300	P3 450	P4 300	P5 150
	Time at start of the step				
	2:07 pm	2:18 pm	2:29 pm	2:40 pm	2:52 pm
Interval (min)	**Meter reading at start of each pressure step (kL)**				
0	1.020	1.830	3.096	4.840	6.179
1	1.086	1.962	3.250	4.965	6.270
2	1.147	2.080	3.409	5.092	6.360
3	1.210	2.193	3.564	5.213	6.449
4	1.279	2.308	3.723	5.338	6.538
5	1.336	2.419	3.880	5.463	6.628
6	1.398	2.533	4.040	5.586	6.716
7	1.462	2.644	4.196	5.709	6.803
8	1.526	2.758	4.353	5.828	6.889
9	1.589	2.870	4.510	5.947	6.972
10	1.653	2.984	4.660	6.065	7.056
Average Leakage (L/sec)	**1.06**	**1.92**	**2.61**	**2.04**	**1.46**
Average Fluctuation +/- (kPa)	**50**	**50**	**25**	**50**	**50**

The Lugeon values and their corresponding hydraulic conductivity estimates for each pressure step are presented in Table E-3.

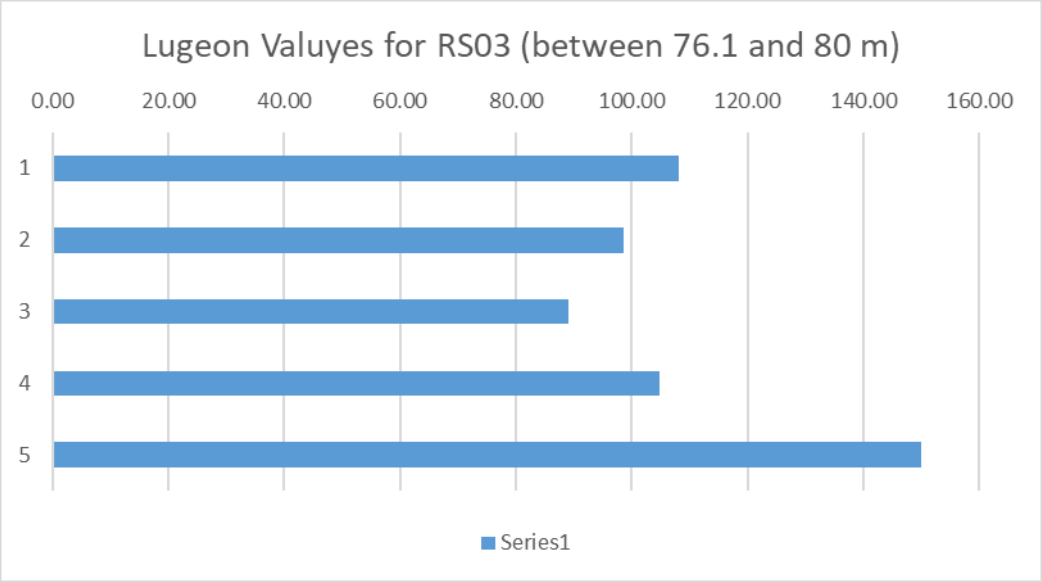
Table E-3: Lugeon values and hydraulic conductivities calculated for bore RS03

Steps	P1 150	P2 300	P3 450	P4 300	P5 150
Pressure Steps (Mpa)	0.15	0.3	0.45	0.3	0.15
Average Flow Rate L/min	63.30	115.40	156.40	122.50	87.70
Lugeon Value	108.21	98.63	89.12	104.70	149.91
Calculated K (m/d)	1.22	1.11	1.00	1.18	1.68

Sources: SRK

The Lugeon pattern for this test is presented in Figure E.4.

Figure E.4: Lugeon pattern for test RS03



Sources: SRK

1.3.2 Runway Outcomes

High to very high lugeon values representing many open fractures or voids and associated turbulent flow recorded at 76.1 to 80m. The average calculated hydraulic conductivity values from RS03 (1.2 m/d) are in line with the 2024 pumping test geomean K values obtained from in Runway (0.76 m/d).

The reason for the failure at 63.2m due to meter has stopped working while trying to increase injection pressure to 300 kpa. The test was abandoned. Suspect inflow rate too high for meter.

The reason for the failure at 45.7m due to not being able to generate any downhole pressure. Flow exceeding 2lps, the test was abandoned.

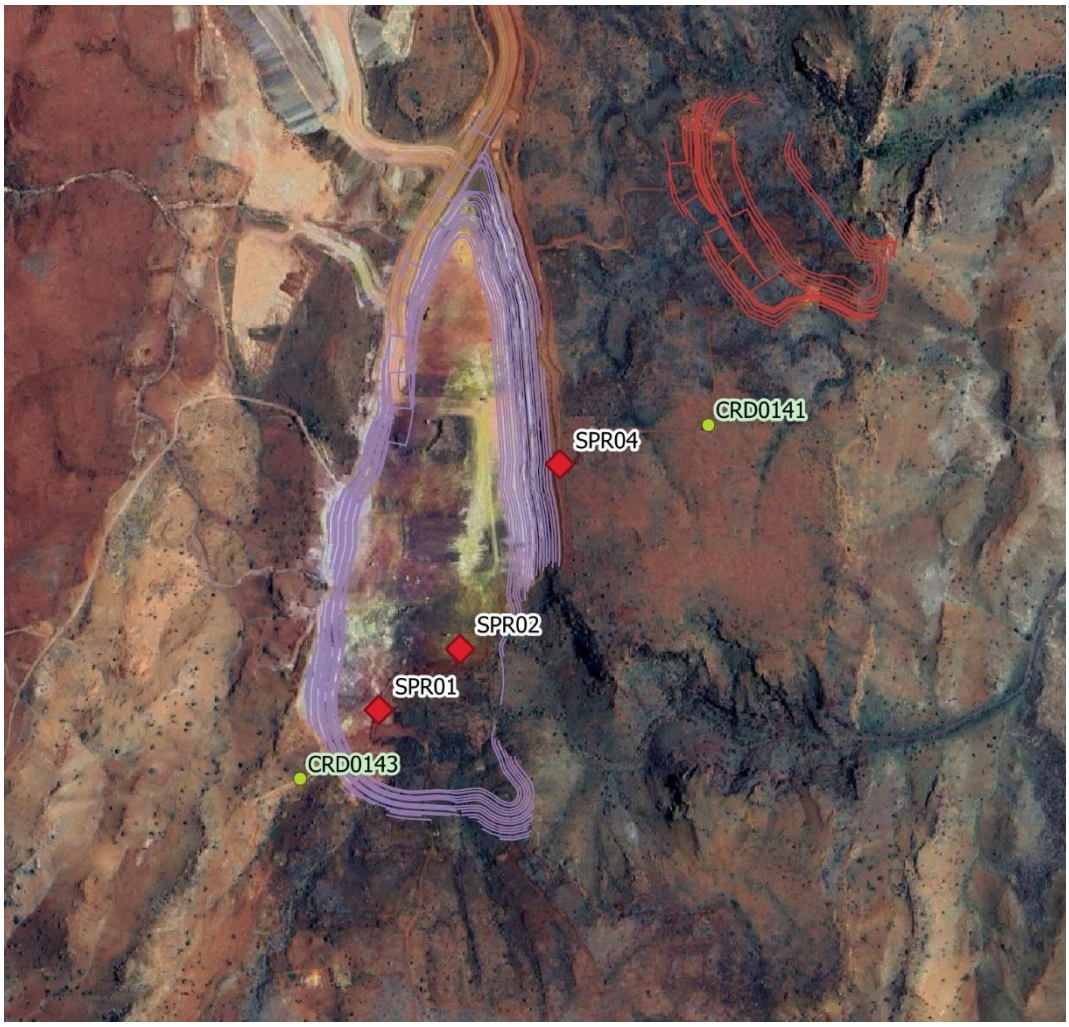
1.3.3 Sparrow Lake

Three bores were packer tested in Sparrow Lake: SPR01, SPR02 and SPR04 shown in Figure E.5.

SPR01 was tested at two different depths successfully (SPR01a and SPR1b). SPR02 and SPR04, tested at two and three different depths respectively, however all failed. The reason for the failure has not been specified.

SPR01a was tested at the interval 111.5-114.2m; SPR01b was testing at the interval: 71.9-73.9m.

Figure E.5 Location of Sparrow Lake pit geotechnical bores used for packer test holes relative to production bores used in the 2024 pumping test results



Notes: Geotechnical bores are red diamonds; Production bores are green circles. Sparrow Lake pit shell in purple and Razorback pit shell in Red.

SPR01a

The raw data obtained from bore SPR01a is summarised in Table E-4.

Table E-4: Raw results obtained in bore SPR01a

Interval (min)	**Pressure Steps (kPa)**				
Steps	P1 150	P2 300	P3 450	P4 300	P5 150
	Time at start of the step				
	12:21pm	12:33 pm	12:44 pm	12:56 pm	1:12 pm
Interval (min)	**Meter reading at start of each pressure step (kL)**				
0	8.345	8.422	8.5298	8.701	8.801
1	8.3516	8.430	8.540	8.7108	8.808
2	8.358	8.439	8.552	8.72	8.814
3	8.364	8.4496	8.5644	8.73	8.8208
4	8.371	8.4592	8.5754	8.7388	8.8272
5	8.3774	8.4698	8.586	8.7482	8.8338
6	8.3842	8.48	8.598	8.7576	8.84
7	8.3908	8.49	8.6092	8.767	8.8468
8	8.3972	8.5	8.6208	8.7766	8.853
9	8.4042	8.510	8.632	8.7864	8.86
10	8.411	8.5192	8.644	8.7958	8.8664
Average Leakage (L/sec)	**0.11**	**0.16**	**0.19**	**0.16**	**0.11**
Average Fluctuation +/- (kPa)	**50**	**50**	**25**	**50**	**50**

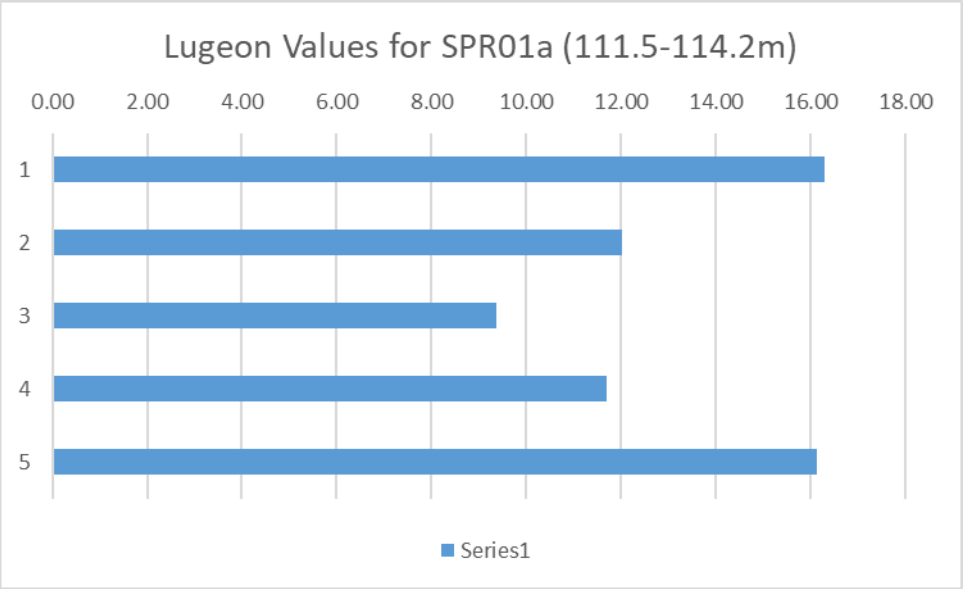
The Lugeon values and their corresponding hydraulic conductivity estimates for each pressure step are presented in Table E-5 and Figure E.6.

Table E-5: Lugeon values and hydraulic conductivities calculated for bore SPR01a

Steps	**P1 150**	**P2 300**	**P3 450**	**P4 300**	**P5 150**
Pressure Steps (Mpa)	0.15	0.3	0.45	0.3	0.15
Average Flow Rate L/min	6.60	9.74	11.38	9.48	6.54
Lugeon Value	16.30	12.02	9.37	11.70	16.15
Calculated K (m/d)	0.18	0.14	0.11	0.13	0.18

Sources: SRK

Figure E.6: Lugeon pattern for test SPR01a



SPR01b

The raw data obtained from bore SPR01b is summarised in Table E-6.

Table E-6: Raw results obtained in bore SPR01b

Interval (min)	**Pressure Steps (kPa)**				
Steps	P1 150	P2 300	P3 450	P4 300	P5 150
	Time at start of the step				
	2:28 pm	2:38 pm	2:48 pm	2:59 pm	3:09 pm
Interval (min)	**Meter reading at start of each pressure step (kL)**				
0	8.916	9.027	9.204	9.446	9.654
1	8.9268	9.044	9.227	9.4654	9.667
2	8.9376	9.061	9.2494	9.4848	9.680
3	8.948	9.077	9.273	9.504	9.693
4	8.959	9.0934	9.296	9.5232	9.7056
5	8.97	9.11	9.319	9.5426	9.7176
6	8.98	9.1258	9.342	9.5622	9.73
7	8.9908	9.142	9.3656	9.582	9.7428
8	9.001	9.158	9.389	9.601	9.7552
9	9.012	9.175	9.412	9.62	9.768
10	9.0228	9.191	9.435	9.639	9.7808
Average Leakage (L/sec)	**0.18**	**0.27**	**0.38**	**0.32**	**0.21**
Average Fluctuation +/- (kPa)	**25**	**25**	**25**	**25**	**25**

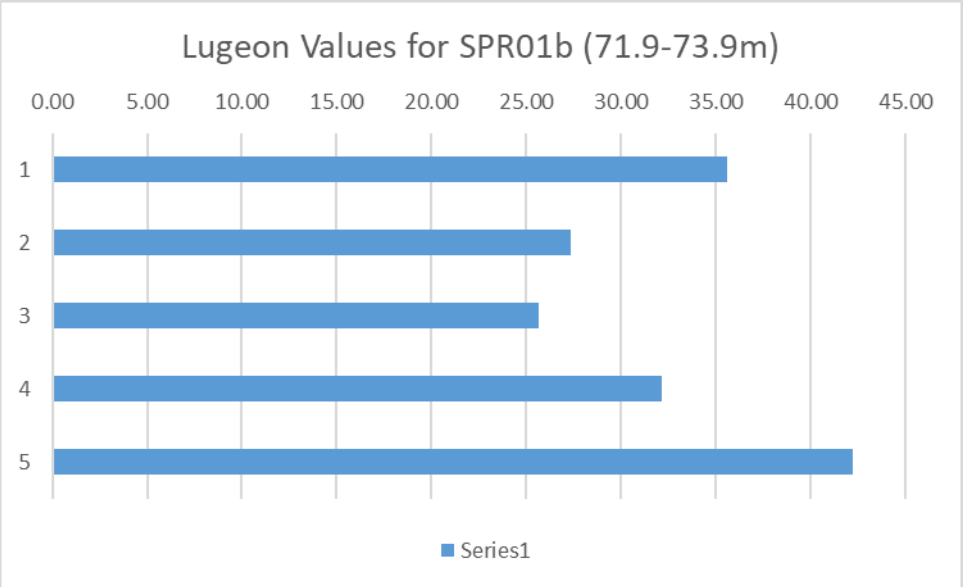
The Lugeon values and their corresponding hydraulic conductivity estimates for each pressure step are presented in Table E-7 and Figure E.7.

Table E-7: Lugeon values and hydraulic conductivities calculated for bore SPR01b

Steps	**P1 150**	**P2 300**	**P3 450**	**P4 300**	**P5 150**
Pressure Steps (Mpa)	0.15	0.3	0.45	0.3	0.15
Average Flow Rate L/min	10.68	16.42	23.08	19.30	12.68
Lugeon Value	35.60	27.37	25.64	32.17	42.27
Calculated K (m/d)	0.40	0.31	0.29	0.36	0.47

Sources: SRK

Figure E.7: Luggeon pattern for test SPR01b



1.3.4 Sparrow Lake Outcomes

SPR01a recorded moderate lugeon values representing few partly open fractures and associated turbulent flow recorded at 111.5 to 114.2m.

SPR01b recorded medium lugeon values representing some open fractures and associated turbulent flow recorded at 71.9 to 73.9m.

The average calculated hydraulic conductivity (K) values from SPR01a (0.15 m/d) and SPR01b (0.37 m/d) are similar but lower than the 2024 pumping test geomean K values obtained from Sparrow Lake pumping tests: CRD0143 (3.31 m/d) and CRD0141 (0.76 m/d).

No specific reason was for the failed tests at SPR02 and SPR04 however it is assumed that, similar to RS04 tests at 63.2m and 45.7m, the flow exceeded 2lps and there was an inability to generate any downhole pressure.

Appendix C Groundwater Quality Report

Final

Groundwater Quality Report

Sanjiv Ridge Below Water Table Mining Hydrogeology Study, WA, Australia
Atlas Iron Pty Ltd

SRK Consulting (Australasia) Pty Ltd ▪ ATL009 ▪ June 2025

srk consulting

Final

Groundwater Quality Report

Sanjiv Ridge Below Water Table Mining Hydrogeology Study, WA, Australia

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Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

°C	degrees Celsius
µS/cm	micro siemens per centimetre
ADWG	Australian Drinking Water Guidelines
Atlas	Atlas Iron Limited
BIF	banded iron formation
BOM	Bureau of Meteorology
DWER	Department of Water and Environmental Regulation
EC	electrical conductivity
FBA	fractured bedrock aquifer
GL	gigalitres
kL	kilolitres
km	kilometres
km^2	square kilometres
m	metres
mg/L	milligrams per litre
mm	millimetres
RC	reverse circulation
SRK	SRK Consulting (Australasia) Pty Ltd
TDS	total dissolved solids
the Project	Sanjiv Ridge Project
UWA	University of Western Australia
VOC	volatile organic compound

1 Introduction

Atlas Iron Pty Ltd (Atlas) is currently developing the Sanjiv Ridge (formally Corunna Downs) Project (the Project) located in the Pilbara region of Western Australia from Stage 4 (above the water table) into Stage 5 (below the water table). The Project involves the mining of iron ore from five open pits using conventional drill and blast methods. Atlas previously engaged SRK Consulting (Australasia) Pty Ltd (SRK) to complete hydrogeological drilling, testing and modelling during the Phase 4 mining studies that were completed in 2019, which included the submission of an H3 report to the Department of Water and Environmental Regulation (DWER) (SRK, 2019a). Atlas further engaged with SRK since 2023 on the following Stage 5 studies:

- hydrogeological drilling and testing
- numerical groundwater modelling
- surface water catchment characterisation and flood modelling
- pit void water balance modelling
- geochemical review, assessment and analysis.

This report presents a comprehensive analysis of groundwater and surface water data collected from across the Project area. The report aims to provide insights into the water quality and hydrological dynamics of the area that will support the regulatory approvals process to continue to the Stage 5 of the Project.

The data utilised in this report has been gathered from:

- regional and site-specific surface water and groundwater monitoring data covering the following periods:
  - 2014 to 2019: covered by the Stage 4 H3 assessment (SRK, 2019a)
  - 2020 to 2025: covering the interim period between the start of Stage 4 and submission of this H3 assessment
- Stage 4 groundwater investigation drilling program completed in 2019
- Stage 5 groundwater investigation drilling program completed in 2024
- radiocarbon isotope analysis data completed in 2024.

The primary objective of this report is to present all new groundwater and surface water data collected since the submission of the Stage 4 H3 report (SRK, 2019) and assess for any observable changes or trends in groundwater characteristics over the five-year period.

An important objective of this report is to evaluate whether the water quality data obtained from the monitored bores and the previously identified permanent pools (refer to Section 2.1) across the Project area align with and support the site's hydrogeological conceptual model. Understanding these relationships is essential for assessing the potential significance of groundwater contributions to these pools and for informing sustainable water management practices in the region.

2 Existing groundwater licence

Atlas abstracts water in accordance with the 5C Licence to Take Groundwater (GWL176960), granted under the *Rights in Water and Irrigation Act 1914* to support various mining activities at the Sanjiv Ridge Mine (Atlas, 2024). The licence permits an annual groundwater abstraction limit of 1,100,000 kL (1.1 GL), with extraction volumes reported annually to the DWER. Additionally, groundwater management is conducted in compliance with the Water Management Plan and Site Water Operating Plan (Atlas, 2019), which includes a detailed monitoring program and the establishment of appropriate triggers, thresholds, and contingencies to mitigate indirect impacts on sensitive receptors. Measures such as adjusting abstraction rates or sourcing water from alternative locations are implemented as necessary to ensure compliance.

2.1 Previously identified sensitive receptors

Previously identified sensitive receptors are water bodies or features that rely to some extent on groundwater and are considered significant due to their heritage value and role as important resources or refuges for conservation-significant vegetation or fauna.

Previous identified receptors were assessed by MWH/Stantec (2018) and SRK (2019, 2023). Information gathered from those studies is provided in Table 2.1 and locations are presented in Figure 2.1

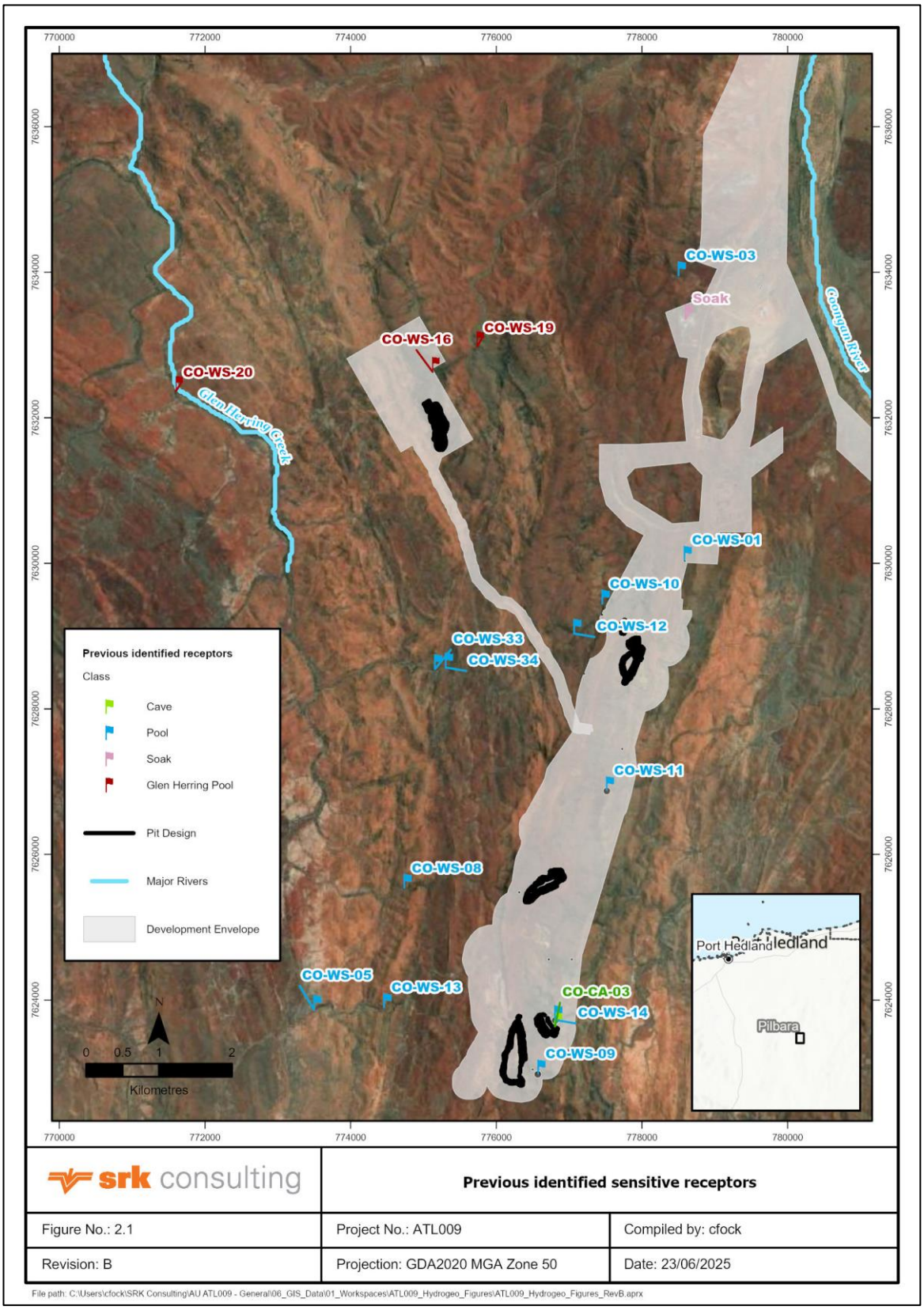
The results of the previous assessments suggest that the pools are likely fed via both groundwater and surface water, with perennial pools located in areas with a more consistent groundwater contribution. Ephemeral pools are considered to be reliant exclusively on surface water or having limited groundwater contribution only during periods of higher groundwater levels.

New potential receptors were identified during the second stage of the Project in the Glen Herring pit area, as shown in Figure 2.1. Initial samples from these pools were collected in 2022, and potential impacts will be assessed in subsequent studies.

Table 2.1: Description of previous identifed receptors

Previous identified receptor	Description
Pool CO-WS-01	Perennial pool and sustained by groundwater discharge based on consistent field observations, chemistry similar to upgradient groundwater, and a comparison of the pool elevation with the estimated water table elevation.
Pool CO-WS-02	Ephemeral pool that is not likely reliant on groundwater. This pool was observed to be dry and has an elevation more than 5 m above the estimated water table surface.
Pool CO-WS-03	Ephemeral pool predominantly fed by surface water based on field observations, geochemical analysis and a comparison of the pool elevation with the estimated water table elevations between 5 m and 10 m below pool.
Pool CO-WS-05	Shallow pool in an area of wet ground which persist following rainfall events and is likely to be sustained by groundwater discharge from the alluvial groundwater system.
Pool CO-WS-08	Ephemeral pool, potentially fed by groundwater intermittently based on field observations, geochemical analysis and a comparison of the pool elevation with the estimated water table elevation is less than 10 m.
Pool CO-WS-09	Ephemeral pool that is not reliant on groundwater and has been observed to be dry. Variation between pool elevation and the estimated water table elevation is more than 5 m.
Pool CO-WS-10	Potentially perennial pool and sustained by groundwater discharge from Pool CO-WS-12, located upstream in the same catchment. This is supported by comparison of the pool elevation with the estimated water table elevation.
Pool CO-WS-11	Ephemeral pool, potentially intermittently fed by groundwater. This is based on field observations, geochemical analysis, and variation of more than 5 m between the pool and the estimated water table elevations.
Pool CO-WS-12	Perennial pool, sustained by groundwater discharge based on field observations, geochemical analysis and a comparison of the pool elevation with the estimated water table elevation. CO-WS-12 discharges upgradient of CO-WS-10.
Pool CO-WS-13	Ephemeral and located an area of wet ground which persists following rainfall events and is likely to be sustained for a period by groundwater discharge from the alluvial groundwater system. Geochemical results suggest a connection to groundwater.
Pool CO-WS-14	Perennial pool, sustained by groundwater discharge based on field observations and a comparison of the pool elevation with the estimated water table elevation. Geochemical results suggest a connection to groundwater.
Cave CO-CA-03	May be reliant on groundwater to support fauna habitat. Pool CO-WS-14 located at the mouth of this cave.
‘Soak’	The Soak is a pan interpreted to be a small ephemeral groundwater recharge/discharge area located at the top of a minor catchment. This area likely hosts a perched, groundwater system and although no active seepage has been observed, the ‘soak’ lies in an area of known shallow groundwater that may periodically discharge to the surface though there is some uncertainty regarding the connectivity with the underlying FBA.

Figure 2.1: Previous identified sensitive receptors



Note: The grey polygon denotes the development envelope of Sanjiv Mine.

2.2 Report structure

This report is structured to provide assessment of water quality and hydrological dynamics for the Sanjiv Ridge Iron Ore Mine as it transitions from Phase 4 (above the water table) to Phase 5 (below the water table).

Chapter 3 introduces the site conditions, including climate, physiography, topography, drainage, and geology. It provides the environmental and geological context of the Sanjiv Ridge Project.

Chapter 4 outlines all data collection works completed between 2014 and 2025. Sampling locations, methodologies, and monitoring parameters are presented in this chapter.

Chapter 5 organises the collected data by area (road, camp, processing plant, Runway pit, Glen Herring pit, Shark Gully pit, Razorback pit, and Sparrow Lake pit) and provides a time-series analysis from 2014 to 2025. Each area is analysed individually, with the following structure:

- Introduction
- Physico-chemical analysis
- Major ions
- Metals
- Other relevant analytes.

Chapter 6 collates the findings from Chapter 5, summarising observed trends and key insights. Recommendations are provided for sustainable water management practices, regulatory compliance, and mitigation measures to address potential impacts on sensitive receptors.

3 Site hydrogeology

3.1 Climate and physiography

3.1.1 Climate and rainfall

The climate of the Pilbara region is classified as semi-arid to arid and is characterised by hot summers and warm winters. The area experiences a climate of extremes where severe droughts and major floods can occur at close intervals. Tropical cyclones can occur between December and April, bringing sporadic, high intensity rainfall events.

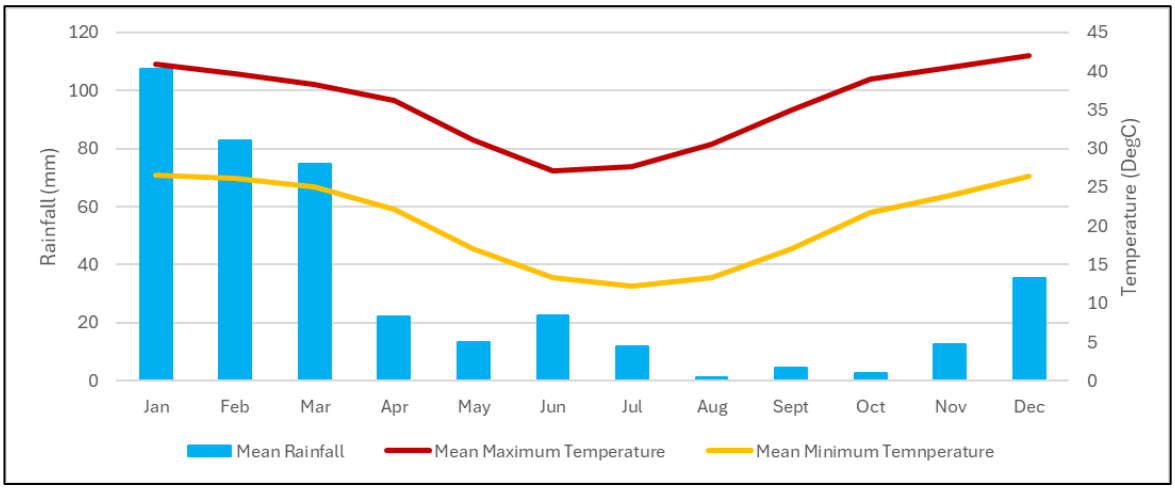
The closest Bureau of Meteorology (BOM) weather station to the Project is located at Marble Bar (Station Number 004106, previously Station Number 004020), approximately 65 km to the northeast (BOM, 2025). Summer in the Pilbara occurs from November to February when the mean maximum temperature for Marble Bar is 40.8°C and the mean minimum temperature is 25.7°C (Table 3.1 and Figure 3.1).

Table 3.1: Marble Bar weather data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean maximum temperature (°C)	40.9	39.7	38.3	36.2	31.1	27.1	27.7	30.5	34.9	38.9	40.5	42
Mean minimum temperature (°C)	26.5	26.1	25.1	22.1	17	13.3	12.2	13.3	17.1	21.7	23.9	26.4
Mean rainfall (mm)	107.3	82.7	74.8	22.2	13.4	22.4	11.8	1.3	4.6	2.8	12.5	35.4

Sources: (BOM, 2025)

Figure 3.1: Marble Bar mean monthly rainfall and temperature



Sources: Marble Bar BOM meteorology station (#004106) for 1900-2025 (BOM, 2025)

Annual evaporation is approximately 3,200 mm to 3,600 mm, almost 10-times precipitation, which varies from a mean of 12.9 mm per day in summer (December) to 5.4 mm per day in winter (June/July). This trend is typically observed throughout the area, as indicated by regional maps provided by BOM (BOM, 2006). Evaporation records for Marble Bar are limited with data available between 1968 and 1988. Evaporation data are presented in Table 3.2.

Table 3.2: **Marble Bar evaporation data (1968–1988)**

Evaporation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily	11.4	10.4	9.7	8.6	6.5	5.4	5.4	6.3	8.7	11.0	12.7	12.9	**9.1**
Mean monthly	353	291	301	258	202	162	167	195	261	341	381	400	**3,322**

Source: (BOM, 2006)

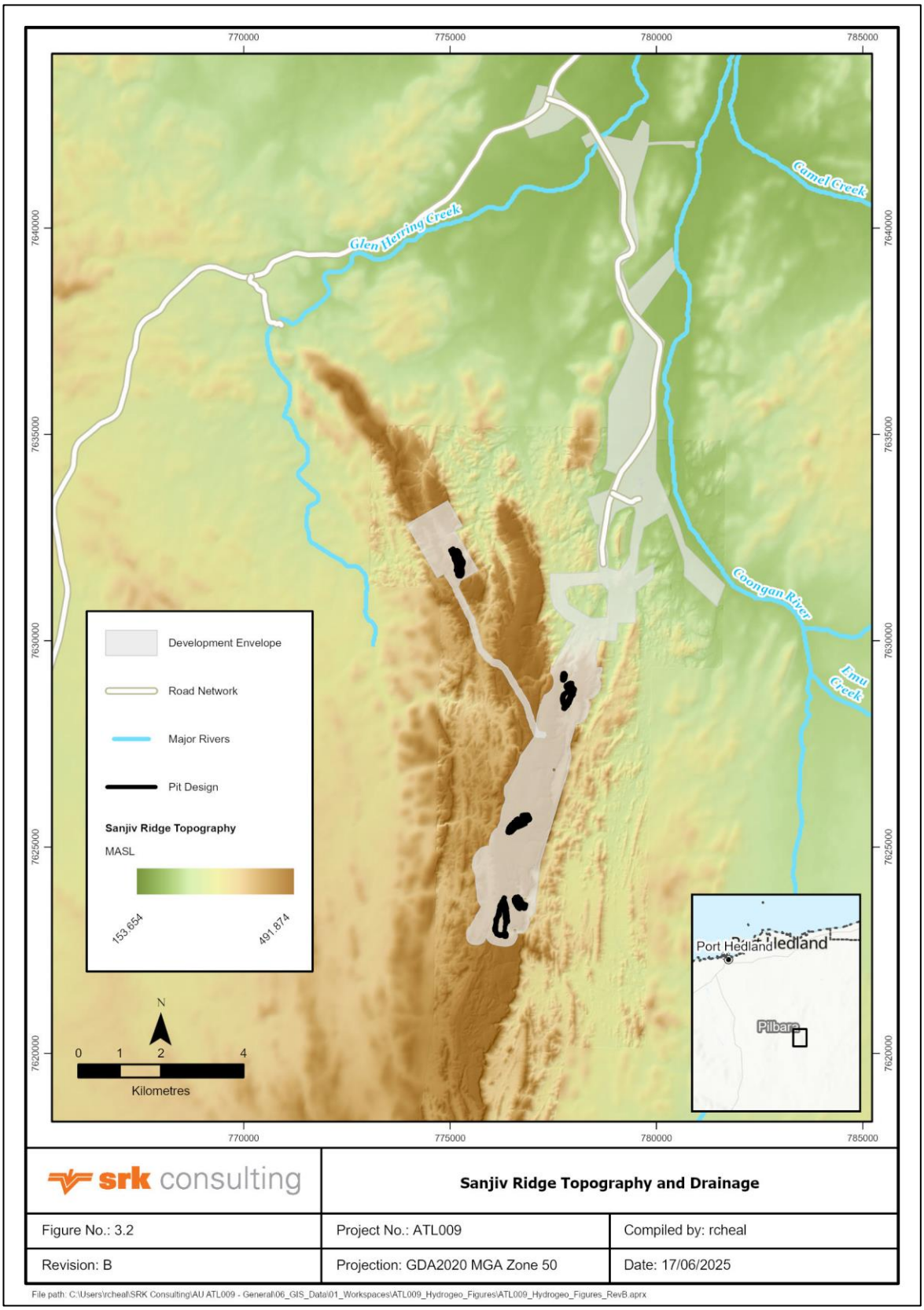
3.1.2 Topography and drainage

Prevalent landforms across the region of the Project area are steep-sided ridges and hills associated with outcrops of banded iron formation (BIF), greenstone, chert and minor sandstone, dolomite and basalt. Mineralisation and proposed mining are centred on the dominant landform in the Project site – an elongated (9 km by ~1.5 km) and elevated (90–110 m high) BIF ridge with gentle slopes at the top and steep cliffs on the western and eastern sides (Figure 3.2). The topography of the ridge is interpreted to be an expression of the north–south striking, sub-vertical dipping stratigraphy in the Project area.

Well-developed drainage lines incised into the ridge areas form gorges and gullies which are interpreted to have been formed along a series of east–west striking faults. Away from the ridges, the topography changes to gentle undulating slopes in the valleys and alluvial valleys and colluvial plains associated with rivers.

The ephemeral Coongan River, which has a total catchment area of 7,090 km^2, is present to the east and north of the Project area and is fed by the Glen Herring, Emu and Camel creeks which drain the Project area. Minor drainage lines along gorges incised into the ridge and minor creeks within the undulating hills drain surface water to the Coongan River from both sides of the BIF Ridge. The ephemeral Shaw River (not in figure) is located 31 km to the west of the site with the easternmost boundary of the Shaw River catchment extending to within 6 km of the Project. The Shaw and Coongan rivers are both tributaries to the De Grey River, which has a catchment of approximately 56,890 km^2.

Figure 3.2: Sanjiv Ridge topography and drainage



3.2 Geology

The regional geology consists of metamorphosed and regionally deformed and faulted Archaean basement, overlain by thin deposits of alluvium and colluvium associated with rivers and creeks (Figure 3.3). BIFs, notably rich in iron, silica, sulfur and manganese (Bekele, 2013), are understood to be steeply inclined, generally striking northeast to southwest and are part of the Coongan Syncline (MWH, 2018).

The main stratigraphic units in the Project area are:

- Cleaverville BIF
- Mount Roe Basalt
- Hardy Formation metasedimentary and metavolcanic units
- Duffer Formation felsic metavolcanics
- Wyman Formation metamorphosed sedimentary and felsic volcanic sequences which include the Euro Basalt Unit in the west and the Dalton Suite to the east.

The Cleaverville BIF is structurally fault-bounded with Mount Roe Basalt to the north, Euro Basalt to the west, and the Dalton Suite to the east. The Cleaverville BIF is the focus of mining and proposed water abstraction activities.

Some alluvial and colluvial deposits associated with surface water drainage channels occur in alluvial valleys in the northern part of the Project area and extend out to approximately 5 km east of the BIF ridge, running roughly parallel to the ridge. These alluvial and colluvial deposits generally overlie the Mount Roe Basalt and Hardy Formation within the Project area (Figure 3.4).

Figure 3.3: Sanjiv Ridge geology

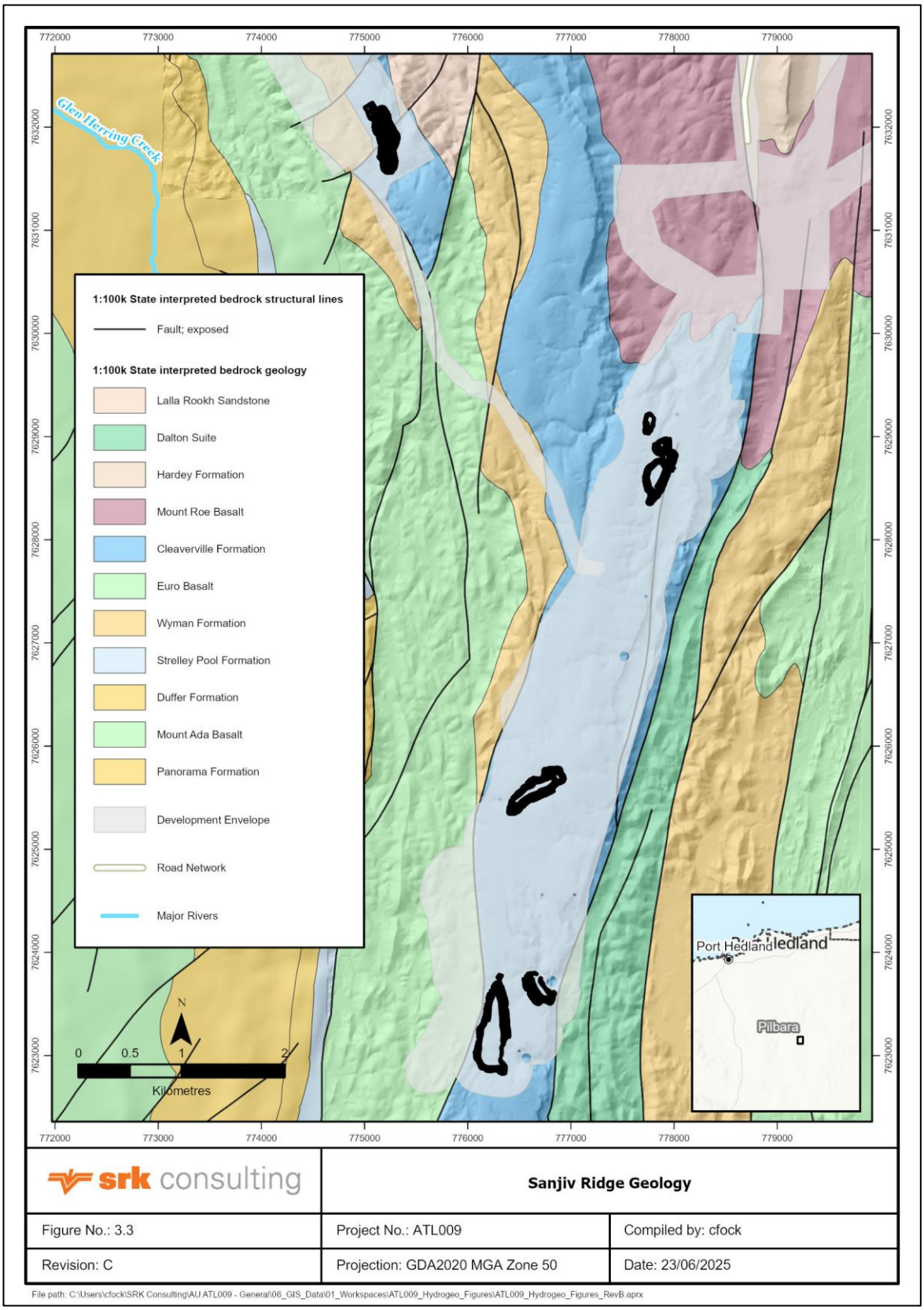
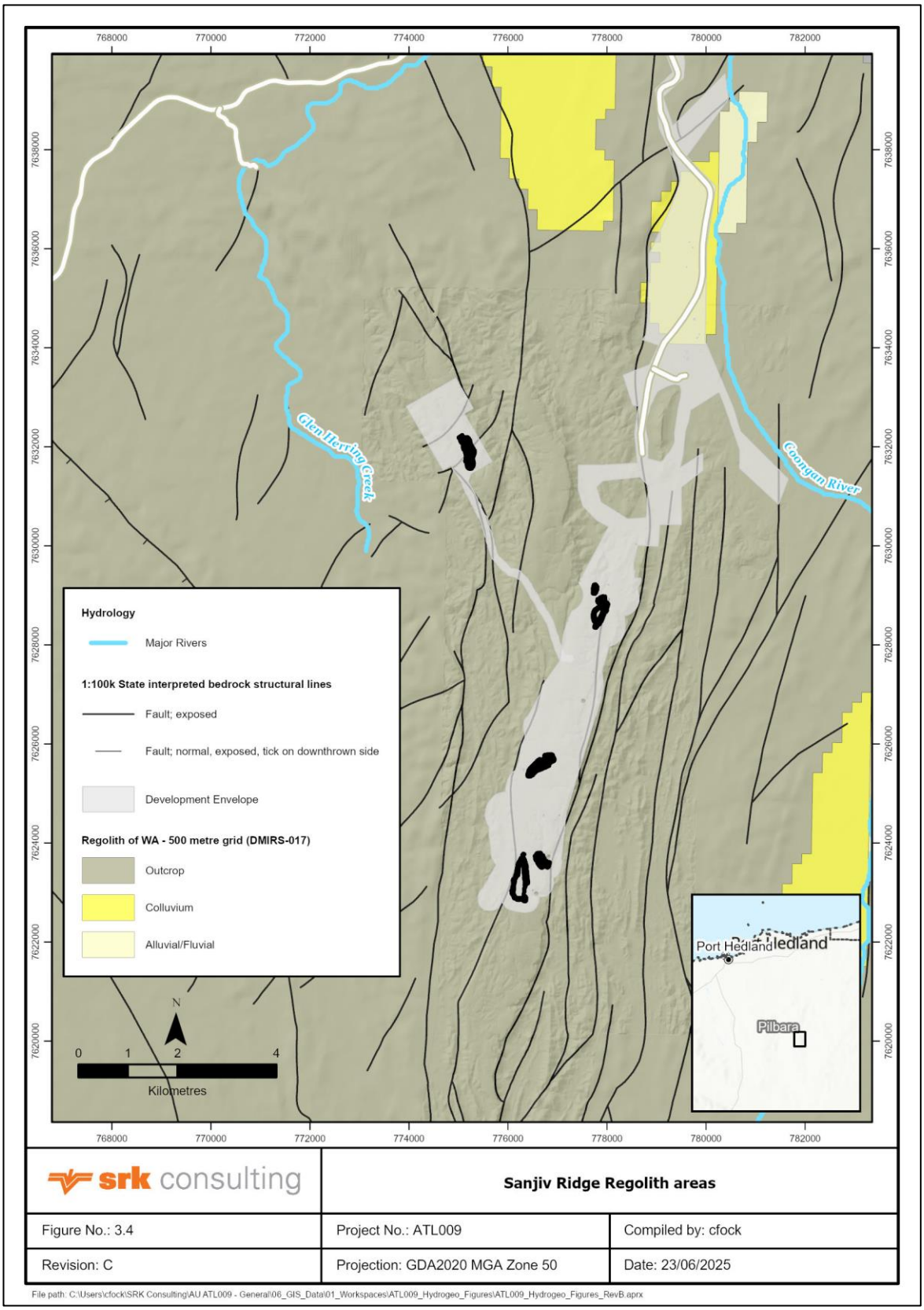


Figure 3.4: Sanjiv Ridge regolith



3.3 Hydrogeology

The Project lies within the Pilbara Groundwater Province of Western Australia. The geology of the province is typified by faulted granitoid rocks and associated folded Archaean-aged greenstone rocks, resulting in structurally controlled permeability throughout the region.

Groundwater occurs where secondary permeability and porosity have developed in fractures, weathered zones and along bedding planes, partings and joints. Therefore, groundwater occurrence tends to be compartmentalised.

Groundwater resources identified in the Project area are located in two aquifer systems:

- fractured bedrock aquifer (FBA)
- ephemeral alluvial groundwater system associated with surface water drainage lines.

3.3.1 Fractured bedrock aquifer system

The FBA is hosted within the BIF, Mount Roe Basalt, Hardy Formation, Dalton Suite, Wyman Formation, and the Euro Basalt, with flow inferred to be dominated by structurally controlled secondary permeability. Folding, faulting and associated fracture network development provides storage and permeability via preferential pathways. Comparatively, diffuse flow through competent rock mass is considered to be low.

The FBA is conceptualised as a highly anisotropic system, with higher hydraulic conductivities inferred along primary BIF, shale and chert bedding planes, and lower hydraulic conductivities at high angles to bedding planes. Hydraulic conductivities are expected to be greatly enhanced by fracture network development, and dissolution and weathering intensity.

Field investigations suggest that the FBA is highly compartmentalised, with variable hydraulic properties within the compartments/host units, varying degrees of hydraulic connectivity between compartments, and variable responses to seasonal patterns. The hydraulic connection between the BIF unit and the surrounding units (particularly the Mount Roe Basalt and Hardy Formation) are considered weak, based on the variability in water levels and the lack of response across formational contacts.

Recharge to the FBA is primarily by direct rainfall infiltration on exposed outcrop. The effective recharge is enhanced where the exposed bedrock is characterised by well-developed weathered zones, shallow fracture zones, or lithological contacts. Recharge may also occur via infiltration from the thin, discontinuous alluvial sediments. This potential recharge mechanism is enhanced where lithological contacts or fracture zones cross ephemeral watercourses. High evaporation rates in the area result in recharge being primarily limited to episodic, heavy rainfall events.

Groundwater gradients within the FBA are typically a subdued reflection of surface topography. The main groundwater flow within the BIF ridge is interpreted to be in a north–south direction, parallel to bedding planes.

Discharge from the FBA is recognised in some points within the Project area to be associated with surface pools that are most of the previous identified sensitive receptors.

3.3.2 Alluvial groundwater system

The alluvial groundwater system is comprised of thin successions of unconsolidated colluvial and alluvial deposits associated with surface water drainage channels incised into the ridge, along valleys and including the Coongan River Valley system. The alluvium associated with these drainage systems forms unconfined aquifers of limited areal extent discontinuously overlying the FBA. The hydraulic connectivity between the thin, discontinuous alluvial groundwater system and the underlying FBA varies based on the composition of the alluvial and colluvial sediments and the extent of weathering and fracture development at the geological contact.

The thin unconsolidated alluvial and colluvial sediments in the Project area are ephemeral and are not considered to form a viable long-term water supply aquifer. When saturated and during periods of low relative evaporation, these unconsolidated sediments may provide a limited source of storage and recharge to the underlying FBA.

Recharge to the alluvial groundwater system occurs via infiltration from accumulated runoff during creek flows and via direct infiltration from rainfall. Groundwater occurrence and levels in the alluvial sediments are consequently highly variable and reflect short-term precipitation patterns.

The alluvial groundwater system is not present within the Project area; however, it is spatially associated with the Coogan River, which runs parallel to the large north–south oriented ridge that hosts the mining (Figure 3.2). Although the alluvial groundwater system is not considered to have significant influence on the groundwater abstraction, recharge to the FBA by leakage may be an important process in local areas.

4 Data collected

As of May 2025, a total of 165 monitoring locations make up the groundwater monitoring network at Sanjiv Ridge. These locations are comprised of production bores, monitoring bores and permanent surface pools. Of these location, 103 locations have completed both field and laboratory analysis, with the remaining 58 having only field analysis (electrical conductivity (EC), pH, and temperature). Four locations have a single sample data but have no location. These locations are presented in Appendix A with the data presented in Appendix B and Appendix C. For the purposes of this report, these locations have been divided into eight areas. These areas are listed below from the most northerly to the most southerly:

- Road
- Camp
- Processing plant
- Runway pit
- Glen Herring pit
- Shark Gully pit
- Razorback pit
- Sparrow Lake pit.

Data collected within the 2014–2019 groundwater monitoring period were originally discussed within the Stage 4 H3 report (SRK, 2019) but have been included within this report for completeness. Data collection has continued since the 2019 H3 report and has been termed the 2020–2025 monitoring period. The locations sampled during each monitoring period have encountered minor changes over time as operations across the Project area have developed. As a result, there are minor differences between each monitoring period with the bores represented in each area.

4.1 2014–2019 monitoring period

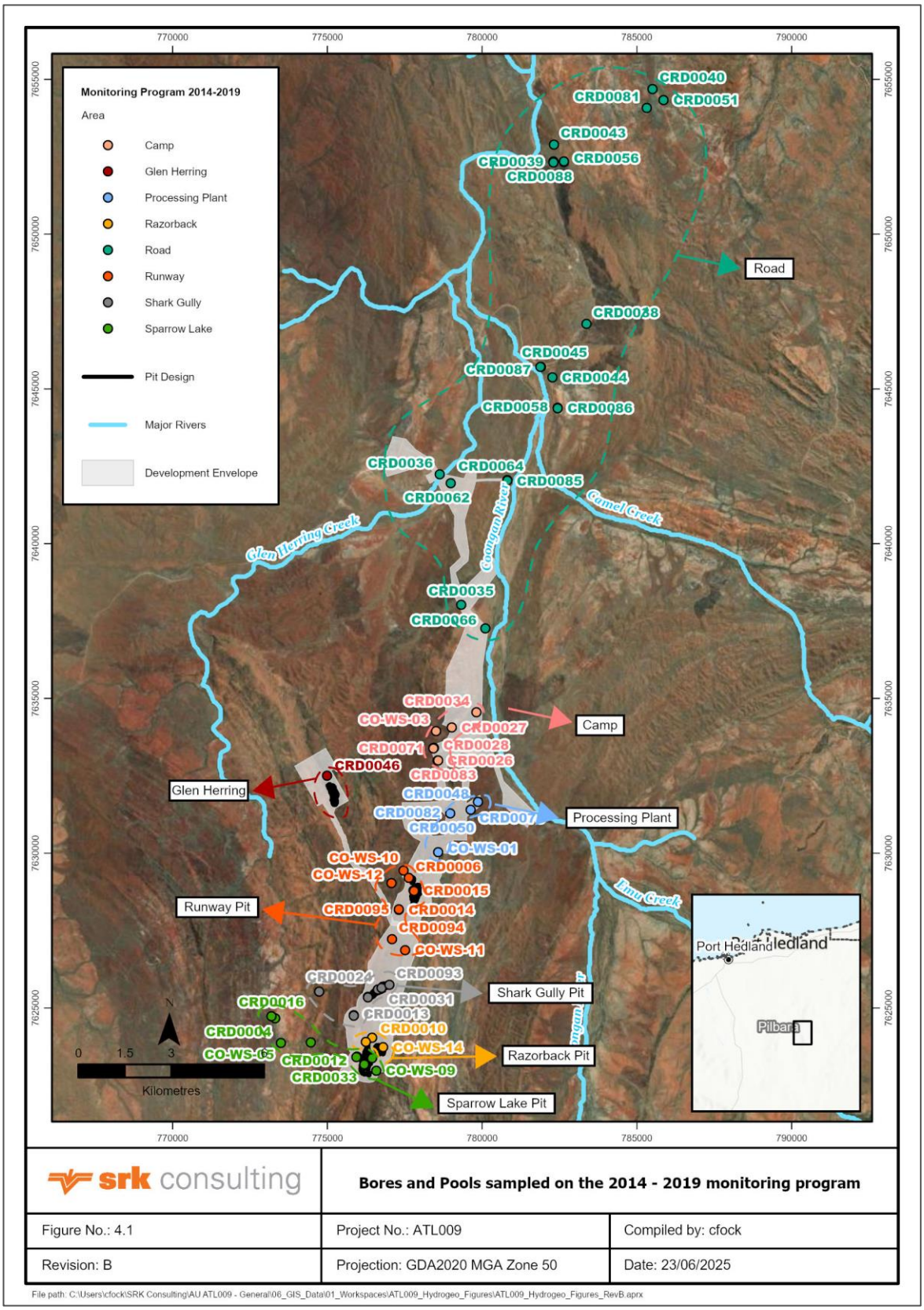
This section summarises the monitoring data results collected from 2014 to 2019, divided into the eight locations listed above.

Laboratory data from groundwater and surface water sampling, conducted by Atlas and other contractors between January 2014 and June 2019, have been incorporated into this section. Regular sampling of pools was carried out by Atlas between 2017 and 2019, except for pools CO-WS-02 and CO-WS-03 due to access restrictions. Further water quality data collected by Atlas during this period has also been included in the study.

During the 2019 site investigation program, SRK collected groundwater samples from production and monitoring bores following drilling, installation and development to establish baseline conditions. Groundwater samples were also collected at set intervals over the duration of constant rate tests.

During this monitoring period, 57 bores and 10 pools were monitored in eight different locations, as is shown in Figure 4.1. Construction details and location are presented in Appendix A.

Figure 4.1: Bore areas for the 2014–2019 groundwater monitoring period



srk consulting	**Bores and Pools sampled on the 2014 - 2019 monitoring program**	
Figure No.: 4.1	Project No.: ATL009	Compiled by: cfock
Revision: B	Projection: GDA2020 MGA Zone 50	Date: 23/06/2025

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