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Memo

To:	Ethan Richardson	**Date:**	November 1, 2013
Company:	Shore Gold Inc.	**From:**	Vladimir Ugorets, SRK
		Review:	Roger Howell, SRK
		Project #:	2CS016.006
Subject:	Results of Additional Groundwater Model Re-Calibration to Measured Pre-Mining Water Levels for Star – Orion South Kimberlite Project		

SRK Consulting (U.S.) Inc. (SRK) has prepared, per your request, this Technical Memorandum, with results of the numerical groundwater model re-calibration to measured pre-mining water levels for the Star-Orion South Kimberlite project.

Background

A previous version of the model described below was developed by SRK in 2011 and presented in a report prepared by SRK in 2011 (SRK, 2011). Hydraulic parameters used in the model and components of the simulated groundwater budget were presented in Tables 7 and 8 of that report, respectively, and the results of the steady state model calibration are shown in Figure 13 of the same report. A plan view of the model showing the model grid, geology incorporated into the uppermost layer, and applied recharge from precipitation is shown in Figure 1 of the current Technical Memorandum. Figure 2 of this Technical Memorandum shows the model cross section (Model A).

Based on the discussion of the results of the groundwater modeling in 2011, between Shore Gold, SRK, and NRCan (meeting in Ottawa on September 13), SRK has completed modeling work to improve the calibration of the model to measured water levels within till and Colorado Group shale. (In the 2011 model the simulated water levels significantly exceeded measured values, as shown in Figure 13 of the SRK report.

Changes in SRK 2011 Groundwater Flow Model

SRK has evaluated numerous scenarios of the numerical groundwater model calibration to measured water levels by:

- Adjusting the vertical hydraulic conductivity of silt/clay and till units;
- Incorporating additional hydrogeological features, which allow drainage of groundwater within till toward the Saskatchewan River; and
- Incorporating additional hydrogeological features, which allow drainage of groundwater within till into the deep groundwater system present within the Mannville Group.

This technical memorandum describes three key scenarios and the results of groundwater modeling for each.

Scenario 1 includes additional hydrogeological features which could potentially reduce simulated water levels within till and Colorado Group shale in the area of the Star and Orion South kimberlite. The changes compared to the SRK 2011 model include:

- Inter-till aquifer with hydraulic conductivity (K) of 0.5 m/d was incorporated between upper and lower till layers;
- A permeable layer of Empress Formation was incorporated at the base of the lower till, immediately above Colorado Group shale, with K=0.5 m/d;

- A permeable "kimberlite halo" zone within Colorado Group shale was incorporated around the Star, Orion South, and Orion North kimberlite with K_h=K_v=0.1 m/d; and
- A lower till zone underlying the Saskatchewan River valley was incorporated into the model with K_h=K_v =0.03 m/d.

Figure 2 shows locations of the new hydrogeological units incorporated into the model (Model B).

Scenario 2 is essentially the same model as in the SRK (2011) report, with two changes as follows:

- Vertical hydraulic conductivity of the lower surficial silt/clay layer was decreased from 1×10^{-4} m/d to 2×10^{-6} m/d; and
- Recharge from precipitation was increased within the upper surficial sand from 20 mm/year to 50 mm/year.

Scenario 3 was the same as Scenario 1, with the two additional changes described in Scenario 2.

Hydraulic conductivity values used in the model for Scenarios 1, 2, and 3 are shown in Tables 1, 2, and 3, respectively. It should also be noted that the general head boundary conditions applied within the Mannville group to simulate flux through the deep groundwater system (SRK, 2011) were modified for Scenarios 2 and 3 by raising boundary hydraulic heads by 30 m compared to SRK 2011 model and Scenario 1. Recharge from precipitation applied to the upper surficial sand was increased for Scenarios 2 and 3 from 20 mm/year (4%) to 50 mm/year (10%).

Results of Additional Groundwater Modeling

The simulated water levels compared to measured values for Scenarios 1, 2, and 3 are shown in Figures 3, 4, and 5, respectively, and the simulated components of the groundwater budget are provided in Tables 4, 5, and 6, respectively.

The results of additional modeling indicate that:

1) Incorporation of additional permeable features as inter-till aquifer, a permeable layer of till immediately above Colorado Group shale, and "kimberlite halo" zones within shale around kimberlites does not lower hydraulic heads in the till and shale units nor significantly improve calibration of the model to measured water levels;
2) Significant improvement of the groundwater model calibration can be achieved only by reducing the recharge to the till from the shallow groundwater system presented within the upper and lower surficial sands. This was achieved by reducing vertical hydraulic conductivity of the low silt/clay layer; and
3) It is possible to increase recharge from precipitation within the upper surficial sand for Scenarios 2 and 3 from 20 mm/year (4%) to 50 mm/year (10%) and still reasonably, in SRK's opinion, calibrate to measured water levels. In this case, the additional recharge would not infiltrate into the till; it would be rejected by the low-permeable silt/clay layer and discharge back into the surface water bodies in low topographic elevations (as shown in Table 5 and 6).

Conclusions

The results of additional groundwater modeling indicate:

1) Improvement of calibration of water levels within till and Colorado Group shale can be achieved by decreasing recharge to the till from the shallow groundwater system present within the upper and lower surficial sands. This can be done by reducing the vertical hydraulic conductivity of the lower silt/clay layer; and
2) In this case, estimates of potential impacts to the shallow groundwater system from proposed large scale dewatering from the Mannville Group (deep groundwater system), completed and described in (SRK, 2011), are conservative. The amount of impact would be lower than presented in (SRK, 2011) if the vertical hydraulic conductivity of the lower silt/clay layer is lower that simulated by the SRK 2011 model.

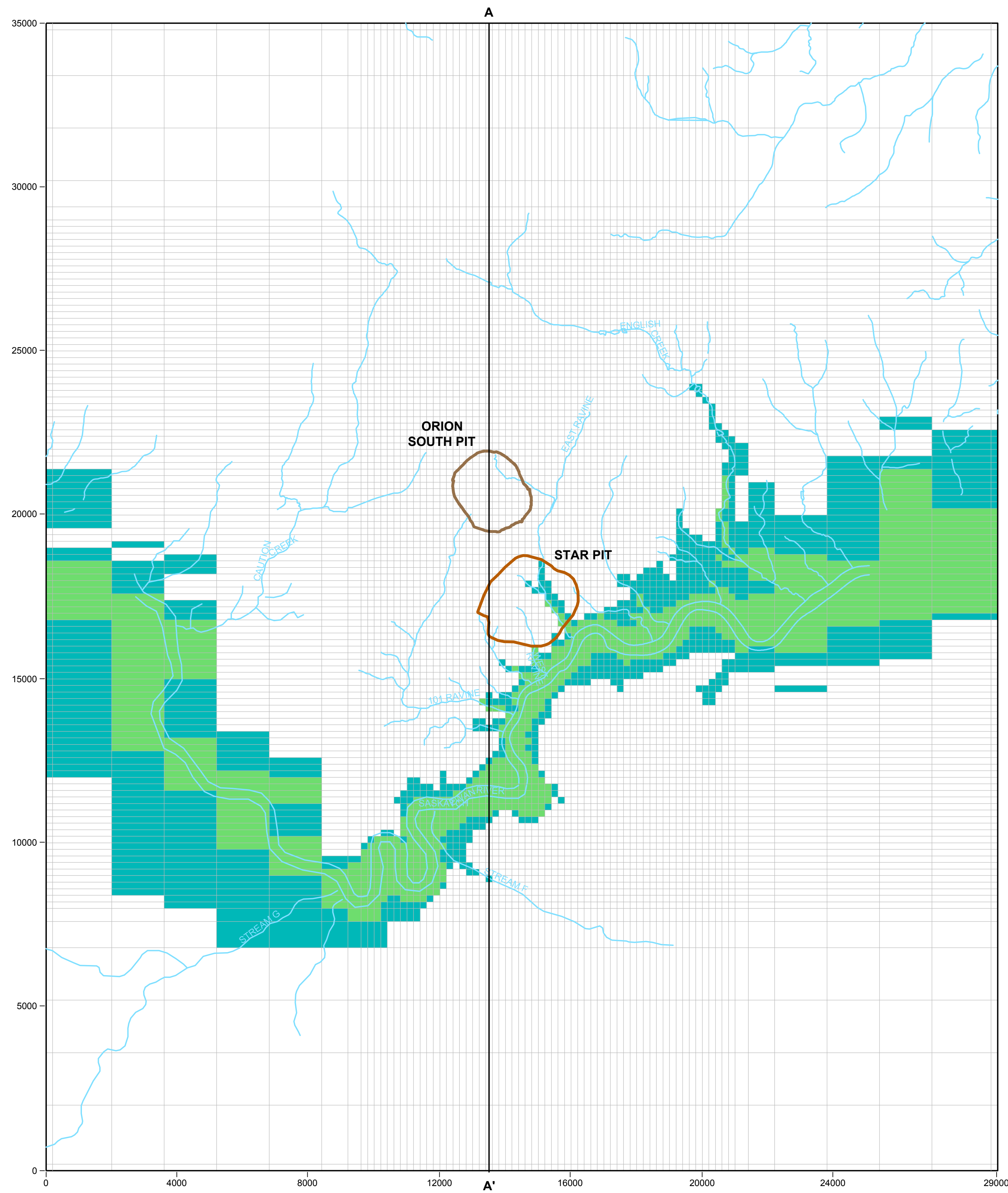
Reference

SRK Consulting, 2011. Groundwater Modeling of Feasibility Dewatering Requirements for Star and Orion South Pits and Possible Hydrogeological Impact: report prepared for Shore Gold, Inc. August 25.

Figures:

Tables:

Figures

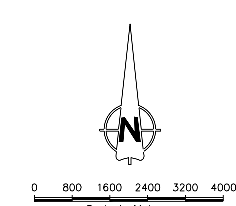


LEGEND

- CREEKS / STREAMS
- LINE OF CROSS-SECTION
- UPPER SURFICIAL SAND, R = 20mm / YEAR FOR SCENARIO 1 AND R = 50mm / YEAR FOR SCENARIO 2 AND 3
- TILL ADJACENT TO SASKATCHEWAN RIVER, R = 5mm / YEAR
- LOWER SURFICIAL SILT / CLAY, R = 5mm / YEAR
- STAR PIT
- ORION SOUTH PIT

NOTE

FINITE-DIFFERENCE GRID IS SHOWN IN MODEL COORDINATES



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SRK JOB NO.: 2CS016.005 / TASK 0260

FILE NAME: 2CS016.004.Fig.1.Rev.A.Geology.and.Recharge.Sim.2013-10-28.dwg

Shore Gold Inc.

SASKATCHEWAN, CANADA

STAR-ORION SOUTH DIAMOND PROJECT

GEOLOGY AND RECHARGE SIMULATED IN UPPERMOST LAYER OF NUMERICAL GROUNDWATER FLOW MODEL

DATE:	APPROVED:	FIGURE:	REVISION NO.
OCT 2013	VU	1	A

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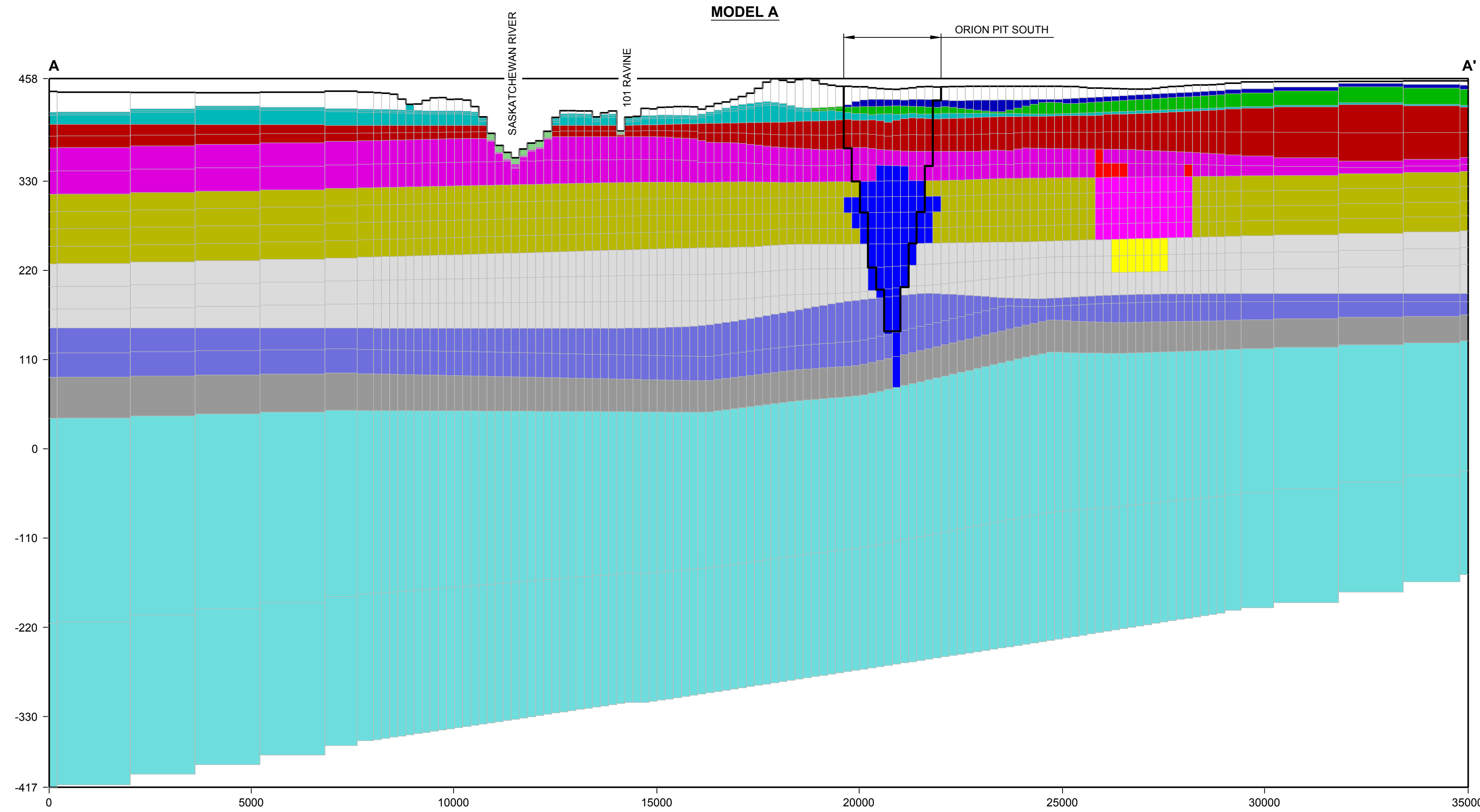

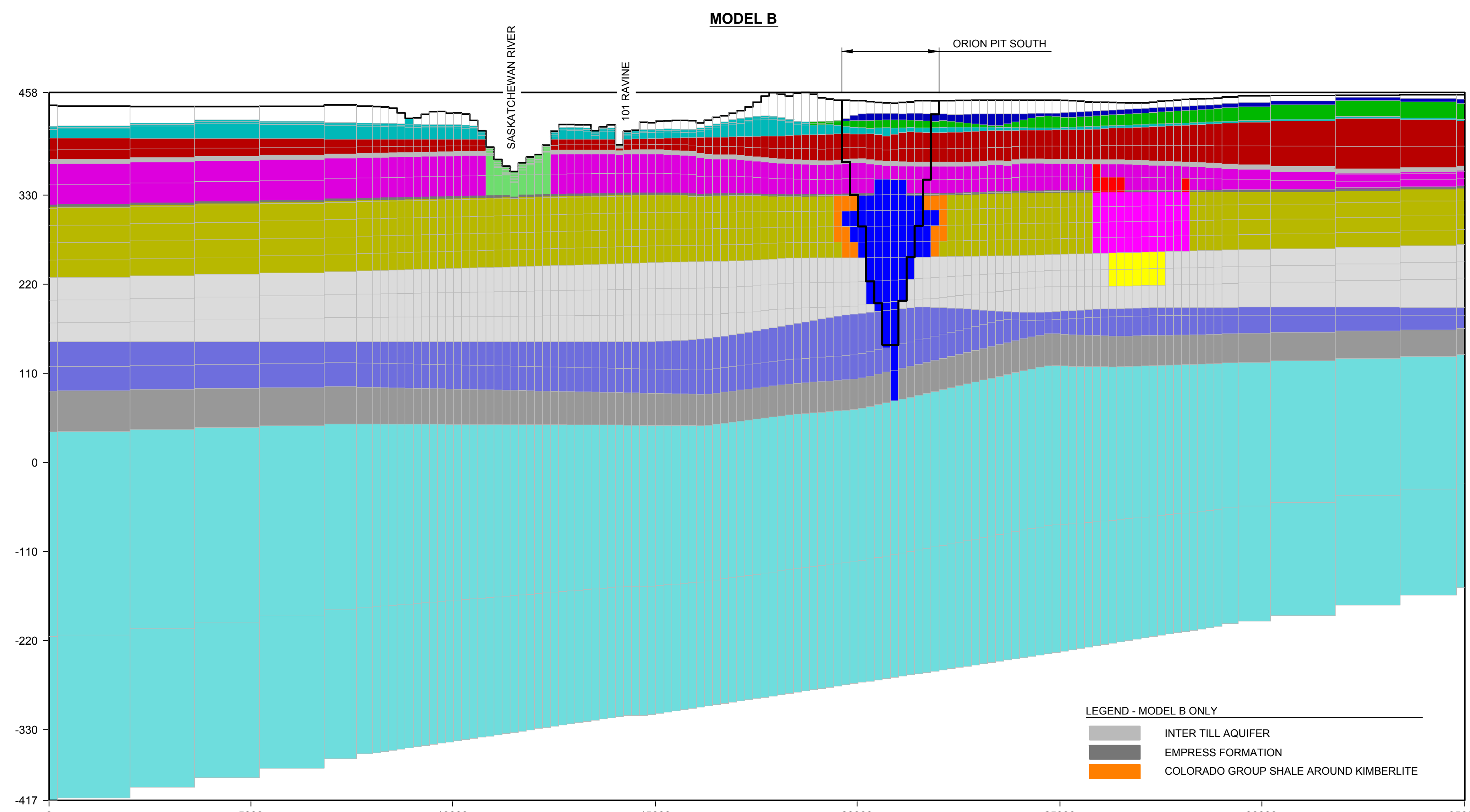

LEGEND

- UPPER SURFICIAL SAND
- UPPER SURFICIAL SILT / CLAY
- LOWER SURFICIAL SAND
- LOWER SURFICIAL SILT / CLAY
- UPPER TILL
- LOWER TILL
- UPPERMOST TILL WITHIN SASKATCHEWAN RIVER
- COLORADO GROUP SHALE
- UPPER SANDSTONE (Mannville Group)
- LOWER SANDSTONE (Mannville Group)
- UPPERMOST LIMESTONE (Souris River Fm)
- LIMESTONE (Souris River Fm)
- TILL WITHIN PALEOCHANNEL
- KIMBERLITE

0 1000 2000 3000 4000 5000

SCALE IN METRES

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SRK JOB NO.: 2CS016.005

FILE NAME: 2CS016.004.Fig.2.Rev.A.Model.Cross.Section.A-A.2013-10-28.dwg

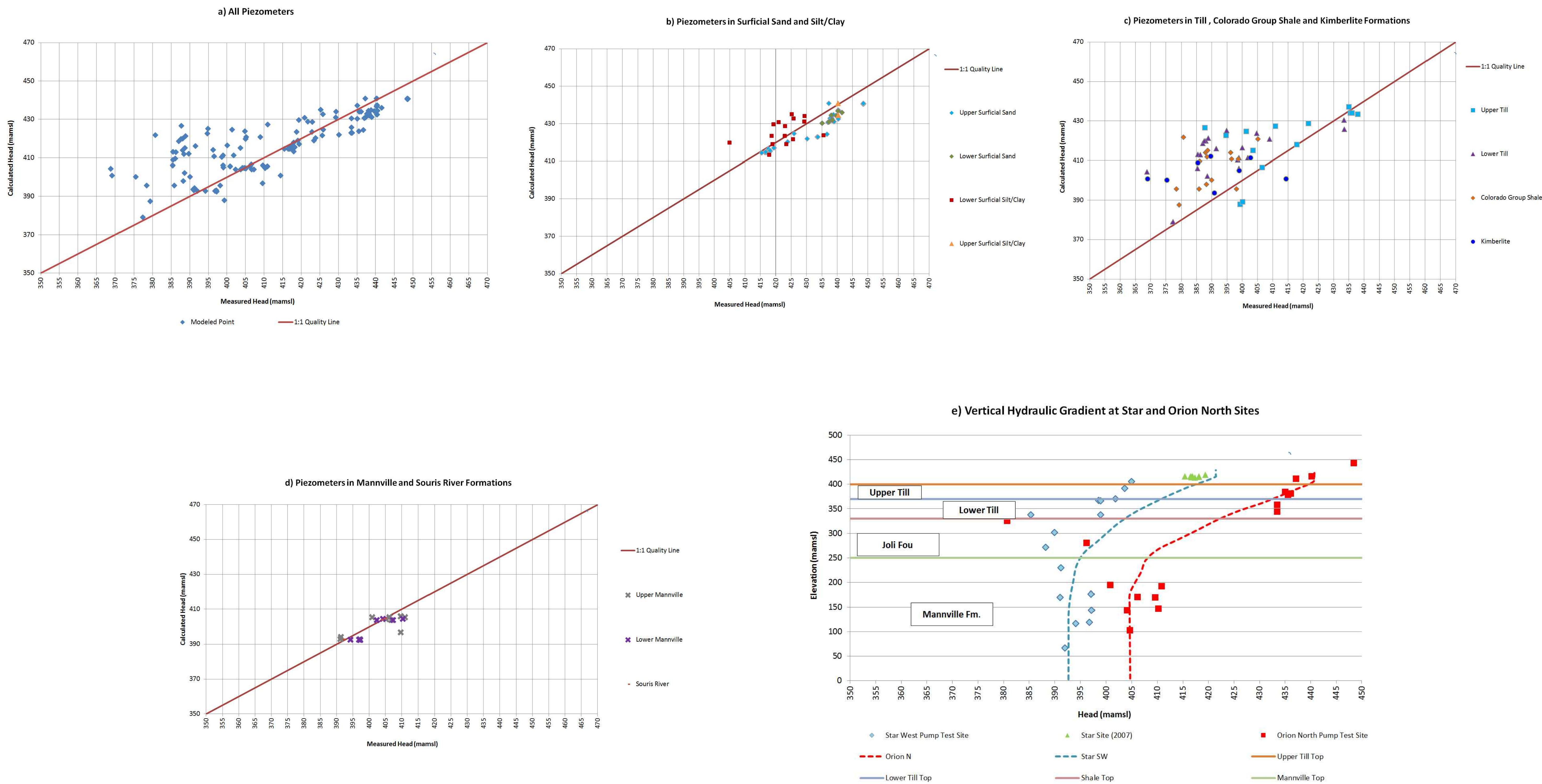
Shore Gold Inc.

SASKATCHEWAN, CANADA

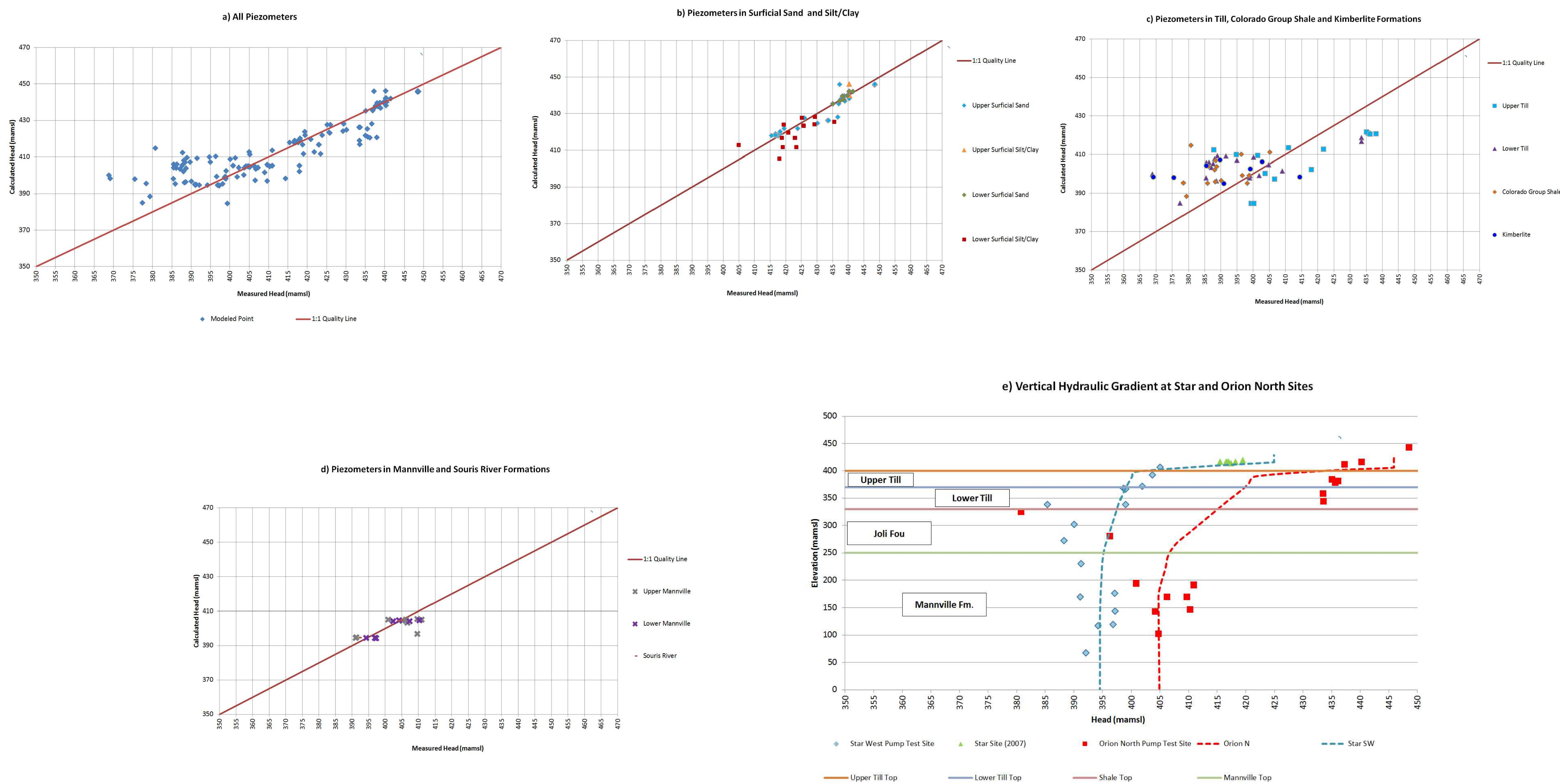
STAR-ORION SOUTH DIAMOND PROJECT

MODEL CROSS SECTION A-A'

DATE:	APPROVED:	FIGURE:	REVISION NO.
OCT. 2013	VU	2	A



srk consulting	Shore Gold Inc.	STAR-ORION SOUTH DIAMOND PROJECT
SRK JOB NO.: 2CS016.005 / TASK 0260		**RESULTS OF CALIBRATION OF MODEL TO MEASURED PRE-MINING WATER LEVELS, SCENARIO 1**
FILE NAME: 2CS016.004.Fig.3.Rev.A.Results.of.Calib.to.Model.2013-10-28.dwg	SASKATCHEWAN, CANADA	DATE: OCT 2013 / APPROVED: VU / FIGURE: 3 / REVISION NO. A



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SRK JOB NO.: 2CS016.005 / TASK 0260

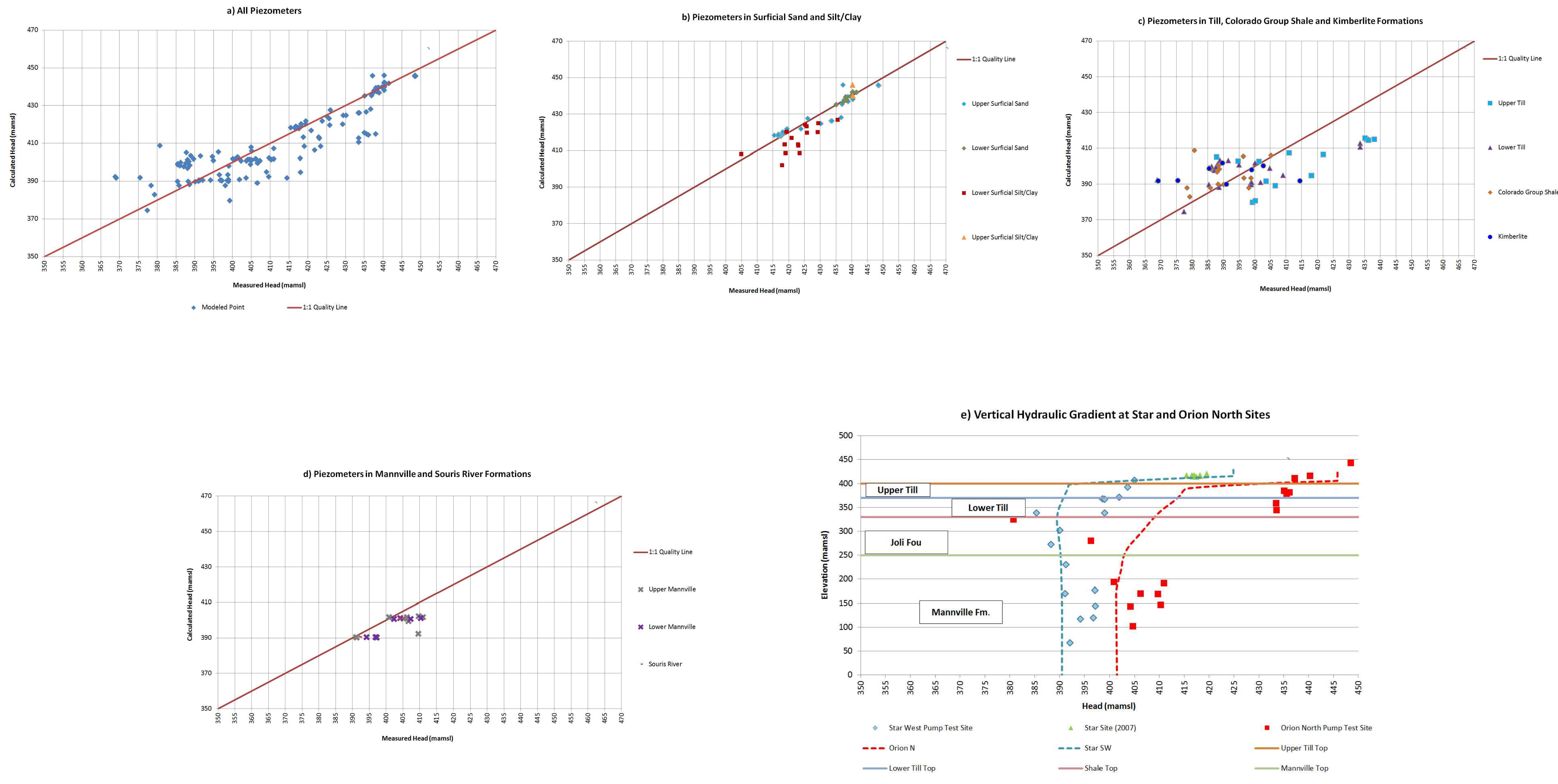
FILE NAME: 2CS016.004.Fig.4.Rev.A.Results.of.Calib.to.Model.2013-10-28.dwg

SASKATCHEWAN, CANADA

STAR-ORION SOUTH DIAMOND PROJECT

RESULTS OF CALIBRATION OF MODEL TO MEASURED PRE-MINING WATER LEVELS, SCENARIO 2

DATE:	APPROVED:	FIGURE:	REVISION NO.
OCT 2013	VU	4	A



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STAR-ORION SOUTH DIAMOND PROJECT

RESULTS OF CALIBRATION OF MODEL TO MEASURED PRE-MINING WATER LEVELS, SCENARIO 3

SASKATCHEWAN, CANADA

SRK JOB NO.: 2CS016.005 / TASK 0260	DATE: OCT 2013	APPROVED: VU	FIGURE: 5	REVISION NO. A
FILE NAME: 2CS016.004.Fig.5.Rev.A.Results.of.Calib.to.Model.2013-10-28.dwg				

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Tables

Table 1: Hydraulic Conductivity Values of Hydrogeologic Units Used in Model, Scenario 1

Hydrogeologic Unit	Horizontal Hydraulic Conductivity K_h (m/day)	Vertical Hydraulic Conductivity K_v (m/day)	Anisotrophy Ratio
Upper Surficial Sand	10	10	1
Upper Surficial Silt/Clay	0.05	0.0005	100
Lower Surficial Sand	0.1	0.01	10
Lower Surficial Silt/Clay	0.03	1.00E-04	300
Uppermost Till within Saskatchewan River Valley	0.1	0.001	100
Upper Till	0.03	0.0001	300
Inter Till Aquifer (Permeable Layer between Upper and Lower Till)	***0.5***	***0.5***	***1***
Lower Till	0.018	0.00006	300
Lower Till Zone Underlying Sasktachewan River Valley	***0.03***	***0.03***	***1***
Empress Formation at Base of Lower Till	***0.5***	***0.5***	***1***
Colorado Group Shale	0.0004	0.00006	7
Sandstone (Upper part of Mannville Fm)	0.01	0.00033	30
Sandstone (Lower part of Mannville Fm)	3	0.1	30
Uppermost Limestone (Souris River Fm)	0.01	0.001	10
Limestone (Souris River Fm)	0.001	0.0001	10
Till within Paleochannel	0.018	0.00006	300
Paleochannel (lower part)	0.1	0.001	100
Kimberlite	0.0002	0.0002	1
Colorado Group Shale around Kimberlite ("Kimberlite Halo Zone")	***0.1***	***0.1***	***1***

Notes:

1) Kv values are obtained from calibration of model to pre-mining water levels

2) Hydraulic conductivity values shown in bold/italics indicate change compared to SRK 2011 model

Table 2: Hydraulic Conductivity Values of Hydrogeologic Units Used in Model, Scenario 2

Hydrogeologic Unit	Horizontal Hydraulic Conductivity K_h (m/day)	Vertical Hydraulic Conductivity K_v (m/day)	Anisotrophy Ratio
Upper Surficial Sand	10	10	1
Upper Surficial Silt/Clay	0.05	0.0005	100
Lower Surficial Sand	0.1	0.01	10
Lower Surficial Silt/Clay	0.03	***2.00E-06***	15000
Uppermost Till within Saskatchewan River Valley	0.1	0.001	100
Upper Till	0.03	0.0001	300
Lower Till	0.018	0.00006	300
Colorado Group Shale	0.0004	0.00006	7
Sandstone (Upper part of Mannville Fm)	0.01	0.00033	30
Sandstone (Lower part of Mannville Fm)	3	0.1	30
Uppermost Limestone (Souris River Fm)	0.01	0.001	10
Limestone (Souris River Fm)	0.001	0.0001	10
Till within Paleochannel	0.018	0.00006	300
Paleochannel (lower part)	0.1	0.001	100
Kimberlite	0.0002	0.0002	1

Notes:

1) Kv values are obtained from calibration of model to pre-mining water levels

2) Hydraulic conductivity values shown in bold/italics indicate change compared to SRK 2011 model

Table 3: Hydraulic Conductivity Values of Hydrogeologic Units Used in Model, Scenario 3

Hydrogeologic Unit	Horizontal Hydraulic Conductivity K_h (m/day)	Vertical Hydraulic Conductivity K_v (m/day)	Anisotrophy Ratio
Upper Surficial Sand	10	10	1
Upper Surficial Silt/Clay	0.05	0.0005	100
Lower Surficial Sand	0.1	0.01	10
Lower Surficial Silt/Clay	0.03	***2.00E-06***	15000
Uppermost Till within Saskatchewan River Valley	0.1	0.001	100
Upper Till	0.03	0.0001	300
Inter Till Aquifer (Permeable Layer between Upper and Lower Till)	***0.5***	***0.5***	***1***
Lower Till	0.018	0.00006	300
Lower Till Zone Underlying Sasktachewan River Valley	***0.03***	***0.03***	***1***
Empress Formation at Base of Lower Till	***0.5***	***0.5***	***1***
Colorado Group Shale	0.0004	0.00006	7
Sandstone (Upper part of Mannville Fm)	0.01	0.00033	30
Sandstone (Lower part of Mannville Fm)	3	0.1	30
Uppermost Limestone (Souris River Fm)	0.01	0.001	10
Limestone (Souris River Fm)	0.001	0.0001	10
Till within Paleochannel	0.018	0.00006	300
Paleochannel (lower part)	0.1	0.001	100
Kimberlite	0.0002	0.0002	1
Colorado Group Shale around Kimberlite ("Kimberlite Halo Zone")	***0.1***	***0.1***	***1***

Notes:
1) Kv values are obtained from calibration of model to pre-mining water levels
2) Hydraulic conductivity values shown in bold/italics indicate change compared to SRK 2011 model

Table 4: Simulated Groundwater Budget for Pre-Mining Steady State Conditions, Scenario 1

Budget Component		**Simulated Flow**		**Measured Stream Base Flow**	
		Inflow (m^3/d)	**Outflow (m^3/d)**	**2009 (m^3/d)**	**2010 (m^3/d)**
Recharge		46,170	-		
Groundwater Discharge to River and Creeks	Saskatchewan River	-	6,960	ND	ND
	Stream A- Caution Creek	-	2,030	27,821	10,700
	Stream B- 101 Ravine	-	890	4,579	518
	Stream C- East Ravine	-	550	7,862	2,851
	Stream D - English Creek	-	5,360	15,034	4,147
	Stream E – West Ravine	-	120	778	778
	Creeks within Northeastern Zone	-	1,180	ND	ND
	Small Creeks Between Zone C and D	-	1,100	ND	ND
	Small Creeks Between Zone A and B	-	180	ND	ND
	Creeks within Eastern Zone	-	2,420	ND	ND
	Creeks within Western Zone	-	1,190	ND	ND
	Stream F - South from Saskatchewan River	-	370	ND	ND
	Stream G - Southwest from Saskatchewan River	-	1,360	ND	ND
	All other Creeks in Model Domain	-	10,000	ND	ND
Total River and Creeks		0	33,710		
Outer Model Boundaries	Northern	1,330	10		
	Southern	0	7,510		
	Western	0	2,470		
	Eastern	0	3,780		
	Paleochannel Western	0	10		
	Paleochannel Eastern	0	10		
Total Outer Model Boundaries		1,330	13,790		
Grand Total		**47,500**	**47,500**		

Note: Components of groundwater budget are rounded

Table 5: Simulated Groundwater Budget for Pre-Mining Steady State Conditions, Scenario 2

Budget Component		Simulated Flow		Measured Stream Base Flow	
		Inflow (m^3/d)	Outflow (m^3/d)	2009 (m^3/d)	2010 (m^3/d)
Recharge		98,930	-		
Groundwater Discharge to River and Creeks	Saskatchewan River	-	2,330	ND	ND
	Stream A- Caution Creek	-	7,200	27,821	10,700
	Stream B- 101 Ravine	-	3,550	4,579	518
	Stream C- East Ravine	-	1,900	7,862	2,851
	Stream D - English Creek	-	14,040	15,034	4,147
	Stream E – West Ravine	-	620	778	778
	Creeks within Northeastern Zone	-	5,480	ND	ND
	Small Creeks Between Zone C and D	-	2,720	ND	ND
	Small Creeks Between Zone A and B	-	840	ND	ND
	Creeks within Eastern Zone	-	6,190	ND	ND
	Creeks within Western Zone	-	2,460	ND	ND
	Stream F - South from Saskatchewan River	-	2,700	ND	ND
	Stream G - Southwest from Saskatchewan River	-	5,890	ND	ND
	All other Creeks in Model Domain	-	39,575	ND	ND
Total River and Creeks		0	95,495		
Outer Model Boundaries	Northern	2,460	0		
	Southern	0	5,020		
	Western	30	405		
	Eastern	260	760		
	Paleochannel Western	0	0		
	Paleochannel Eastern	0	0		
Total Outer Model Boundaries		2,750	6,185		
Grand Total		**101,680**	**101,680**		

Note: Components of groundwater budget are rounded

Table 6: Simulated Groundwater Budget for Pre-Mining Steady State Conditions, Scenario 3

Budget Component		Simulated Flow		Measured Stream Base Flow	
		Inflow	Outflow	2009	2010
		(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
Recharge		99,340	-		
Groundwater Discharge to River and Creeks	Saskatchewan River	-	4,350	ND	ND
	Stream A- Caution Creek	-	7,080	27,821	10,700
	Stream B- 101 Ravine	-	3,490	4,579	518
	Stream C- East Ravine	-	1,820	7,862	2,851
	Stream D - English Creek	-	13,890	15,034	4,147
	Stream E – West Ravine	-	630	778	778
	Creeks within Northeastern Zone	-	5,480	ND	ND
	Small Creeks Between Zone C and D	-	2,720	ND	ND
	Small Creeks Between Zone A and B	-	820	ND	ND
	Creeks within Eastern Zone	-	6,320	ND	ND
	Creeks within Western Zone	-	2,420	ND	ND
	Stream F - South from Saskatchewan River	-	2,600	ND	ND
	Stream G - Southwest from Saskatchewan River	-	5890	ND	ND
	All other Creeks in Model Domain	-	39,500	ND	ND
Total River and Creeks		0	97,010		
Outer Model Boundaries	Northern	2,570	0		
	Southern	0	4,710		
	Western	100	210		
	Eastern	440	530		
	Paleochanel Western	0	0		
	Paleochanel Eastern	10	0		
Total Outer Model Boundaries		3,120	5,450		
Grand Total		**102,460**	**102,460**		

Note: Components of groundwater budget are rounded