Appendix E

Technical Memorandum from Stephen Day at SRK to Miguel Wong at Barr. Dated September 12, 2008 Regarding Updates to Water Quality Predictions in Support of RS74 (Draft 02)

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Memo

To:	Miguel Wong, Barr Engineering	**Date:**	September 12, 2008
cc:	Jim Scott, PolyMet	**From:**	Stephen Day
Subject:	Updates to Water Quality Predictions in Support for RS74 (Draft 2) DRAFT	**Project #:**	1UP005.001

This memorandum summarizes methods used to produce updated source term water quality estimates for waste rock and lean ore stockpiles, open pits, tailings and hydrometallurgical residues at the NorthMet Project. These estimates are used as inputs to assessment of groundwater and surface water effects downstream of the project facilities and reported in RS74 (Draft 2) prepared by Barr Engineering (Barr).

The original basis for the source term predictions was provided in the Draft 1 versions of RS53/42 (Waste Rock, issued February 2007), RS31 (Pit Water, July 2007), RS46 (Tailings, July 2007) and RS65 (Hydrometallurgical Residues, February 2007). Subsequent to issuance of these draft reports, the agency review team have provided comments and discussion in writing and at several meetings. Partly as a result, a stochastic assessment of the uncertainties in the water chemistry predictions is ongoing. The current source term predictions are being used by Barr as input into a parallel deterministic assessment, and as a result are based on the same methodology as presented in the Draft 1 versions of the reports with revised inputs generated from ongoing laboratory testwork and other information.

The following sections of this memorandum describe any changes in modeling methodology and inputs to the calculations.

1 RS53/42 Waste Rock

1.1 Waste Rock and Lean Ore Stockpiles

The methodology used to predict average annual water chemistry for the waste rock and lean stockpiles is the same as that presented in RS53/42 (Draft 1).

The list of parameters was increased, as follows:

- Antimony – Predictions were not provided in Draft 1 due to quality problems with chemistry data from humidity cells. Predictions have been developed using information from the MDNR reactor experiments.

The methodology used to predict fluoride and vanadium was changed:

- Fluoride – Predictions in Draft 1 were directly scaled from humidity cells; however, calcium fluoride (fluorite) is a probable mineralogical control on fluoride concentrations. The relationship between calcium and fluoride activity for fluorite solubility was used to estimate fluoride from calcium. The resulting fluoride concentrations were well below the water quality standard (2 mg/L) and therefore the under-estimation resulting from use of concentrations in an activity relationship was not considered to be significant.

- Vanadium – Similarly, vanadium concentrations were directly scaled from humidity cells in Draft 1. However, vanadium has very low natural solubility due to its association with resistant oxides (e.g. magnetite) rather than sulphides and the postulated ferrous vanadate as a solubility control (Hem 1992). Concentrations have been re-calculated using the scale-up methodology but a concentration cap was applied. The highest observed concentration in PolyMet's testwork was 0.17 mg/L under initially strongly basic leachate from a Duluth Complex sample. This is well above natural background and in the same range as acid thermal waters summarized by Hem (1992).

Dissolution rates for each humidity cell were re-calculated to reflect data available to April 2008 (about 2½ years of data). 95th percentile rates for each rock category used in the calculations are provided in Table 1. Slightly different rates were used for the Proposed Project and Reasonable Alternative 1 (RA1). For the Proposed Project, the waste rock classification criteria used were those shown in Table 6-2 of RS42. In this classification system, both sulfur and copper to sulfur ratios were used to produce Categories 1/2, 3 and 4. For RA1, the classification system was revised to eliminate the use of copper to sulfur ratios resulting in new Categories 1, 2/3 and 4. The sulfur concentration of 0.12% provides the cutoff between Categories 1 and 2/3.

The quantity of rock used in the calculation for the proposed project was unchanged from RS53/42 Draft 01. For RA1, Barr provided resized quantities (email from Christie Kearney, May 22, 2008).

Infiltration inputs were provided for three climatic scenarios (low, average and high) by Barr (email from Miguel Wong, May 20, 2008).

1.2 Overburden Stockpiles

The RS53/42 report did not include predicted chemistry for water originating from the overburden stockpile. An overburden drilling program was completed in January 2008 and samples were tested according to a Sampling and Analysis Plan developed through discussion with MDNR. Field observations and subsequent analysis identified four types of overburden based on physical and chemical characteristics (Table 2):

- Peat – Organic soil.
- Unsaturated Mineral Overburden – This material was found to contain low concentrations of sulfur and leachates from Meteoric Water Mobility Procedures (MWMPs, NDEP 1996) were non-acidic and showed relatively low leachable metal concentrations.
- Saturated Mineral Overburden – A common observation during drilling was that saturated or unoxidized overburden appeared to contain iron sulfide that was not necessarily associated with Duluth Complex rock. Testing of this material confirmed that sulfur concentrations in the fine fraction were elevated compared to its coarse fraction and unsaturated overburden (Table 2). Based on the association with the fine fraction, it was concluded that the iron sulfide was formed by chemical processes occurring in the overburden after glacial deposition. The presence of chemically-reducing conditions was indicated by low oxidation-reduction potential. It is postulated that sulfate reduction is naturally occurring in these materials allowing iron sulfide to precipitate. MWMP leachates from two samples of this material were acidic (pH 3 to 4) and showed elevated concentrations (in or approaching the mg/L range) of cobalt, copper, nickel and zinc. Sulfate concentrations were near 200 mg/L. These results indicated that weathering of this material might cause it to acidify.

- Overburden Containing Duluth Complex – Some drill hole intersections contained Duluth Complex rock that was visibly mineralized.

Based on these findings, the need to mitigate potential for acid and metal leaching from the saturated mineral overburden was identified. The current plan is to compact the mixed overburden material as it is being placed to limit oxidation and infiltration and also enhance reaction of any acidic leachate with unsaturated materials. Mitigation measures will be designed so that water originating from the overburden stockpile will be non-acidic and mostly be storm water rather than seepage. Barr has calculated the resulting average water chemistry from the mass-weighted average of the median MWMP leachate chemistry for each group in Table 2.

2 RS31 – Pit Water

2.1 Proposed Project

The modeling approach for the Proposed Project was the same as that presented in RS31 Draft 01.

As for waste rock and lean ore, the list of parameters modeled was increased by adding antimony.

The geometry of the pits remained the same as RS31 Draft 01.

The following changes were made to the East Pit water balance as shown in Figure 6-3 of RS31 Draft 01 based on hydrological information provided by Barr Engineering:

- Water is occasionally removed from the East Pit during the flooding phase (year 12 to 20) in order to manage the water level in the pit during flooding. This water is sent to the waste water treatment facility (WWTF) and the tailings impoundment.
- Liner leakage from the Category 3 stockpile no longer reports to the East Pit. Liner leakage from the Category 1/2 and 1 Stockpiles continues to report to the East Pit.

Similarly, the West Pit model has the following changes:

- Tailings pond water is no longer directed to the West Pit after year 20.
- Liner leakage from the Category 3 stockpile no longer reports to the West Pit. Liner leakage from the Category 1/2 and 1 Stockpiles continues to report to the West Pit.

Updated water balance information was provided by Barr (email from Greg Williams, September 8, 2008) for low, average and high climatological conditions. In addition, the current calculations included a revised groundwater inflow model for the West Pit. Inflows are a function of pit water elevation.

Two aspects were changed in the geochemical calculations:

- Dissolution rates applied to the walls were updated using the rates indicated in Table 1 (Proposed Project).
- Groundwater and surface water inflow chemistry were updated using data provided by Barr (email from Miguel Wong May 20, 2008) (Table 3).

2.2 Reasonable Alternative 1

For RA1, the East Pit will be backfilled with oxidized Category 2/3 and 4 waste rock stockpiled during mining of the East Pit. Ongoing waste rock production in these categories from West Pit will also be backfilled to East Pit. Initial assessment of the concept considered the effect of dissolution of acidic weathering products as the rock was backfilled. The inventory of weathering products was found to create a very long term source of sulfate and metals in the pore water that would contribute to groundwater moving towards the Partridge River. To address this concern, addition of limestone to the stockpiles during mining has been proposed to prevent the onset of acidic conditions. While this will not eliminate generation of weathering products, the maintenance of non-acidic conditions will cause the rock to oxidize at a slower rate than under acidic conditions. This in turn will reduce the inventory of oxidation products available for dissolution when the rock is inundated in the East Pit. Nonetheless, water chemistry in the backfill will be driven by the dissolution of oxidation products formed under non-acidic conditions. Any water that comes into contact with the backfill is expected to acquire a chemistry that reflects equilibration with the weathering products.

The pollutant load discharging from the East Pit to the West Pit was therefore calculated from the sum of load in water flowing the wetland and load in water that seeps from the backfill. Both sources were assumed to have constant concentrations for the duration of filling the West Pit. The chemistry of water flowing through the wetland was provided by Barr and is the same chemistry used in RS31 (Draft 01). The chemistry of backfill pore water was based on a pH of 8 and was assigned the same chemistry as non-acidic drainage from the Category 1/2 and 3 waste rock in RS53/42 (Table 7-2). The assignment of this pH condition assumes that limestone addition to the stockpiles will ensure to a high degree of certainty that oxidation in the piles does not accelerate and cause rapid build-up of weathering products. In the event that pH depression does occur in the stockpiles prior to re-handling to the East Pit, additional pH modification using lime may be needed during backfilling to raise the pH of the pore water.

The discharge from the East Pit to the West Pit is then used to predict chemistry of water in the West Pit. Water balance information for three climatological scenarios under RA1were provided by Barr (email from Greg Williams, September 8, 2008).

3 RS54/46 – Tailings

3.1 Tailings Oxidation Model

The general methodology used to predict source water quality for the tailings is the same as that presented in RS54/46 (Draft 1). In RS54/46 the predictions were carried forward to provide predictions of chemistry of water captured in the horizontal drains and in groundwater downgradient of the tailings disposal area. In the current modeling, SRK predicted pore water chemistry and provided the results to Barr. Barr then used the pore water chemistry to estimate the chemistry of water in the drains and downgradient of the site.

Eighteen elements were modeled in RS46. The list was updated to include fluoride, chloride, barium, iron, manganese, molybdenum, and tin. Leaching of all these elements is assumed to be driven by sulfide oxidation. As described previously, water chemistry is calculated for sulfate by modeling sulfide oxidation. Leaching of other elements was modeled using the molar ratio element release to sulfate release observed in the kinetic testwork. Molar release ratios were updated based on recent testwork results.

3.2 Process Pond Model

The process pond water balance is the same as that presented in RS54/46 (Draft 01).

The process pond load balance was updated as follows:

- Initial pond chemistry in RS54/46 was assumed to be pure water. This input was replaced with actual monitoring data from the LTV process ponds since operation of the ponds stopped in 2001. The 95th percentile concentration was used as the input for the initial NorthMet Project tailings pond. Where data were not available, Colby Lake water chemistry data were used as the next best approximation because this source will be used as make-up water for the pond. Table 4 indicates the concentrations used and the data source.

- Beach runoff loadings were calculated using humidity cell data (Table 5). The calculation methodology was unchanged.
- In RS54/46, the feedback between seepage return and process pond was not incorporated. The portion of loading in the seepage originating as pond water and tailings stream supernatant were calculated from constant concentrations (Tables 7-14 and 7-17 in RS54/46). These constant concentrations were maximum values obtained during preliminary runs of the model. The modeling was improved by iterating between monthly seepage chemistry predictions and average process pond chemistry until median and highest concentrations in the process pond stabilized. This usually occurred after one or two iterations demonstrating that the loading in seepage originating from oxidation of the tailings was more significant than the loading carried by process pond water incorporated in the tailings and feeding seepage.

4 RS33/65 – Hydrometallurgical Residues

The predicted pore water chemistry for the hydrometallurgical residues presented in Table 6-2 RS33/65 was updated to include additional parameters required for modeling in RS74. The methodology used to obtain the values was the same as previously described. The complete list of parameters is shown in Table 6.

5 References

Hem J.D. 1992. Study and interpretation of the chemical characteristics of natural water. US Geological Survey Paper 2254.

Nevada Division of Environmental Protection. 1996. Meteoric Water Mobility Procedure (MWMP) Standardized Column Test Procedure. NDEP publication MWMP.ltr. May 3 1996. 6p

Table 1. 95th Percentile Dissolution Rates (in mg/kg/week) for Waste Rock and Lean Ore Stockpiles for Proposed Project and RA1

Category	Acidity	Alkalinity	F	Cl	SO_4	Al	Sb	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	Se	Ag	Tl	V	Zn
Proposed Project																									
2	1.4	3.3	0.025	0.1	1.9	0.063	0.0015	0.0033	0.0056	0.00011	0.0027	0.00002	0.0001	0.000053	0.0009	0.0095	0.000041	0.0012	0.000042	0.00034	0.0001	0.000026	9.9E-06	0.0013	0.0012
3	1.8	3.7	0.024	0.12	9.9	0.036	0.0015	0.0034	0.0085	0.00011	0.0034	0.000064	0.0001	0.017	0.098	0.04	0.000056	0.028	0.000036	0.21	0.00027	0.0001	0.000011	0.00079	0.011
4	1.5	7.2	0.031	0.1	11	0.042	0.0015	0.0024	0.0054	0.000099	0.02	0.000029	0.00012	0.00064	0.001	0.019	0.000044	0.0085	0.000088	0.0077	0.00042	0.000062	0.00001	0.0051	0.0013
4 - Virginia	26	0.17	0.033	0.1	50	0.5	0.0002	0.00054	0.0042	0.00057	0.016	0.0032	0.00012	0.039	0.007	9.7	0.0006	0.088	0.000024	0.48	0.00051	0.000031	0.000012	0.000097	0.51
Ore	2.1	2.8	0.031	0.11	20	0.0081	0.0015	0.00077	0.0063	0.000098	0.011	0.00007	0.000098	0.037	0.059	0.006	0.000054	0.086	0.000029	0.62	0.00023	0.000025	0.000014	0.00011	0.015
RA1																									
2	1.4	6.3	0.025	0.11	1.3	0.063	0.0015	0.00035	0.0056	0.00011	0.0013	0.00002	0.0001	0.000053	0.00088	0.0069	0.000042	0.00081	0.000041	0.00035	0.000098	0.000024	9.9E-06	0.00021	0.0012
3	1.6	6.3	0.025	0.12	5.8	0.037	0.0015	0.009	0.0057	0.00011	0.0038	0.000035	0.0001	0.01	0.068	0.013	0.000036	0.019	0.00018	0.12	0.00012	0.00006	9.6E-06	0.0018	0.0097
4	19	3.3	0.2	0.11	50	0.12	0.0015	0.0042	0.0066	0.00017	0.28	0.00039	0.00011	0.056	0.0075	7.8	0.00016	0.18	0.00013	0.56	0.0007	0.00003	0.000017	0.00044	0.054
4- Virginia	21	3.2	0.033	0.1	42	0.48	0.0002	0.00048	0.0041	0.00055	0.016	0.0031	0.00012	0.027	0.0064	7.7	0.00058	0.068	0.000024	0.34	0.00043	0.000031	0.000011	0.0001	0.49
Ore	2.1	2.8	0.031	0.11	20	0.0081	0.0015	0.00077	0.0063	0.000098	0.011	0.00007	0.000098	0.037	0.059	0.006	0.000054	0.086	0.000029	0.62	0.00023	0.000025	0.000014	0.00011	0.015

Table 2. Characteristics of Overburden

Material Type Tess Performed	Stat	Cu mg/kg	Ni mg/kg	Total S %,S	S as Sulfide %,S	pH	F mg/L	Cl mg/L	SO_4 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Tl mg/L	V mg/L	Zn mg/L
Peat	P5	43	33	0.066	<0.01	6.8	0.083	3.4	27	0.2	<0.00006	0.0017	0.028	<0.0002	0.033	<0.00003	0.0011	0.00081	0.014	0.15	0.00036	0.2	0.0015	0.0074	0.00064	<0.00005	0.000072	0.0021	0.0043
6 Solid Analyses	Median	120	72	0.09	0.04	6.2	0.11	9.7	59	0.81	0.0003	0.003	0.032	<0.0002	0.10	0.000075	0.002	0.0018	0.042	0.45	0.0015	0.3	0.0053	0.014	0.001	<0.00005	0.00009	0.0032	0.0065
2 MWMPs	P95	240	110	0.15	0.25	5.7	0.14	16	90	1.4	0.00066	0.0043	0.035	<0.0002	0.17	0.00018	0.0029	0.0027	0.069	0.74	0.0027	0.39	0.0091	0.021	0.0014	<0.00005	0.00011	0.0042	0.0088
Unsaturated Mineral	P5	27	27	<0.02	<0.01	7.3	0.17	0.86	4.7	0.069	<0.00006	0.0004	0.0032	<0.0002	0.015	<0.00003	<0.0002	0.00051	0.005	0.041	<0.00005	0.046	0.0002	0.0016	<0.0002	<0.00005	<0.00002	0.00042	0.0021
13 Solid Analyses	Median	53	59	0.01	0.01	7.1	0.32	1.9	17	0.091	0.0003	0.0004	0.0051	<0.0002	0.03	0.00005	<0.0002	0.0006	0.0054	0.05	<0.00005	0.051	0.0024	0.0029	<0.0002	<0.00005	<0.00002	0.0006	0.003
4 MWMPs	P95	150	100	0.11	0.01	6.9	0.46	1.9	21	0.3	0.001	0.0029	0.013	<0.0002	0.035	0.00015	0.00097	0.0015	0.007	0.059	<0.00005	0.10	0.013	0.0033	0.00052	<0.00005	0.000025	0.0006	0.0057
Saturated Mineral	P5	32	23	<0.01	0.01	8	0.24	1.3	5.9	0.029	<0.0001	0.0016	0.0071	<0.0002	0.013	<0.00004	<0.0002	0.00011	0.0034	<0.001	<0.00005	0.044	0.00033	0.002	0.00055	<0.00005	<0.00002	<0.0002	<0.0004
19 Solid Analyses	Median	59	63	0.05	0.02	7.4	0.42	2.3	68	0.14	0.0004	0.0027	0.014	<0.0002	0.037	<0.00004	0.0003	0.0013	0.017	0.15	<0.00005	0.12	0.027	0.019	0.0019	<0.00005	<0.00002	0.0014	0.003
6 MWMPs	P95	560	230	0.32	0.11	3.5	1.0	7.6	220	0.61	0.0012	0.0032	0.041	0.0005	0.19	0.0054	0.0012	0.25	0.44	5.4	0.0012	1.2	0.032	2.2	0.0038	0.00096	0.000082	0.0025	0.86
OB with Mineralized Rock	P5	110	59	0.015	0.031	7.1	0.19	3.3	10	0.013	<0.00008	0.00053	0.0037	<0.0002	<0.001	0.000051	<0.0002	0.00016	0.008	<0.009	<0.00005	0.022	0.0054	0.0046	<0.00009	<0.00005	<0.00002	<0.0002	0.0021
3 Solid Analyses	Median	780	370	0.15	0.22	7.1	0.23	3.5	84	0.039	0.00015	0.0008	0.006	<0.0002	<0.001	0.00006	<0.0002	0.0025	0.0082	0.005	<0.00005	0.16	0.019	0.038	0.0009	<0.00005	<0.00002	0.00015	0.0025
2 MWMPs	P95	1100	500	0.45	0.41	7.1	0.28	3.6	160	0.065	0.00038	0.0011	0.0082	<0.0002	<0.001	0.000069	<0.0002	0.0048	0.0083	0.019	<0.00005	0.29	0.032	0.072	0.0019	<0.00005	<0.00002	0.00047	0.003
All	P5	29	24	<0.02	<0.003	7.8	0.11	1.1	2.8	0.019	<0.0001	0.0004	0.0033	<0.0002	<0.001	<0.00004	<0.0002	<0.0001	0.0038	<0.01	<0.00005	0.027	0.00017	0.0012	<0.0002	<0.00005	<0.00002	<0.0002	0.0003
41 Solid Analyses	Median	87	62	0.04	0.01	7.1	0.28	2.5	32	0.11	0.00035	0.0023	0.012	<0.0002	0.028	0.00005	0.00005	0.0013	0.0086	0.065	<0.00005	0.11	0.008	0.013	0.001	<0.00005	<0.00002	0.00065	0.003
14 MWMPs	P95	850	390	0.31	0.17	3.6	0.85	12	200	1.0	0.0011	0.0037	0.039	0.00015	0.2	0.0039	0.0019	0.19	0.28	3.2	0.0019	1.2	0.033	1.3	0.0037	0.00046	0.0001	0.0031	0.53
	Max	1600	520	0.61	0.43	3.4	1.1	17	230	1.5	0.0012	0.0044	0.046	0.0008	0.23	0.0066	0.003	0.31	0.58	7.3	0.0028	1.3	0.034	3.0	0.0038	0.0014	0.00011	0.0043	1.2

Notes:
Solids concentrations are on -200 mesh fraction
Solution concentrations are from MWMPs.

Table 3. Groundwater and Surface Water Inflow to Pits

	Acidity mg/L	Alkalinity mg/L	Hardness mg/L	F mg/L	Cl mg/L	SO_4 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Tl mg/L	V mg/L	Zn mg/L
Groundwater	7.9	61	66	0.28	6.6	16	0.13	0.0015	0.0022	0.022	0.00015	0.087	0.0001	0.0055	0.0017	0.003	2.8	0.0011	0.12	3.4E-06	0.0084	0.016	0.0019	0.00055	0.000004	0.0043	0.028
Surface Water	4.7	70	110	0.07	8	9	0.07	0.0015	0	0	0	0.045	0	0.0011	0	0.0017	1.6	0.0005	0.15	0.000003	0	0	0	0	0.0004	0.0009	0.016

Table 4. Initial Process Pond Chemistry

	Alkalinity mg/L	Cl mg/L	F mg/L	Hardness mg/L	NO_3+NO_2 mg N/L	NH_3 mgN/L	SO_4 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Na mg/L	Tl mg/L	V mg/L	Zn mg/L
Source	Pond	Pond	Pond	Pond	Colby	Colby	Pond	Colby	Colby	Pond	Colby	Colby	Colby	Colby	Pond	Colby	Pond	Colby	Pond	Colby	Pond	Colby	Colby	Colby	Colby	Colby	Pond	Colby	Hem	Colby
Concentration	340	26	7.7	350	0.1	0.1	130	0.31	0.003	0.0069	0.053	0.0002	0.14	0.000054	36	0.0035	0.001	0.0048	0.057	0.00049	63	0.28	0.017	0.0028	0.0009	0.001	100	0.001	0.0009	0.0069

Table 5. Dissolution Rates (mg/m^2 of beach/month) Used to Calculate Tailings Beach Runoff

Type	Acidity	Alkalinity	F	Cl	SO_4	Al	Sb	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	Se	Ag	Tl	V	Zn
Coarse	140	2400	2.8	21	700	7.1	0.029	0.16	0.063	0.011	2.1	0.0022	0.015	0.0079	0.31	1.4	0.0097	0.73	0.049	0.14	0.012	0.0028	0.0011	0.043	0.067
Fine	140	2300	2.8	22	1000	8.0	0.029	0.097	0.087	0.011	2.0	0.0022	0.016	0.014	0.12	2.1	0.0071	0.65	0.045	0.16	0.012	0.0028	0.0011	0.042	0.15

Table 6. Predicted Pore Water Concentrations in Hydrometallurgical Residues

pH Range	Ag mg/L	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Sb mg/L	Se mg/L	SO_4 mg/L	Tl mg/L	V mg/L	Zn mg/L
6.6 to 8.5	0.0005	0.18	0.004	0.14	0.005	0.002	0.0004	0.005	0.05	0.015	0.4	0.0023	0.14	0.098	0.0005	0.004	0.054	7347	0.0002	0.002	0.01