Fact Sheet

NPDES Permit Number: ID-002540-2
Date: June 8, 2000
Public Notice Expiration Date: July 23, 2000
Technical Contact: Patty McGrath, (206) 553-0979
1-800-424-4372 (within Region 10)
mcgrath.patricia@epa.gov

The U.S. Environmental Protection Agency (EPA) Proposes to Reissue a Wastewater Discharge Permit To:

Thompson Creek Mining Company
P.O. Box 62
Clayton, Idaho 83227

and

the State of Idaho Proposes to Certify the Permit

EPA proposes NPDES permit reissuance.
EPA proposes to reissue the existing National Pollutant Discharge Elimination System (NPDES) permit to the Thompson Creek Mining Company (TCMC). The draft permit sets conditions on the discharge of pollutants from the Thompson Creek Mine facilities to Thompson Creek, Squaw Creek, and the Salmon River. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged.

This Fact Sheet includes:
- information on public comment, public hearing, and appeal procedures
- a description of the current discharges
- a listing of proposed effluent limitations and other conditions
- a map and description of the discharge locations
- background information supporting the conditions in the draft permit

The State of Idaho proposes certification.
The Idaho Division of Environmental Quality (IDEQ) proposes to certify the NPDES permit for the TCMC under section 401 of the Clean Water Act. The state submitted a preliminary 401 certification prior to the public notice which is incorporated in the draft permit.

Public comment on the draft permit.
Persons wishing to comment on or request a public hearing for the draft permit may do so in writing by the expiration date of the public notice. A request for a public hearing must state the nature of the issues to be raised, as they relate to the permit, as well as the requester's name, address, and telephone number. All comment and requests for public hearings must be in writing and submitted to EPA as described in the Public Comments section of the attached public notice. After the public notice expires, and all substantive comments have been considered, EPA's regional Director for the Office of Water will make a final decision regarding permit reissuance.

If no substantive comments are received, the tentative conditions in the draft permit will become final, and the permit will become effective upon issuance. If comments are received, EPA will address the comments and issue the permit. The permit will become effective 30 days after the issuance date, unless a request for an evidentiary hearing is submitted within 30 days.

Public comment on the State preliminary 401 certification
The Idaho Division of Environmental Quality (IDEQ) provides the public with the opportunity to review and comment on preliminary 401 certification decisions. Any person may request in writing, that IDEQ provide that person notice of IDEQ's preliminary 401 certification decision, including, where appropriate, the draft certification. Persons wishing to comment on the preliminary 401 certification should submit written comments by the public notice expiration date to the Idaho Division of Environmental Quality (IDEQ), Idaho Falls Regional Office, 900 N. Skyline, Idaho Falls, ID 83402.

Documents are available for review.
The draft NPDES permit and related documents can be reviewed or obtained by visiting or contacting EPA's Regional Office in Seattle between 8:30 a.m. and 4:00 p.m., Monday through Friday (see address below). .

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue, OW-130
Seattle, Washington 98101
(206) 553-0523 or
1-800-424-4372 (within Alaska, Idaho, Oregon, and Washington)

The fact sheet and draft permit are also available at:

EPA Idaho Operations Office
1435 North Orchard Street
Boise, Idaho 83706
(208) 378-5746

Idaho Division of Environmental Quality
Idaho Falls Regional Office
900 N. Skyline
Idaho Falls, Idaho 83402
(208) 528-2650

Challis Public Library
Sixth and Main
Challis, Idaho 83226

The draft permit and fact sheet can also be found by visiting the Region 10 website at www.epa.gov/r10earth/water.htm.

For technical questions regarding the permit or fact sheet, contact Patty McGrath at the phone numbers or email address at the top of this fact sheet. Those with impaired hearing or speech may contact a TDD operator at 1-800-833-6384 (ask to be connected to Patty McGrath at the above phone numbers). Additional services can be made available to person with disabilities by contacting Patty McGrath.

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LIST OF ACRONYMS

AML	Average Monthly Limit
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practices
BPT	Best Practicable Control Technology
CFR	Code of Federal Regulations
cfs	cubic feet per second
CV	coefficient of variation
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
IDEQ	Idaho Division of Environmental Quality
LA	left abutment wastewater
MDL	maximum daily limit
mgd	million gallons per day
MZ	mixing zone
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
PBS	pumpback system wastewater
PIT	pit wastewater
RP	Reasonable Potential
RPM	Reasonable Potential Multiplier
TCM	Thompson Creek Mine
TCMC	Thompson Creek Mining Company
tpd	tons per day
TSD	Technical Support Document (EPA 1991)
TSS	Total Suspended Solids
TU	Toxic Unit (TU_a = acute toxic unit, TU_c = chronic toxic unit)
USFS	Unites States Forest Service
WET	Whole Effluent Toxicity
WLA	Wasteload Allocation

I. APPLICANT

Thompson Creek Mining Company
NPDES Permit No.: ID-002540-2

Mailing Address: P.O. Box 62
Clayton, Idaho 83227
Facility Location: See Figure A-1 in Appendix A

Facility Contact: Bert Doughty, Supervisor Environmental Affairs
(208) 838-2200

II. FACILITY ACTIVITY

The Thompson Creek Mine (TCM) is a molybdenum mine and mill located in Custer County, Idaho, approximately 30 miles southwest of Challis (see Figure A-1). The mine and mill are owned and operated by the Thompson Creek Mining Company (TCMC). The facility has been in operation since 1983 with periods of temporary closure in 1991 and from December 1992 to April 1994. At the current processing rate of 28,000 to 32,000 tpd, the life of the TCM is estimated at 15 years.

The mine facilities encompass approximately 2400 acres on both private lands and public lands. The federal land area is managed by the U.S. Forest Service (Salmon-Challis National Forest) and the U.S. Bureau of Land Management (Challis Resource Area). The mine facilities are located in the Bruno Creek, Buckskin Creek, and Pat Hughes Creek drainages. These creeks are tributaries to Thompson and Squaw creeks which flow into the Salmon River approximately 5 miles from the mine site (see Figure A-1).

Molybdenum ore is mined via open pit methods. At the mill, the ore is processed by flotation to produce a molybdenum concentrate. The molybdenum concentrate is transported off-site for refining. Tailings (the residuals from flotation) are piped in a slurry from the mill to the tailings impoundment. The tailings impoundment is constructed in the upper Bruno Creek watershed and covers approximately 280 acres. The impoundment currently contains approximately 90 million tons of tailings. Waste rock (rock that is removed from the mine in order to gain access to the ore) is hauled from the mine for disposal in either the Pat Hughes or Buckskin waste rock dumps. To-date approximately 350 million tons of waste rock have been disposed in the Buckskin Creek dump and 50 million tons in the Pat Hughes dump. More detailed information on the TCM operations can be found in the Supplemental Plan of Operations (TCMC 1998).

The facility currently discharges wastewater from the Buckskin and Pat Hughes waste rock dumps through two outfalls (001 and 002) and storm water through Outfall 003. The proposed permit will allow discharge through two new outfalls (004 and 005) from the tailings impoundment in the event of excess precipitation or mine closure. In addition, wastewater from Outfalls 001 and 002 may be discharged instead out of Outfall 005. The parameters of concern in the discharges include pH, total suspended solids (TSS), and metals. The following table summarizes each outfall. A more detailed description of each outfall is proved in Appendix B. A map of the outfall locations is provided in Appendix A (Figure A-2).

Table 1: Proposed NPDES Outfalls

Outfall	Receiving Water	Description of Discharge[1]	Flow Rate[2]
001	Thompson Creek	seepage and runoff from the Buckskin waste rock dump	discharge generally occurs in April-July only calculated avg. discharge = 1.2 cfs measured max. discharge = 8.4 cfs
002	Thompson Creek	seepage and runoff from the Pat Hughes waste rock dump	discharge continuous, peaks in May - July calculated avg. discharge = 0.7 cfs measured max discharge = 12 cfs
003	Squaw Creek	storm water, mine road runoff, Bruno Creek diversion	discharge continuous, peaks in May - July calculated avg. discharge = 1.1 cfs measured max discharge = 9.7 cfs
004	Squaw Creek	tailings impoundment seepage	predicted max discharge = 1.3 cfs
005	Salmon River	tailings impoundment seepage and open pit mine water[3]	predicted max. discharge = 2.7 cfs

Footnotes:
1 - See also Appendix B.
2 - Flows are based on the last five years of monitoring conducted by TCMC.
3 - TCMC may discharge effluent from outfalls 001 and 002 out of Outfall 005.

III. FACILITY BACKGROUND

A. Permit History

EPA first issued a National Pollutant Discharge Elimination System (NPDES) permit for the TCM on June 10, 1981. The current permit was reissued by EPA on August 1, 1988. The current permit expired on August 2, 1993. A timely application for renewal of the permit and for establishment of Outfall 004 was submitted to EPA on September 17, 1992. A revised application for establishment of Outfall 005 was submitted on September 7, 1993. A second revised application for Outfalls 001 and 002 (applying to discharge from either the original outfall locations or the Outfall 005 location) was submitted to EPA on February 22, 2000. Additional information related to this permit reissuance was submitted by TCMC to EPA on September 1, 1999, September 21, 1999, and February 22, 2000. Because the Permittee submitted a timely application for renewal, the 1988 permit has been administratively extended and remains fully effective and enforceable until reissuance.

On July 14, 1994 a draft NPDES Permit for the TCM was issued for public notice. The effluent limits for metals in the July 1994 draft permit were based on State of Idaho water quality criteria that were expressed as total recoverable. While EPA was finalizing the permit, the State of Idaho adopted new water quality criteria that express some metals as dissolved. In addition, a new criteria for arsenic was promulgated. To accommodate these changes and the new information submitted by TCMC, this new draft permit has been prepared and is being reissued for public comment.

B. Compliance History

TCMC submits monthly discharge monitoring reports (DMRs) to EPA summarizing the results of effluent monitoring required by the permit. The following effluent limit violations were noted based on review of the past five years' DMRs:

> Outfall 001: In June and July 1995, pH was reported at 9.1 (outside the pH limit of 6 - 9).
>
> Outfall 002: Violations of the maximum daily effluent limits were reported in March 1999 (TSS only), May 1999 (TSS and zinc), and August 1999 (cadmium and zinc). TCMC attributed the March violation to heavy snow pack and the subsequent violations to a break in the pit diversion line located beneath the waste rock dump. TCMC stopped discharging while investigating and fixing the break. The diversion line has since been fixed and discharges are within the effluent limits.

IV. RECEIVING WATERS

As discussed in Section II, the TCM outfalls discharge to Squaw Creek, Thompson Creek, and the Salmon River. The *Idaho Water Quality Standards and Wastewater Treatment Requirements* designate beneficial uses for waters of the State. These three waters are classified by the State of Idaho for protection of the following uses: (1) agricultural water supply, (2) cold water biota, (3) salmonid spawning, and (4) secondary contact recreation. In addition, the Salmon River is protected for domestic water supply and primary contact recreation and is classified as a Special Resource Water.

The State water quality standards specify water quality criteria that is deemed necessary to support the use classifications. These criteria may by numerical or narrative. The water quality criteria applicable to the proposed permit are provided in Appendix C (Section III.A.). These criteria provide the basis for most of the effluent limits in the draft permit.

Portions of Thompson Creek and the Salmon River are listed on Idaho's 303(d) list (a list of impaired waters compiled under Section 303(d) of the Clean Water Act). The 303(d) list identifies water bodies that do not meet or are not expected to meet water quality standards.

Specifically, these waters were listed as not meeting standards for:

Thompson Creek (about three miles downstream from Outfall 002 to the confluence with the Salmon River) - sediment and metals
Salmon River (including the discharge location) - sediment and temperature

Section 303(d) of the Clean Water Act (CWA) requires States to develop a Total Maximum Daily Load (TMDL) management plan for water bodies on the 303(d) list. A TMDL allocates loading capacities to point and nonpoint sources to the water body. Permit limits for point sources must be consistent with applicable TMDL allocations. A TMDL for Thompson Creek and this part of the Salmon River is scheduled to be completed in 2001. The General Provisions section of the draft permit contains a provision to allow EPA to reopen the permit (e.g., to incorporate any applicable effluent limitations and conditions which may result from final TMDLs on these receiving waters).

V. EFFLUENT LIMITATIONS

EPA followed the Clean Water Act (CWA), state and federal regulations, and EPA's 1991 *Technical Support Document for Water Quality-Based Toxics Control* (TSD) to develop the effluent limits in the draft permit. In general, the CWA requires that the effluent limit for a particular pollutant be the more stringent of either the technology-based limit or water quality-based limit. Appendix C provides discussion on the legal basis for the development of technology-based and water quality-based effluent limits.

EPA sets technology-based limits based on the effluent quality that is achievable using readily available technology. The Agency evaluates the technology-based limits to determine whether they are adequate to ensure that water quality standards are met in the receiving water. If the limits are not adequate, EPA must develop additional water quality-based limits. Water quality-based limits are designed to prevent exceedances of the Idaho water quality standards in the receiving waters.

The proposed permit includes technology-based limits for total suspended solids (TSS), water quality-based and technology-based limits for pH, and water quality-based limits for most metals. Tables 2 and 3 compare the existing effluent limits for outfalls 001 and 002 with the proposed effluent limits in the draft permit. Tables 4 and 5 include the proposed effluent limits for the new discharges from outfalls 004 and 005. Appendix C describes in detail how the effluent limits were developed.

Two sets of limits (tiered limits) were developed for outfalls 001, 002, and 004 to allow for seasonal variability of the flows in the receiving waters. Except for pH and TSS, the proposed effluent limits are expressed in terms of both mass (pounds/day) and concentration (ug/l) for outfalls 004 and 005. Establishment of mass-based limits ensures that total loadings to the receiving waters are controlled. Mass limits were not calculated for outfalls 001 and 002 since the effluent flow from these outfalls is dependent upon precipitation and varies with the receiving water flow. Concentration-based limits for these outfalls were calculated based on the ratio of effluent flow to receiving water flow (the dilution ratio) for each flow tier. Therefore, mass loadings for these outfalls will be controlled by limiting the dilution ratio consistent with the dilution ratio used to develop the concentration-based effluent limits (see also Section IV. of Appendix C).

Effluent limits were not developed for Outfall 003. Rather, “best management practices” (BMPs) and monitoring are the permit conditions used to address storm water (see Sections VI.C. and VII.B. of this fact sheet).

Table 2: Effluent Limitations for Outfall 001

Parameter	units	Existing Effluent Limitations		Proposed Effluent Limitations[3]			
				at Thompson Creek flow < 7 cfs[4]		at Thompson Creek flow $\geq$ 7 cfs[4]	
		Maximum Daily	Monthly Average	Maximum Daily	Monthly Average	Maximum Daily	Monthly Average
dilution ratio[1]	none	--	--	0.011	0.011	0.092	0.092
arsenic	ug/l	490	--	--	--	–	–
cadmium	ug/l	5.3[2]	–	35	24	6.8	4.7
copper	ug/l	24.5[2]	--	270	180	31	21
lead	ug/l	58.9[2]	--	94	64	19	13
mercury	ug/l	0.2[2]	--	0.46	0.32	0.073	0.050
selenium	ug/l	--	--	150[5]	110[5]	42[5]	30[5]
zinc	ug/l	165[2]	--	1500	750	210	150
TSS	mg/l	30	20	30	20	30	20
pH	su	within the range of 6 - 9		within the range of 6.5 - 9.0		within the range of 6.5 - 9.0	

Footnotes:
1 - The dilution ratio is calculated by dividing the effluent flow by the flow in Thompson Creek upstream of the discharge.
2 - Alternate effluent limits were established based on background or the maximum daily technology-based effluent guidelines (see Appendix C, Table C-1) whichever is more stringent.
3 - Metals are to be measured as total recoverable, except for mercury which is to be measured as total.
4 - The flow tiers are representative of flow upstream of the outfall.
5 - Compliance with the selenium limits must be achieved within 4 years and 11 months of the effective date of the permit (see Section VIII.B. of the fact sheet).

Table 3: Effluent Limitations for Outfall 002							
Parameter	units	Existing Effluent Limitations		Proposed Effluent Limitations[3]			
				at Thompson Creek flow < 7 cfs[4]		at Thompson Creek flow $ 7 cfs[4]	
		Maximum Daily	Monthly Average	Maximum Daily	Monthly Average	Maximum Daily	Monthly Average
dilution ratio[1]	none	--	--	0.085	0.085	0.18	0.18
arsenic	ug/l	490	--	--	--	--	--
cadmium	ug/l	5.3[2]	–	11	7.8	5.2	3.5
copper	ug/l	24.5[2]	--	53	36	22	15
lead	ug/l	58.9[2]	--	31	21	12	8.3
mercury	ug/l	0.2[2]	--	0.077	0.053	0.047	0.032
selenium	ug/l	--	--	23[5]	16[5]	17[5]	11[5]
zinc	ug/l	165[2]	--	290	200	220	150
TSS	mg/l	30	20	30	20	30	20
pH	su	within the range of 6 - 9		within the range of 6.5 - 9.0		within the range of 6.5 - 9.0	

<u>Footnotes:</u>
1 - The dilution ratio is calculated by dividing the effluent flow by the flow in Thompson Creek upstream of the discharge.
2 - Alternate effluent limits were established based on background or the maximum daily technology-based effluent guidelines (see Appendix C, Table C-1) whichever is more stringent.
3 - Metals concentrations to be measured as total recoverable, except for mercury which is to be measured as total.
4 - The flow tiers are representative of flow upstream of the outfall.
5 - Compliance with the selenium limits must be achieved within 4 years and 11 months of the effective date of the permit (see Section VIII.B. of the fact sheet).

Table 4: Effluent Limitations for Outfall 004

Parameter	units	Proposed Effluent Limitations[1]			
		at Squaw Creek flow < 50 cfs[2]		at Squaw Creek flow $ 50 cfs[2]	
		Maximum Daily	Monthly Average	Maximum Daily	Monthly Average
cadmium	ug/l	12	5.8	26	13
	lb/day	0.084	0.041	0.18	0.091
chromium	ug/l	40	20	--	--
	lb/day	0.28	0.14	--	--
copper	ug/l	48	24	120	58
	lb/day	0.34	0.17	0.84	0.41
lead	ug/l	37	18	21	10
	lb/day	0.26	0.13	0.15	0.070
mercury	ug/l	0.037	0.018	0.21	0.10
	lb/day	0.00026	0.00013	0.0015	0.00070
silver	ug/l	--	--	22	11
	lb/day	--	--	0.15	0.077
zinc	ug/l	290	140	860	430
	lb/day	2.0	0.98	6.0	3.0
TSS	mg/l	30	20	30	20
pH	su	within the range of 6.5 - 9.0		within the range of 6.5 - 9.0	

Footnotes:
1 - Metals concentrations to be measured as total recoverable, except for mercury which is to be total.
2 - The flow tiers are representative of flow upstream of the outfall.

Table 5: Effluent Limitations for Outfall 005			
Parameter	units	Proposed Effluent Limitations[s]	
		Maximum Daily	Monthly Average
cadmium	ug/l	12	6.2
	lb/day	0.17	0.090
copper	ug/l	120	59
	lb/day	1.7	0.86
lead	ug/l	21	10
	lb/day	0.30	0.15
mercury	ug/l	0.61	0.30
	lb/day	0.0089	0.0044
silver	ug/l	12	6.0
	lb/day	0.17	0.087
zinc	ug/l	1000	500
	lb/day	15	7.3
TSS	mg/l	30	20
pH	su	within the range of 6.5 - 9.0	

Footnote:
1 - Metals concentrations to be measured as total recoverable, except for mercury which is to be measured as total.

VI. MONITORING REQUIREMENTS

Section 308 of the Clean Water Act and federal regulation 40 CFR 122.44(i) require that monitoring be included in permits to determine compliance with effluent limitations. Monitoring may also be required to gather data for future effluent limitations or to monitor effluent impacts on receiving water quality. TCMC is responsible for conducting the monitoring and reporting the results to EPA on monthly DMRs and in annual reports. This section describes the monitoring requirements in the draft permit.

A. Effluent Monitoring

The effluent monitoring requirements in the draft permit are summarized in Table 6. The monitoring frequency for outfalls 001 and 002 is the same as included in the current permit (monthly for most parameters) . The monitoring frequency for most of the outfall 004 and 005 parameters is weekly. More frequent monitoring and composite sampling was determined to be necessary for these outfalls due to the composition of the outfalls (process water), the more continuous nature of the discharges, and the Special Resource status of the Salmon River (Outfall 005). Flow monitoring of the receiving waters is required for outfalls 001, 002, and 004 to determine which set of tiered effluent limits apply and to calculate dilution ratios (outfalls 001 and 002 only). Monitoring of Outfall 003 is discussed in Section VI.C., below.

Some of the water quality-based effluent limits in the draft permit are close to the capability of current analytical technology to detect and/or quantify (close to method detection limits). To address this concern, the draft permit contains a provision requiring TCMC to use analytical methods that can achieve a method detection limit less than the effluent limitation. Method detection limits are the minimum levels that can be accurately detected by current analytical technology.

Table 6: Effluent Monitoring Requirements

Parameter	Outfalls 001 and 002		Outfalls 004 and 005	
	frequency	sample type	frequency	sample type
dilution ratio	daily	calculation	--	--
outfall flow, cfs	continuous	recording	continuous	recording
metals with effluent limits[1], ug/l	monthly	grab	weekly	24-hour composite
molybdenum, ug/l	quarterly	grab	quarterly	24-hour composite
selenium[2], ug/l	monthly	grab	quarterly	24-hour composite
TSS, mg/l	weekly	grab	weekly	24-hour composite
pH, standard units (su)	weekly	grab	daily	grab
hardness, as $CaCO_3$, mg/l	monthly	grab	weekly	24-hour composite
temperature, °C	weekly	grab	weekly	grab
Acute WET[3], TU_a	annually	grab	annually	24-hour composite
Chronic WET[3], TU_c	annually	grab	quarterly	24-hour composite
Thompson Creek Flow[4], cfs	daily	recording	daily	recording
Squaw Creek Flow[5], cfs	daily	recording	daily	recording

Footnotes:
1 - metals to be measured include: cadmium, chromium (outfall 004 only), copper, lead, mercury, selenium (outfalls 001 and 002 only), silver (outfalls 004 and 005 only), and zinc.
2 - selenium monitoring required for outfalls 001 and 002 (see footnote 1) and 005.
3 - See Section VI.B., below for specific information regarding the whole effluent toxicity (WET) monitoring.
4 - Thompson Creek flow monitoring is required upstream of each outfalls 001 and 002.
5 - Squaw Creek flow monitoring is required upstream of Outfall 004.

B. Whole Effluent Toxicity Testing

Whole effluent toxicity (WET) is defined as the aggregate toxic effect of an effluent measured directly by an aquatic toxicity test. WET tests are standardized laboratory tests that measure the total toxic effect of an effluent by exposing organisms to the effluent and noting the effects. There are two different durations of toxicity tests: acute and chronic. Acute toxicity tests measure the test organisms survival over a 96-hour test exposure period. Chronic toxicity tests measure reductions in survival, growth, and reproduction over a 7-day exposure.

TCMC has conducted limited WET testing on their effluents. In 1993, one set of WET tests were performed on effluent from outfalls 001 and 002 and some of the sources of wastewater to outfalls 004 and 005 (LA and PBS wastewaters). Results indicated no acute toxicity. Chronic toxicity was indicated for Outfall 001 and the LA and PBS wastewaters at 100% effluent, however, the tests were not performed at dilutions representing the mixing zones. In 1999, TCMC conducted an additional set of WET tests on outfalls 001 and 002. These tests indicated no acute toxicity. Chronic toxicity was indicated for one species tested on Outfall 002.

Federal regulations at 40 CFR 122.44(d)(1) require that permits contain limits on WET when a discharge has reasonable potential to cause or contribute to an exceedence of a water quality standard. In Idaho, the relevant water quality standard states that surface waters of the State shall be free from toxic substances in concentrations that impair designated beneficial uses (see Appendix C, Table C-2). The TSD provides guidance on implementing WET testing in NPDES permits. The preliminary CWA Section 401 Certification provided by IDEQ included specific WET testing requirements for this permit (see also Section VIII.B.).

Because the limited amount of existing WET testing on the TCM effluents is not adequate to determine the need for WET effluent limits, WET testing has been incorporated into the draft permit. The draft permit requires TCMC to conduct acute WET testing annually on effluent from each outfall. Chronic WET testing must be conducted annually for outfalls 001 and 002 and quarterly for outfalls 004 and 005. TCMC is required to perform the acute tests using the salmonid species *Oncorhynchus mykiss* (rainbow trout) and the chronic tests using both *Pimephales promelas* (fathead minnow) and *Ceriodaphnia dubia* (water fleas). Different species are used for testing to represent different aquatic phyla (fish and invertebrates) and because different species have different sensitivities. The tests will be conducted at a range of dilutions that mimic the effluent-receiving water mixing conditions. Results of these tests will be used to ensure that toxics in the effluent are controlled and to determine the need for future WET limits. In addition, the permit establishes toxicity trigger levels for each outfall (see Appendix C, Section IV.B.), that, if exceeded, trigger additional WET testing and, potentially, investigations to reduce toxicity.

C. Storm Water Monitoring

The current permit requires TCMC to monitor the receiving water upstream and downstream of the Outfall 003 sediment ponds for turbidity. The monitoring is specified as weekly during

February through June and monthly for the other months of the year. The draft permit continues this turbidity monitoring. In addition, the draft permit requires daily monitoring of effluent flow and monthly monitoring of Outfall 003 for metals (cadmium, copper, lead, mercury, and zinc), hardness, TSS, pH, and temperature to ensure that water quality standards are maintained.

The storm water discharge should not adversely affect water quality. This assumes appropriate design and implementation of best management practices (BMPs) in lieu of numerical effluent limits. The monitoring required in the draft permit, along with periodic inspections, are required to evaluate the effectiveness of BMPs and to provide sufficient information to determine if these discharges either cause or contribute to water quality standards exceedences. Section VII.B., below, discusses the BMP requirements.

D. Receiving Water Monitoring

The current permit requires TCMC to provide for water quality monitoring in accordance with the program agreed upon by the Interagency Task Force (members of which include the USFS, BLM, IDEQ, EPA, and TCMC). TCMC's current environmental monitoring program is described in the Consolidated Environmental Monitoring Program (TCMC 1999a). This program includes monitoring of the surface water, sediments, and aquatic biology in the receiving waters.

The draft permit requires TCMC to continue this monitoring as it relates to the permitted discharges by specifying monitoring at selected locations within and around the discharge areas. The water quality monitoring requirements in the draft permit are, for the most part, consistent with TCMC's Consolidated Monitoring Program. However, some additional monitoring has been added since two new outfalls are proposed (004 and 005), one of the new outfalls (005) discharges to a Special Resource Water, and to verify that bioaccumulation is not of concern. The following summarizes the monitoring requirements in the draft permit.

Surface Water Quality Monitoring: Surface water quality monitoring of the receiving waters is required four times per year upstream and downstream of each outfall for the parameters listed in Table 7. When there is a discharge from outfalls 004 or 005, the permit requires that the monitoring frequency for metals in the Salmon River be increased to monthly. This was a requirement of IDEQ's preliminary CWA Section 401 Certification for discharge into a Special Resource Water (see also Section VIII.B.). IDEQ also required that, for each sampling event, metals concentrations in the receiving water be compared to aquatic life chronic water quality criteria. If the concentrations exceed the criteria, then future sampling for that parameter will be expanded to determine 4-day average concentrations (since chronic criteria are expressed as 4-day average concentrations).

The receiving water quality monitoring data is used to evaluate the water quality impacts of the NPDES discharges. The data will also be used during the next permitting cycle to determine the need for incorporating and retaining water quality-based effluent limits into the permit. In order to perform these evaluations, it is necessary that the ambient monitoring use analytical methods that have method detection limits below the water quality criteria. Therefore, the draft permit specifies method detection limits for metals required for surface water monitoring (see Table 7 of the draft permit).

<table>
<tr><th colspan="3">Table 7: Surface Water Quality Monitoring Requirements</th></tr>
<tr><td>Monitoring Locations[1]</td><td>Monitoring Frequency</td><td>Parameters</td></tr>
<tr><td>Thompson Creek Stations:
TC-1, TC-2, TC-3, TC-4</td><td rowspan="2">4 times per year[2] for all parameters</td><td rowspan="3">Metals[3]:
Cadmium
Chromium-VI (Squaw Creek only)
Copper
Lead
Mercury
Molybdenum
Selenium (Thompson Creek and Salmon River only)
Silver (Squaw Creek and Salmon River only)
Zinc

Total Suspended Solids (TSS)
pH
Temperature
Turbidity
Hardness
Dissolved Oxygen</td></tr>
<tr><td>Squaw Creek Stations:
SQ-2 and SQ-3</td></tr>
<tr><td>Salmon River Stations:
SR-1 and SR-3</td><td>4 times per year[2] for all parameters

In addition, when there is a discharge from outfalls 004 or 005, monthly monitoring for metals (except molybdenum) is required.</td></tr>
<tr><td colspan="3"><u>Footnotes:</u>
1 - See Figure A-2 in Appendix A for a map showing the monitoring locations.
2 - Monitoring is required during spring low flow (April), spring high flow (June), summer low flow (August), and fall low flow (October)
3 - Metals must be monitored and reported as dissolved, except for mercury which must be monitored as total and molybdenum and selenium, which must be monitored as total recoverable.</td></tr>
</table>

<u>Bioassessment Program:</u> Under the Consolidated Environmental Monitoring Program, TCMC currently monitors Thompson Creek and Squaw Creek upstream and downstream from the NPDES outfalls for benthic macroinvertebrates and fish. The proposed permit contains requirements to continue to monitor benthic macroinvertebrates annually and fish bi-annually at these locations and expands the monitoring to include the Salmon River upstream and downstream of Outfall 005. As requested by IDEQ in their preliminary certification, the proposed permit also requires annual monitoring of periphyton at these locations.

The purpose of the bioassessment program is to monitor and evaluate changes in the receiving water biological community that may occur as a result of activities associated with the discharges from the facility. If the results of the bioassessment monitoring indicate downstream differences in comparison to the upstream station or declining trends over time, the proposed permit requires that TCMC undertake an investigation to identify and remedy the cause.

Bioaccumulation Study: Pursuant to the preliminary certification from IDEQ, the proposed permit requires that TCMC conduct a bioaccumulation study to determine whether exposure to mercury or selenium through bioaccumulation poses a risk of adverse effects to aquatic life in Thompson Creek. Mercury and selenium are parameters of concern due to their potential to bioaccumulate (become concentrated in living organisms and move up the food chain). Specifically, the draft permit requires sampling and analysis of sediment, *aufwuchs* (periphyton and abiotic material embedded in the periphyton), macroinvertebrates, and fish (sculpin or trout) upstream and downstream of outfalls 001 and 002 for mercury and selenium. Sampling is only required for Thompson Creek since it has received long-term discharges from outfalls 001 and 002.

If the results of the study indicate downstream differences in comparison to the upstream station or exceedences of the biological screening levels in the draft permit (see Table 9 of the draft permit), the proposed permit requires that TCMC undertake an investigation to identify and remedy the cause.

E. Representative Sampling

The draft permit has expanded the requirement in the federal regulations regarding representative sampling (40 CFR 122.41[j]). This provision now specifically requires representative sampling whenever a bypass, spill, or non-routine discharge of pollutants occurs, if the discharge may reasonably be expected to cause or contribute to a violation of an effluent limit under the permit. This provision is included in the draft permit because routine monitoring could miss permit violations and/or water quality standards exceedences that could result from bypasses, spills, or non-routine discharges. This requirement directs TCMC to conduct additional, targeted monitoring to quantify the effects of these occurrences on the final effluent discharge.

VII. OTHER PERMIT CONDITIONS

A. Quality Assurance Plan

Federal regulations at 40 CFR 122.41(e) require permittees to properly operate and maintain their facilities, including “adequate laboratory controls and appropriate quality assurance procedures.” To implement this requirement, the draft permit requires that TCMC develop a Quality Assurance Plan (QAP) to ensure that the monitoring data submitted is accurate and to explain data anomalies if they occur. The QAP must include standard operating procedures the permittee must follow for collecting, handling, storing and shipping samples, laboratory analysis, and data reporting. The draft permit requires TCMC to submit the QAP to EPA within 60 days of the effective date of the permit and implement the QAP within 120 days of the effective date.

B. Best Management Practices Plan

Section 402 of the Clean Water Act and federal regulations at 40 CFR 122.44(k)(2) and (3) authorize EPA to require best management practices (BMPs) in NPDES permits. BMPs are measures that are intended to prevent or minimize the generation and the potential for release of pollutants from industrial facilities to waters of the U.S. These measures are important tools for waste minimization and pollution prevention.

The draft permit requires TCMC to prepare and implement a BMP Plan within 120 days and 180 days, respectively, of permit issuance. The BMP Plan is intended to achieve the following objectives: minimize the quantity of pollutants discharged from the facility, reduce the toxicity of discharges to the extent practicable, prevent the entry of pollutants into waste streams, and minimize storm water contamination. The BMP Plan will apply to all components of the TCM. The draft permit requires that the BMP Plan be maintained and that any modifications to the facility are made with consideration to the effect the modification could have on the generation or potential release of pollutants. The BMP Plan must be revised if the facility is modified and as new pollution prevention practices are developed.

The draft permit also requires comprehensive site compliance evaluations and submittal of annual reports documenting the compliance evaluations, observations related to implementation of the BMP Plan, any incidents of non-compliance, and any corrective actions and BMP Plan modifications over the year.

C. Additional Permit Provisions

In addition to facility-specific requirements, most of sections III, IV, and V of the draft permit contain “boilerplate” requirements. Boilerplate is standard regulatory language that applies to all permittees and must be included in NPDES permits. Because the boilerplate requirements are based on regulations, they cannot be challenged in the context of an NPDES permit action. The boilerplate covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and general requirements.

VIII. OTHER LEGAL REQUIREMENTS

A. Endangered Species Act

The Endangered Species Act requires federal agencies to consult with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service (collectively referred to as the Services) if their actions could beneficially or adversely affect any threatened or endangered species. The Services have identified several threatened and endangered species in the vicinity of TCM discharges. EPA has initiated informal consultation with NMFS and the USFWS, including preparation of a Biological Evaluation to evaluate the potential impacts of the NPDES discharges on the listed species. If the consultation results in reasonable and prudent measures or alternatives that require more stringent permit conditions, EPA will incorporate those conditions into the final permit. Appendix E provides further information on the listed species and consultation process.

B. State Certification

Section 401 of the Clean Water Act requires EPA to seek certification from the State that the permit is adequate to meet State water quality standards before issuing a final permit. The regulations allow for the state to stipulate more stringent conditions in the permit, if the certification cites the Clean Water Act or State law references upon which that condition is based. In addition, the regulations require a certification to include statements of the extent to which each condition of the permit can be made less stringent without violating the requirements of State law.

The State provided EPA with a preliminary certification of this permit (IDEQ 2000). The preliminary certification contained the following requirements that have been incorporated into the draft permit:

Mixing Zones: IDEQ proposed mixing zones for outfalls 001, 002, 004, and 005. The water quality-based limits in the draft permit are based on the dilution available in those mixing zones (see Appendix C, Section III.B.).

WET Testing: IDEQ specified requirements for WET testing of the effluents.

Receiving Water Monitoring: IDEQ proposed specific monitoring requirements for the surface water quality monitoring, bioassessment monitoring, and the bioaccumulation study as discussed in Section VI.C.

Special Resource Water Monitoring: The designation of the Salmon River as a Special Resource Water imparts specific considerations to ensure protection of the Salmon River from new and increased point source discharges. Therefore, in addition to the receiving water monitoring recommendations for all the receiving waters, IDEQ provided additional requirements for monitoring the Salmon River (more frequent monitoring, statistical analysis of results to detect differences, etc.).

Compliance Schedule for Selenium: New selenium limits have been established for outfalls 001 and 002. The State water quality standards includes a provision for compliance schedules which allow a discharger to phase in, over time, compliance with new water quality-based limits. The preliminary certification included a compliance schedule that allows TCMC up to five years to achieve compliance with the selenium effluent limits. Since compliance schedules must be less than the effective life of the permit (which is 5 years), the deadline for compliance was set at 4 years and 11 months. The compliance schedule specified work that TCMC must perform and report each year until compliance is achieved (see Table 9 of the draft permit).

The above recommendations have been incorporated into the draft permit. After the public comment period, a preliminary final permit will be sent to the State for final certification. If the State authorizes different requirements in its final certification, EPA will incorporate those requirements into the permit. For example, if the State authorizes different mixing zones in its final certification, EPA will recalculate the effluent limitations in the final permit based on the dilution available in the final mixing zones.

C. Antidegradation

In setting permit limitations, EPA must consider the State's antidegradation policy. This policy is designed to protect existing water quality when the existing quality is better than that required to meet the standard and to prevent water quality from being degraded below the standard when existing quality just meets the standard. For high quality waters, antidegradation requires that the State find that allowing lower water quality is necessary to accommodate important economic or social development before any degradation is authorized. This means that, if water quality is better than necessary to meet the water quality standards, increased permit limits can be authorized only if they do not cause degradation or if the State makes the determination that it is necessary.

The current permit has effluent limitations for arsenic for outfalls 001 and 002. Since the reasonable potential analysis indicated no reasonable potential to cause or contribute to an exceedence of water quality criteria, limits for arsenic were not included in the draft permit.

Because the effluent limits in the draft permit are based on current water quality criteria or technology-based limits that have been shown to not cause or contribute to an exceedence of water quality standards the discharges as authorized in the draft permit will not result in degradation of the receiving water. In addition, the State presented an antidegradation analysis for the new discharge to the Salmon River. Therefore, the conditions in the permit will comply with the State's antidegradation requirements.

D. Permit Expiration

This permit will expire five years from the effective date of the permit.

APPENDIX A - TCMC FACILITY MAPS

APPENDIX B - TCM WASTE STREAMS

As a supplement to Section II of the Fact Sheet, this appendix describes wastewater management and discharges from the TCM. Following is a description of each of the waste streams currently discharged from the facility (outfalls 001, 002, and 003) and proposed for discharge from the facility (outfalls 004 and 005). A map of the discharge locations is provided in Appendix A (Figure A-2).

Outfall 001

This outfall discharges seepage and surface run-off from the Buckskin waste rock dump. The Buckskin waste rock dump overlies Buckskin Creek. A series of subdrains constructed underneath the dump are used to collect infiltration and seepage from beneath the waste rock. The subdrains flow to a sediment pond at the bottom of the waste rock dump. Run-off from the surface of the waste rock dump is also routed to the sediment pond. The sediment pond serves to trap soil and other fines eroded from the dump area and to provide settling. The sediment pond is designed to provide for 24-hour retention of average springtime flows in addition to the equivalent of the 10-year, 24-hour storm event. Overflow from the pond (designated Outfall 001) is discharged to Buckskin Creek, approximately 2000 feet above the confluence of Thompson Creek. The discharge is intermittent in nature, generally present only during the months of April through August. The flow is highly influenced by precipitation and snow melt. Based on flow data reported by TCMC in Discharge Monitoring Reports (DMRs) over the last five years, the average flow of Outfall 001 when it is discharging is 1.2 cfs. The maximum flow reported was 8.4 cfs.

Pollutants of concern in Outfall 001 include metals (aluminum, antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel selenium, silver, and zinc), total suspended solids (TSS), and pH.

Outfall 002

This outfall discharges seepage and surface run-off from the Pat Hughes waste rock dump. The Pat Hughes waste rock dump overlies Pat Hughes Creek. The waste water management (subdrains and sediment pond) is the same as described for the Buckskin dump. The only difference is that the sediment pond also collects the diverted flow of upper Pat Hughes Creek (which is routed around the waste rock dump). Overflow from the Pat Hughes sediment pond (designated Outfall 002) is discharged to Pat Hughes Creek approximately 2000 feet above the confluence with Thompson Creek. The discharge experiences peak flows during May through July and has continuous low flows during the remainder of the year. Based on DMR data over the last five years, the average and maximum flows from Outfall 002 were 0.7 cfs and 12 cfs, respectively. The pollutants of concern are the same as for Outfall 001.

Outfall 003

Storm water runoff from the mill and mine roads is collected in ditches which drain to a series of two in-stream sediment ponds located in lower Bruno Creek. As discussed under Outfall 004 below, flows in upper Bruno Creek are either diverted around the tailings impoundment or are captured for use as process water in the mill. When Bruno Creek flow is diverted around the impoundment, the diverted flow reenters the lower Bruno Creek channel and the sediment ponds. Twin Apex Creek flows into Bruno Creek above the sediment ponds. An inactive mine (the Twin Apex Mine) discharges into Twin Apex Creek. Therefore, the sediment ponds contain flows from storm water, Twin Apex Creek, and, at times, the Bruno Creek diversion.

Overflow from the sediment ponds (designated Outfall 003) is discharged to Bruno Creek just above the confluence of Squaw Creek. The discharge experiences peak flows during May through July and has continuous low flows during the remainder of the year. Based on monitoring conducted by TCMC, the yearly average and maximum flows from Outfall 003 are 1.1 cfs and 9.7 cfs, respectively.

The pollutants of concern in Outfall 003 include suspended solids.

Outfall 004

Mine water from the open pit mine and tailings from the mill are disposed of in a tailings impoundment that is constructed across the upper Bruno Creek catchment. Flows from Bruno Creek are either diverted around the impoundment or are captured for use in the mill. The impoundment serves to separate the water and solids portions of the tailings via settling. Water is reclaimed from the surface of the impoundment and pumped to the mill for reuse. A system of drains underneath the impoundment and embankment collect drainage which flows to a seepage return dam (SRD) located below the impoundment. Wastewater from the SRD is pumped to the mill for reuse or back to the tailings impoundment. The SRD was originally planned to contain all seepage from the tailings impoundment, however seepage was identified downstream of the SRD. This seepage is collected via a lined sump and pumped back to the SRD (this wastewater stream is called pumpback system water (PBS)).

The tailings impoundment water management system was designed and is operated as a closed system with zero discharge. During operation and normal precipitation, the water entering the tailings pond (tailings water and precipitation) is balanced by the water exiting the pond (for use in the mill). During times of reduced milling operations, no operation, or abnormally wet water years, water accumulates in the pond. This accumulated water must periodically be discharged to maintain the stability of the dam as designed. The new outfalls 004 and 005 were designed to accommodate this need.

Discharge from Outfall 004 will consist of waste water collected from the tailings embankment left abutment drain (LA) and pumpback system water (PBS). These collected flows will be piped to discharge in Squaw Creek at the confluence with Bruno Creek. TCMC is installing a diffuser to allow for efficient mixing in Squaw Creek. Based on flow volume monitoring conducted by TCMC over the last three years, the maximum flow of Outfall 004 is estimated at 1.3 cfs (1 cfs from the LA and 0.3 cfs from the PBS). Pollutants of concern in Outfall 004 include metals, TSS, and pH.

Outfall 005

During periods when the mine is not operating, water will not be withdrawn from the tailings impoundment for reuse. This water needs to be discharged to maintain a safe water level in the impoundment. Outfall 004 alone, would not provide enough discharge capacity to reduce the water level. Therefore, an additional outfall is included in the draft permit. Outfall 005 will include the same sources of wastewater as Outfall 004 (LA and PBS water), as well as wastewater collected from the open pit mine (PIT). These wastewaters will be discharged through the existing mine make-up water underground pipeline directly to the Salmon River, just below the confluence with Thompson Creek. TCMC is installing a custom designed diffuser on the pipeline to allow for efficient mixing in the river. Based on flow volume monitoring conducted by TCMC over the last three years, the maximum flow of Outfall 005 is estimated as 2.7 cfs (1.0 cfs from the LA, 0.3 cfs from the PBS, and 1.4 cfs from PIT). Pollutants of concern include metals, TSS, and pH.

TCMC submitted a permit application for discharging effluent from either or both of Outfalls 001 and 002 through Outfall 005 to the Salmon River. Therefore, the source of wastewater in Outfall 005 may consist of the LA, PBS, and PIT wastewaters and/or Outfall 001 and 002 wastewaters.

APPENDIX C - DEVELOPMENT OF EFFLUENT LIMITATIONS

This section discusses the basis for and the development of effluent limits in the draft permit. This section includes: an overall discussion of the statutory and regulatory basis for development of effluent limitations (Section I); discussions of the development of technology-based effluent limits (Section II) and water quality-based effluent limits (Section III); and, a summary of the effluent limits developed for this draft permit (Section IV).

I. Statutory and Regulatory Basis for Limits

Sections 101, 301(b), 304, 308, 401, 402, and 405 of the Clean Water Act (CWA) provide the basis for the effluent limitations and other conditions in the draft permit. The EPA evaluates the discharges with respect to these sections of the CWA and the relevant National Pollutant Discharge Elimination System (NPDES) regulations to determine which conditions to include in the draft permit.

In general, the EPA first determines which technology-based limits must be incorporated into the permit. EPA then evaluates the effluent quality expected to result from these controls, to see if it could result in any exceedances of the water quality standards in the receiving water. If exceedances could occur, EPA must include water quality-based limits in the permit. The proposed permit limits will reflect whichever requirements (technology-based or water quality-based) are more stringent.

II. Technology-based Evaluation

Section 301(b) of the CWA requires technology-based controls on effluents. This section of the Clean Water Act requires that, by March 31, 1989, all permits contain effluent limitations which: (1) control toxic pollutants and nonconventional pollutants through the use of "best available technology economically achievable" (BAT), and (2) represent "best conventional pollutant control technology" (BCT) for conventional pollutants by March 31, 1989. In no case may BCT or BAT be less stringent than "best practical control technology currently achievable" (BPT), which is the minimum level of control required by section 301(b)(1)(A) of the Clean Water Act.

In many cases, BPT, BCT, and BAT limitations are based on effluent guidelines developed by EPA for specific industries. On December 3, 1982, EPA published effluent guidelines for the mining industry. These guidelines are found in 40 CFR 440. Effluent guidelines applicable to molybdenum mines, such as the TCM are found in the Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory (Subpart J) of Part 440. The BAT(40 CFR 440.103) and BPT (40 CFR 440.102) effluent limitation guidelines that apply to the TCM discharges are shown in the following table.

TABLE C-1: Technology-Based Effluent Limitations for the TCM				
Effluent Characteristic	Effluent Limitations for Mine Drainage (outfalls 001 and 002)		Effluent Limitations for Mill Process Waters (outfalls 004 and 005)	
	daily maximum	monthly average	daily maximum	monthly average
cadmium, ug/l	100	50	100	50
copper, ug/l	300	150	300	150
lead, ug/l	600	300	600	300
mercury, ug/l	2	1	2	1
zinc, ug/l	1500	750	1000	500
TSS, mg/l	30	20	30	20
pH, su	within the range 6.0 -9.0		within the range 6.0 - 9.0	

III. Water Quality-based Evaluation

In addition to the technology-based limits discussed above, EPA evaluated the TCMC's discharges to determine compliance with Section 301(b)(1)(C) of the CWA. This section requires the establishment of limitations in permits necessary to meet water quality standards by July 1, 1977.

The regulations at 40 CFR 122.44(d) implement section 301(b)(1)(C) of the CWA. These regulations require that permits include limits for all pollutants or parameters which "are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality." The limits must be stringent enough to ensure that water quality standards are met, and must be consistent with any available wasteload allocation (WLA).

In determining whether water quality-based limits are needed and developing those limits when necessary, EPA follows guidance in the *Technical Support Document for Water Quality-based Toxics Control* (TSD, EPA 1991). The water quality-based analysis consists of four steps:

1. Determine the appropriate water quality criteria (see Section III.A., below)
2. Determine if there is "reasonable potential" for the discharge to exceed the criteria in the receiving water (see Section III.B.)
3. If there is "reasonable potential", develop a WLA (see Section III.C.)
4. Develop effluent limitations based on the WLA (see Section III.C.)

The following sections provide a detailed discussion of each step. Appendix D provides an example calculation to illustrate how these steps are implemented.

A. Water Quality Criteria

The first step in developing water quality-based limits is to determine the applicable water quality criteria. For Idaho, the State water quality standards are found at IDAPA 16, Title 1, Chapter 2 (IDAPA 16.01.02). The applicable criteria are determined based on the beneficial uses of the receiving water. As discussed in Section IV. of the Fact Sheet, the beneficial uses for the receiving waters of the Thompson Creek Mine discharges are as follows:

> Thompson Creek (outfalls 001 and 002) - agricultural water supply, cold water biota, salmonid spawning, secondary contact recreation (IDAPA 16.01.02130.01.e.)
>
> Squaw Creek (Outfall 004) - agricultural water supply, cold water biota, salmonid spawning, secondary contact recreation (IDAPA 16.01.02130.01.f.)
>
> Salmon River (Outfall 005) - domestic water supply, agricultural water supply, cold water biota, salmonid spawning, primary contact recreation, secondary contact recreation, special resource water (IDAPA 16.01.02130.01.a.)

For any given pollutant, different uses may have different criteria. To protect all beneficial uses, the permit limits are based on the most stringent of the water quality criteria applicable to those uses. The applicable criteria based on the above uses are summarized in Tables C-2 through C-4.

Idaho's aquatic life criteria for several of the metals of concern are calculated as a function of hardness measured in mg/l of calcium carbonate ($CaCO_3$). As the hardness of the receiving water increases, the toxicity decreases and the numerical value of the criteria decreases. The hardness used to calculate the criteria was the hardness in the receiving water after mixing with the effluent. For the existing outfalls (001 and 002), the actual hardness measured downstream of each outfall was used to calculate the hardness-based criteria. For the new outfalls (004 and 005), the hardness was calculated based on a flow-proportioned mix of the expected effluent hardness and existing receiving water hardness. The equations used to derive criteria that are based on hardness are shown in Table C-3. The numerical values of the hardness-based criteria for each outfall is provided in Table C-4. The footnotes of Table C-4 provide more details on how hardness was derived for each outfall.

In addition to the calculation for hardness, Idaho's criteria for some metals include a "conversion factor" to convert from total recoverable to dissolved criteria. Conversion factors address the relationship between the total amount of metal in the water column (total recoverable metal) and the fraction of that metal that causes toxicity (bioavailable metal). Conversion factors for most of the dissolved criteria are shown in Table C-3.

Table C-2: Water Quality Criteria Applicable to TCMC Discharges[1]				
Parameter, µg/l unless otherwise noted	Cold Water Biota - Aquatic Life Criteria[2]		Human Health Criteria	
	Acute Criteria	Chronic Criteria	Domestic Water Supply Criteria (consumption of water & organisms)[3]	Primary and Secondary Contact Recreation Criteria (consumption of organisms)[4]
Antimony	NA	NA	14	NA
Arsenic	360	190	50	50
Cadmium	see Table C-4	see Table C-4	NA	NA
Chromium III	see Table C-4	see Table C-4	NA	NA
Chromium VI	16	11	NA	NA
Copper	see Table C-4	see Table C-4	NA	NA
Lead	see Table C-4	see Table C-4	NA	NA
Mercury	2.1	0.012	0.14	0.15
Nickel	see Table-4	see Table C-4	610	4600
Selenium	20	5	NA	NA
Silver	see Table C-4	NA	NA	NA
Zinc	see Table C-4	see Table C-4	NA	NA
pH (s.u.)	within the range of 6.5 - 9.5		NA	NA
Turbidity (NTU)	below mixing zone, shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than 10 days		NA	NA
WET (TU)	surface waters shall be free from toxic substances in concentrations that impair designated beneficial uses[5]			

Footnotes:

1 - Per IDAPA 16.01.02250.03.b, water quality criteria for agricultural water supplies will generally be satisfied by the water quality criteria set forth in Section 200 (surface waters shall be free from toxic substances in concentrations that impair designated beneficial uses).

2 - The aquatic life criteria are based on IDAPA 16.01.02250.02. This section cites the National Toxics Rule (NTR), 40 CFR 131.36(b)(1), and the NTR subparts for toxics (metals). The aquatic life criteria for arsenic, cadmium, chromium, copper, lead, mercury (acute only), nickel, silver, and zinc are expressed as the dissolved fraction of the metal. The aquatic life criteria for cadmium, chromium III, copper, lead, nickel, silver, and zinc are calculated as a function of hardness per the equations shown in Table C-3. See Table C-4 for the numerical values.

3 - The domestic water supply criteria are based on IDAPA 16.01.02250.03.a., which cites the NTR (except for arsenic which is specified as 50 ug/l in the Idaho standards). These criteria are applicable to the Salmon River.

4 - The recreation criteria are based on IDAPA 16.01.02250.01., which cites the NTR (except for arsenic which is specified as 50 ug/l in the Idaho standards).

5 - EPA's recommended magnitudes for this narrative criterion are 1 TU_c and 0.3 TU_a for the chronic and acute criteria, respectively (TSD 1991). TU means toxicity units, where TU_c is equal to the reciprocal of the effluent concentration that causes no observable effect in a chronic toxicity test and TU_a is the reciprocal of the effluent concentration that causes 50% mortality in an acute toxicity test.

Table C- 3: Hardness-Based Water Quality Criteria Equations			
Parameter		dissolved criterion = conversion factor x total criterion (H = hardness)	
		conversion factor	total criterion
Cadmium	acute	1.136672 - (0.041838)lnH	exp [(1.128(lnH) - 3.828]
	chronic	1.101672 - (0.041838)lnH	exp [(0.7852)lnH - 3.490]
Chromium III	acute	0.316	exp [(0.818)lnH + 3.688]
	chronic	0.86	exp [(0.818)lnH + 1.561]
Copper	acute	0.960	exp [(0.9422)lnH - 1.464]
	chronic	0.960	exp [(0.8545)lnH -1.465]
Lead	acute	1.46203 - (0.145712)lnH	exp [(1.273)lnH - 1.460]
	chronic	1.46203 - (0.145712)lnH	exp [(1.273)lnH - 4.705]
Nickel	acute	0.998	exp [0.846(lnH) + 3.3612]
	chronic	0.997	exp [0.846(lnH) + 1.1645]
Silver	acute	0.85	exp [1.72(lnH) - 6.52]
Zinc	acute	0.978	exp [0.8473(lnH) + 0.8604]
	chronic	0.986	exp [0.8473(lnH) + 0.7614]

Table C-4: Hardness-Based Water Quality Criteria Applicable to TCMC Discharges								
Parameter, ug/l dissolved		Outfall 001 based on Thompson Creek flow (see note)		Outfall 002 based on Thompson Creek flow (see note)		Outfall 004 based on Squaw Creek flow (see note)		Outfall 005 (see note)
		< 7 cfs	$ 7 cfs	< 7 cfs	$ 7 cfs	< 50 cfs	$ 50 cfs	
Cadmium	acute	3.1	1.9	3.4	2.6	15	2.4	0.89
	chronic	0.91	0.66	0.98	0.81	2.3	0.77	0.39
Chromium III	acute	480	340	520	420	1300	400	190
	chronic	160	110	170	140	430	130	61
Copper	acute	15	9.7	16	12	46	12	5.0
	chronic	9.9	6.8	11	8.6	28	8.1	3.7
Lead	acute	54	33	60	45	200	42	15

Table C-4: Hardness-Based Water Quality Criteria Applicable to TCMC Discharges

Parameter, ug/l dissolved		Outfall 001 based on Thompson Creek flow (see note)		Outfall 002 based on Thompson Creek flow (see note)		Outfall 004 based on Squaw Creek flow (see note)		Outfall 005 (see note)
		< 7 cfs	$ 7 cfs	< 7 cfs	$ 7 cfs	< 50 cfs	$ 50 cfs	
	chronic	2.1	1.3	2.3	1.8	7.8	1.6	0.59
Nickel	acute	1200	850	1300	1100	3500	1000	470
	chronic	140	95	150	120	390	110	52
Silver	acute	2.6	1.2	3.0	2.0	22	1.7	0.36
Zinc	acute	100	69	110	87	280	82	38
	chronic	91	63	98	79	260	74	34

Note: The hardness value used is the hardness measured or calculated after the effluent is mixed with the receiving water. The data used to determine hardness was based on the last five years of data. Only the last five years was used as it is most representative of current and future conditions. Hardness for each outfall was determined as described below.

Outfall 001: Hardness values of 85 mg/l $CaCO_3$ and 55 mg/l $CaCO_3$ were used for Thompson Creek flows of < 7 cfs and $ 7 cfs, respectively. These values represent the 5^{th} percentile of the hardness values measured at TC-3 (downstream of Outfall 001) during these flow regimes over the last five years.

Outfall 002: Hardness values of 93 mg/l $CaCO_3$ and 72 mg/l $CaCO_3$ were used for Thompson Creek flows of < 7 cfs and $ 7 cfs, respectively. These values represent the 5^{th} percentile of the hardness values measured at TC-1 (downstream of Outfall 002) during these flow regimes over the last five years.

Outfall 004: A hardness value of 290 mg/l $CaCO_3$ was used for Squaw Creek flows of < 50 cfs. A hardness of 67 mg/l $CaCO_3$ was used for Squaw Creek flows of $50 cfs. These values represent the mixed effluent and receiving water hardness calculated using a mass balance equation (similar to Equation 1 presented in Section B, below). The following values were used in the mass balance equation:
- effluent flow and hardness: a hardness of 912 mg/l for the effluent (based on the flow proportioned 5^{th} percentile hardness values of wastewaters from the LA and PBS over the last five years)
- effluent flow: the maximum flow for Outfall 004 was used
- receiving water hardness: 110 mg/l and 45 mg/l for Squaw Creek flows of < 50 cfs and $50 cfs, respectively (these are the 5^{th} percentile of the hardness values measured at SQ-2, downstream of proposed Outfall 004, at these flow tiers). The downstream location was used to take into account the contribution from Bruno Creek and Outfall 003
- receiving water flows: the 7Q10 Squaw Creek flow for the <50 cfs tier and 50 cfs for the $50 cfs flow tier

Outfall 005: A hardness of 27 mg/l $CaCO_3$ was used. It represents the mixed effluent and receiving water hardness calculated using a mass balance equation (see Equation 1). The following values were used in the mass balance equation:
- effluent hardness: Since Outfall 005 may include wastewaters from 001 and 002 as well as, or instead of, the LA, PBS, and PIT wastewaters, the 5^{th} percentile hardness of each of these sources was calculated and the minimum 5^{th} percentile hardness value was used. This resulted in an effluent hardness of 190 mg/l (the 5^{th} percentile hardness of Outfall 002)
- effluent flow: the maximum flow for Outfall 005
- receiving water hardness: a hardness of 25 mg/l for the receiving water (it represents the 5^{th} percentile of the hardness values measured at SR-3, upstream of proposed Outfall 005)
- receiving water flow: the 7Q10 flow of the Salmon River

B. Reasonable Potential Evaluation

To determine if there is "reasonable potential" to cause or contribute to an exceedence of water quality criteria for a given pollutant (and therefore whether a water quality-based effluent limit is needed), for each pollutant present in a discharge, EPA compares the maximum projected receiving water concentration to the criteria for that pollutant. If the projected receiving water concentration exceeds the criteria, there is "reasonable potential", and a limit must be included in the permit. EPA uses the recommendations in Chapter 3 of the TSD to conduct this "reasonable potential" analysis. This section discusses how reasonable potential is evaluated.

The maximum projected receiving water concentration is determined using the following mass balance equation.

$$C_d \times Q_d = (C_e \times Q_e) + (C_u \times Q_u)$$

where, C_d = receiving water concentration downstream of the effluent discharge (concentration at the edge of the mixing zone)
C_e = maximum projected effluent concentration
C_u = receiving water upstream concentration of pollutant
Q_e = effluent flow
Q_u = receiving water upstream flow
Q_d = receiving water flow downstream of the effluent discharge = $(Q_e + Q_u)$

If a mixing zone is allowed and solving for C_d, the mass balance equation becomes :

$$C_d = \frac{(C_e \times Q_e) + [C_u \times (Q_u \times MZ)]}{Q_e + (Q_u \times MZ)} \qquad \text{(Equation 1)}$$

where, MZ = the percent mixing zone based on receiving water flow

Where no mixing zone is allowed, $C_d = C_e$ (Equation 2)

For some of the metals of concern the aquatic life water quality criteria are expressed as dissolved (see Table C-2, footnote 2). Yet effluent concentrations and NPDES permit limits are expressed as total recoverable metals. The dissolved metal is the concentration of an analyte that will pass through a 0.45 micron filter. Total metal is the concentration of an analyte in an unfiltered sample. To account for the difference between total effluent concentrations and dissolved criteria, "translators" are used in the reasonable potential (and permit limit derivation) equations. Translators can either be site-specific numbers or default numbers. EPA guidance related to the use of translators in NPDES permits is found in *The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion* (EPA 823-B-96-007, June 1996). In the absence of site-specific translators, this guidance recommends the use of the water quality criteria conversion factors (see Table C-3) as the default translators. Because site-specific translators were not available, the conversion factors were used as default translators in the reasonable potential and permit calculations for the TCMC discharges. Therefore, for those metals with criteria expressed as dissolved, Equations 1 and 2 become:

where a mixing zone is allowed:

$$C_d = \frac{\text{translator} \times (C_e \times Q_e) + [C_u \times (Q_u \times MZ)]}{Q_e + (Q_u \times MZ)} \qquad \text{(Equation 3)}$$

where no mixing zone is allowed: $C_d = \text{translator} \times C_e$ (Equation 4)

After C_d is determined, it is compared to the applicable water quality criterion. If it is greater than the criterion, a water quality-based effluent limit is developed for that parameter. The following discusses each of the factors used in the mass balance equation to calculate C_d.

C_e (maximum projected effluent concentration): Per the TSD, the maximum projected effluent concentration in the mass balance equation is represented by the 99th percentile of the effluent data. The 99th percentile is calculated using the statistical approach recommended in the TSD, i.e., by multiplying the maximum reported effluent concentration by a reasonable potential multiplier (RPM):

$$C_e = (\text{maximum measured effluent concentration}) \times RPM \qquad \text{(Equation 5)}$$

The RPM accounts for uncertainty in the effluent data. The RPM depends upon the amount of effluent data and variability of the data as measured by the coefficient of variation (CV) of the data. The RPM decreases as the number of data points increases and the variability (CV) of the data decreases. When there are not enough data to reliably determine a CV, the TSD recommends using 0.6 as a default value. Once the CV of the data is determined, the RPM is determined using the statistical methodology discussed in Section 3.3 of the TSD.

Maximum reported effluent concentrations, CVs, and RPMs used in the reasonable potential calculations were based on data collected by TCMC (DMR data and other monitoring) and EPA (compliance inspection data) since January 1994. Only the last five years of data was used since it was determined to be most representative of current and future conditions. See Tables C-8 through C-11 for a summary of the maximum reported effluent concentrations, CVs, and RPMs used in the reasonable potential analysis.

C_u (upstream concentration of pollutant): The ambient concentration in the mass balance equation is based on a reasonable worst-case estimate of the pollutant concentration upstream from the discharge point. Where sufficient data exists, the 95^{th} percentile of the ambient data is generally used as an estimate of worst-case.

TCMC has been monitoring the receiving waters since the beginning of mine operations. EPA reviewed the ambient data collected by TCMC to calculate C_u. Two difficulties were encountered in evaluating the ambient data. First, much of the data was reported as non-detect and in some cases the detection limits exceeded the water quality criteria. Second, most of the metals data was reported as total, whereas for some metals the aquatic life water quality criteria are expressed as dissolved. In the most recent rounds of ambient monitoring (1998 and 1999), TCMC analyzed for both total and dissolved metals and reported lower detection limits. Therefore, only this most recent data was used to determine background concentrations. Since, only two to six data points were available for each parameter, the maximum value detected (instead of the 95^{th} percentile) was used as C_u. Where all the values were less than the low detection limits, zero was assumed.

The C_u's used for each outfall and the ambient monitoring stations used to determine C_u are identified in Tables C-8 through C-11 (see Figure A-2 for monitoring station locations).

Q_u (upstream flow): The upstream flow used in the mass balance equation depends upon the criterion that is being evaluated. The critical low flows used to evaluate compliance with the water quality criteria are:

- The 1-day, 10-year low flow (1Q10) is used for the protection of aquatic life from acute effects. It represents the lowest daily flow that is expected to occur once in 10 years.

- The 7-day, 10-year low flow (7Q10) is used for protection of aquatic life from chronic effects. It represents the lowest 7-day average flow expected to occur once in 10 years.

- The 30-day, 5-year low flow (30Q5) is used for the protection of human health and agricultural uses from non-carcinogens. It represents the 30-day average flow expected to occur once in 5 years.

- The harmonic mean flow is a long-term average flow and is used for the protection of human health and agricultural uses from carcinogens. It is the number of daily flow measurements divided by the sum of the reciprocals of the flows.

Data collected from United States Geological Survey (USGS) stations on Squaw Creek, Thompson Creek, and the Salmon River were used to estimate the critical low flows applicable to each outfall. Table C-5, below, provides this information.

Thompson Creek and Squaw Creek flows vary dramatically with precipitation and snow melt, with peak flows occurring in May through July. Therefore, two sets of effluent limits were developed for outfalls 001, 002, and 004 representative of both high and low flow conditions and the reasonable potential analysis for these outfalls was conducted for both flow conditions. Flows representative of critical low flow conditions are those provided in Table C-5. Based on a hydrologic analysis conducted by TCMC, receiving water flows used for the high flow conditions are 7 cfs for Thompson Creek and 50 cfs for Squaw Creek (TCMC 1999). These flows approximate the lowest receiving flows recorded during the peak flow months

Table C-5: Receiving Water Flow Data

Flow Information	Thompson Creek	Squaw Creek	Salmon River[1]
USGS Station #	13297330	13297355	13296500
period of record	1973 - 1995	1973 - 1995	1922 - 1991
1Q10, cfs	1.58	4.06	295
7Q10, cfs	2.05	4.56	323
30Q5, cfs	2.64	5.83	390
harmonic mean (HM), cfs	5.75	12.32	686

footnote:
1 - The Salmon River gauge is located below the confluence with the Yankee Fork. Flows from this gauge were multiplied by the drainage basin ratio between the gauge and the diffuser location to obtain the Salmon River flows at the diffuser location shown in this table (IDEQ 2000).

Q_e (effluent flow): The effluent flow used in the mass balance equation is the maximum effluent flow. Because the effluent flows from outfalls 001 and 002 exhibit dramatic seasonal variations, separate effluent flows were determined for both high and low receiving water flows. The effluent flows used and how they were determined are shown in the following table.

Table C-6: Effluent Flows

Outfall	Receiving Water Flow Tier	Effluent Flow (Q_e)	Basis
001	< 7 cfs	0.023 cfs	critical dilution ratio = 0.011 (see footnote 1) therefore Q_e = 0.011 x Q_u = 0.011 x 2.05 cfs = 0.023 cfs
	$ 7 cfs	0.645 cfs	critical dilution ratio = 0.0922 (see footnote 1) therefore Q_e = 0.0922 x Q_u = 0.0922 x 7 cfs
002	< 7 cfs	0.175 cfs	critical dilution ratio = 0.0852 (see footnote 1) therefore Q_e = 0.0852 x Q_u = 0.0852 x 2.05 cfs
	$ 7 cfs	1.25 cfs	critical dilution ratio = 0.179 (see footnote 1) therefore Q_e = 0.179 x Q_u = 0.179 x 7 cfs
004	both flow tiers	1.3 cfs	maximum flows of LA and PBS waste waters as monitored by TCMC over the last three years
005	no flow tiers	2.7 cfs	maximum flow of LA, PBS, and PIT waste waters as monitored by TCMC over the last three years and diffuser design flow

Table C-6: Effluent Flows

Footnote:
1- Because the effluent flow varies dramatically and the variations are similar to the receiving water flow variations, the effluent flows for outfalls 001 and 002 were calculated based on the ratio of the effluent flow to upstream receiving water flow (dilution ratio) for each flow tier. Dilution ratios were determined based on daily flow monitoring of the outfalls and Thompson Creek since the outfalls began discharging (since 1983). Critical dilution ratios were calculated by IDEQ as the highest ratio expected to occur in a 4-day period once every 4 years, which corresponds to the biologically based water quality criteria (IDEQ 2000). For the Thompson Creek data set, this corresponds to the 99.6th-percentile of the dilution ratios.

MZ (the percent mixing zone based on receiving water flow): Mixing zones are defined as a limited area or volume of water where the discharge plume is progressively diluted by the receiving water. Water quality criteria may be exceeded in the mixing zone as long as acutely toxic conditions are prevented from occurring and the applicable existing designated uses of the water body are not impaired as a result of the mixing zone. Mixing zones are allowed at the discretion of the State, based on the State waster quality standards regulations.

The Idaho water quality standards at IDAPA 16.01.02060 allow for the use of mixing zones after a biological, chemical, and physical appraisal of the receiving water and the discharge. The standards allow water quality within a mixing zone to exceed chronic water quality criteria so long as chronic water quality criteria are met at the boundary of the mixing zone. Acute water quality criteria may be exceeded within a zone of initial dilution inside the chronic mixing zone. In accordance with state water quality standards, only IDEQ may authorize mixing zones. As discussed in Section VIII.B. of the Fact Sheet, IDEQ has prepared a preliminary CWA Section 401 Certification authorizing mixing zones for the TCM discharges. The mixing zone volumes are shown in Table C-7. More information on the mixing zones (including the biological, chemical, and physical appraisal) is available in IDEQ's preliminary certification (IDEQ 2000).

If IDEQ authorizes a different size mixing zone in its final 401 certification, EPA will recalculate the reasonable potential and effluent limits based on the final mixing zones. If the State does not authorize a mixing zone in its 401 certification, EPA will recalculate the limits based on meeting water quality criteria at the point of discharge (i.e., "end-of-pipe" limits).

Table C-7: Mixing Zones For The TCM Discharges For Aquatic Life Water Quality Criteria[1]
(expressed as percent of receiving water flow)

Parameter	Outfall 001		Outfall 002		Outfall 004		Outfall 005
	< 7 cfs	$ 7 cfs	< 7 cfs	$ 7 cfs	< 50 cfs	$ 50 cfs	
Arsenic	25	25	25	25	25	25	25
Cadmium	25	50	50	50	50	50	25
Chromium	25	25	25	25	50	25	25
Copper	25	20	25	12.5	0	25	25
Lead	25	66.7	50	50	25	25	25

Table C-7: Mixing Zones For The TCM Discharges For Aquatic Life Water Quality Criteria[1]
(expressed as percent of receiving water flow)

Parameter	Outfall 001		Outfall 002		Outfall 004		Outfall 005
	< 7 cfs	$ 7 cfs	< 7 cfs	$ 7 cfs	< 50 cfs	$ 50 cfs	
Mercury	25	25	25	25	25	25	25
Nickel	25	25	25	25	25	25	25
Selenium	25	50	25	40	50	25	25
Silver	25	25	25	25	25	25	25
Zinc	25	20	25	40	0	25	25

footnote 1 - The Idaho standards are silent regarding mixing zones for human health criteria. EPA uses 100% of the receiving water for dilution for human health criteria, since the mixing zone size limitation for aquatic life is to account for fish passage.

<u>Reasonable Potential Summary:</u> A summary of the data used to determine reasonable potential for each outfall is provided in Tables C-8 through C-11. Results of the reasonable potential analysis for each outfall is provided in Tables C-12 through C-15. Based on the reasonable potential analysis, water quality-based effluent limits were developed for the following parameters:

- Outfall 001: cadmium, copper, lead, mercury, selenium, and zinc (at $ 7 cfs only)
- Outfall 002: cadmium, copper, lead, mercury, selenium, and zinc
- Outfall 004: cadmium, chromium (at < 50 cfs only), copper, lead, mercury, silver (at $ 50 cfs only), and zinc
- Outfall 005: cadmium, copper, lead, mercury, silver, and zinc

To demonstrate the reasonable potential analysis, an example of the reasonable potential determination for cadmium in Outfall 001 is provided in Appendix D (see Steps 1 and 2).

C. Water Quality-Based Permit Limit Derivation

Once EPA has determined that a water quality-based limit is required for a pollutant, the first step in developing the permit limit is development of a wasteload allocation (WLA) for the pollutant. A WLA is the concentration (or loading) of a pollutant that the permittee may discharge without causing or contributing to an exceedence of water quality standards in the receiving water. WLAs and permit limits are derived based on guidance in the TSD. WLAs for this permit were established in two ways: based on a mixing zone (for most metals) and based on meeting water quality criteria at “end-of-pipe” (for pH and for copper and zinc in Outfall 004 at low flow since no mixing zone was authorized).

The WLAs are then converted to long-term average concentrations (LTAs) and compared. The most stringent LTA concentration for each parameter is converted to effluent limits. This section describes each of these steps.

Calculation of WLAs: Where the state authorizes a mixing zone for the discharge, the WLA is calculated as a mass balance, based on the available dilution, background concentration of the pollutant, and the water quality criterion. WLAs are calculated using the same mass balance equation used in the reasonable potential evaluation (see Equation 1). However, C_d becomes the criterion and C_e the WLA. Making these substitutions, Equation 1 is rearranged to solve for the WLA, becoming:

$$WLA = \frac{\text{criterion} \times [Q_e + (Q_u \times MZ)] - (C_u \times Q_u \times MZ)}{Q_e} \qquad \text{(Equation 6)}$$

As discussed previously the aquatic life criteria for some metals is expressed as dissolved. However, the NPDES regulations require that metals limits be based on total recoverable metals (40 CFR 122.45(c)). This is because changes in water chemistry as the effluent and receiving water mix could cause some of the particulate metal in the effluent to dissolve. Therefore, a translator is used in the WLA equation to convert the dissolved criteria to total. The translator is the same translator discussed in the reasonable potential evaluation in the previous section (the criteria conversion factors are used as the default translators). For criteria expressed as dissolved a translator is added to Equation 6 and the WLA is calculated as:

$$WLA = \frac{\text{criterion} \times [Q_e + (Q_u \times MZ)] - (C_u \times Q_u \times MZ)}{Q_e \times \text{translator}} \qquad \text{(Equation 7)}$$

Where no mixing zone is allowed, the criterion becomes the WLA (see Equations 8 and 9). Establishing the criterion as the WLA ensures that the permittee does not contribute to an exceedence of the criteria.

no mixing zone: $WLA = \text{criterion}$ (Equation 8)

$WLA = \text{criterion/translator}$ (for criteria expressed as dissolved) (Equation 9)

WLAs for the parameters that exhibited reasonable potential for each outfall are provided in Tables C-16 through C-22 at the end of this appendix. Appendix D (see Step 3) provides an example of how the WLAs for cadmium in Outfall 001 were developed.

Calculation of Long-term Average Concentrations (LTAs): As discussed above, WLAs are calculated for each parameter for each criterion. Because the different criteria (acute aquatic life, chronic aquatic life, human health) apply over different time frames and may have different mixing zones, it is not possible to compare the criteria or the WLAs directly to determine which criterion results in the most stringent limits. For example, the acute criteria are applied as a onehour average and may have a smaller (or no) mixing zone, while the chronic criteria are applied as a four-day average and may have a larger mixing zone.

To allow for comparison, the acute and chronic aquatic life criteria are statistically converted to long-term average (LTA) concentrations. This conversion is dependent upon the coefficient of variation (CV) of the effluent data and the probability basis used. The probability basis corresponds to the percentile of the estimated concentration. EPA uses a 99th percentile for calculating a long-term average, as recommended in the TSD. The following equation from Chapter 5 of the TSD is used to calculate the LTA concentrations (alternately, Table 5-1 of the TSD may be used):

$$LTA = WLA \times \exp[0.5F^2 - zF] \quad \text{(Equation 10)}$$

where:

F^2 = $\ln(CV^2 + 1)$ for acute aquatic life criteria
= $\ln(CV^2/4 + 1)$ for chronic aquatic life criteria
CV = coefficient of variation
z = 2.326 for 99th percentile probability basis, per the TSD

Calculation of Effluent Limits: The LTA concentration is calculated for each criterion and compared. The most stringent LTA concentration is then used to develop the maximum daily (MDL) and monthly average (AML) permit limits. The MDL is based on the CV of the data and the probability basis, while the AML is dependent upon these two variables and the monitoring frequency. As recommended in the TSD, EPA used a probability basis of 95 percent for the AML calculation and 99 percent for the MDL calculation. The MDL and AML are calculated using the following equations from the TSD (alternately, Table 5-2 of the TSD may be used):

$$MDL \text{ or } AML = LTA \times \exp[zF - 0.5F^2] \quad \text{(Equation 11)}$$

for the MDL: $F^2 = \ln(CV^2 + 1)$
z = 2.326 for 99th percentile probability basis, per the TSD

for the AML: $F^2 = \ln(CV^2/n + 1)$
n = number of sampling events required per month
z = 1.645 for 95th percentile probability basis, per the TSD

For setting water quality-based limits for protection of human health uses, the TSD recommends setting the AML equal to the WLA, and then calculating the MDL (i.e., no calculation of LTAs). The human health MDL is calculated based on the ratio of the AML and MDL as expressed by Equation 11. The MDL, therefore, is based on effluent variability and the number of samples per month. AML/MDL ratios are provided in Table 5-3 of the TSD.

The water quality-based effluent limits developed for each outfall for each parameter that exhibited reasonable potential are shown in Tables C-16 through C-22. These tables also show intermediate calculations (i.e., WLAs, LTAs) used to derive the effluent limits. Appendix D shows an example of the permit limit calculation for cadmium in Outfall 001 (see Steps 3 and 4).

IV. Summary of Draft Permit Effluent Limitations and WET Triggers

A. Summary of Draft Permit Effluent Limitations

As discussed in Section I of this appendix, technology-based limits were applied to each discharge and evaluated (via the reasonable potential evaluation discussed in Section III) to determine whether these limits may result in any exceedences of water quality standards in the receiving water. If exceedences could occur, then water quality-based effluent limits were developed. The following summarizes the final proposed effluent limits developed for each outfall.

Metals: The technology-based effluent limits applicable to TCMC's discharges were presented in Table C-1. The water-quality based effluent limits for metals applicable to the discharges are shown in Tables C-16 through C-22. The zinc limit for Outfall 001 during low flow conditions is technology-based. All of the other metals limits were based on water quality-standards.

TSS: The State does not have a water quality standard for TSS. Therefore, the TSS limits included in the draft permit are the technology-based limits shown in Table C-1.

pH: The State water quality standard for pH is 6.5 - 9.5 standard units for the protection of aquatic life (see Table C-2). The technology-based effluent limits specify a pH of 6.0 - 9.0 (see Table C-1). The draft permit incorporates the more stringent water quality-based minimum of 6.5 and the technology-based maximum of 9.0 standard units.

mass-based limits: The effluent limitations thus far have been expressed in terms of concentration. However, with a few exceptions, the NPDES regulations (40 CFR 122.45(f)) require that effluent limits also be expressed in terms of mass. The following equation is used to convert the concentration-based limits into mass-based limits:

mass limit (lb/day) = concentration limit (ug/l) x effluent flow rate x conversion factor (Equation 12)

where,

conversion factor = 0.005379 (to convert units on the right side of the equation to lb/day)
effluent flow rate = maximum discharge rate in cfs (see Table C-6)

The above equation was used to calculate mass-based limits for outfalls 004 and 005, where the maximum effluent flow was used to calculate the effluent limits (per the TSD, the flows used to calculate mass-based limits should be consistent with those used to develop the WLAs). Mass-based limits for these outfalls are shown in Tables 4 and 5 of the Fact Sheet.

However, for outfalls 001 and 002, the effluent limits were based on a dilution ratio (since the effluent flows vary dramatically and vary with receiving water flow). Therefore, mass loading will be controlled for these outfalls via the dilution ratio used to develop the effluent limits. The draft permit requires that the dilution ratios shown in Table C-6 not be exceeded.

B. Whole Effluent Toxicity (WET) Triggers

As discussed in Section VI.B. of the fact sheet, there was not an adequate amount of WET data to determine the need for effluent limits in the draft permit. The draft permit includes WET monitoring and establishes trigger levels for each outfall, that, if exceeded would trigger additional WET testing and, potentially, investigations to reduce toxicity. The trigger levels were calculated based on the WET criteria, receiving water flow, effluent flow, and available dilution. The trigger levels were calculated using the following mass-balance equation (this is basically the same as Equation 6):

$$\text{WET toxicity trigger} = \frac{\text{criterion} \times [Q_e + (Q_u \times MZ)] - (C_u \times Q_u \times MZ)}{Q_e} \qquad \text{(Equation 13)}$$

where,

criterion = 1 TU_c for compliance with the chronic criterion (see Table C-2)

Q_e = effluent flow (see Table C-6)

Q_u = upstream flow (see page C-9 and Table C-5)

C_u = upstream concentration = 0 for WET (assuming no upstream toxicity)

MZ = mixing zone = 1 for compliance with chronic criteria (IDEQ's preliminary certification stated that chronic WET testing and triggers be based on 100% dilutions)

Solving equation 13 resulted in the chronic trigger values in Table 6 of the draft permit. The acute trigger value was set at 1 TU_a for all outfalls based on the IDEQ preliminary certification of no acute toxicity with 100% effluent.

TABLE C- 8: Summary of Data Used to Determine Reasonable Potential and Develop Effluent Limits for Outfall 001

Parameter[1] ug/l	Effluent Data[2]				Receiving Water Upstream Concentration (C_u)[6]	
	Maximum Effluent Concentration[3]	Coefficient of Variation (CV)[4]	Number of Samples	Reasonable Potential Multiplier (RPM)[5]	total	dissolved
Arsenic	2	0.6	25	2.1	3	0.5
Cadmium	100	0.6	na	1	na	0.07
Chromium	10	0.6	22	2.2	na	0
Copper	300	0.6	na	1	na	0.5
Lead	600	0.6	na	1	na	0.12
Mercury	2	0.6	na	1	0	0
Nickel	10	0.6	22	2.2	0.7	0.7
Selenium	42	0.5	21	2.3	1	na
Silver	0.05	0.6	22	2.2	na	0
Zinc	1500	0.6	na	1	na	5

na = not applicable, used for two situations -
number of samples column: The number of samples is used to develop the RPM. For parameters with technology-based effluent limitation guidelines the RPM is 1 therefore the number of samples is not important
receiving water concentration columns: the receiving water concentrations are only needed for the form in which the criterion is expressed

Footnotes:
1 - Reasonable potential (RP) was determined only for parameters with an adequate amount of data of adequate quality. For example, RP was not determined for WET since only two data sets were available.

2 - The effluent data is based on sampling of Outfall 001 conducted by TCMC and EPA (compliance inspection data) since 1994. Because limited effluent data existed for chromium, nickel, selenium, and silver, EPA used analyses for these parameters from the Buckskin sediment pond. The metals data is expressed as the total form.
3 - For parameters with technology-based effluent limitation guidelines (cadmium, copper, lead, mercury, zinc), the maximum effluent concentration used to determine RP is the technology-based maximum daily limitation (see Table C-1). The technology-based limit is used since water quality-based limits are only required if discharge at the technology-based limits have reasonable potential to exceed water quality standards in the receiving water. For other parameters, the maximum effluent concentration used is the maximum detected concentration.

4- Where the majority of the effluent data was reported at less then detection limits, effluent-specific variability cannot be determined, so a default CV of 0.6 was used. This was the case for all parameters except selenium. Adequate data was available for selenium to calculate the CV (standard deviation divided by the mean).

5 - For parameters with technology-based effluent limitation guidelines, the RPM is 1. For other parameters the RPM is based on the CV and the number of data points (number of samples collected over the last five years).

6 - The receiving water concentrations are based on samples collected from Thompson Creek monitoring location TC-4, upstream of Outfall 001. Except for selenium, only data from 1998 and 1999 was used, since the detection limits from previous sampling events were not adequate to quantify background (detection limits were too high). The concentrations in the table represents the maximum concentration detected. Where all the data was reported at less than detection limits, zero was used as C_u. For selenium, the background value is based on a high-resolution analysis conducted in December 1999 by a selenium specialty lab.

TABLE C- 9: Summary of Data Used to Determine Reasonable Potential and Develop Effluent Limits for Outfall 002

Parameter[1] ug/l	Effluent Data[2]				Receiving Water Upstream Concentration (C_u)[6]	
	Maximum Effluent Concentration[3]	Coefficient of Variation (CV)[4]	Number of Samples	Reasonable Potential Multiplier (RPM)[5]	total	dissolved
Arsenic	2.4	0.6	58	1.6	0.7	0.7
Cadmium	100	0.6	na	1	na	0.06
Chromium	0.6	0.6	23	2.2	na	0.7
Copper	300	0.6	na	1	na	0.6
Lead	600	0.6	na	1	na	0.18
Mercury	2	0.6	na	1	0	0
Nickel	1.9	0.6	23	3.8	0.9	0.9
Selenium	17	0.6	21	2.3	2 and 2.7	na
Zinc	1500	0.6	na	1	na	30

na = not applicable, used for two situations -
number of samples column: The number of samples is used to develop the RPM. For parameters with technology-based effluent limitation guidelines the RPM is 1 therefore the number of samples is not important
receiving water concentration columns: the receiving water concentrations are only needed for the form in which the criterion is expressed

Footnotes:
1 - Reasonable potential (RP) determined only for parameters with an adequate amount of data of adequate quality. For example, RP was not determined for silver since all the effluent data was reported at less than detection limits.

2 - The effluent data is based on sampling of Outfall 002 conducted by TCMC and EPA (compliance inspection data) since 1994. Because limited effluent data existed for chromium, nickel, selenium, and silver, EPA also used analyses for these parameters from the Pat Hughes sediment pond. The metals data is expressed as the total form.

3 - See footnote 3, Table C-8.

4- Since the majority of the effluent data was reported at less then detection limits, effluent-specific variability cannot be determined, so a default CV of 0.6 was used.

5 - See footnote 5, Table C-8.

6 - The receiving water concentrations are based on samples collected from Thompson Creek monitoring location TC-2, upstream of Outfall 002. Except for selenium, only data from 1998 and 1999 was used, since the detection limits from previous sampling events were not adequate to quantify background (detection limits were too high). The concentrations in the table represents the maximum concentration detected. Where all the data was reported at less than detection limits, zero was used as C_u. For selenium, the background values were calculated by IDEQ based on the background value upstream of Outfall 001 (TC-4, see Table C-8) plus the increase in selenium due to Outfall 001. The calculated background values for selenium were 2 ug/l at Thompson Creek flows of < 7 cfs and 2.7 ug/l at Thompson Creek flows $ 7 cfs (IDEQ 2000).

TABLE C- 10: Summary of Data Used to Determine Reasonable Potential and Develop Effluent Limits for Outfall 004

Parameter[1] ug/l	Effluent Data[2]				Receiving Water Upstream Concentration (C_u)[6]	
	Maximum Effluent Concentration[3]	Coefficient of Variation (CV)[4]	Number of Samples	Reasonable Potential Multiplier (RPM)[5]	total	dissolved
Arsenic	4.0	0.6	17	2.5	0.8	0.8
Cadmium	100	0.6	na	1	na	0.13
Chromium	40	0.6	16	2.5	na	0.6
Copper	300	0.6	na	1	na	1.3
Lead	600	0.6	na	1	na	0.68
Mercury	2	0.6	na	1	0	0
Nickel	40	0.6	17	2.5	1	1
Selenium	5.1	0.6	17	2.5	0	na
Silver	9.2	0.6	17	2.5	na	0
Zinc	1000	0.6	na	1	na	3

na = not applicable, used for two situations -
number of samples column: The number of samples is used to develop the RPM. For parameters with technology-based effluent limitation guidelines the RPM is 1 therefore the number of samples is not important
receiving water concentration columns: The receiving water concentrations are only needed for the form in which the criterion is expressed.

Footnotes:

1 - Reasonable potential (RP) determined only for parameters with an adequate amount of data of adequate quality.

2 - The effluent data is based on sampling of the LA and PBS waste streams conducted by TCMC since 1994. The metals data is expressed as the total form.

3 - For parameters with technology-based effluent limitation guidelines (cadmium, copper, lead, mercury, and zinc), the maximum effluent concentration used to determine reasonable potential is the technology-based maximum daily limitation concentration (see Table C-1). For other parameters, the maximum effluent concentration used is the flow-weighted average of the maximum detected concentrations in PBS and LA samples.

4- A default CV of 0.6 is used because the data for this discharge is from different sources (LA and PBS), the exact flow-proportioned combination of which is uncertain (and therefore variability is uncertain).

5 - See footnote 5, Table C-8.

6 - The receiving water concentrations are based on samples collected from Squaw Creek monitoring location SQ-2. Only data from 1998 and 1999 was used, since the detection limits from previous sampling events were not adequate to quantify background (detection limits were too high). The concentrations in the table represents the maximum concentration detected (except for lead, where the highest concentration was determined to be an outlier). Where all the data was reported at less than detection limits, zero was used as C_u.

TABLE C- 11: Summary of Data Used to Determine Reasonable Potential and Develop Effluent Limits for Outfall 005						
Parameter[1] ug/l	Effluent Data[2]				Receiving Water Upstream Concentration (C_u)[6]	
	Maximum Effluent Concentration[3]	Coefficient of Variation (CV)[4]	Number of Samples	Reasonable Potential Multiplier (RPM)[5]	total	dissolved
Antimony	9.9	0.6	6	3.8	0.16	na
Arsenic	30	0.6	9	3.2	2.1	1.9
Cadmium	100	0.6	na	1	na	0.16
Chromium	40	0.6	6	3.8	na	0
Copper	300	0.6	na	1	na	1
Lead	600	0.6	na	1	na	0.20
Mercury	2	0.6	na	1	0	0
Nickel	50	0.6	6	3.8	1.1	1.1
Selenium	42	0.6	6	2.3	0	na
Silver	9.2	0.6	6	3.8	na	0
Zinc	1000	0.6	na	1	na	3

TABLE C- 11: Summary of Data Used to Determine Reasonable Potential and Develop Effluent Limits for Outfall 005

na = not applicable, used for two situations -
<u>number of samples column:</u> The number of samples is used to develop the RPM. For parameters with technology-based effluent limitation guidelines the RPM is 1 therefore the number of samples is not important
<u>receiving water concentration columns</u>: The receiving water concentrations are only needed for the form in which the criterion is expressed.

<u>Footnotes:</u>
1 - Reasonable potential (RP) determined only for parameters with an adequate amount of data of adequate quality.

2 - The effluent data is based on sampling of the LA, PBS, and PIT waste streams conducted by TCMC since 1994. Since discharge of effluent from outfalls 001 and 002 through 005 will be allowed, the effluent data was also based on sampling from these outfalls since 1994. The metals data is expressed as the total form.

3 - For parameters with technology-based effluent limitation guidelines (cadmium, copper, lead, mercury, and zinc), the maximum effluent concentration used to determine RP is the technology-based maximum effluent concentration (see Table C-1). For other parameters, the maximum effluent concentration used is the maximum of either, the flow-weighted average of the maximum detected concentrations in PBS, LA, and PIT samples, or the maximum detected concentration in outfalls 001 and 002.

4- A default CV of 0.6 is used because the data for this discharge is from different sources (LA, PBS, and PIT) the exact flow-proportioned combination of which is uncertain, and potentially from outfalls 001 and 002, (and therefore variability is uncertain).

5 - See footnote 5, Table C-8.

6 - The receiving water concentrations are based on samples collected from Salmon River monitoring location SR-3. Only data from 1998 and 1999 was used, since the detection limits from previous sampling events were not adequate to quantify background (detection limits were too high). The concentrations in the table represents the maximum concentration detected (except for lead, where the highest concentration was determined to be an outlier). Where all the data was reported at less than detection limits, zero was used as C_u.

TABLE C- 12: Summary of Reasonable Potential (RP) Determination for Outfall 001

Parameter, ug/l	RP for Thompson Creek Flows < 7 cfs				RP for Thompson Creek Flows $ 7 cfs			
	Maximum Projected Receiving Water Concentration, $(C_d)^2$			RP[3] (yes or no)	Maximum Projected Receiving Water Concentration, $(C_d)^2$			RP[3] (yes or no)
	aquatic life acute	aquatic life chronic	recreation		aquatic life acute	aquatic life chronic	recreation	
Arsenic	0.70	0.66	0.52	no	1.5	1.5	0.81	no
Cadmium	**5.3**	**4.0**	na	yes	**15**	**15**	na	yes
Chromium[1]	1.2	0.91	na	no	5.8	**5.7**	na	no
Copper	**16**	**13**	na	yes	**91**	**91**	na	yes

TABLE C- 12: Summary of Reasonable Potential (RP) Determination for Outfall 001

Lead	27	**21**	na	yes	64	**64**	na	yes
Mercury	0.094	**0.086**	0.017	yes	0.46	**0.54**	**0.17**	yes
Nickel	1.9	1.6	0.88	no	6.4	6.4	2.5	no
Selenium	**6.3**	**5.1**	na	yes	16	**16**	na	yes
Silver	0.0051	na	na	no	0.0025	na	na	no
Zinc	85	68	na	no	**470**	**470**	na	yes

na = not applicable (no criterion for comparison)

Footnotes:

1 - Chromium was assumed to be in the hexavalent form for comparison to the criteria for chromium-VI (the most stringent of the chromium criteria).

2 - The aquatic life maximum projected receiving water concentrations are expressed as dissolved for arsenic, cadmium, copper, lead, nickel, silver, and zinc. All other metal concentrations in these columns are expressed as total.

3 - Reasonable Potential (RP) exists if the maximum projected receiving water concentration exceeds the criteria (see Tables C-2 and C-4). The maximum projected receiving water concentrations in bold are those that exceed criteria.

TABLE C- 13: Summary of Reasonable Potential (RP) Determination for Outfall 002

Parameter, ug/l	RP for Thompson Creek Flows < 7 cfs				RP for Thompson Creek Flows $ 7 cfs			
	Maximum Projected Receiving Water Concentration, $(C_d)^2$			RP[3] (yes or no)	Maximum Projected Receiving Water Concentration, $(C_d)^2$			RP[3] (yes or no)
	aquatic life acute	aquatic life chronic	recreation		aquatic life acute	aquatic life chronic	recreation	
Arsenic	1.7	1.5	0.79	no	2.0	20	1.2	no
Cadmium	**17**	**13**	na	yes	**25**	**24**	na	yes
Chromium[1]	0.88	0.85	0.74	no	0.95	0.94	0.79	no
Copper	**89**	**74**	na	yes	**170**	**170**	na	yes
Lead	**87**	**70**	na	yes	**130**	**130**	na	yes
Mercury	0.52	**0.51**	0.12	yes	0.71	**0.83**	**0.30**	yes
Nickel	1.9	1.7	1.1	no	2.3	2.3	1.4	no
Selenium	13	**11**	na	**yes**	14	**14**	na	yes
Zinc	**470**	**400**	na	yes	**470**	**480**	na	yes

TABLE C- 13: Summary of Reasonable Potential (RP) Determination for Outfall 002
na = not applicable (no criterion for comparison) footnotes: Same as Table C-12 footnotes.

TABLE C- 14: Summary of Reasonable Potential (RP) Determination for Outfall 004

Parameter, ug/l	RP for Squaw Creek Flows < 50 cfs				RP for Squaw Creek Flows $ 50 cfs			
	Maximum Projected Receiving Water Concentration, $(C_d)^2$			RP[3] (yes or no)	Maximum Projected Receiving Water Concentration, $(C_d)^2$			RP[3] (yes or no)
	aquatic life acute	aquatic life chronic	recreation		aquatic life acute	aquatic life chronic	recreation	
Arsenic	6.0	5.7	1.7	no	1.7	1.7	1.0	no
Cadmium	**35**	**31**	na	yes	**4.8**	**4.6**	na	yes
Chromium[1]	**39**	**35**	na	yes	9.8	9.6	na	no
Copper	**290**	**290**	na	yes	**28**	**28**	na	yes
Lead	**220**	**200**	na	yes	**49**	**49**	na	yes
Mercury	0.96	**1.1**	**0.37**	yes	0.16	**0.19**	**0.0051**	yes
Nickel	57	54	19	no	10	10	3.5	no
Selenium	5.0	4.6	na	no	1.2	1.2	na	no
Silver	11	na	na	no	**1.8**	na	na	yes
Zinc	**978**	**986**	na	yes	**95**	**96**	na	yes

na = not applicable (no criterion for comparison) footnotes: Same as Table C-12 footnotes.

TABLE C-15: Summary of Reasonable Potential Determination for Outfall 005

Parameter	Maximum Projected Receiving Water Concentration $(C_d)^2$, ug/l			Reasonable Potential[3] (yes or no)
	aquatic life acute	aquatic life chronic	domestic or recreation	
Antimony	na	na	0.42	no
Arsenic	5.2	4.9	2.3	no
Cadmium	**3.7**	**3.3**	na	yes
Chromium[1]	5.3	4.7	na	no
Copper	**11**	**10**	na	yes
Lead	**21**	**19**	na	yes
Mercury	0.060	**0.065**	0.014	yes
Nickel	7.8	7.2	2.4	no
Selenium	3.4	3.1	na	no
Silver	**1.1**	na	na	yes

TABLE C-15: Summary of Reasonable Potential Determination for Outfall 005

Zinc	**55**	**51**	na	yes

na = not applicable (no criterion for comparison)   footnotes: Same as Table C-12 footnotes.

TABLE C-16: Summary of Permit Limit Derivation for Outfall 001 at Thompson Creek Flow < 7 cfs

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Recreational Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	58.0	21.4	18.6	11.3	na	na	chronic	35	24
Copper	267	22.8	85.9	120	na	na	acute	270	180
Lead	1200	56.9	387	30.0	na	na	chronic	94	64
Mercury	43.6	0.279	14.0	0.147	17.4	25.3	chronic	0.46	0.32
Selenium	346	94.1	129	54.7	na	na	chronic	150	110
Zinc	no RP	no RP	no RP	no RP	na	na	tech.	1500	750

na = not applicable (no criterion for comparison)
no RP = no reasonable potential to exceed water quality criteria, therefore water quality-based limits not developed

<u>Footnotes:</u>
1- Parameters which exhibited reasonable potential (see Table C-12) or have technology-based limits (see Table C-1).
2- Effluent limits based on the most stringent aquatic life criteria (lowest LTA) were compared to limits based on recreational use and technology-based limits (see Table C-1). The most stringent of these represents the final effluent limits.

TABLE C-17: Summary of Permit Limit Derivation for Outfall 001 at Thompson Creek Flow $ 7 cfs

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Recreational Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	12.2	4.13	3.92	2.18	na	na	chronic	6.8	4.7
Copper	30.9	21.4	9.91	11.3	na	na	acute	31	21
Lead	313	11.3	101	5.94	na	na	chronic	19	13
Mercury	8.91	0.0446	2.86	0.0235	1.78	2.59	chronic	0.073	0.050
Selenium	123	26.7	45.9	15.5	na	na	chronic	42	30

TABLE C-17: Summary of Permit Limit Derivation for Outfall 001 at Thompson Creek Flow $ 7 cfs								
Zinc	212	191	68.2	101	na	na	acute	210	150

na = not applicable (no criterion for comparison)
footnotes: Same as Table C-16 footnotes.

TABLE C-18: Summary of Permit Limit Derivation for Outfall 002 at Thompson Creek Flow < 7 cfs

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Recreational Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	19.6	6.96	6.31	3.67	na	na	chronic	11	7.8
Copper	52.5	41.8	16.9	22.1	na	na	acute	53	36
Lead	409	18.6	131	9.80	na	na	chronic	31	21
Mercury	7.82	0.0471	2.51	0.0249	2.41	3.52	chronic	0.077	0.053
Selenium	60.6	13.8	19.5	7.27	na	na	chronic	23	16
Zinc	289	302	92.9	160	na	na	acute	290	200

na = not applicable (no criterion for comparison)

Footnotes:
1 - Parameters which exhibited reasonable potential (see Table C-13).
2 - See footnote 2, Table C-16.

TABLE C-19: Summary of Permit Limit Derivation for Outfall 002 at Thompson Creek Flow $ 7 cfs

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Recreational Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	10.1	3.15	3.25	1.66	na	na	chronic	5.2	3.5
Copper	21.7	14.7	6.96	7.78	na	na	acute	22	15
Lead	204	7.36	65.4	3.88	na	na	chronic	12	8.3

TABLE C-19: Summary of Permit Limit Derivation for Outfall 002 at Thompson Creek Flow $ 7 cfs								
Mercury	5.76	0.0288	1.85	0.0152	0.99	1.44	chronic	0.047	0.032
Selenium	58.8	10.2	18.9	5.35	na	na	chronic	17	11
Zinc	218	192	70.1	101	na	na	acute	220	150

na = not applicable (no criterion for comparison)
footnotes: Same as Table C-18 footnotes.

TABLE C-20: Summary of Permit Limit Derivation for Outfall 004 for Squaw Creek Flows of < 50 cfs

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Recreational Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	33.3	7.08	10.7	3.74	na	na	chronic	12	5.8
Chromium	40.0	29.2	12.9	15.4	na	na	acute	40	20
Copper	48.3	29.4	15.5	15.5	na	na	acute & chronic	48	24
Lead	563	22.2	181	11.7	na	na	chronic	37	18
Mercury	4.27	0.0225	1.37	0.0119	0.823	1.65	chronic	0.037	0.018
Zinc	288	261	92.6	138	na	na	acute	290	140

na = not applicable (no criterion for comparison)

Footnotes:
1- Parameters which exhibited reasonable potential (see Table C-14).
2 - See footnote 2, Table C-16.

TABLE C-21: Summary of Permit Limit Derivation for Outfall 004 for Squaw Creek Flows of $ 50 cfs

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Recreational Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	49.3	15.5	15.8	8.18	na	na	chronic	26	13

TABLE C-21: Summary of Permit Limit Derivation for Outfall 004 for Squaw Creek Flows of $ 50 cfs									
Copper	116	76.1	37.2	40.1	na	na	acute	120	58
Lead	513	12.6	165	6.64	na	na	chronic	21	10
Mercury	25.5	0.127	8.18	0.672	5.92	11.9	chronic	0.21	0.10
Silver	21.6	na	6.95	na	na	na	acute	22	11
Zinc	855	772	275	407	na	na	acute	860	430

na = not applicable (no criterion for comparison)
footnotes: Same as Table C-20 footnotes.

TABLE C- 22: Summary of Permit Limit Derivation for Outfall 005

Parameter[1] ug/l	Aquatic Life Criteria Wasteload Allocations (WLA)		Aquatic Life Criteria Long Term Average (LTA) Concentration		Limits Based on Domestic Use or Recreational Use Criteria		Effluent Limits		
	acute WLA	chronic WLA	acute LTA	chronic LTA	WLA = AML	MDL	Basis[2]	maximum daily limit (MDL)	average monthly limit (AML)
Cadmium	21.0	7.57	6.74	4.00	na	na	chronic	12	6.2
Copper	118	88.2	37.8	46.5	na	na	acute	120	59
Lead	431	12.5	138	6.58	na	na	chronic	21	10
Mercury	68.0	0.371	21.8	0.196	21.8	43.8	chronic	0.61	0.30
Silver	1.21	na	3.88	na	na	na	acute	12	6.0
Zinc	1010	989	342	522	na	na	acute	1000	500

na = not applicable (no criterion for comparison)

Footnotes:
1- Parameters which exhibited reasonable potential (see Table C-15).
2- See footnote 2, Table C-16.

APPENDIX D -
EXAMPLE WATER QUALITY-BASED EFFLUENT LIMIT CALCULATION

This appendix demonstrates how the water quality- based analysis (reasonable potential determination and development of effluent limits) that was described in Section III. of Appendix C was performed using cadmium in Outfall 001 as an example.

Step 1: Determine the applicable water quality criteria.

Applicable water quality criteria for cadmium in Outfall 001 are proved in Tables C-2 and C-4. The cadmium criteria applicable to the low flow tier (< 7 cfs in Thompson Creek) are (see Table C-4):

aquatic life acute = 3.1 ug/l (expressed as dissolved)
aquatic life chronic = 0.91 ug/l (expressed as dissolved)

The cadmium criteria applicable to high flow tier ($7 cfs in Thompson Creek) are (Table C-4):

aquatic life acute = 1.9 ug/l (expressed as dissolved)
aquatic life chronic = 0.66 ug/l (expressed as dissolved)

Step 2: Determine if there is reasonable potential (RP) for the discharge to exceed the criteria in the receiving water.

To determine reasonable potential, the maximum projected receiving water concentration (C_d) is compared to the applicable water quality criterion. If C_d exceeds the criterion, then reasonable potential exists and a water quality-based effluent limit is established. Since the cadmium criteria is expressed as dissolved and a mixing zone is allowed, C_d is determined with Equation 3.

$$C_d = \frac{\text{translator} \times (C_e \times Q_e) + [C_u \times (Q_u \times MZ)]}{Q_e + (Q_u \times MZ)} \quad \text{(Equation 3)}$$

The values for the parameters in the above equation are:

translator = the water quality criteria conversion factor is used as the translator (see page C-7). The conversion factors for cadmium are based on hardness and calculated according to the equations shown in Table C-3.

The hardness applicable to Outfall 001 for the low flow tier is 85 mg/l $CaCO_3$ (see footnotes of Table C-4). The conversion factors based on this hardness are:

acute conversion factor = 1.136672 - (0.041838) ln (85) = 0.951
chronic conversion factor = 1.101672 - (0.041838) ln (85) = 0.916

The hardness applicable to Outfall 001 under the high flow tier is 55 mg/l $CaCO_3$ (see footnotes of Table C-4). The conversion factors based on this hardness are:

acute conversion factor = 1.136672 - (0.041838) ln (55) = 0.969
chronic conversion factor = 1.101672 - (0.041838) ln (55) = 0.934

C_e = maximum projected effluent concentration. This is determined via Equation 5:

C_e = (max. measured effluent concentration) x RPM (Equation 5)

Since cadmium has a technology-based effluent limitation, the maximum technology-based effluent limitation (100 ug/l) is used as the maximum effluent concentration and the RPM is 1 (see Table C-8 and footnotes 3 and 5 of that table). Therefore, C_e is calculated as:

C_e = (100 ug/l) x 1 = 100 ug/l

C_u = upstream receiving water concentration = 0.07 ug/l, dissolved (see Table C-8).

Q_u = upstream receiving water flow (see Table C-5)

for low flow tier	=	1.58 cfs for comparison to acute aquatic life criterion
	=	2.05 cfs for comparison to chronic aquatic life criterion
for high flow tier	=	7 cfs for all criteria

Q_e = effluent flow (see Table C-6) = 0.023 cfs for the low flow tier
= 0.645 cfs for the high flow tier

MZ = mixing zone (see Table C-7) = 0.25 for the low flow tier
= 0.50 for the high flow tier

Now plug the above values into Equation 3 and solve:

For the low flow tier:

Determine the reasonable potential to exceed acute aquatic life criterion:

$$C_d = \frac{(0.951)(100)(0.023) + (0.07)(1.58)(0.25)}{0.023 + (1.58)(0.25)} = 5.3 \text{ ug/l}$$

Since the maximum projected receiving water concentration (C_d = 5.3 ug/l) exceeds the acute aquatic life criterion (3.1 ug/l), there is reasonable potential for the effluent to cause an exceedence to the water quality standard, and a water quality-based effluent limit is required (see Table C-12).

Determination of reasonable potential to exceed chronic aquatic life criterion:

$$C_d = \frac{(0.916)(100)(0.023) + (0.07)(2.05)(0.25)}{0.023 + (2.05)(0.25)} = 4.0 \text{ ug/l}$$

Since C_d exceeds the chronic aquatic life criterion (0.91 ug/l), there is reasonable potential for the effluent to cause an exceedence to the water quality standard, and a water quality-based effluent limit is required (see Table C-12).

For the high flow tier:

Determine the reasonable potential to exceed acute aquatic life criterion:

$$C_d = \frac{(0.969)(100)(0.645) + (0.07)(7)(0.50)}{0.645 + (7)(0.50)} = 15 \text{ ug/l}$$

Since the C_d exceeds the acute aquatic life criterion (1.9 ug/l), there is reasonable potential for the effluent to cause an exceedence to the water quality standard, and a water quality-based effluent limit is required (see Table C-12).

Determination of reasonable potential to exceed chronic aquatic life criterion:

$$C_d = \frac{(0.934)(100)(0.645) + (0.07)(7)(0.50)}{0.645 + (7)(0.50)} = 15 \text{ ug/l}$$

Since C_d exceeds the chronic aquatic life criterion (0.66 ug/l), there is reasonable potential for the effluent to cause an exceedence to the water quality standard, and a water quality-based effluent limit is required (see Table C-12).

NOTE: If reasonable potential exists to exceed any one of the criteria for a particular parameter, then water-quality based effluent limits are required for that parameter.

Step 3: Since there is reasonable potential, determine the wasteload allocation (WLAs).

Since the applicable criteria are expressed as dissolved, the WLAs for cadmium in Outfall 001 are calculated using Equation 7:

$$WLA = \frac{\text{criterion} \times [Q_e + (Q_u \times MZ)] - (C_u \times Q_u \times MZ)}{Q_e \times \text{translator}} \quad \text{(Equation 7)}$$

The variables in the WLA equation have already been defined in Steps 1 and 2. Plugging these into Equation 7 and solving:

For the low flow tier:

Determination of the WLA for protection of acute aquatic life:

$$WLA_{acute} = \frac{(3.1)[0.023 + (1.58)(0.25)] - (0.07)(1.58)(0.25)}{(0.023)(0.951)} = 58.0 \text{ ug/l}$$

Determination of the WLA for protection of chronic aquatic life:

$$WLA_{chronic} = \frac{(0.91)[0.023 + (2.05)(0.25)] - (0.07)(2.05)(0.25)}{(0.023)(0.916)} = 21.4 \text{ ug/l}$$

These WLAs are shown in Table C-16.

For the high flow tier:

Determination of the WLA for protection of acute aquatic life:

$$WLA_{acute} = \frac{(1.9)[0.645 + (7)(0.50)] - (0.07)(7)(0.50)}{(0.645)(0.969)} = 12.2 \text{ ug/l}$$

Determination of WLA for protection of chronic aquatic life:

$$WLA_{chronic} = \frac{(0.66)[0.645 + (7)(0.50)] - (0.07)(7)(0.50)}{(0.645)(0.934)} = 4.13 \text{ ug/l}$$

These WLAs are shown in Table C-17.

Step 4a: Develop Long-term Average Concentrations (LTAs) based on the WLAs.

Effluent limits are developed by converting the aquatic life WLAs to long-term average concentrations (LTAs). The most stringent of the acute or chronic LTA is then used to develop the effluent limits. The aquatic life WLAs are converted to long-term average concentrations (LTAs) using Equation 10:

$$LTA = WLA \times \exp[0.5F^2 - zF] \qquad \text{(Equation 10)}$$

where,

z = 2.326 for 99th percentile probability basis (per the TSD)
CV = 0.6 (see Table C-8)
for acute criteria, $F^2 = \ln(CV^2 + 1) = \ln(0.6^2 + 1) = 0.3075$
for chronic criteria, $F^2 = \ln(CV^2/4 + 1) = \ln(0.6^2/4 + 1) = 0.0862$

Plugging the above values and the WLAs from step 3 into Equation 10 and solving:

For the low flow tier:

LTA_{acute} = (58.0) x exp [0.5(0.3075) - (2.326)(0.5545)] = 18.6 ug/l

$LTA_{chronic}$ = (21.4) x exp [0.5(0.0862) - (2.326)(0.2936)] = 11.3 ug/l

These LTA concentrations are also shown in Table C-16. Since the LTA concentration based on the chronic criterion is more stringent than the LTA based on the acute criterion, the chronic LTA is used to derive the aquatic life effluent limits for cadmium (see Step 4b, below).

For the high flow tier:

LTA_{acute} = (12.2) x exp [0.5(0.3075) - (2.326)(0.5545)] = 3.92 ug/l

$LTA_{chronic}$ = (4.13) x exp [0.5(0.0862) - (2.326)(0.2936)] = 2.18 ug/l

These LTA concentrations are also shown in Table C-17. Since the LTA concentration based on the chronic criterion is more stringent than the LTA based on the acute criterion, the chronic LTA is used to derive the aquatic life effluent limits for cadmium (see Step 4b, below).

Step 4b: Develop Effluent Limits Based on the LTA.

The most stringent LTA concentration for each flow condition is converted to a maximum daily limit (MDL) and an average monthly limit (AML) via Equation 11:

$$MDL, AML = LTA \times \exp[zF - 0.5F^2] \qquad \text{(Equation 11)}$$

where,

for the MDL: z = 2.326 for 99^{th} percentile probability basis (per the TSD)
$F^2 = \ln(CV^2 + 1) = \ln(0.6^2 + 1) = 0.3075$

for the AML: z = 1.645 for 95^{th} percentile probability basis (per the TSD)
$F^2 = \ln(CV^2/n + 1) = \ln(0.6^2/1 + 1) = 0.3075$
since, n = number of samples per month = 1
(monthly monitoring for cadmium in Outfall 001)

Substituting the above values and the lowest LTA concentrations from Step 4a into Equation 11 and solving:

For the low flow tier:

MDL = (11.3) exp [(2.326)(0.5545) - 0.5 (0.3075)] = 35 ug/l

AML = (11.3) exp [(1.645)(0.5545) - 0.5 (0.3075)] = 24 ug/l

For the high flow tier:

MDL = (2.18) exp [(2.326)(0.5545) - 0.5 (0.3075)] = 6.8 ug/l

AML = (2.18) exp [(1.645)(0.5545) - 0.5 (0.3075)] = 4.7 ug/l

These are the cadmium effluent limits for Outfall 001 in the draft permit (see also Tables C-16 and C-17).

APPENDIX E - ENDANGERED SPECIES ACT

As discussed in Section VIII.A. of the fact sheet, Section 7 of the Endangered Species Act requires federal agencies to consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) regarding potential affects a federal action may have on threatened and endangered species. In response to a request for a list of threatened and endangered species in the vicinity of the discharge, the USFWS identified the following federally-listed species in a letter dated October 15, 1999. The species denoted by a * are under the jurisdiction of NMFS:

<u>Endangered Species:</u>

- Gray Wolf (*Canis lupus*) - experimental
- Sockeye salmon (*Oncorhynchus nerka*) *

<u>Threatened Species:</u>

- Bald Eagle (*Haliaeetus leucocephalus*)
- Spring/summer and fall chinook salmon (*Oncorhynchus tshawytscha*) *
- Steelhead trout (*Oncorhynchus mykiss*) *
- Bull Trout (*Salvelinus confluentus*)
- Ute' ladies-tresses (*Spiranthes diluvialis*)

<u>Proposed Threatened Species:</u>

- Lynx (*Lynx canadensis*)

In addition to these species, the USFWS has listed two species of concern: wolverine (*Gulo gulo luscus*) and white sturgeon (*Accipenser gentilis*).

EPA is currently undergoing informal consultation with the NMFS and USFWS. As part of the consultation, EPA is preparing a Biological Evaluation (BE) to evaluate the potential impacts of the NPDES discharge on the endangered and threatened species. If the consultation results in reasonable and prudent alternatives or measures that require more stringent permit conditions, EPA will incorporate those conditions into the final permit.

APPENDIX F - REFERENCES

EPA 1988. NPDES Permit No. ID-002540-2. Issued June 30, 1988.

EPA 1991. *Technical Support Document for Water Quality-based Toxics Control*. Office of Water Enforcement and Permits, Office of Water Regulations and Standards. Washington, D.C., March 1991. EPA/505/2-90-001.

EPA, 1996a. *EPA Region 10 Guidance For WQBELs Below Analytical Detection/Quantitation Level. NPDES Permits Unit*, EPA Region 10, Seattle, WA. March 1996.

EPA, 1996b. *The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion*, EPA 823-B-96-007, June 1996.

IDEQ 2000. Idaho Division of Environmental Quality. April 26, 2000. Draft Mixing Zone Determination and Proposed Authorization for New Discharges into Special Resource Waters, Thompson Creek Mine, NPDES No. ID 002540-2.

TCMC 1992. Thompson Creek Mining Company. September 15, 1992. NPDES Permit Application for Outfalls 001-004.

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TCMC 1998. Thompson Creek Mining Company. February 1998. Supplemental Plan of Operations for the Cyprus Thompson Creek Project.

TCMC 1999a. Thompson Creek Mining Company. June 1999. Consolidated Environmental Monitoring Program and SPOO Monitoring Plan, prepared by EnviroNet Inc.

TCMC 1999b. Thompson Creek Mining Company. September 1, 1999. Additional application Materials and Comments Regarding Renewal of the NPDES Permit for the Thompson Creek Mine.

TCMC 1999c. Thompson Creek Mining Company. September 21, 1999. Information for the Renewal of the Thompson Creek Mine NPDES Permit.

TCMC 1999d. Thompson Creek Mining Company. November 15, 1999. Thompson Creek Water and Discharge Modeling Using 1981-99 Hydrology Database, prepared by EnviroNet Inc.

TCMC 2000. Thompson Creek Mining Company. February 22, 2000. Letter to Patty McGrath, EPA and Modified NPDES Permit Application for Outfalls 001 and 002.