Grantham, Nancy

From: (b) (6)
Sent: Friday, December 04, 2015 6:22 PM
To: Grantham, Nancy
Cc: Peterson, Cynthia
Subject: RE: still looking for 2 powerpoint presentations
Attachments: BulkheadDesignPlan-Red and Bonita Mine.pptx

Here's the presentation on the Red and Bonita bulkhead plan. The discussion about the Gold King investigation followed the discussion about the Red and Bonita. (b) (6) with DRMS participated in discussing both operations with the ARSG / public meeting.

(b) (6)
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Federal On-Scene Coordinator
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Office: 303-312-(b) (6)

From: Grantham, Nancy
Sent: Friday, December 04, 2015 3:12 PM
To: (b) (6)
Cc: Grantham, Nancy
Subject: still looking for 2 powerpoint presentations

1. (b) (6) presentation at 5/15 arsg meeting
2. Presentation to Administrator when she visited Durango second week in August

Thanks ng

Nancy Grantham
US EPA
202-564-6879
857-829-8250

ARSG MEETING SUMMARY
May 27, 2015

ATTENDEES: Peter Butler, Bill Simon, Steve Fearn, Ty Churchwell, Larry Perino, John Ferguson, Ray Ferguson, Kirstin Brown, Gene Larson, Tim Cutter, Mary Blanchard, Brian Lloyd, Tom Schillaci, (b) (6), (b) (6), Jen Beck, Doug Jamison, Randy Perlis, Mark Esper, Dan Wall, Paula Schmittdiel, Cynthia Peterson, Steve Wharton, William Tookey.

ANNOUNCEMENTS: None

Briefs:

Non-Responsive

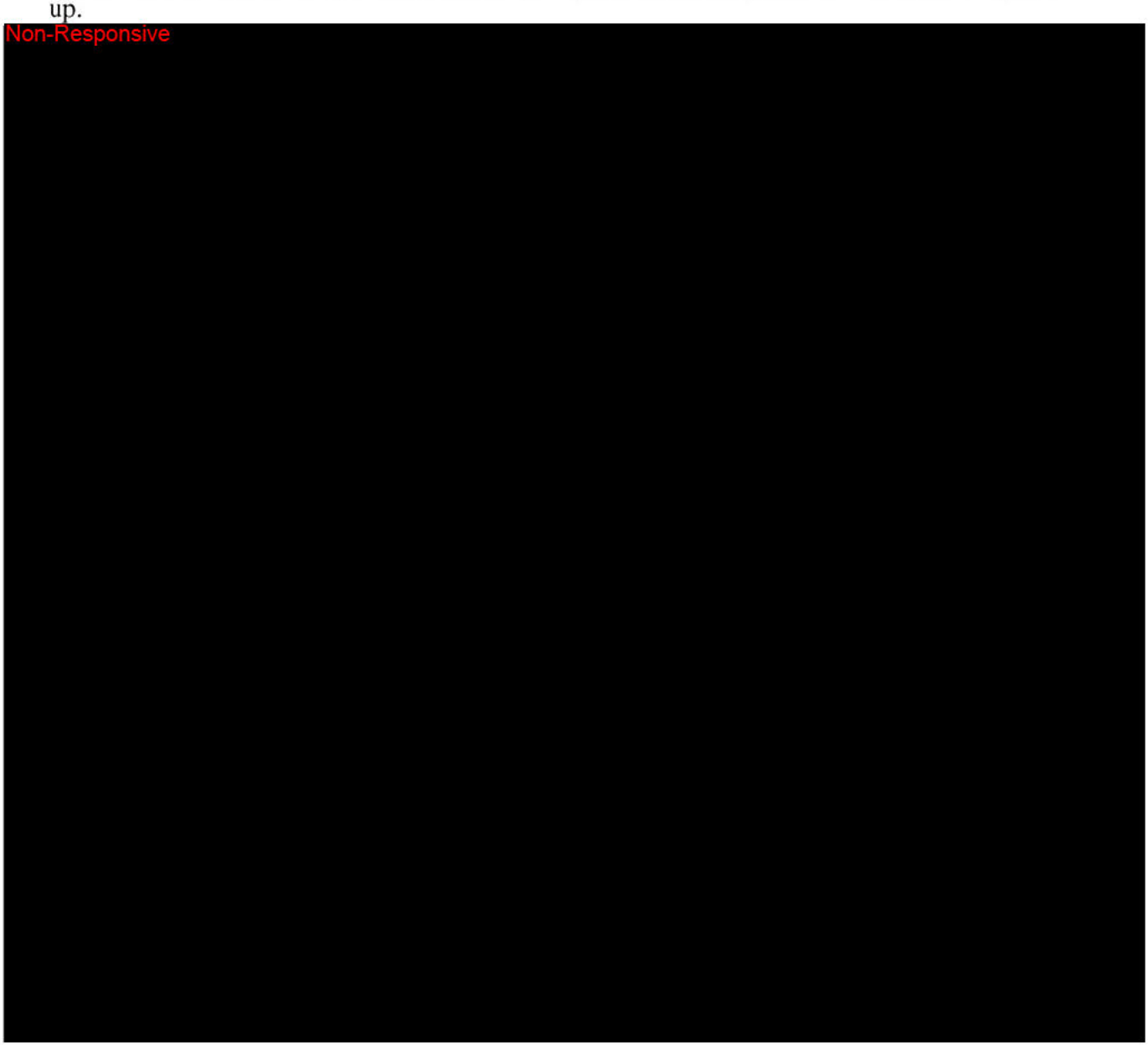
Topics:

6. Activities Regarding Red & Bonita and Gold King: (b) (6) with EPA and (b) (6) with DRMS gave a presentation on installing the Red & Bonita bulkhead this summer. Much of the discussion focused on the location of the fracture zone we call the Bonita fault which may be the source of most of the water. The expectation is that the water level will rise in the fracture zone and possibly express in a new location. The question is where might it surface, how much will surface, and what will be the quality. One possibility is that water will surface

where the North Fork of Cement Creek crossed the fault zone, below the Gold King #7 level. EPA plans on an intensive sampling program at many sites within the vicinity of the Red & Bonita once the bulkhead valve is closed. Work will begin in a few weeks. Closure is expected in early fall. The process will be reversible if need be because the valve can be re-opened.

The first step for installing the bulkhead is to muck out the sludge in the tunnel back to the bulkhead site. The sludge will be caught and treated in a system directly below the mine. (As a side note, (b) (6) mentioned that last year when the mine was explored, they found evidence of check dams and diversions indicating that at some point, the miners were dealing with water in the mine workings.) Once this step has been completed, the contractor will start to open up the Gold King #7 level. There is a pool of water several feet deep behind the collapsed portal. The treatment system at the Red & Bonita will be used to handle the water and muck from the Gold King as work begins there. EPA is willing to remove the initial blockage into the Gold King, but if there is another collapse farther in, they may not want to expend the resources to open it up.

Non-Responsive



Non-Responsive

[redacted]

Possible Agenda Items for Next Meeting:
Red & Bonita and Gold King
Upcoming WQCC Hearings regarding Animas
Koehler Bulkhead Valve
Bullion King
Arrastra Gulch

Red and Bonita Mine

Removal Action – Bulkhead Plan Summary

May 2015

Mine Discharge and Underground Workings

- Flow is approximately 200 to 300 gpm
- Zinc concentration is consistently near 16,000 ug/L
- Cadmium concentrations are near 30 ug/L
- Iron concentration is approximately 93,000 ug/L
- pH ranges from 5.5 to 6 su.
- Underground workings are estimated at 3000 to 3500 ft.
- EPA and DRMS were able to access approximately 2000 ft in 2013

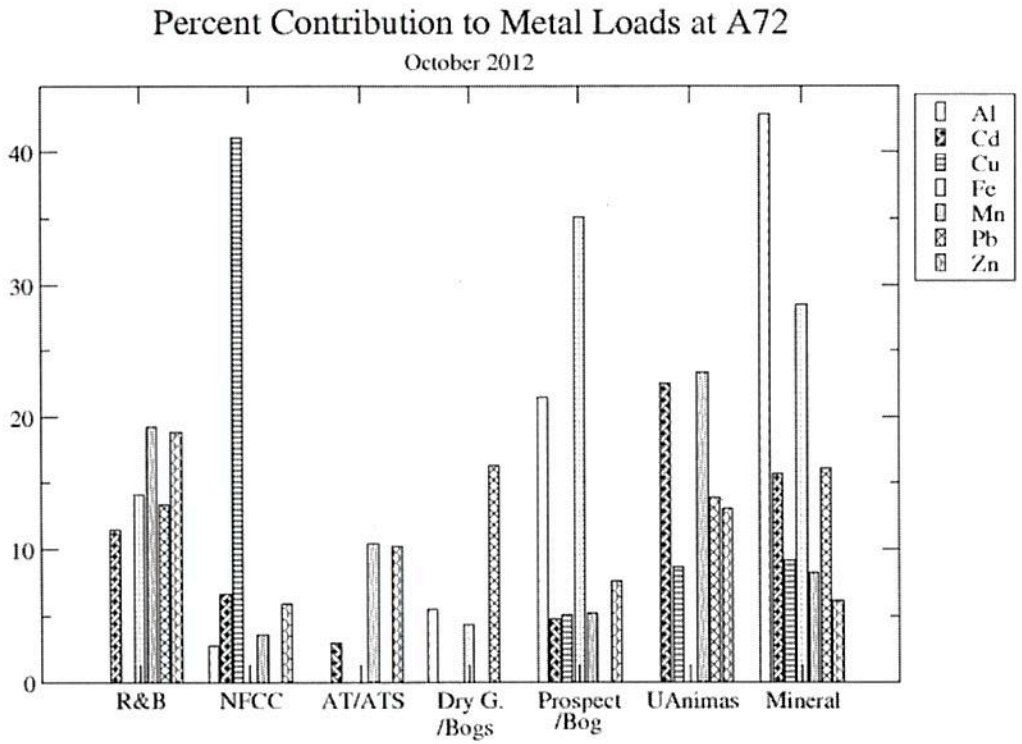
Adits Flows in Cement Ck from 2005 to 2012

Mine Adit Discharge 2005 to 2011

Mine	Elevation (feet AMSL)	Bulkhead Install	Flow Rate (gpm)						
			July 2005	September 2005	October 2006	Average 2010	Average 2011	July 2012	Oct 2012
Mogul (pH 3.5)	11,376	2003	21	27	11	54	56	128	90 (?)
Gold King 7 Level (pH 2.5 to 5)	11,386	None	42	135	314	206	140	128	55 – 85
Red & Bonita (pH 6)	**10,893**	**None**	**210**	**224**	**233**	**216**	**319**	314	**202**
American Tunnel (pH 5)	10,540	1997 2001 2002	95	90	84	101	101	193	103

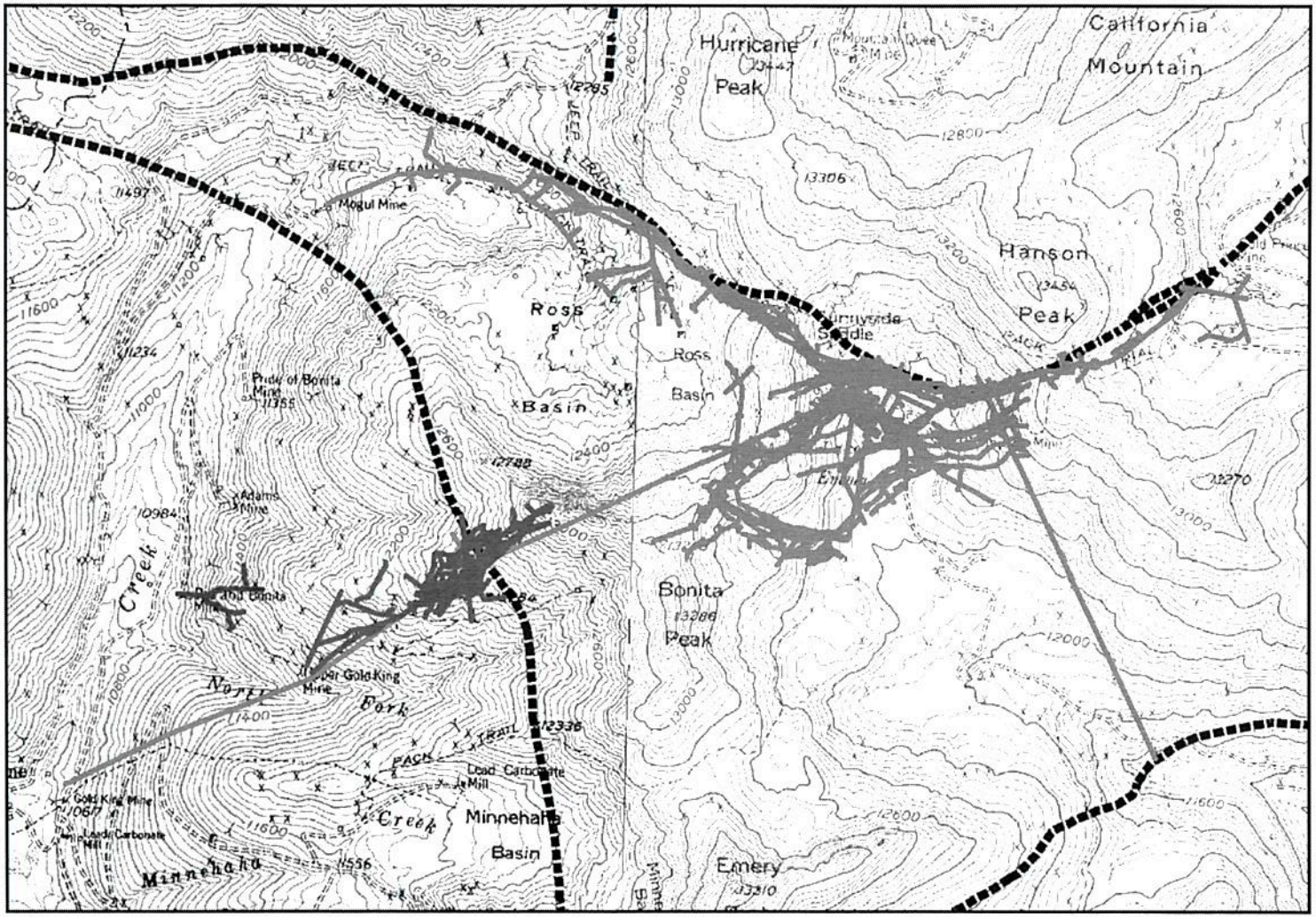
gpm – Gallons per minute.

USGS - Part IV: Results – Loads & Sources



Adit Loading Analysis Conclusion

- Red and Bonita contributes approximately 18% of the Zn and 12% of the Cd load in Oct 2012 in the Animas at A72 (relative source contributions vary seasonally)
- The flow from Red and Bonita averages approximately 300 gpm and appears to have stabilized since the Am Tnnl plugs
- Zn and Cd are two of the primary contaminants of concern based on the Screening Level Ecological Risk Assessment
- No other single mine source contributes as much Zn in either Cement Ck or the Animas
- USGS reactive / transport modeling indicates that the Zn from R n B adit is conserved in transport to A72



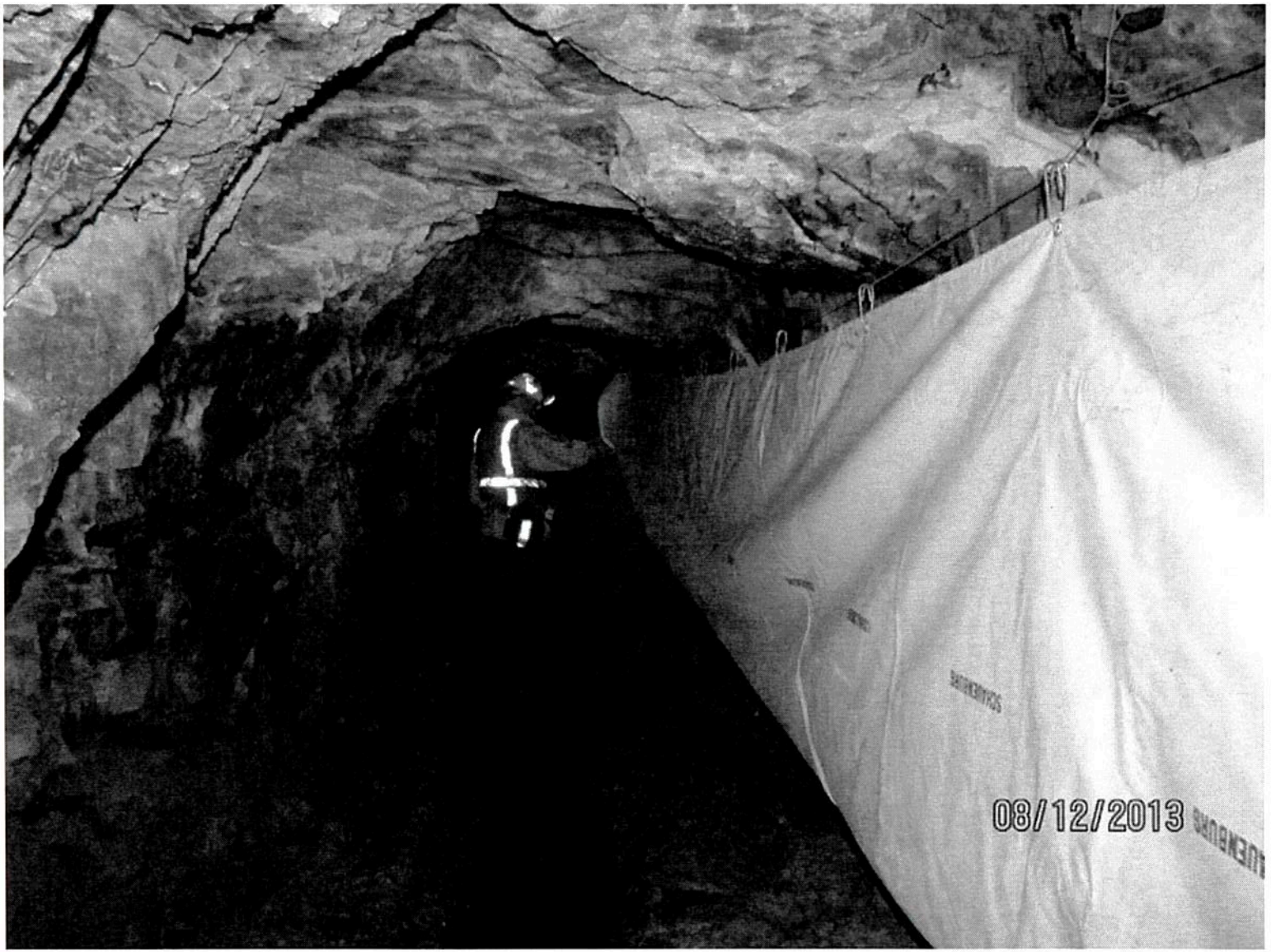
Prepared by Kirstin Brown, CDRMS, 1/21/2014

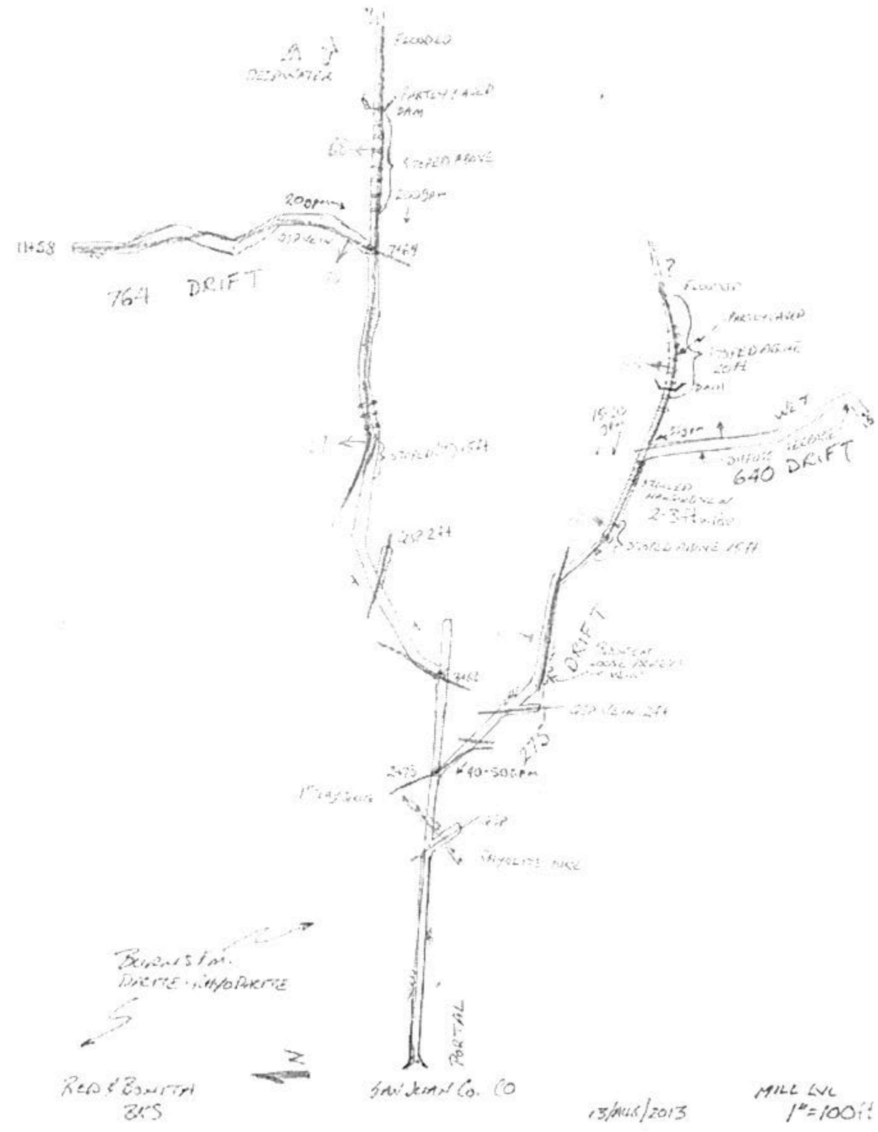
0 625 1,250 2,500 3,750 5,000 Feet

RED AND BONITA MAP
Mine Workings past cave-ins are only projected to line of sight
SUNNYSIDE WORKINGS
Most Recent workings, needs more work
GOLD KING WORKINGS
There is more data that needs to be added on 7 Level

Legend
R & B Workings (Stover)
GoldKing15Inu7
SunnysideWorkings
USGS Mapped Faults PP 1651

N W E S


08/12/2013


FLOODED
764 DRIFT
11+58
200gpm
640 DRIFT
WET
DRIFT
PORTAL
Red & Bonita
BKS
N
San Juan Co. CO
13/Aug/2013
Mill Lvl
1"=100ft

Design Factors and Investigation Results

- Underground Investigations – rock conditions and workings extent
- Rock Quality: American Tunnel (Burns Member) cores & rock hardness results
- Secondary permeability index- packer tests in Red and Bonita at the bulkhead location – effectively impermeable / 1.54×10^{-14} L/m2
- Overburden elevation at bulkhead site ~ 196 feet
- Hydraulic fracturing and hydraulic jacking/fractures
- Probable head pressures analysis

Mine Elevations/Bulkheads/mine pool elevations

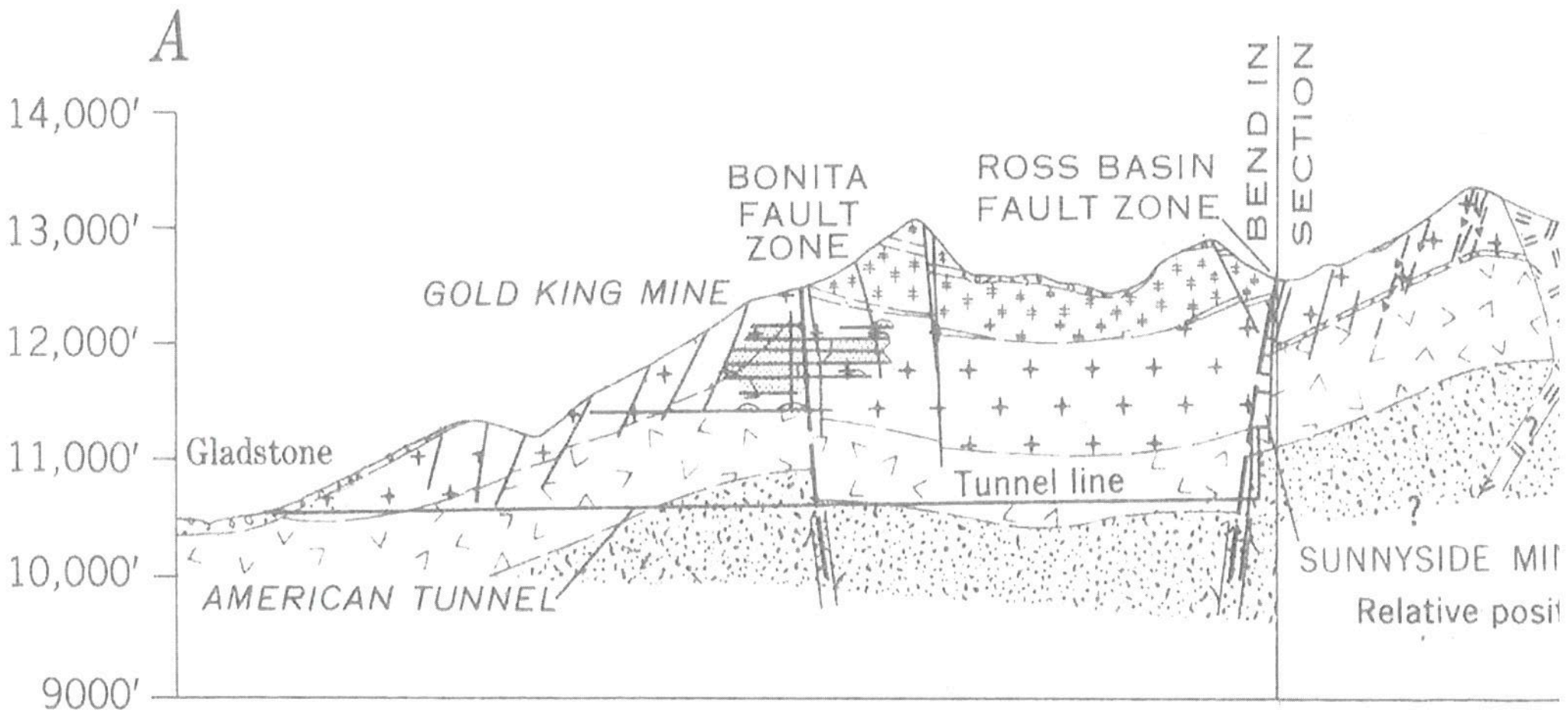
DATE	Mine & Bulkhead Status & Pressure (psi)	Elevations
9/xx/1994 ?	Terry Tunnel Bulkhead #1 – constructed	Portal 11,554 ft
9/9/1996	American Tunnel Bulkhead #1 - closed	Portal 10,660 ft
	Red and Bonita Mine Portal	Portal 10, 957 ft
	Mogul Mine – bulkhead	Portal 11,400 ft
	Gold King Level #7	Portal 11,440 ft
	American Tunnel Bulkhead #1 Pressure Gauge	
9/3/1997	312	Mine Pool elev. 11,380 feet
8/28/1998	359	Mine Pool elev. 11,488 feet
9/24/1999	415	Mine Pool elev. 11,618 feet
10/10/2000	440	
12/4/2000	438	Mine Pool elev. 11,671 feet
3/27/2001	438	
5/14/2001	438 Final Pressure	Final Measure 11,671 ft

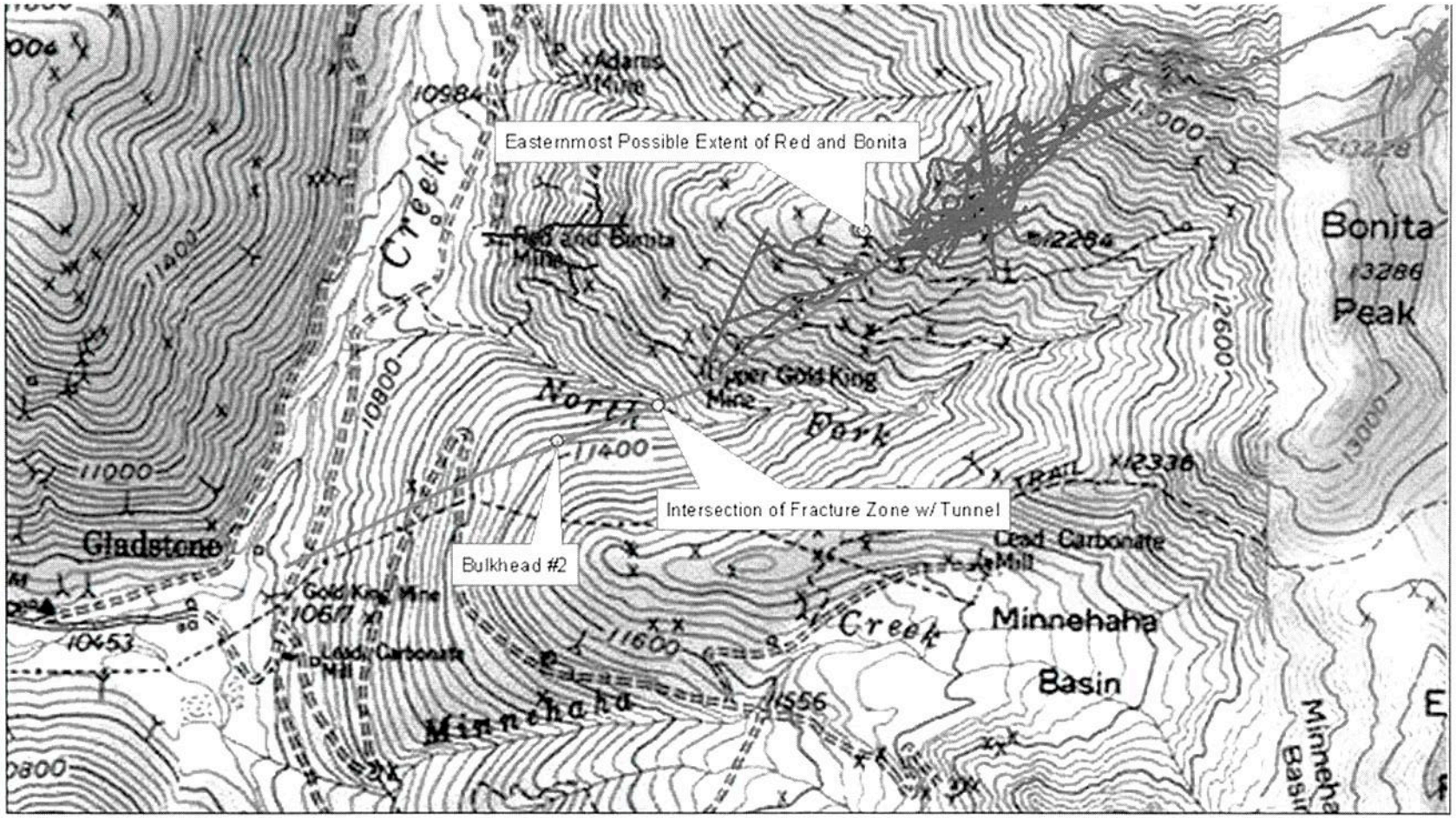
Water Elevations / Pressure Heads / Rock Thickness

Pressure Head	Water Pressure	Required Rock Thickness
1253 feet (Lake Emma)	543 psi	237 feet
714 feet (Sunnyside Mine Pool)	309 psi	135 feet
500 feet (Probable Head)	217 psi	95 feet
1037 feet (hydro-fracing Point)	449 psi	196 feet

Water Elevations and Bulkhead Pressures

- American Tunnel bulkhead #2: constructed for a maximum water head of 640 feet, equating to a water table at 11, 251 feet elevation
- bulkhead #2 pressure equilibrated at 11,015 feet elevation when the water intersected an outlet to surface via the Red and Bonita mine, elevation 10, 957 feet.
- Red and Bonita bulkhead - potentially cause an increase in ground water to the 11, 251 feet, which is the projected Am Tn #2 pressure.
- At 11,251 ft, the pressure head of 294 feet (127 psi) at the Red and Bonita bulkhead.
- The next pathway for ground water to surface would be at the Gold King level #7, 11, 440, which would create a pressure head of 483 feet (209 psi) at the Red and Bonita bulkhead.


A
14,000′
13,000′
12,000′
11,000′
10,000′
9000′
BONITA
FAULT
ZONE
ROSS BASIN
FAULT ZONE
BEND IN
SECTION
GOLD KING MINE
Gladstone
Tunnel line
AMERICAN TUNNEL
SUNNYSIDE MI
Relative posi



Upper Cement Creek

5/14/2015

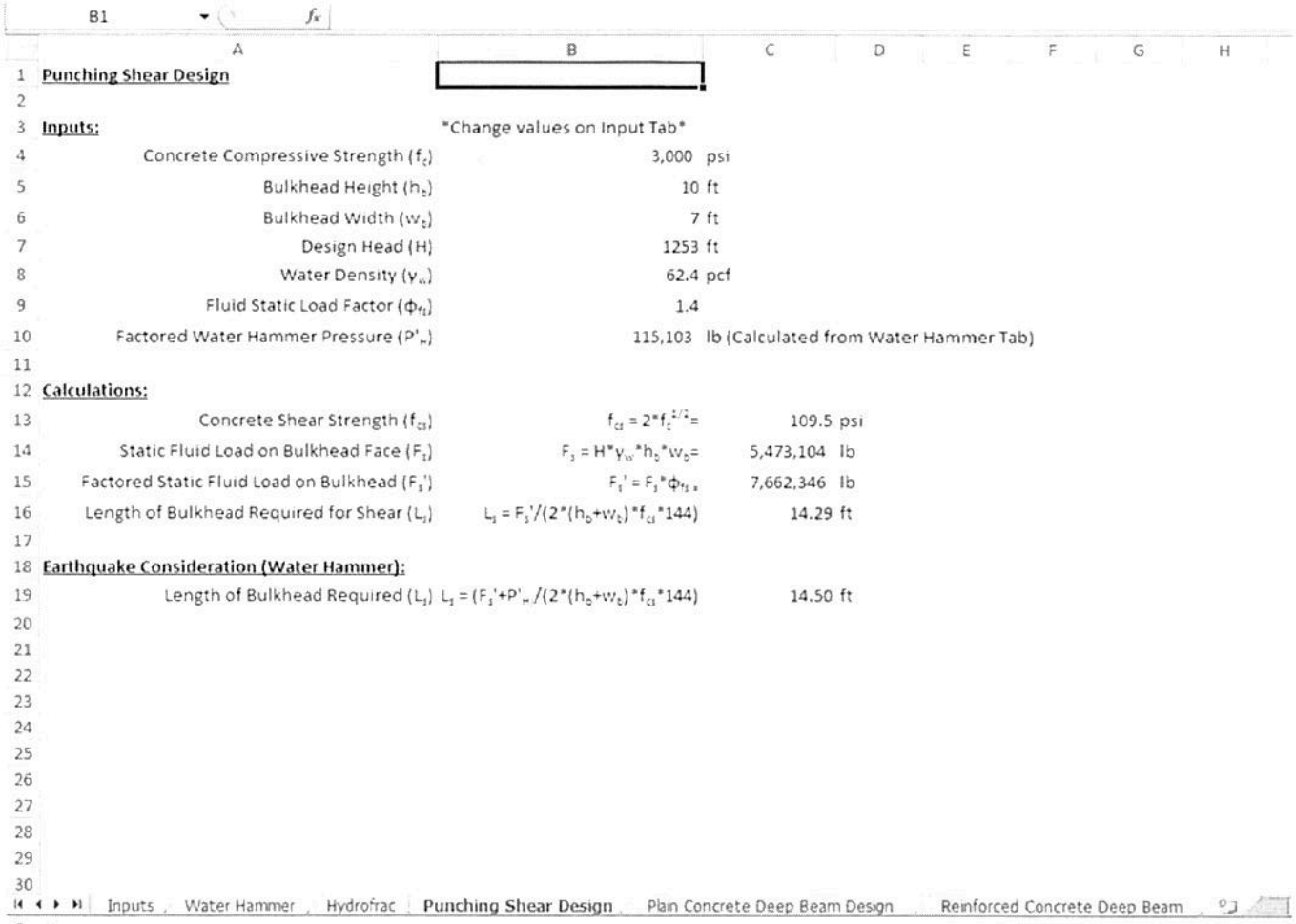
0 0.125 0.25 0.5 0.75 1 Miles

Legend
- Mogul and Grand Mogul
- Red and Bonita
- Gold King
- Sunnyside

Red and Bonita Bulkhead Design Basis – analysis and results

- 6 foot long bulkhead (reinforced) will perform adequately under a pressure head of 500 feet (217 psi), which is Gold King – 7 level plus
- 15 foot long bulkhead (reinforced) will perform adequately under a pressure head of 1253 feet (543 psi), which is the pressure head that would occur on the Red and Bonita mine if the Sunnyside mine pool were to climb to the Lake Emma outlet elevation.
- While this scenario is considered highly unlikely, EPA and CIMRP determined that it is prudent to construct the Red and Bonita bulkhead to this conservative standard. (The cost difference is small.)
- This is true even in the case of a potential Gold King mine bulkhead.
- This design uses the methodologies detailed in Einarson and Abel (1990) and Lang (1999) for maximum hydrostatic head at the bulkhead of 1253 feet and an earthquake acceleration of 0.185 g.

Red and Bonita Bulkhead Design Spreadsheet



	A	B	C	D	E	F	G	H
1	**Punching Shear Design**							
2								
3	**Inputs:**	*Change values on Input Tab*						
4	Concrete Compressive Strength (f_c)	3,000	psi					
5	Bulkhead Height (h_b)	10	ft					
6	Bulkhead Width (w_b)	7	ft					
7	Design Head (H)	1253	ft					
8	Water Density (γ_w)	62.4	pcf					
9	Fluid Static Load Factor (Φ_{fl})	1.4						
10	Factored Water Hammer Pressure (P'_w)	115,103	lb (Calculated from Water Hammer Tab)					
11								
12	**Calculations:**							
13	Concrete Shear Strength (f_{cs})	$f_{cs} = 2*f_c^{1/2} =$	109.5	psi				
14	Static Fluid Load on Bulkhead Face (F_s)	$F_s = H*\gamma_w*h_b*w_b =$	5,473,104	lb				
15	Factored Static Fluid Load on Bulkhead (F_s')	$F_s' = F_s*\Phi_{fl} =$	7,662,346	lb				
16	Length of Bulkhead Required for Shear (L_s)	$L_s = F_s'/(2*(h_b+w_b)*f_{cs}*144)$	14.29	ft				
17								
18	**Earthquake Consideration (Water Hammer):**							
19	Length of Bulkhead Required (L_t)	$L_t = (F_s'+P'_w)/(2*(h_b+w_b)*f_{cs}*144)$	14.50	ft				
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

Inputs | Water Hammer | Hydrofrac | **Punching Shear Design** | Plain Concrete Deep Beam Design | Reinforced Concrete Deep Beam

Red and Bonita Bulkhead Features and Specifications

- bulkhead dimensions are 6’ x 8’ x 15’ long
- bulkhead volume is 27 cubic yards – this may require adjustment once bulkhead location is scaled and mucked
- low pressure grouting is necessary around the upper contact of the concrete with the roof of the adit
- flexural reinforcing at the bulkhead outby end is #9 bars on 9 inch centers and temperature shrinkage rebar at the bulkhead inby end is #6 bars
- eight inch stainless steel bypass and three-fourth inch monitoring piping will be installed
- Concrete will use sulfate resistant Type V cement, 559 lbs. per cubic yard of concrete and 240 lbs. fly ash, water/cement ratio of 0.52 by weight, and will include Xypex® admixture for waterproofing

LONGITUDINAL CROSS SECTION OF BULKHEAD

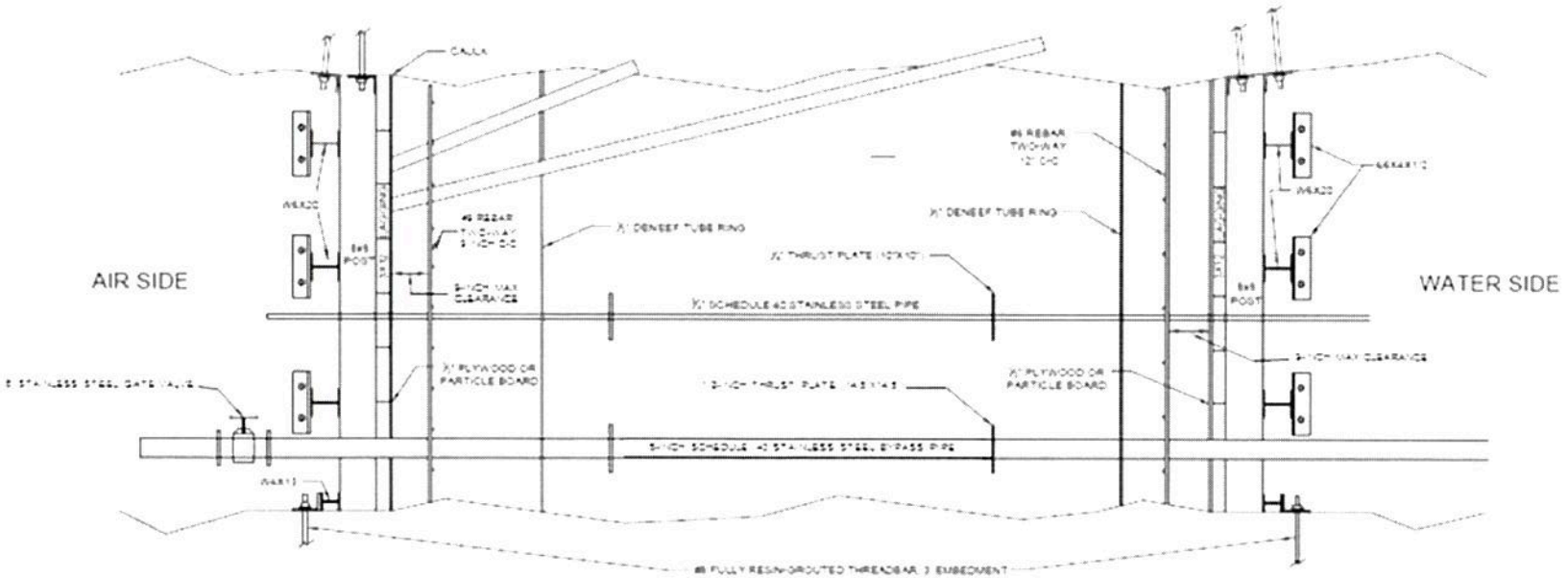


PLATE 1	RED AND BONITA MINE BULKHEAD
SCALE 0 FT — 5 FT	COLORADO Division of Reclamation, Mining and Safety

Monitoring Pressure and Water Flow / Quality

- Pressure Monitoring – transducer and standard pressure gauge
- Bulkhead Sampling Port and Injection Line
- Water Flow and Quality Monitoring
  - Adits: Gold King, Mogul, American Tunnel, Gold Point, Adams and Silver Ledge
  - Surface Water: NFCC, bracket R n B reach CC03 & 03B, CC17 CC18B, CC18, C48, , Eureka Gulch, A72
  - Seeps/surveillance – R n B vicinity
- Visual inspection of the bulkhead and surrounding zone