# Zinc concentrations in the Eagle River determine what fish will be present in the river

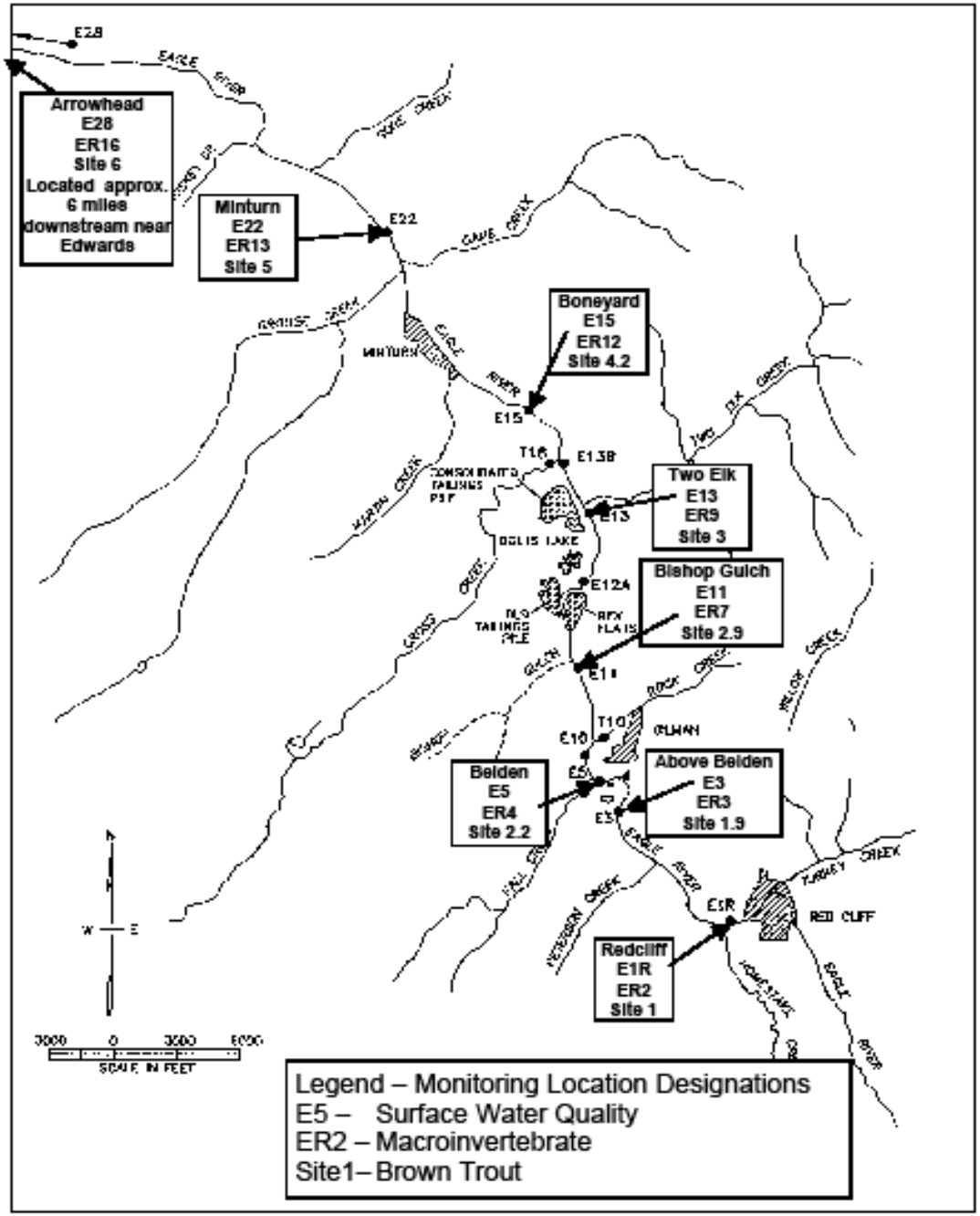
The Colorado Water Quality Control Commission adopts and approves the zinc standards for the Eagle River

# The Eagle Mine

- Dating back to the beginning of the Twentieth Century the mines at Belden have long added zinc and other contaminants to the Eagle River

# The Eagle Mine

- Restoration at the mine site started in 1984. By 2005 the work agreed to by various parties was completed.  State and CBS still doing some restoration


Arrowhead
E28
ER16
Site 6
Located approx.
6 miles
downstream near
Edwards
Minturn
E22
ER13
Site 5
Boneyard
E15
ER12
Site 4.2
Two Elk
E13
ER9
Site 3
Bishop Gulch
E11
ER7
Site 2.9
Belden
E5
ER4
Site 2.2
Above Belden
E3
ER3
Site 1.9
Redcliff
E1R
ER2
Site 1
E28
E22
E15
E13B
E13
E12A
E11
E10
E5
E3
E1R
EAGLE RIVER
GAME CREEK
MINTURN
TWO ELK CREEK
DOLLY LAKE
ROCK CREEK
GILMAN
RED CLIFF
TURKEY CREEK
SCALE IN FEET
Legend – Monitoring Location Designations
E5 – Surface Water Quality
ER2 – Macroinvertebrate
Site1– Brown Trout

# Zinc an interesting metal

- The mine upstream of Minturn was once called New Jersey Zinc. Thus lots of zinc gets in the water from the mine.
- This mine was a very important part of the nationwide effort in World War II for production of zinc.
- The mine closed in 1984 and was declared a Superfund site.
- Zinc is a micronutrient required by all life, including fish and humans.
- Too much zinc can be toxic.
- Tens of millions of dollars have been spent on restoration projects since 1990 to decrease zinc and other metals in the Eagle River.

# Zinc toxicity is a serious problem in many streams and rivers in Colorado

- A level of 38 parts per billion (ppb) of zinc killed 50% of the mottled sculpin after a nine day exposure period.
- A ppb is a very small number. One way of describing a ppb is to distribute 7 special oranges to random people on the earth and then trying to find those specific oranges.

# All fish are not equally sensitive to zinc

- Toxicity of zinc varies from fish species to fish species.

| Sensitivity ranking | Species |
|---|---|
| 1 = most sensitive | Sculpin |
| 2 | Rainbow and cutthroat |
| 3 | Brown trout |
| 4 = most resistant | Brook trout |

# Brook trout are very resistant to zinc – for a fish

- Brook trout can survive in zinc concentrations greater than 500 parts per billion in the Eagle River while sculpin require zinc levels less than about 20 parts per billion.

# Brown trout and zinc

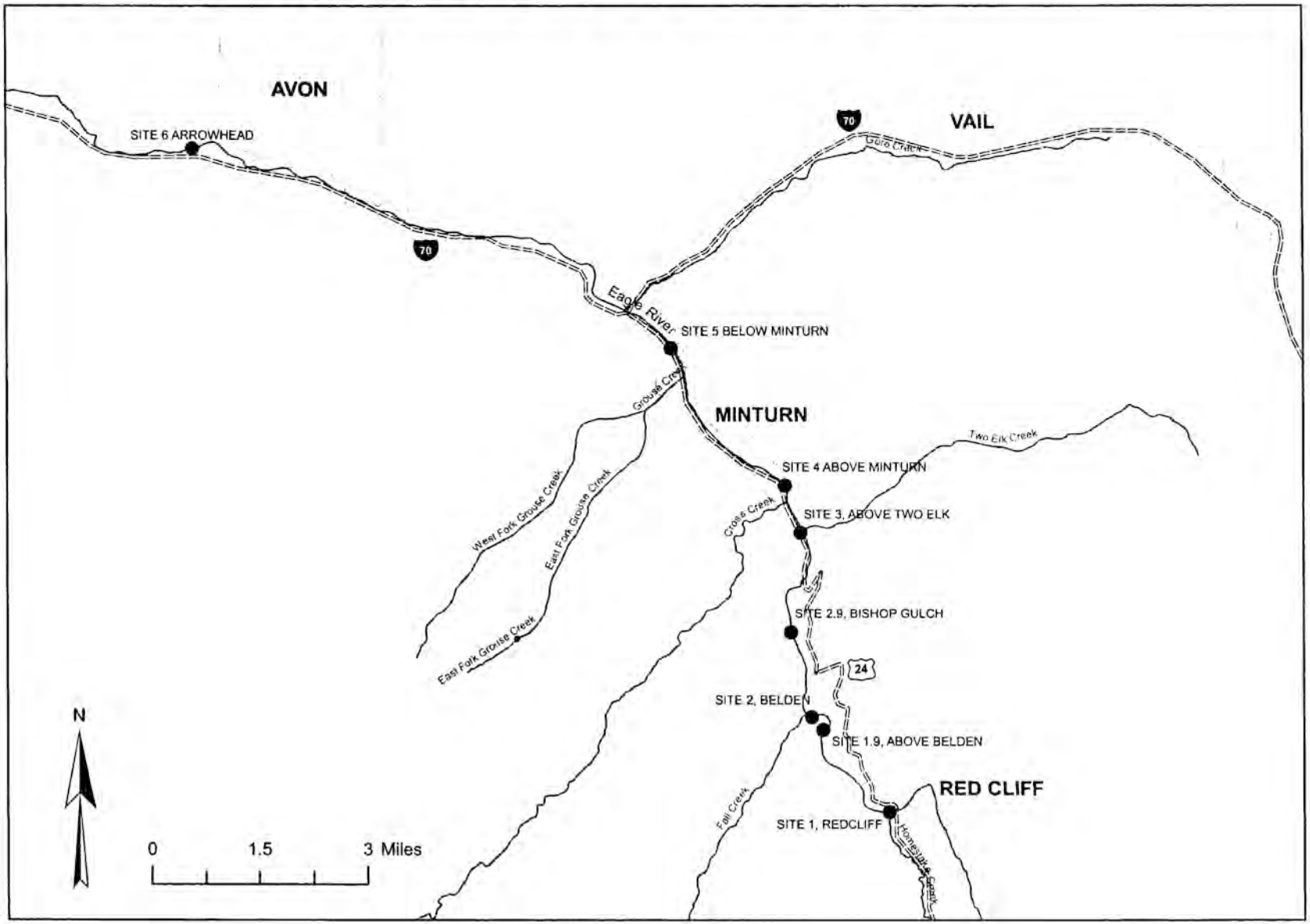
- No specific level of zinc kills brown trout, the length of exposure and concentration matter. As hardness increases the toxicity of a given zinc concentration decreases.
- Toxicity tests run for 96 hours are used to determine how much of a metal kills brown trout.
- Zinc concentrations that kill ½ of the brown trout ranged from 392 parts per billion (ppb) to 1,578 ppb in a series of 4 tests run by the Colorado Division of Wildlife.
- A concentration of about 200 ppb zinc would protect brown trout in the Eagle River.

# Eagle River fish sampling sites

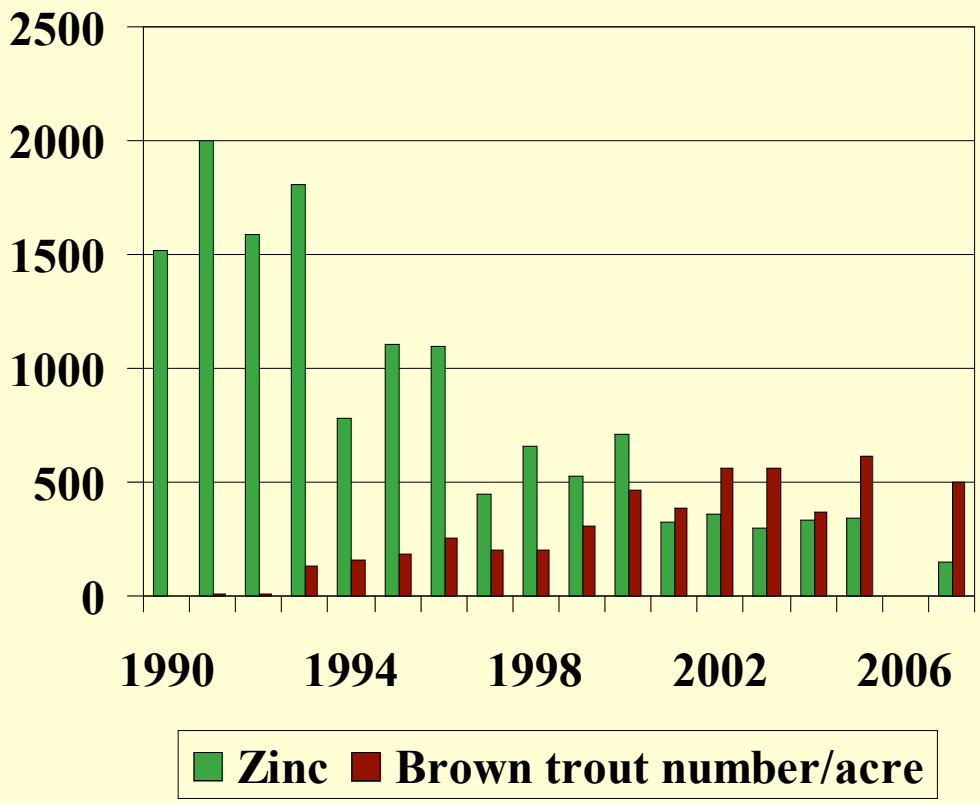
- Site 1 = Redcliff
- Site 1.9 = Upstream of Belden
- Site 2 = Belden
- Site 2.9 = At Bishop Gulch
- Site 3 = Just upstream of Two Elk Creek
- Site 4 = South side of Minturn
- Site 5 = Downstream of Minurn
- Site 6 = Arrowhead

Red = reference site
Black = mine site

# FIGURE 1 Eagle River Mine Site Study Area



# Relation of zinc to brown trout population estimates on the Eagle River at Site 3, above Two Elk Creek



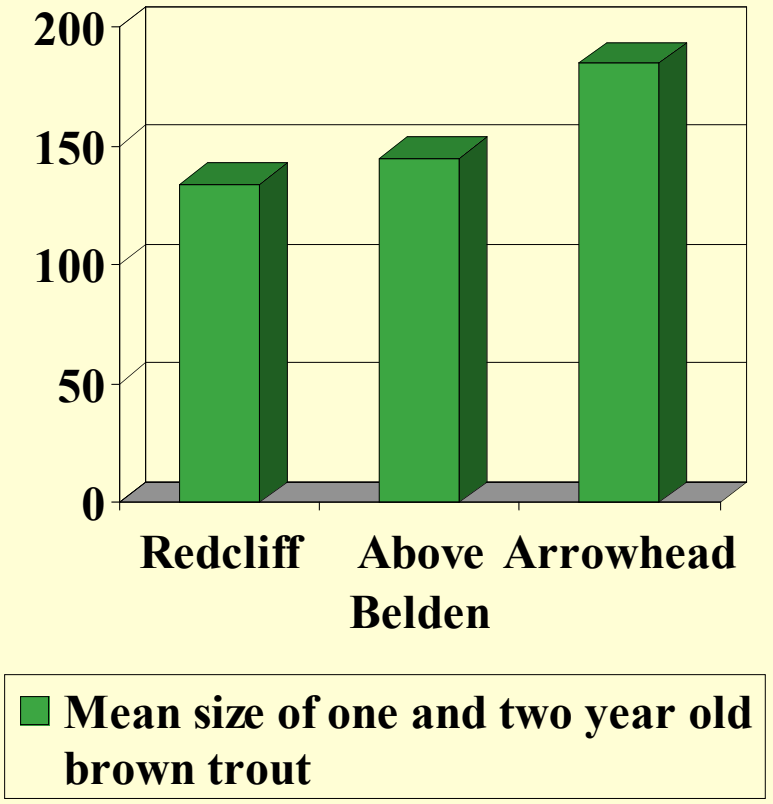

- Very few fish present when sampling started in 1990
- Treatment plant starts in 1993, zinc drops and brown trout numbers go up
- During drought years of early 2000s, zinc lower still and brown trout numbers go up more.
- As zinc decreases the number of brown trout increases.

# Zinc toxicity

- Most zinc toxicity tests used death of test organisms as a measuring point. These tests have been used to set stream standards.
- Stream standards are designed to protect fish from sub-lethal impacts such as reproductive failure or decreased growth rates.
- Trout exposed to metals often weigh less or are smaller than fish not exposed to a toxicant

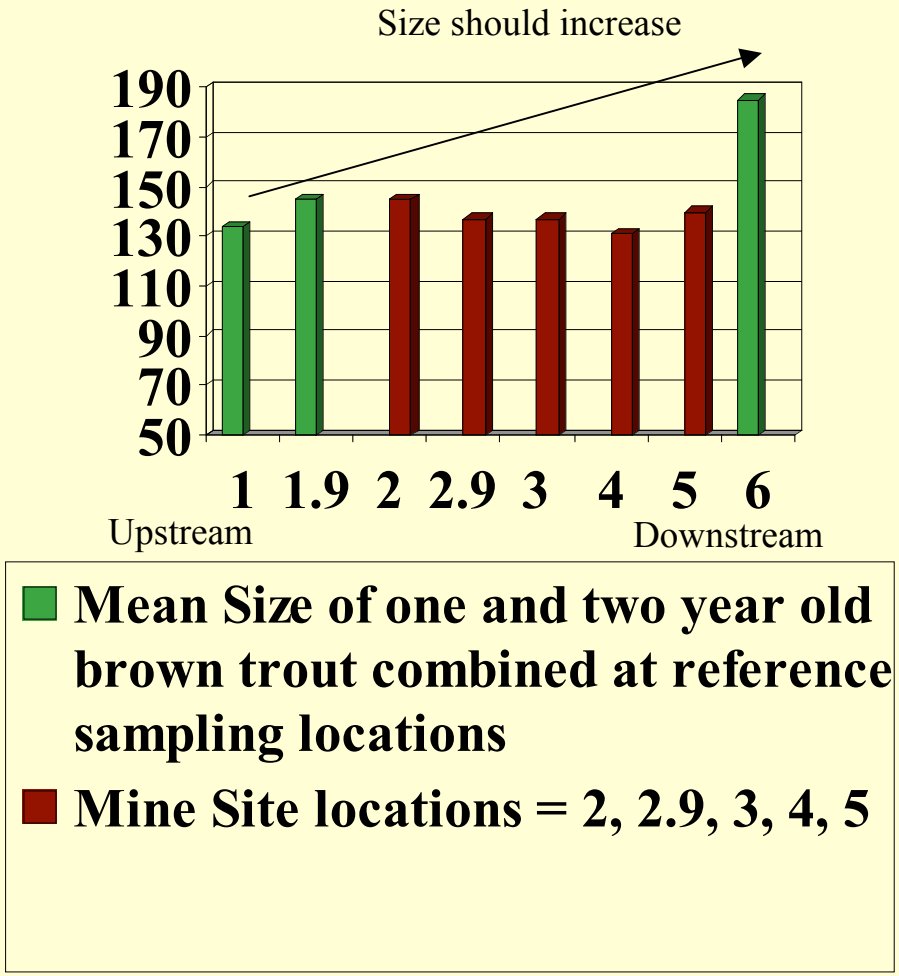
# Growth effects to brown trout

- Brown trout in high elevation streams grow at a slower rate than fish in a warmer stream reach
- Brown trout in the Eagle River follow this pattern in reaches outside the Eagle Mine Site.
- The average size of one and two year old fish were smaller at Redcliff than just upstream of Belden or at Arrowhead using 2007 data.



# Growth effects to brown trout

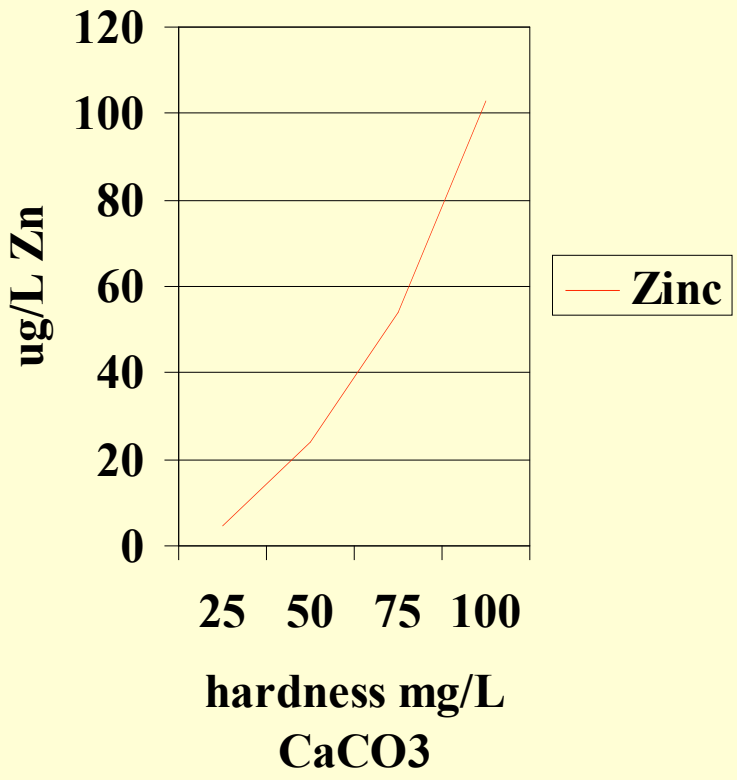
- Brown trout at locations within the mine site did not follow this pattern
- The average size of one and two year old fish did not increase in a downstream direction due to warmer waters.
- Low levels of zinc reduced the growth of younger brown trout within the Eagle Mine Site.
- The data used in this analysis was taken in 2007, the year zinc concentrations were the lowest since 1989.



- Even after all the restoration actions zinc concentrations still induce chronic toxicity to brown trout and are lethal to sculpin

# Zinc Toxicity

- This graph shows the zinc concentrations needed to protect sculpin
- All or almost all zinc loading from Eagle Mine Site must be removed to achieve these zinc concentrations.

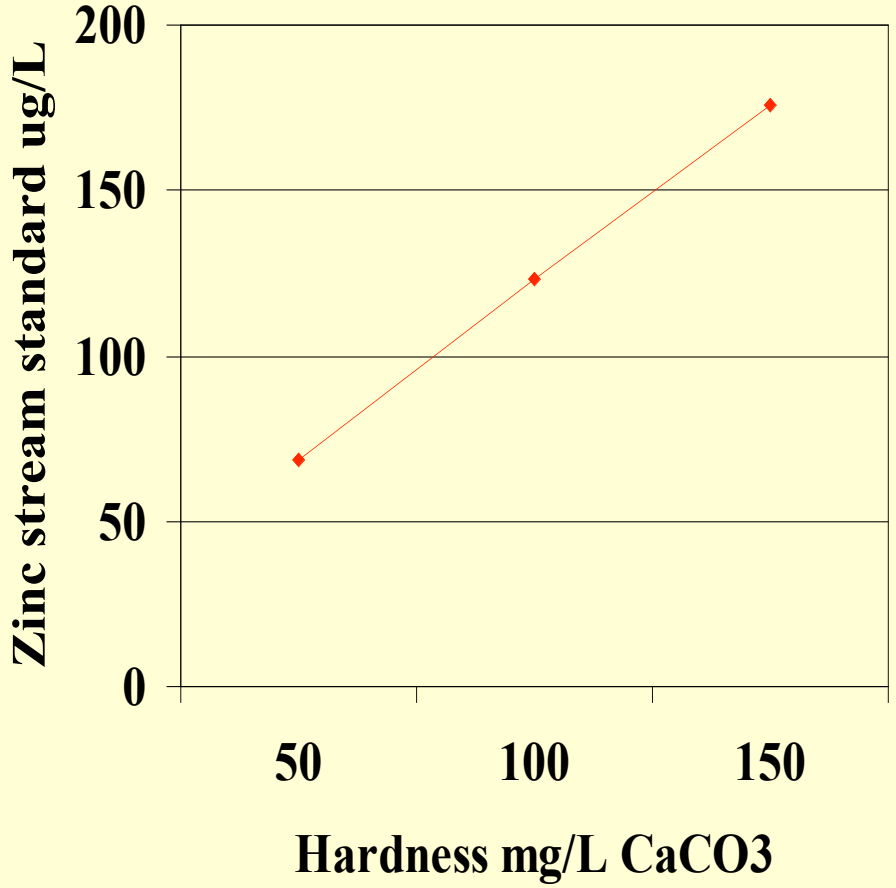


# Zinc toxicity

- The Commission adopts two types of standards
- Acute standards protect against a short timer period event that can happen once every three year.
- Chronic standards protect over a long period of time and are set as 30 day average values.

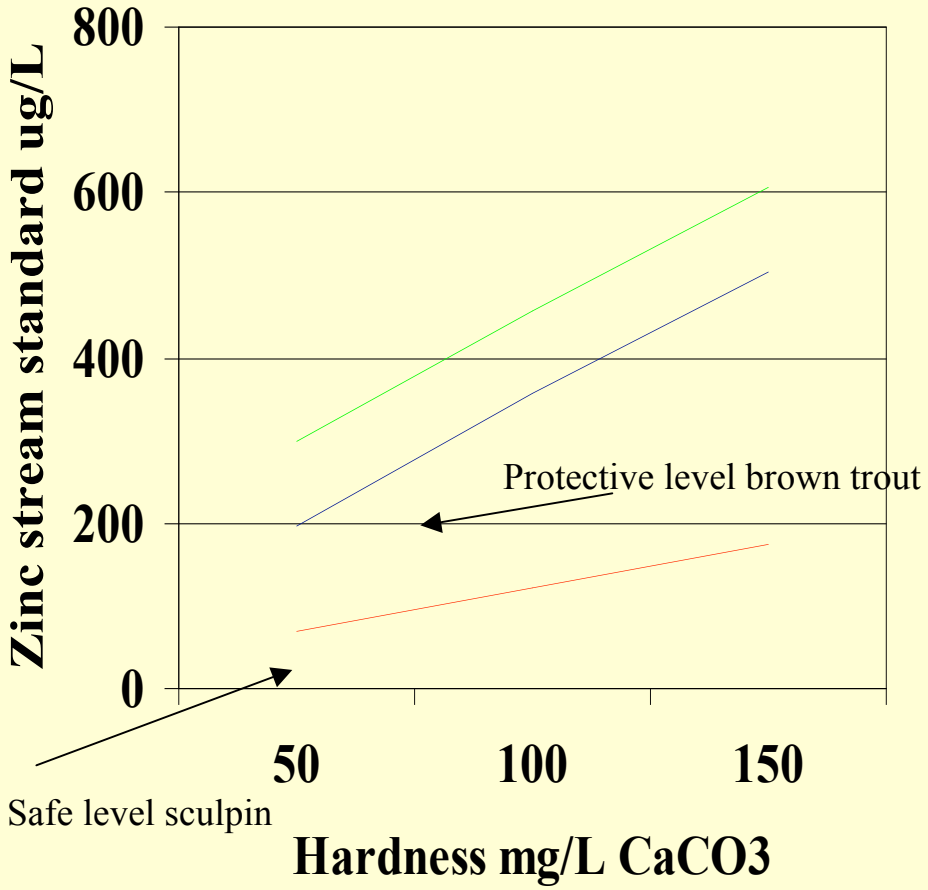
# Chronic zinc standard in relation to stream hardness

- The amount of zinc allowed in a stream increases as hardness increases.
- The red line opposite represents the allowable zinc standards at a hardness of 50-150 mg/L CaCO3 based on the current Colorado Water Quality Control Commission Table Value zinc standard.
- Hardness concentrations in the Eagle River generally range from about 60-120 mg/L CaCO3.



# Proposed Chronic zinc standards for June 2008 Water Quality Control Commission hearing

- Red line = "Table Value Standard." Does not protect sculpin but protects brown trout
- The blue line is the standard proposed by State Health Department. This does not completely protect brown trout. May have reproductive failure. Will result in lower growth for brown trout.
- Green line is standard proposed by CBS. Does not protect brown trout.



## Citizens in the Eagle River Basin are encouraged to offer testimony the Colorado Water Quality Control Commission regarding stream standards

- What standards do you want the Commission to adopt?
- A standard to protect all fish, including the sculpin
- A standard to protect the most abundant fish, the brown trout.
- A standard that will require more restoration but still will not protect brown trout - the State Health Department proposal.
- A standard that will not require any more stream restoration - the CBS proposal.

## Citizens in the Eagle River Basin are encouraged to offer testimony the Colorado Water Quality Control Commission regarding stream standards

- When thinking about an appropriate standard keep the following in mind.
- The Colorado Department of Health believes that the standard they are proposing is the most protective standard that can be achieved.
- The Colorado Department of Health will request further clean-up if their proposal is adopted

# Zinc standards

- Form letters are available on the Eagle River Watershed Council, Eagle Mine Site Webpage.
- Please download the letter that most accurately reflects your opinion, sign and mail to the Colorado Water Quality Control Commission.