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Calculations to Determine Baseline Water Quality and Evaluate the Level or Significance of Degradation

See 2020 Water Quality Management Plan / Continuous Planning Process Appendix A Sections 4 and 5.

Determine Critical Low Flow / Mixing Zones (See 20.6.4.11 NMAC (Applicability of Water Quality Standards):

	Streams:	**Lakes, Reservoirs, Playas:**
Human Health-Organism Only Criteria	= Harmonic Mean (HM) or Modified Harmonic Mean (MHM) See 20.6.4.7 (H)(2) & 20.6.4.11(B)(1) NMAC.	Mixing zones are not allowed. Effluent discharges shall meet criteria at point of discharge. See 20.6.4.11(E)(1) NMAC.
All Other Narrative and Numeric Criteria	= 4Q3 See 20.6.4.7 (A)(1) & 20.6.4.11(B)(2) NMAC. 4Q3 is the minimum average flow over four consecutive days that occurs with a frequency of once in three years. 4Q3 may be determined on an annual, a seasonal, or a monthly basis, as appropriate, after due consideration of site-specific conditions.	Mixing zones are not allowed. Effluent discharges shall meet criteria at point of discharge. See 20.6.4.11(E)(1) NMAC. Omit Mixing Zone Limitations in 20.6.4.11 NMAC (Applicability of Water Quality Standards). Critical lake and reservoir water levels will be determined on a case-by-case basis.

Determine Reasonably Expected Concentration Effluent (Ce):

Reasonably Expected Pollutants: Determined by a review of effluent data in the NPDES application, Form 2; effluent and stormwater data provided for NMED GWQB discharge permits (DPs), and site-specific background water quality data provided by NMED SWQB MASS.

Determine Baseline Water Quality (bwq):

Baseline Water Quality Concentration (Cbwq) = concentration of pollutant in stream/waterbody above the discharge; baseline water quality

Cbwq Calculation Notes:
- Minimum Detection Limit = MDL (See 2020 WQMP/CPP Appendix A Glossary and USEPA 40 CFR 136 Appendix B)
- Minimum Level (ML) = Reported Level (RL) or Quantitation Level (See USEPA Sufficiently Sensitive Method Rule)
- If pollutant is "not detected" or is "less than" MDL and MDL < or = Cwqs; then use Geometric Mean of MDL
- If at least one data point is detected (i.e., = or > MDL meaning estimated data may be used), then use MDL/2 for "less than"
- If data not provided / not retested at MDL that is lower or < Cwqs, then Cbwq = MDL/2
- If data not reported to MDL, then may substitute reported or quantitation minimum level (ML)
- If higher ML or 1/2 ML (using same instructions for MDL) results in no or allowable degradation, then use of MDL or 1/2 MDL will also result in no or allowable degradation.

Evaluate Level of Degradation (Surface Water + Discharge):

See 2020 Water Quality Management Plan / Continuous Planning Process Appendix A Section 5.3 Calculations to Determine Significance of Degradation.

Mass Balance Equation:

[(discharge flow x discharge concentration) + (stream/waterbody flow x stream/waterbody concentration)]
= (resulting flow downstream of discharge x resulting concentration downstream of discharge)
[(Qs x Cs) + (Qd x Cd)] = (Qr x Cr)

Where (for streams):	**Where (for lakes, reservoirs, and playas):**
Qs = stream flow above discharge (cfs or MGD) 4Q3 or HM	Qs = volume of lake at critical lake water level (ac-ft or MG)
Qd = discharge flow (cfs or MGD)	Qd = discharge flow (cfs or MGD) or discharge volume (ac-ft or MG)
Qr = resulting flow in-stream downstream of discharge (cfs or MGD) Qs + Qd (cfs or MGD)	Qr = resulting volume of lake after discharge (ac-ft or MG) Qs + Qd (ac-ft or MG)
Cs = concentration of pollutant in stream above the discharge (mg/L)	Cs = concentration of pollutant in lake (mg/L)
Cd = concentration of pollutant in discharge (mg/L)	Cd = concentration of pollutant in discharge (mg/L)
Cr= resulting concentration of pollutant in-stream downstream of discharge (mg/L)	Cr = resulting concentration of pollutant in lake (mg/L)

Solve for Cd

Cd= [(Qr x Cr) - (Qs x Cs)] / Qd
{[(Qs + Qd) x Cr] - (Qs x Cs)} / Qd

Determining Assimilative Capacity

Concentration Water Quality Standard (Cwqs)= segment-specific criteria or designated use-specific numeric criteria (mg/L or other unit as indicated)

Assimilative Capacity (AC)= The difference between the most stringent applicable water quality standard for a pollutant (Cwqs) and the baseline water quality concentration for that pollutant (Cbwq).
Cwqs - Cbwq (mg/L)

Notes:
- If AC is negative (-), then water may not be high-quality. Antidegradation Tier 2 review may not applicable at this time.
- If AC is negative (-), then evaluate the need for additional testing or condition that Ce = Cwqs at point of discharge, outfall or end of pipe.
- For example, a permittee may re-test at a lower MDL (if available) if a pollutant is reasonably expected in discharge

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For purposes of Tier 2 antidegradation reviews, NMED solves for the discharge concentration that uses 10% of the assimilative capacity.

Calculated Resulting Concentration of Pollutant at 10% AC (Cr_{10})= Calculate the resulting concentration of pollutant in-stream downstream of the discharge (mg/L) when 10% of the assimilative capacity has been used.
(AC x 0.1) + Cbwq
((Cwqs - Cbwq) x 0.1) + Cbwq

Calculated Concentration of Pollutant in the Discharge that uses 10% AC (Cd_{10}) = Calculate the discharge concentration at 10% AC using Cr_{10}
= {[(((Cwqs – Cbwq) x 0.1) + Cbwq) x (Qs + Qd)] – (Qs x Cs)} / Qd

50% cumulative cap = Not applicable for only one (1) regulated discharge
= Only applicable for multiple regulated discharges to the same receiving water over time

Comparison (comprehensive Tier 2 antidegradation review includes an alternatives analysis and social and economic demonstration - See 2020 WQMP/CPP Appendix A Sections 6 & 7):

No significant degradation. If $Cd_{10\%}$ > Ce, then antidegradation review process is complete and the permitting process may proceed.

Further degradation analysis needed. Calculated maximum loading capacity (with increased 10% assimilative capacity) would be flagged if further comprehensive review required.
If $Cd_{10\%}$ < or = Ce or if Ce > 50% cumulative cap, then "Further Antidegradation Required."

References:

State of New Mexico Water Quality Management Plan / Continuing Planning Process Appendix A
Antidegradation Policy Implementation Procedure for Regulated Activities Revision October 23, 2020
https://www.env.nm.gov/surface-water-quality/wqs/

State of New Mexico Water Quality Standards (NMWQS) effective April 23, 2022 for state purposes
https://www.env.nm.gov/surface-water-quality/wqmp-cpp/

2024-2026 Integrated Report Clean Water Act 303(d)/305(b) Integrated Report, EPA-Approved May 13, 2024
https://www.env.nm.gov/surface-water-quality/303d-305b/

Additional Information:

20.6.4.900(J)(1) Use-specific criteria (effective 04/23/22)
(2) Notes applicable to the table of numeric criteria in Paragraph (1) of this subsection.
(a) Where the letter “a” is indicated in a cell, the criterion is hardness-based and can be referenced in Subsection I of 20.6.4.900 NMAC.
(b) Where the letter “b” is indicated in a cell, the criterion can be referenced in Subsection C of 20.6.4.900 NMAC.
(c) Criteria are in µg/L unless otherwise indicated.
(d) Abbreviations are as follows: CAS - chemical abstracts service (see definition for “CAS number” in 20.6.4.7 NMAC);
DWS - domestic water supply; Irr/Irr storage- irrigation and irrigation storage; LW - livestock watering;
WH - wildlife habitat; HH-OO - human health-organism only; C – criteria based on cancer-causing endpoint; P - persistent toxic pollutant.
(e) The criteria are based on analysis of an unfiltered sample unless otherwise indicated. The
acute and chronic aquatic life criteria for aluminum are based on analysis of total recoverable aluminum in a sample that is filtered to
minimize mineral phases as specified by the department.
(f) The criteria listed under human health-organism only (HH-OO) are intended to protect human
health when aquatic organisms are consumed from waters containing pollutants. These criteria do not protect the aquatic life itself;
rather, they protect the health of humans who ingest fish or other aquatic organisms.
(g) The dioxin criteria apply to the sum of the dioxin toxicity equivalents expressed as 2,3,7,8-TCDD dioxin.
(h) The criteria for polychlorinated biphenyls (PCBs) apply to the sum of all congeners, to the sum of all homologs or to the sum of all aroclors.
(i) The acute and chronic aquatic life criteria for dissolved aluminum only apply when the
concurrent pH is less than 6.5 or greater than 9.0 S.U. If the concurrent pH is between 6.5 and 9.0 S.U. then the hardness-dependent
total recoverable aluminum criteria in Paragraphs (1) and (2) of Subsection I of 20.6.4.900 NMAC apply.

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Permittee / Applicant:	Chevron Mining Inc.
Facility / Proposed Discharge:	Questa Mine, Outfall 004
NPDES Permit/Application Tracking #:	NM0022306
Source Water:	Stormwater discharges (Source: NPDES application, Form 2F; ECHO data; DMR data submitted to NMED& EPA)
Receiving Water:	Red River, Segment 20.6.4.122 NMAC in the Rio Grande Basin
Segment:	20.6.4.122 NMAC
Designated Uses:	Coldwater aquatic life, fish culture, irrigation/irrigation storage, livestock watering, wildlife habitat and primary contact.
Existing Uses:	Same as designated uses.
Segment Specific Numeric Criteria:	The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less. 20.6.4.122(B) NMAC
Use Specific Numeric Criteria / Table:	20.6.4.900(J)(1) NMAC (Applicable to Existing, Designated or Attainable Uses unless otherwise specified in 20.6.4.97 through 20.6.4.899 NMAC)
Impairments:	Assessment Unit Red River (Rio Grande to Placer Creek), assessment unit ID NM-2119_10. TMDL for dissolved aluminum approved in 2006, and withdrawn in 2013 because dissolved aluminum criteria no longer apply. TMDL for turbidity approved in 2025. (Source: 2024-2026 Integrated Report https://www.env.nm.gov/surface-water-quality/303d-305b/ and TMDLS https://www.env.nm.gov/surface-water-quality/tmdl/).

Cd ={ [((Cwqs - Cbwq) x 0.1 + Cbwq) x (Qd + Qs)] - [(Cbwq x (Qs)]}/Qd

Cd_{10} = concentration of pollutant in discharge (mg/L)
Cwqs = water quality standard
Cbwq = baseline water quality (mg/L)
Qd = discharge flow (cfs or MGD) or discharge volun
Qs = volume of lake at critical lake water level, case by case (acre-feet (ac-ft) or million gallons (MG))
Cs = concentration of pollutant in lake (mg/L)
Cr = Cr =resulting concentration of pollutant at 10% Assimilative capacity, set equal to (((Cwqs-Cbwq) x 0.1) + Cbwq)

1 MGD = 1.547 cfs
1 cfs = 0.6464 MGD

Solve for Cd (NMED solves for the discharge concentration that would use up 10% of the assimilative capacity):

	cubic feet per second (cfs)	million galls per day (MGD)	
Q_{d1} (effluent discharge flow 1) =	0.246 cfs	0.159 MGD	From NPDES application Form 2F Table D - Outfall 004 Stormwater and ECHO data
Qd (effluent discharge) =	0.246 cfs	0.159 MGD	
Qs (4Q3) =	9.814 cfs	6.344 MGD	from calculation StreamStats
Qd + Qs (total streamflow) =	10.060 cfs	6.503 MGD	
Qs (harmonic mean) =	21.679 cfs	14.013 MGD	from calculation StreamStats
Qd + Qs (total streamflow, HM for HH-OO) =	21.925 cfs	14.172 MGD	
Cs (in-stream) =	Same as Cbwq, baseline water quality		
Cbwq =	Upstream of facility		
Cd_{10} (mg/L) =	**Effluent discharge concentration using 10% AC**		

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The calculated discharge concentration (Cd) is compared with the proposed discharge concentration. If the proposed discharge is less than 10% of the assimilative capacity (calculated > proposed) and existing uses are maintained, the antidegradation review process is complete and the permitting process may proceed. If the proposed discharge consumes more than 10% of available assimilative capacity (calculated < proposed), a comprehensive Tier 2 review is required.

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							Mixing Calculation		Loading Calculation	
Pollutant	**CAS**	**20.6.4 NMAC Water Quality Standard (Cwqs),** *ug/L*	**20.6.4 NMAC Water Quality Standard (Cwqs),** mg/L	**Baseline Concentration (Cbwq) In-Stream,** *mg/L*	**Assimilative Capacity (AC) (Cwqs-Cbwq),** *mg/L*	**Significant degradation (Cbwq+10% AC),** *mg/L*	**Calculated Effluent Concentration (Cd)** ((Cwqs-Cbwq) x 0.1 + Cbwq) x (Qd + Qs), *mg/L*	**Cs*Qs**	**Calculated Effluent Concentration @ 10% of AC Daily Max (Cd_{10}),** *mg/L*	**Allowable Effluent Load @ 10% of AC Daily Max,** *lbs/day*
Aluminum, dissolved	7429-90-5	5,000	5.000	0.221	4.779	0.699	4.544554	1.402	19.767	26.212
Aluminum, total recoverable *	7429-90-5	7,594.76	7.59	0.842	6.753	1.517	9.866414	5.341	28.460	37.739
Antimony, dissolved**	7440-36-0	640	0.64	0.0000339	0.640	0.0640	0.907472	0.000475	5.704	7.564
Arsenic, dissolved**	7440-38-2	9	0.009	0.0000913	0.00891	0.00098	0.013919	0.001279	0.079	0.105
Boron, dissolved	7440-42-8	750	0.75	0.00060	0.749	0.076	0.491226	0.00381	3.066	4.065
Cadmium, dissolved *	7440-43-9	3.091	0.0031	0.0000340	0.00306	0.000340	0.002209	0.000216	0.013	0.017
Chromium, dissolved	7440-47-3	100	0.100	0.0000632	0.100	0.010	0.065398	0.000401	0.409	0.542
Cobalt, dissolved	7440-48-4	50	0.050	0.000644	0.0494	0.00558	0.036283	0.00409	0.203	0.269
Copper, dissolved *	7440-50-8	23.265	0.0233	0.000181	0.0231	0.00249	0.016187	0.00115	0.095	0.125
Cyanide, total recoverable	57-12-5	5.2	0.005	0.000700	0.00450	0.00115	0.007478	0.00444	0.019	0.025
Lead, dissolved *	7439-92-1	100.000	0.10000	0.000025	0.100	0.0100	0.065172	0.000156	0.409	0.542
Manganese, dissolved *	7439-96-5	3624.924	3.62	0.0884	3.537	0.442	2.874444	0.561	14.552	19.297
Mercury, dissolved	7439-97-6	1.4	0.001	0.00000490	0.001395	0.0001444	0.000939	0.0000311	0.006	0.008
Mercury, total	7439-97-6	0.77	0.001	0.00000572	0.000764	0.0000822	0.000534	0.0000363	0.003	0.004
Molybdenum, dissolved	7439-98-7	1,000	1.000	0.00272	0.997	0.102	0.666223	0.0173	4.081	5.412
Molybdenum, total recoverable	7439-98-7	7,920	7.920	0.00272	7.917	0.794	5.166199	0.0173	32.383	42.942
Nickel, dissolved *	7440-02-0	766.401	0.766	0.00106	0.765	0.078	0.504568	0.0067	3.131	4.152
Selenium, dissolved	7782-49-2	50	0.050	0.000239	0.050	0.0052	0.033914	0.00152	0.204	0.270
Selenium, total recoverable	7782-49-2	5	0.005	0.000240	0.005	0.000716	0.004654	0.00152	0.020	0.026
Silver, dissolved *	7440-22-4	8.760	0.009	0.0000116	0.00875	0.000886	0.005764	0.000073	0.036	0.047
Thallium, dissolved**	7440-28-0	0.47	0.000	0.00000911	0.000461	0.0000552	0.000782	0.0001276	0.00412	0.005
Uranium, dissolved	7440-61-1	30	0.030	0.00000842	0.0300	0.00301	0.019558	0.0000534	0.123	0.163
Vanadium, dissolved	7440-62-2	100	0.100	0.0000264	0.1000	0.0100	0.065183	0.000168	0.409	0.542
Zinc, dissolved *	7440-66-6	271.743	0.272	0.0072000	0.265	0.0337	0.218849	0.045676	1.089	1.444

* hardness-based criteria

** Human health-organism only (HH-OO) criteria

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	Antidegradation Analysis					
Pollutant	**Average (Geomean) Effluent Data,** *mg/L*	**Proposed load based on current effluent data,** lbs/day	**Proposed Discharge: if > Allowable Effluent Load @ 10% of AC Daily, then Further Degradation Analysis Required**	**Pollutants Reported at MDL or Non-Detect (ND) (Only considered for pollutants Further Degradation Analysis Needed)**	**Flagging Pollutants Reported at MDL, all others No Additional Degradation Analysis Required**	**Additional analysis**
Aluminum, dissolved	7.0000	9.282	No Additional Degradation Analysis Required		*Aquatic life WQS only applies when the concurrent pH is less than 6.5 or greater than 9.0 S.U.*	
Aluminum, total recoverable *	14.3300	19.002	No Additional Degradation Analysis Required			
Antimony, dissolved**	0.0005	0.001	No Additional Degradation Analysis Required			
Arsenic, dissolved**	0.0020	0.003	No Additional Degradation Analysis Required			
Boron, dissolved	0.0077	0.010	No Additional Degradation Analysis Required			
Cadmium, dissolved *	0.0053	0.007	No Additional Degradation Analysis Required			
Chromium, dissolved	0.0440	0.058	No Additional Degradation Analysis Required			
Cobalt, dissolved	0.3100	0.411	Further Degradation Analysis Needed	Calculated by result	Not applicable	Effluent geomean is total recoverable cobalt.
Copper, dissolved *	0.3600	0.477	Further Degradation Analysis Needed	Calculated by result	Not applicable	Effluent geomean is total recoverable copper.
Cyanide, total recoverable	0.0025	0.003	No Additional Degradation Analysis Required			
Lead, dissolved *	0.0003	0.000	No Additional Degradation Analysis Required			
Manganese, dissolved *	25.0000	33.152	Further Degradation Analysis Needed	Calculated by result	Not applicable	Effluent geomean is total recoverable manganese.
Mercury, dissolved	0.0001	0.0001	No Additional Degradation Analysis Required			
Mercury, total	0.0001	0.0001	No Additional Degradation Analysis Required			
Molybdenum, dissolved	0.0130	0.017	No Additional Degradation Analysis Required			
Molybdenum, total recoverable	0.0130	0.017	No Additional Degradation Analysis Required			
Nickel, dissolved *	0.1700	0.225	No Additional Degradation Analysis Required			
Selenium, dissolved **	0.00001	0.00002	No Additional Degradation Analysis Required			
Selenium, total recoverable	0.0025	0.0033	No Additional Degradation Analysis Required			
Silver, dissolved *	0.0000006	0.000001	No Additional Degradation Analysis Required			
Thallium, dissolved**	0.0001	0.0002	No Additional Degradation Analysis Required			
Uranium, dissolved	0.0140	0.019	No Additional Degradation Analysis Required			
Vanadium, dissolved	0.0530	0.070	No Additional Degradation Analysis Required			
Zinc, dissolved *	0.7700	1.021	No Additional Degradation Analysis Required			

* hardness-based criteria
** Human health-organism only (HH-OO) criteria