STATE OF COLORADO

Gagnon - DNR, Nikie <nikie.gagnon@state.co.us>

RE: Technical Revision 38 Adequacy Review Responses, Permit M-1977-348

1 message

Hickman, Ron <rhickman1@fmi.com> Wed, May 14, 2025 at 4:04 PM
To: "Zuber - DNR, Rob" <rob.zuber@state.co.us>
Cc: "Gagnon - DNR, Nikie" <nikie.gagnon@state.co.us>, "Hamarat, Miguel" <mhamarat@fmi.com>

Rob,

I can't tell if this report was provided back in 2012 during TR-04, that was a bit before my time. Please see the Ultimate Canal Hydrologic Design basis that outlies the 200-year snowmelt with extra conservatism added into the design. The 200-year flood resulted in a flow rate of 64 cfs at the end of the canal. The canal was designed with a 1.5 factor of safety to bring it to 100 CFS at the end as shown on drawing UC-1-01. You will note in the report that the Ultimate Canal was assumed to fail temporarily during the PMP event from the 2005 study, which is the same assumption in the updated report provided in TR-38.

I have also provided the Ultimate Canal certification and as-builts and approval from 2012.

Let me know if you have any more questions.

Thanks,

Ron Hickman, P.E.

Chief Environmental Engineer

Henderson Operations

Office: (720)-942-3438

Cell: (970)-393-7515

Email: rhickman1@fmi.com

Climax Molybdenum
A Freeport-McMoRan Company

From: Zuber - DNR, Rob <rob.zuber@state.co.us>
Sent: Wednesday, May 14, 2025 2:57 PM
To: Hickman, Ron <rhickman1@fmi.com>
Cc: Gagnon - DNR, Nikie <nikie.gagnon@state.co.us>; Hamarat, Miguel <mhamarat@fmi.com>
Subject: Re: Technical Revision 38 Adequacy Review Responses, Permit M-1977-348

You don't often get email from rob.zuber@state.co.us. Learn why this is important

Thanks for the quick response, Ron. Can you direct me to a hydrology study (or other documentation) that includes an analysis of the 200-year snowmelt flood and the source of the 100 cfs value?

Thanks in advance.

Rob

Rob Zuber, P.E.

Environmental Protection Specialist

Active Mines Program

Phone: 720.601.2276 | ***Fax: 303.832.8106***

Physical Address:

1313 Sherman Street, Room 215

Denver, CO 80203

Address for FedEx or UPS:

Division of Reclamation, Mining and Safety, Room 215

1001 East 62nd Avenue

Denver, CO 80216

rob.zuber@state.co.us | http://drms.colorado.gov

On Wed, May 14, 2025 at 2:47 PM Hickman, Ron <rhickman1@fmi.com> wrote:

> Nikie,
>
> The design capacity of the Ultimate Canal system is based on safely conveying the 200-year snowmelt flood around the tailing storage facility (TSF) without compromising the integrity of the canal or the TSF itself. The canal system includes five spillway structures strategically located along the canal alignment. The intent of the spillway structures is to divert water into the TSF decant pond if the actual canal flows exceed the design capacity. The flow requirement varies across the canal's length depending on the inflow basin size, but at this section is 100 CFS (compared to 33 CFS between spillway A and B on the upper portion of the Canal). This is shown on Drawing UC-1-01 of the as-built that were submitted as a part of the EPP in TR-04. Let me know if you would like me to resend that.
>
> Let me know if you have any more questions.

Thanks!

Ron Hickman, P.E.

Chief Environmental Engineer

Henderson Operations

Office: (720)-942-3438

Cell: (970)-393-7515

Email: rhickman1@fmi.com

Climax Molybdenum
A Freeport-McMoRan Company

From: Gagnon - DNR, Nikie <nikie.gagnon@state.co.us>
Sent: Wednesday, May 14, 2025 11:59 AM
To: Hickman, Ron <rhickman1@fmi.com>
Subject: Re: Technical Revision 38 Adequacy Review Responses, Permit M-1977-348

Hi Ron.

Thank you for submitting the response. Our engineer reviewing it said the hydraulic analysis looks good. We have one follow-up question on item #1. Where did you get the value of 100 cfs for a design flow for the Ultimate Canal System?

Nikie

On Tue, May 13, 2025 at 5:09 PM Hickman, Ron <rhickman1@fmi.com> wrote:

> Good afternoon, Nikie,
>
> Please see the attached TR 38 Life of Mine Plan adequacy review responses.
>
> Please let me know if you have any questions.
>
> Thanks,
>
> **Ron Hickman, P.E.**
>
> Chief Environmental Engineer

Henderson Operations

Office: (720)-942-3438

Cell: (970)-393-7515

Email: rhickman1@fmi.com

Climax Molybdenum
A Freeport-McMoRan Company

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3 attachments

20250514-Mill-Out 17feb13_HendMill_Interceptor_Report-Rev1 69.pdf
7456K

20120320-Mill-Out-TR04 Ultimate Canal Certification and As-Built.pdf
2865K

20120420-Mill-In-TR04 Ultimate Canal Certification and As-Built Approval.pdf
78K

STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106

COLORADO DIVISION OF RECLAMATION MINING & SAFETY

April 20, 2012

Mr. Miguel Hamarat
Climax Molybdenum Company
Henderson Mill
P.O. Box 68
Empire, CO 80438

Re: Henderson Mine, Permit No. M-1977-342, Technical Revision TR-04 Partial Approval, Ultimate Canal As-Built Drawing and Post Construction Certifications

Dear Mr. Hamarat:

On April 20, 2012, the Division of Reclamation, Mining and Safety approved the partial Technical Revision application submitted to the Division on March 21, 2012, addressing the following:

- *TR-04 – Submittal of Construction Certifications and As-Built Drawing for Ultimate Canal*

The terms of the partial Technical Revision No. 4 approved by the Division are hereby incorporated into Permit No. M-1977-342. All other conditions and requirements of Permit No. M-1977-342 remain in full force and effect.

If you have any questions, please contact me at (303) 866-3567 Ext. 8124 or peter.hays@state.co.us.

Sincerely,

Peter S. Hays
Environmental Protection Specialist

Cc: Tom Kaldenbach; DRMS

Climax Molybdenum
A Freeport-McMoRan Company

COLORADO OPERATIONS
Henderson Mill
P.O. Box 68
Empire, CO 80438
Phone (303) 569-3221
Fax (303) 569-2830

March 20, 2012

Via Email and UPS Tracking Number: 1Z 804 847 13 7196 9866

Mr. Peter Hays
Division of Reclamation Mining and Safety
1313 Sherman St., Rm. 215
Denver, CO 80203

Re: Permit M-1977-342, TR-04, Submittal of Construction Certifications and As-Built Drawing for Ultimate Canal

Dear Mr. Hays:

Climax Molybdenum Company (CMC) is pleased to submit Construction Certification and As-Built Drawing for the Henderson Mill "ultimate" clean water interceptor canal (Ultimate Canal), as approved by the Division of Reclamation, Mining and Safety (DRMS) on July 18, 2006.

Upon review and approval, CMC requests that the DRMS send written approval of the facility as-built drawing and construction certification.

Please contact me at (303) 569-3221, ext. 1233 or Bryce Romig (ext. 1204) if you have any questions.

Sincerely,

Miguel Hamarat

Miguel Hamarat
Chief Environmental Engineer
Climax Molybdenum Company
Henderson Operations

Attachments:

1. Ultimate Canal Construction Certification and As-Built Drawing

cc (via email):

B. Romig, Climax
T. Haynes, Climax

Attachment 1

Ultimate Canal Construction Certification and As-Built Drawing

March 9, 2012

Mr. Miguel Hamarat
Henderson Mine and Mill
Climax Molybdenum Company
19302 County Road 3
Parshall, CO 80468

Re: Ultimate Canal As-Built Certification

Dear Miguel:

W. W. Wheeler & Associates, Inc. (Wheeler) has been involved throughout the design and construction of the Ultimate Canal at the Henderson Mill. The purpose of this letter is to document that the Ultimate Canal has been constructed in general conformance with the design, with the exceptions noted herein. The design was completed and construction plans and specifications were issued in 2006. The design capacity of the canal system was based on safely conveying the 200-year snowmelt flood around the tailing storage facility (TSF) without compromising the integrity of the canal or the TSF itself. The canal system includes five spillway structures strategically located along the canal alignment. The intent of the spillway structures is to divert water into the TSF decant pond if the actual canal flows exceed the design capacity.

Construction of the canal system took place during the summer construction seasons of 2006 and 2007. By the end of July 2007, the construction phase of the project was essentially complete. A Project Closeout Report that provides a discussion on the design philosophy and a summary of construction was prepared and issued by Wheeler following completion of construction. That phase of construction was substantially completed in accordance with the design drawings and specifications. A complete set of records drawings (as-builts) was submitted to Henderson in December 2007.

During the canal commissioning phase in 2008 and 2009, Henderson construction crews completed several minor modifications to the canal system, primarily to mitigate erosion and sloughing of the cut and fill slopes on outer banks of the canal. The canal was placed into full operation in 2010 when the lower canal became inundated by the TSF. An as-built survey was conducted in September 2010 and Wheeler personnel performed a site walk-through in September 2011 to document changes that have been implemented following the 2007 phase of construction. The current configuration of the canal system is shown on Drawing UC-1-01 Rev4, which is a revised version of the original record drawing.

The following list summarizes the improvements that have been incorporated into the canal system after preparation of the 2007 closeout report.

- Several riprap-lined rundowns were constructed on the cut slopes on the uphill side of the canal to mitigate back erosion caused by overland inflows, primarily occurring during the snowmelt and early summer season.
- A gabion retaining wall was installed on the left side of the access road, above the canal where the canal is inside a culvert, from about Station 37+30 to 38+20. The gabion wall ranges from about four to seven feet tall and was installed to mitigate sloughing on the cut slope below a Tri-State powerpole. The powerpole was in-place at the time of the canal construction.
- A rock-filled toe drain was installed along the toe of a large fill section on the right outer bank of the canal from Station 68+00 to 74+00. The intent of this toe drain is to facilitate proper drainage of the embankment fill material.
- A six-inch-diameter corrugated HDPE (CHDPE) drain pipe was installed beneath the canal at Station 74+00 to collect seepage from the canal invert and convey it in a controlled manner to the right outer bank. The intent of this configuration is to mitigate oversaturation of the outer bank fill material caused by leakage from the canal.
- 60-inch-diameter CHDPE pipe was installed from Station 88+40 to 92+05 to lengthen the existing canal culvert and to mitigate concerns about sloughing from the steep cut slope above the left inner bank.
- 60-inch-diameter CHDPE pipe was installed from Station 95+46 to 95+79 to provide vehicular access across the canal.

- A boulder retaining wall was installed on the left inner bank of the canal from about Station 100+50 to 103+80 to mitigate sloughing on the cut slope above the canal. The wall is about four to six feet tall and constructed with random-sized boulders up to about 24 inches in diameter. The boulder wall ties into the existing gabion retaining wall at Station 103+80.
- 60-inch-diameter corrugated metal pipe (CMP) was installed from Station 175+13 to 175+73 and from Station 217+60 to 218+00 to replace the existing CHDPE pipe culverts at haul road crossings. The existing CHDPE pipes were reportedly deforming under heavy haul road traffic.
- The canal invert and inner banks were lined with shotcrete from Station 203+30 to 204+00 to mitigate erosion.
- 60-inch-diameter CHDPE pipe was installed to connect the new CMP at Station 218+00 to the start of the existing CHDPE drop culvert at Station 221+72 to mitigate sloughing on the inner banks, to mitigate erosion of the canal invert, and to prevent intrusion of runoff from nearby topsoil stockpiles.
- 60-inch-diameter CHDPE pipe was installed from Station 234+20 to Station 241+00 to lengthen the existing canal culvert, to mitigate sloughing on the inner banks, and to prevent excessive canal leakage to the pervious soils underlying the canal invert.

The 2010 as-built survey data along with observations and measurements made during the 2011 canal inspection were incorporated into an updated hydraulics model using the *U.S. Army Corps of Engineers* HEC-RAS computer program.

The modifications to the canal system that took place after the record drawings were issued had a minor impact on the hydraulic capacity of the canal at certain locations. The HEC-RAS model indicates that the canal system is still capable of passing the 200-year snowmelt flood without overtopping the outer bank of the canal. However, some water may be released into the TSF decant pond through the spillway structure at about Station 93+00. The addition of the 60-inch-diameter CHDPE culvert at Station 95+46 creates a backwater effect, which leads to water spilling out the spillway structure at Station 93+00. The volume of this inflow into the decant pond is not expected to be significant and can be managed within the process water system.

In summary, the results of our analysis indicate that the current configuration of the Ultimate Canal system generally conforms to the original design criteria, with the exception of the minor controlled and manageable spill thru the spillway structure at Station 93+00.

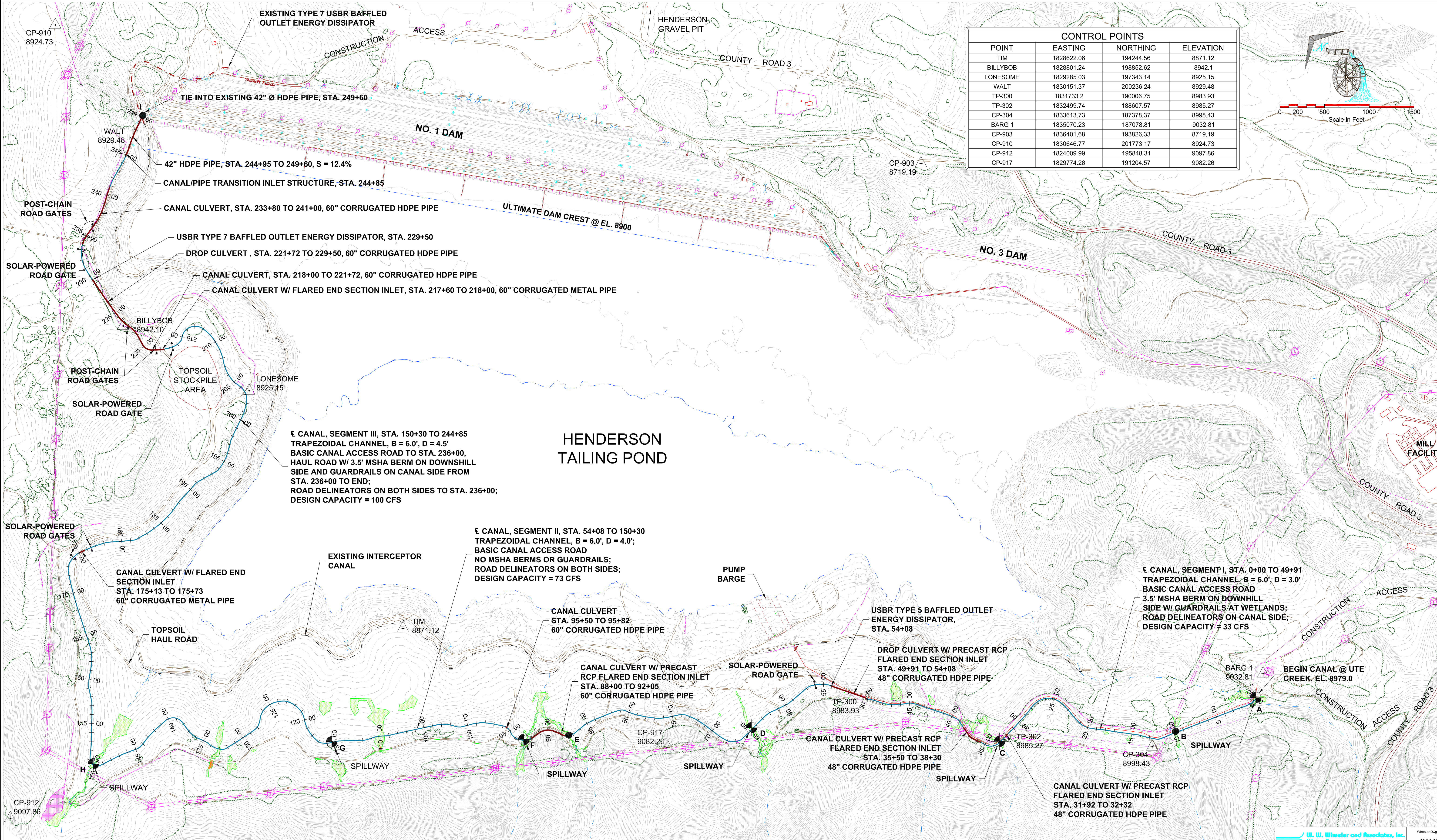
If you have any questions, comments, or concerns or would like to discuss further the configuration, operation, or performance of the Ultimate Canal system at the Henderson Mill, please contact us at your earliest convenience.

Sincerely,

Michael Stonefelt, P.E.

W. W. Wheeler and Associates, Inc.

r:\1300\1333\1333.16 (ultimate canal)\documents\12mar09l.hamarat.asbuilt.docx



CONTROL POINTS

POINT	EASTING	NORTHING	ELEVATION
TIM	1828622.06	194244.56	8871.12
BILLYBOB	1828801.24	198852.62	8942.1
LONESOME	1829285.03	197343.14	8925.15
WALT	1830151.37	200236.24	8929.48
TP-300	1831733.2	190006.75	8983.93
TP-302	1832499.74	188607.57	8985.27
CP-304	1833613.73	187378.37	8998.43
BARG 1	1835070.23	187078.81	9032.81
CP-903	1836401.68	193826.33	8719.19
CP-910	1830646.77	201773.17	8924.73
CP-912	1824009.99	195848.31	9097.86
CP-917	1829774.26	191204.57	9082.26

REVISIONS

NO.	DATE	MADE BY	CKD. BY	REMARKS
1	3/24/06	MDS	SMM	RELEASED FOR CONTRACTOR BIDDING
2	6/19/06	MDS	SMM	APPROVED FOR CONSTRUCTION
3	12/14/07	MDS	SMM	RECORD DRAWINGS
4	12/09/11	DT	MDS	REVISED RECORD DRAWING

PRINT RECORD

ISSUED / REV. NO.	1	2	3	4	5	6	7	8	DRAWING NO.

REFERENCE DWGS

DRAWING NO.	REFERENCE

W. W. Wheeler and Associates, Inc.
Water Resources Engineers

Wheeler Dwg. No. 1333.16

Henderson Ultimate Canal System

General Arrangement

Site Plan

Climax Molybdenum Henderson Mill
Parshall, Colorado

MADE BY MDS	12/29/05	SCALE As Noted
ACCEPTED BY ML	3/24/06	DRAWING NO.
CHECKED BY SMM	12/29/05	UC-1-01 (4)

November 17, 2005

Mr. Mitch Lapp
Climax Molybdenum Company, Henderson Mill
19302 County Road 3
Parshall, CO 80468

Re: ***#1333.16*** ***Henderson Ultimate Canal Hydrologic Design Basis***

Dear Mitch:

The purpose of this letter report is to present our proposed hydrologic design basis for the Ultimate Canal project. The proposed Ultimate Canal will replace the existing interceptor canal, and will be designed at an elevation above the projected final tailing pond elevation. The design of the existing canal, which was performed in 1990 and 1991, was based on estimated snowmelt flows that were presented in the Wheeler report *Rainflood and Snowmelt Flood Studies for the Henderson Mill Site*, revised October 1982. The data that was apparently used to generate the snowmelt flows in that report were somewhat limited. Our proposed scope of work for the current design included the task of updating the 1982 flow estimates using additional streamflow data that are available during the period after 1982. Presented herein are the results of our analysis and a description of the proposed design basis for the new canal system.

As shown on Figure 1, the basin that is tributary to the interceptor canal actually consists of several small tributaries that enter the canal at various points along its route. These “sub-basins” are delineated on the figure and the drainage area of each is noted. The total area that is tributary to the proposed canal system is 3.81 square miles (2,438 acres).

Description of Analysis

Our analysis began with collecting snow pack, average daily stream flow, and yearly peak flow data within the Williams Fork Basin and other basins geographically similar to the basin above the Henderson Tailing Pond. The streamflow gages that were considered in this analysis include:

USGS Gages

- Bobtail Creek
- Williams Fork below Steelman Creek
- Williams Fork above Darling Creek
- Darling Creek
- South Fork Williams Fork
- Williams Fork near Leal
- Keyser Creek

Climax Gages

- Henderson Gage 101
- Lost Creek (Gages 103 + 104)
- Skylark Creek (Gages 105 + 106)

USFS Gages

- East St. Louis Creek
- Lower Fool Creek

Stream data impacted by upstream diversions, primarily through the Gumlick Tunnel, were corrected to their virgin flows. An analysis in Wheeler's 1982 report demonstrated that the unit runoff (cfs/sq. mi.) increases with basin elevation. An important characteristic of the USGS streamflow gages that were evaluated was that they all include sub-alpine and alpine areas that typically produce high snowmelt runoff. The basins that are tributary to the proposed canal do not include these high elevation areas and the runoff rates would be significantly less. In an effort to generate data that would be representative of the tailing pond basin, we located streamflow data for Lost Creek and Skylark Creek that were collected during the early design phases of the Henderson mill. The Lost Creek and Skylark Creek basins are geographically close and similar to the tailing pond basins. However, the period of record at these stations is not sufficient to perform a reliable Log Pearson Type III frequency analysis.

In an effort to extend the period of record, linear regressions were performed to determine if there was a relationship between the Climax gages and a gage with a longer-term record. The relationship that was selected as the basis for this analysis was between the unit runoffs for Lost Creek and the Williams Fork River near Leal gage, which has a 71-year period of record (1934 to 2004). The results of the correlation are summarized in the table below:

Correlation	R^2	Equation
Lost Creek to Williams Fork near Leal	0.58	$y = 0.3905x - 1.0253$

x = recorded unit runoff at the Williams Fork near Leal gage
y = estimated unit runoff at Lost Creek

The Lost Creek basin is located adjacent to the tailing pond basin on the north side and the basin elevations are very similar. However, due to the somewhat low R-squared value and scatter of the data points, one standard deviation was added to the regression analysis. The resulting relationship, adjusted by one standard deviation, enveloped all of the correlated data points. A graph of the correlation is shown on Figure 2.

The flood frequency was estimated using the synthesized Lost Creek Data (plus the standard deviation) and the Log Pearson Type III frequency analysis. The resulting unit discharge values for the various frequency floods are listed below.

Synthesized Lost Creek Unit Frequency Floods

Units in cfs/sq.mi.	Average Annual	50-Year Flood	100-Year Flood	200-Year Flood
Lost Creek	3.5	6.2	6.6	7.0

Areas of the sub-basins above the tailing pond were delineated using USGS quadrangle maps and AutoCAD. Due to their similarity, it was assumed that it would be appropriate to apply the frequency floods synthesized for Lost Creek to synthesize the snowmelt flood flows for sub-basins tributary to the tailing pond and the proposed canal. The tailing pond sub-basin areas were multiplied by the synthesized Lost Creek unit runoff to establish the average annual, 50-, 100-, and 200-year snowmelt flood flows.

The analyses described thus far were based on the use of peak average daily flow rates since peak instantaneous flow data were not available for Lost Creek. In order to convert these flows to instantaneous peak values, a peaking factor must be applied. Peaking factors were determined for each year of record for East St. Louis Creek, Fool Creek, Keyser Creek, and Darling Creek. Keyser Creek and Darling Creek data were obtained from the USGS water database, which only provides one annual instantaneous peak flow. For these gages, the instantaneous peak was divided by the average flow on the day of the peak. The East St. Louis Creek and Fool Creek gages, obtained from the Forest Service's Fraser Experimental Forest database, have daily instantaneous peak, as well as average daily flow records. Preliminary analyses showed that many of the highest peaking factors occurred in summer months and likely resulted from heavy rainstorms.

For this analysis, the peaking factor was acquired from the May and June data since the runoff during these months is primarily from snowmelt. The peaking factor was calculated as the maximum instantaneous peak during May and June divided by the average daily flow recorded on the day of the peak.

The peaking factors were fairly consistent, with a maximum value of 3.00, which was considered to be an outlier. The 95th percentile of the yearly peaking factors from all four stations was calculated to be 1.60. In order to represent the maximum snowmelt flow rate, the frequency floods at each sub-basin were multiplied by the peaking factor. The resulting peak snowmelt flows for each canal sub-basin are shown in Table 1.

Proposed Canal Design Criteria

The design of the existing canal was reportedly based on the Probable Maximum Snowflood values listed in the 1982 report. However, it is our understanding the design of the upper bypass system, including the East Branch Reservoir Bypass and the Ute Creek Reservoir and Horseshoe systems are based on the 200-year snowmelt flood. We have reviewed the development of the PM Snowmelt flood that is described in the 1982 report and have found that the derivation of this flood was somewhat arbitrary and may be difficult to defend or justify. Unlike PM rainstorm floods, the development of PM snowmelt floods is not well defined in hydrologic references.

We propose to base the design of the new canal on the 200-year snowmelt flood flow rates. It is our opinion that this would be sufficiently conservative and would be consistent with the design basis for the upper bypass system. However, we also propose to apply an adjustment factor or factor of safety to this flow rate. Comparison to other gaged streams in the area and to previous studies indicates that an adjustment factor of 1.5 would be appropriate. This adjustment factor can be justified because of several factors, including: use of synthesized data to generate flood flows, comparison to gaged basins, relatively short period of record at the Henderson gages, possibility of deforestation in the basin due to beetle kill, etc.

The proposed design flow rates for the new canal, including the adjustment factor, are summarized in Table 2. Floods for each sub-basin were added sequentially to determine the required channel capacity at each sub-basin inlet. Runoff from the "UTE-1" basin, which is the basin tributary to Ute Creek Reservoir, is not included in this calculation because, for the magnitude of the snowmelt floods evaluated, it will be entirely diverted through the existing fresh water bypass system at the reservoir. In the design of the canal, a freeboard allowance will be added to canal depths and culvert sizes where it is appropriate.

As previously described, the existing canal was designed for the Probable Maximum Snowmelt flood. The design flow rate at the end of the canal was 98 cfs. As shown in Table 2, the proposed design flow rate of the new canal at the end would be 64 cfs. For comparison, the 200-year snowmelt flood described in the 1982 study at the end of the canal was 59 cfs.

Probable Maximum Precipitation Event

A Probable Maximum Precipitation Flood study was completed for the tailing pond in February 2005. It is important to note that the assumption was made in the flood study that the interceptor canal would fail during this extreme precipitation event. The flow rates resulting from the PM rainflood event are on the order of several hundred cubic feet per second in each of the sub-basin tributaries, with a combined total flow rate of over 2,000 cfs. Designing the canal to accommodate these extreme flows was determined to be unreasonable. The proposed canal design criteria described herein is consistent with the assumptions made in the 2005 flood study.

Canal Spillways

Our proposed design includes the installation of several small spillway structures that would be located at the points along the canal where it crosses and intercepts the major sub-basin tributaries. The primary purpose of these spillways is to protect the canal from unusually high peak flows that may result from extreme thunderstorm events, or from unexpectedly high peak snowmelt flows. The spillways would also protect the canal in the event of a blockage that could otherwise result in canal overtopping and potential failure. The spillways will also include low-level slidegates that will allow for the bypass of canal flows. During the first year or two after canal construction, and before the canal is put into full service, the slidegates could be left open to allow time for the re-vegetation of areas disturbed during construction to develop. The bypassed flows would then be intercepted by the existing canal. The slidegates can also be used to drain the canal for maintenance or repair of downstream sections or to divert water from the canal into the tailing pond if necessary for make-up water.

The hydraulic design of the spillways is based on a synthetic 100-year rainfall flood. That flood was developed from the hypothetical 100-year precipitation depths from NOAA Atlas 2 and reasonable (i.e. not overly conservative) basin hydrologic parameters. The spillways will enable the canal to safely pass the synthetic 100-year rainfall flood without overtopping by spilling excess flows into the tailing pond. This criterion will protect the canal from failure due to overtopping during severe events while still conveying as much of the flood runoff as practicably possible.

Please review the proposed design criteria described above and let us know if it is acceptable. If you have any questions or require additional explanation, please call.

Sincerely,

W. W. Wheeler and Associates, Inc.

Steven M. Maly, P.E.

SMM:sk

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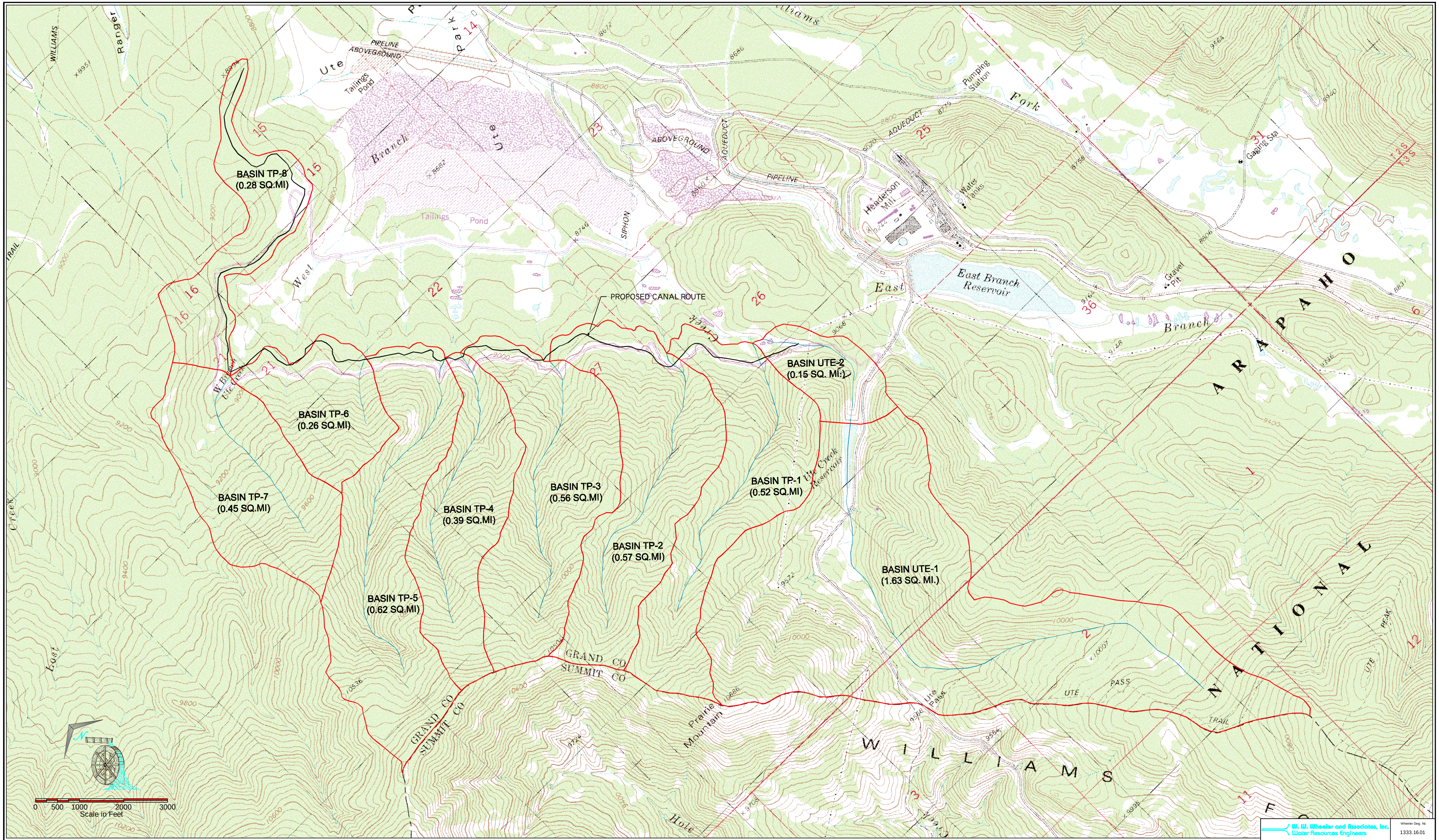

REVISIONS NO.	DATE	MADE BY	CKD. BY	REMARKS
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"This drawing together with any and all additions, corrections, changes and alterations thereof is the property of Climax Molybdenum Company and is furnished on the express condition that it shall not be reproduced, copied, lent, or disposed of directly or indirectly, nor used for any other purpose than for which it is specifically furnished without the prior written consent of said Climax Molybdenum Company."

PRINT RECORD ISSUED / REV. NO.	1	2	3	4	5	6	7	8	DRAWING NO.

REFERENCE DWGS DRAWING NO.	REFERENCE

Henderson Ultimate Canal System

Tailing Pond Sub-Basins

Climax Molybdenum Henderson Mill
Parshall, Colorado

MADE BY: MDS
SCALE: As Noted
ACCEPTED BY:
DRAWING NO.: Figure 1
CHECKED BY:

Figure 2
Correlation of the Williams Fork River near Leal to Lost Creek

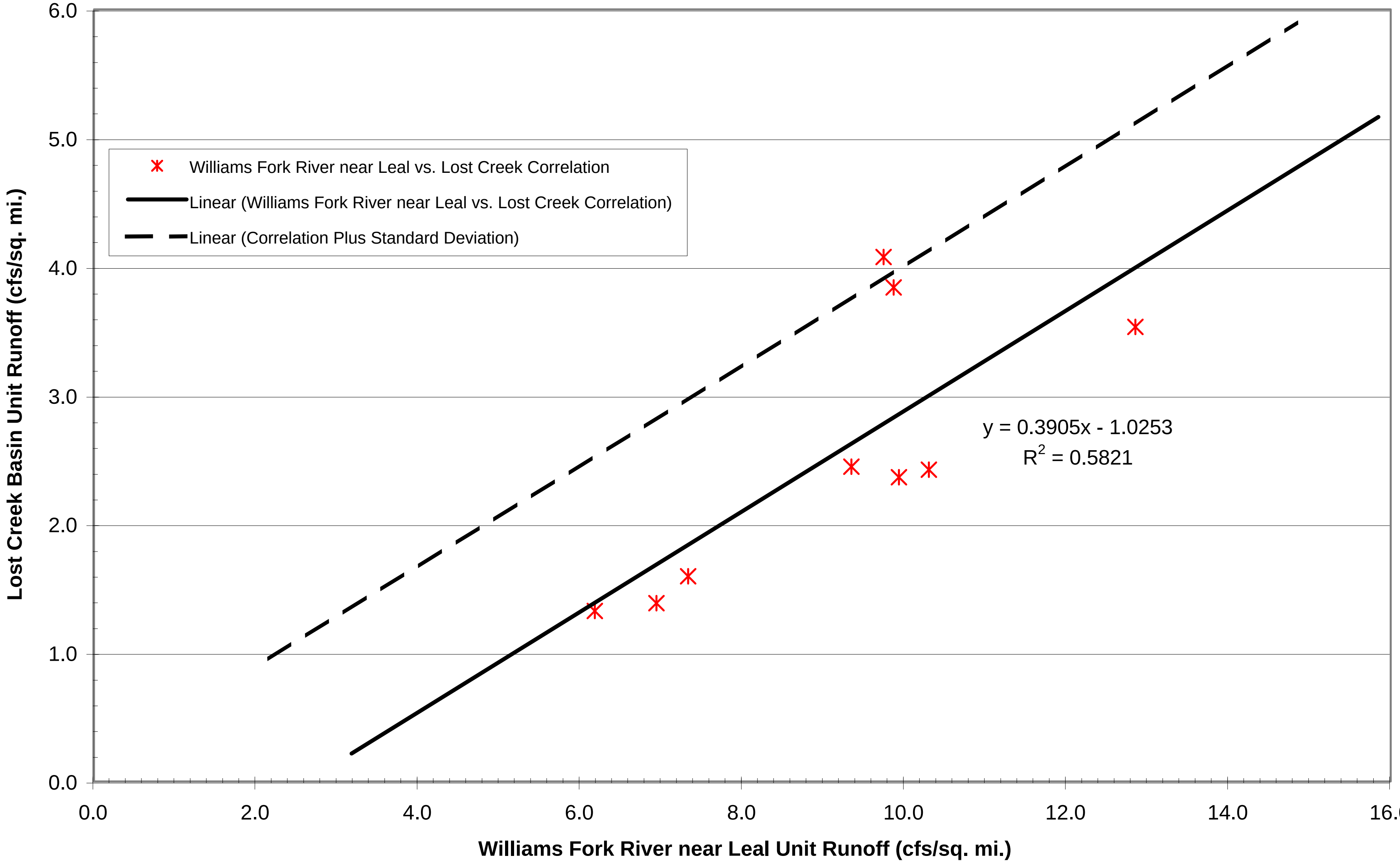
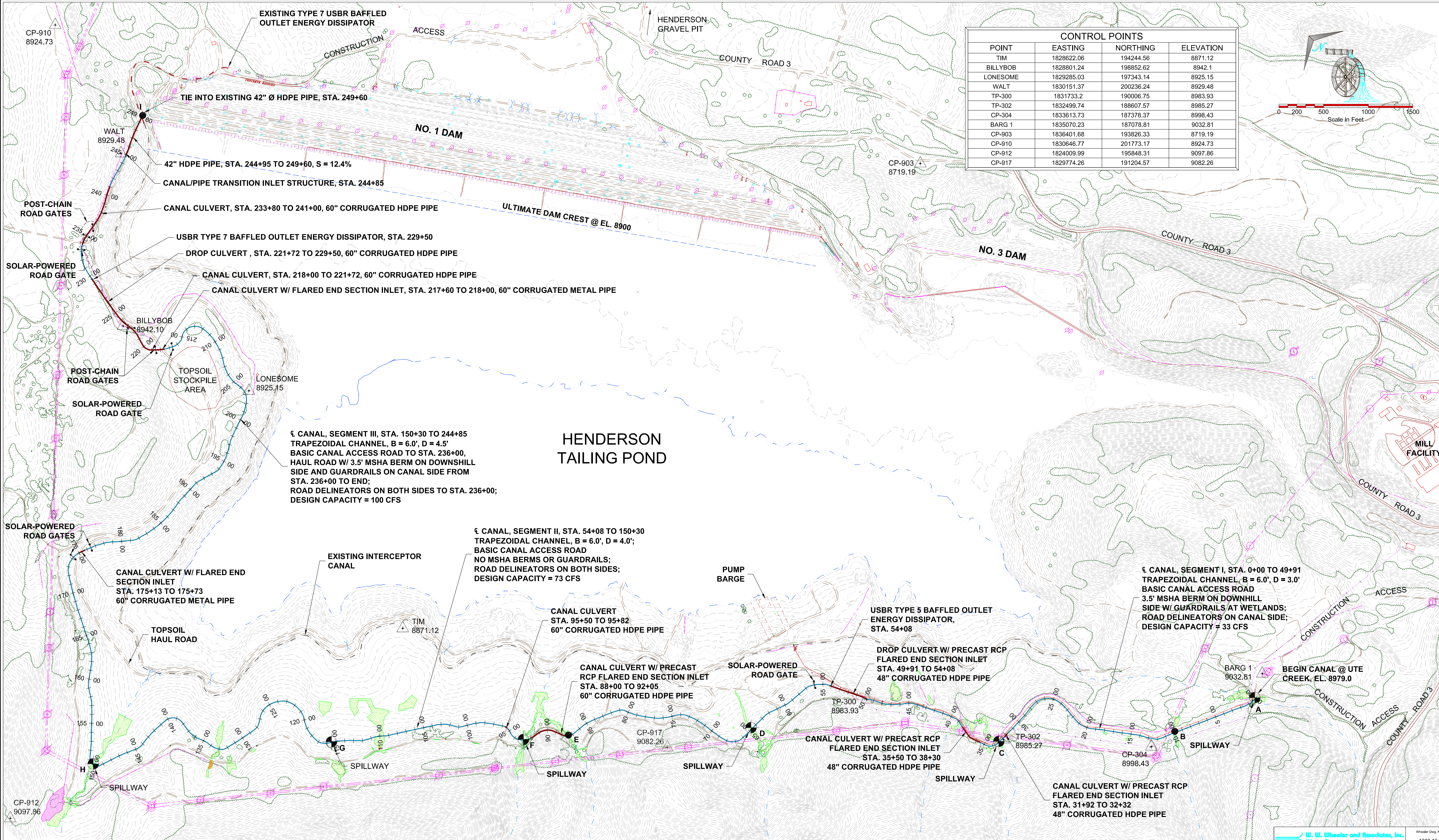


Table 1
Synthesized Peak Snowmelt Flood Flows

Sub-Basin	Drainage Area (sq. mi.)	Average Annual (cfs)	50-Year Flood (cfs)	100-Year Flood (cfs)	200-Year Flood (cfs)
UTE-1	1.63	9.2	16.2	17.3	18.3
UTE-2	0.15	0.9	1.5	1.6	1.7
TP-1	0.52	3.0	5.2	5.5	5.9
TP-2	0.57	3.2	5.7	6.1	6.4
TP-3	0.56	3.2	5.6	5.9	6.3
TP-4	0.39	2.2	3.9	4.1	4.4
TP-5	0.62	3.5	6.2	6.6	7.0
TP-6	0.26	1.5	2.6	2.8	2.9
TP-7	0.45	2.6	4.5	4.8	5.1
TP-8	0.28	1.6	2.8	3.0	3.1

Table 2
Cumulative Adjusted Peak Snowmelt Flood Flows

Sub-Basin	Drainage Area (sq. mi.)	Average Annual (cfs)	50-Year Flood (cfs)	100-Year Flood (cfs)	200-Year Flood (cfs)
UTE-2	0.15	1.3	2.3	2.4	2.5
TP-1	0.52	5.7	10.1	10.7	11.3
TP-2	0.57	10.6	18.6	19.8	20.9
TP-3	0.56	15.3	27.0	28.7	30.3
TP-4	0.39	18.6	32.8	34.9	36.9
TP-5	0.62	23.9	42.1	44.8	47.4
TP-6	0.26	26.1	46.0	48.9	51.7
TP-7	0.45	30.0	52.7	56.1	59.3
TP-8	0.28	32.3	56.9	60.6	64.0



CONTROL POINTS			
POINT	EASTING	NORTHING	ELEVATION
TIM	1828622.06	194244.56	8871.12
BILLYBOB	1828801.24	198852.62	8942.1
LONESOME	1829285.03	197343.14	8925.15
WALT	1830151.37	200236.24	8929.48
TP-300	1831733.2	190006.75	8983.93
TP-302	1832499.74	188607.57	8985.27
CP-304	1833613.73	187378.37	8998.43
BARG 1	1835070.23	187078.81	9032.81
CP-903	1836401.68	193826.33	8719.19
CP-910	1830646.77	201773.17	8924.73
CP-912	1824009.99	195848.31	9097.86
CP-917	1829774.26	191204.57	9082.26

REVISIONS

NO.	DATE	MADE BY	CKD. BY	REMARKS
1	3/24/06	MDS	SMM	RELEASED FOR CONTRACTOR BIDDING
2	6/19/06	MDS	SMM	APPROVED FOR CONSTRUCTION
3	12/14/07	MDS	SMM	RECORD DRAWINGS
4	12/09/11	DT	MDS	REVISED RECORD DRAWING

PRINT RECORD

ISSUED / REV. NO.	1	2	3	4	5	6	7	8	DRAWING NO.

REFERENCE DWGS

DRAWING NO.	REFERENCE

W. W. Wheeler and Associates, Inc.
Water Resources Engineers

Wheeler Dwg. No. 1333.16

Henderson Ultimate Canal System

General Arrangement

Site Plan

Climax Molybdenum Henderson Mill
Parshall, Colorado

MADE BY MDS	12/29/05	SCALE As Noted
ACCEPTED BY ML	3/24/06	DRAWING NO.
CHECKED BY SMM	12/29/05	UC-1-01 (Rev. 4)

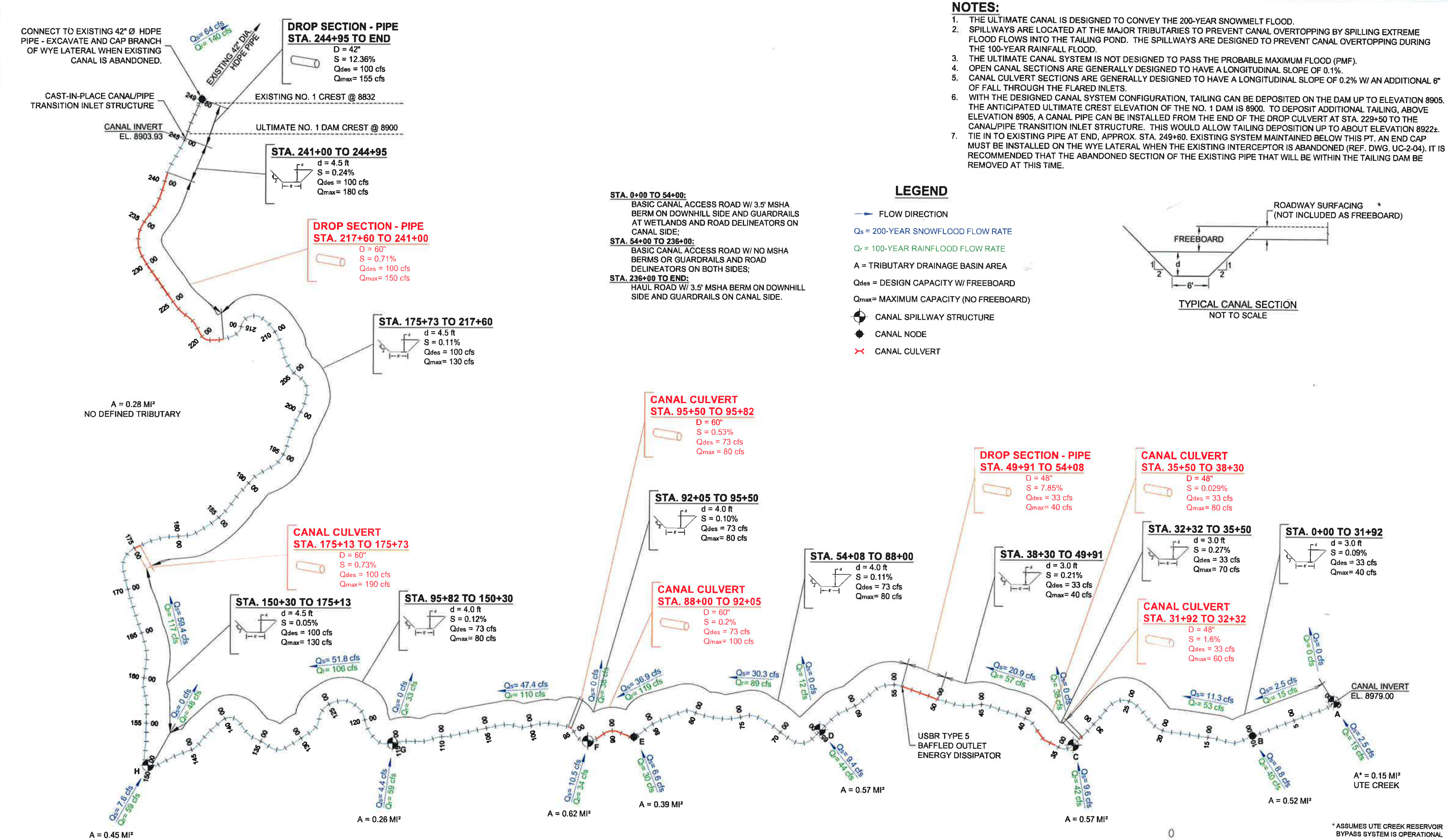
NOTES:

1. THE ULTIMATE CANAL IS DESIGNED TO CONVEY THE 200-YEAR SNOWMELT FLOOD.
2. SPILLWAYS ARE LOCATED AT THE MAJOR TRIBUTARIES TO PREVENT CANAL OVERTOPPING BY SPILLING EXTREME FLOOD FLOWS INTO THE TAILING POND. THE SPILLWAYS ARE DESIGNED TO PREVENT CANAL OVERTOPPING DURING THE 100-YEAR RAINFALL FLOOD.
3. THE ULTIMATE CANAL SYSTEM IS NOT DESIGNED TO PASS THE PROBABLE MAXIMUM FLOOD (PMF).
4. OPEN CANAL SECTIONS ARE GENERALLY DESIGNED TO HAVE A LONGITUDINAL SLOPE OF 0.1%.
5. CANAL CULVERT SECTIONS ARE GENERALLY DESIGNED TO HAVE A LONGITUDINAL SLOPE OF 0.2% W/ AN ADDITIONAL 6" OF FALL THROUGH THE FLARED INLETS.
6. WITH THE DESIGNED CANAL SYSTEM CONFIGURATION, TAILING CAN BE DEPOSITED ON THE DAM UP TO ELEVATION 8905. THE ANTICIPATED ULTIMATE CREST ELEVATION OF THE NO. 1 DAM IS 8900. TO DEPOSIT ADDITIONAL TAILING, ABOVE ELEVATION 8905, A CANAL PIPE CAN BE INSTALLED FROM THE END OF THE DROP CULVERT AT STA. 229+50 TO THE CANAL/PIPE TRANSITION INLET STRUCTURE. THIS WOULD ALLOW TAILING DEPOSITION UP TO ABOUT ELEVATION 8922±.
7. TIE IN TO EXISTING PIPE AT END, APPROX. STA. 249+60. EXISTING SYSTEM MAINTAINED BELOW THIS PT. AN END CAP MUST BE INSTALLED ON THE WYE LATERAL WHEN THE EXISTING INTERCEPTOR IS ABANDONED (REF. DWG. UC-2-04). IT IS RECOMMENDED THAT THE ABANDONED SECTION OF THE EXISTING PIPE THAT WILL BE WITHIN THE TAILING DAM BE REMOVED AT THIS TIME.

STA. 0+00 TO 54+00:
BASIC CANAL ACCESS ROAD W/ 3.5' MSHA BERM ON DOWNHILL SIDE AND GUARDRAILS AT WETLANDS AND ROAD DELINEATORS ON CANAL SIDE;
STA. 54+00 TO 236+00:
BASIC CANAL ACCESS ROAD W/ NO MSHA BERMS OR GUARDRAILS AND ROAD DELINEATORS ON BOTH SIDES;
STA. 236+00 TO END:
HAUL ROAD W/ 3.5' MSHA BERM ON DOWNHILL SIDE AND GUARDRAILS ON CANAL SIDE.

LEGEND

- FLOW DIRECTION
- Q_s = 200-YEAR SNOWFLOOD FLOW RATE
- Q_r = 100-YEAR RAINFLOOD FLOW RATE
- A = TRIBUTARY DRAINAGE BASIN AREA
- Q_{des} = DESIGN CAPACITY W/ FREEBOARD
- Q_{max} = MAXIMUM CAPACITY (NO FREEBOARD)
- CANAL SPILLWAY STRUCTURE
- CANAL NODE
- CANAL CULVERT



* ASSUMES UTE CREEK RESERVOIR BYPASS SYSTEM IS OPERATIONAL.

NO	DATE	MADE BY	CKD. BY	REMARKS
1	3/24/06	MDS	SMM	RELEASED FOR CONTRACTOR BIDDING
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3	12/14/07	MDS	SMM	RECORD DRAWINGS
4	11/23/11	DT	MDS	AS-BUILT

REVISIONS

"This drawing together with any and all additions, corrections, changes and alterations thereof is the property of Climax Molybdenum Company and is furnished on the express condition that it shall not be reproduced, copied, lent, or disposed of directly or indirectly, nor used for any other purpose than for which it is specifically furnished without the prior written consent of said Climax Molybdenum Company."

PRINT RECORD — ISSUED — REV. NO 1 2 3 4 5 6 7 8 — DRAWING NO

REFERENCE DWGS — DRAWING NO — REFERENCE

W. W. Wheeler and Associates, Inc. Water Resources Engineers — 1333.16

Henderson Ultimate Canal System

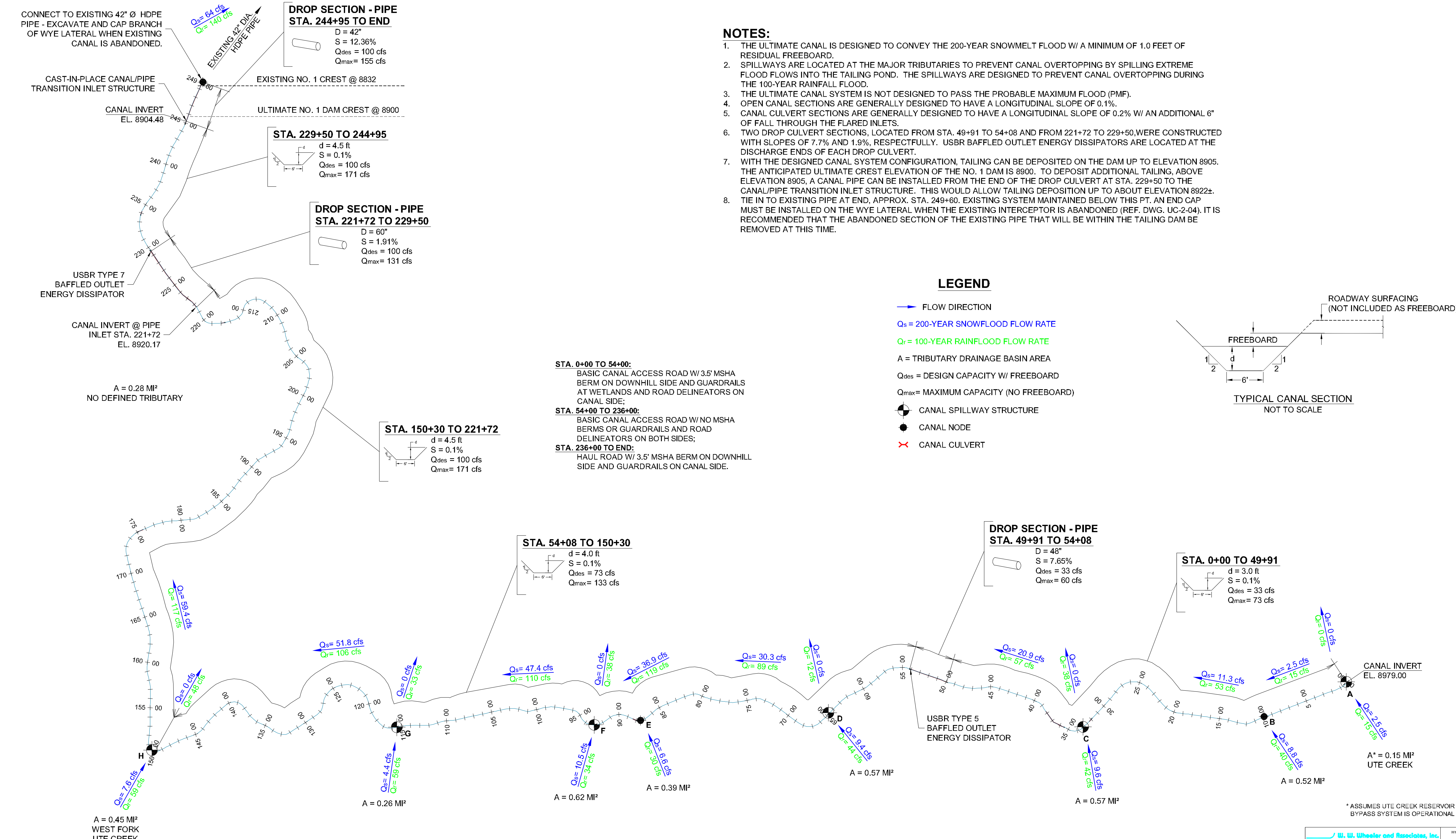
Flow Diagram

Climax Molybdenum Henderson Mill
Parshall, Colorado

MADE BY	DT	11/23/11	SCALE As Noted
ACCEPTED BY	ML	/11	DRAWING NO.
CHECKED BY	MDS	/11	UC-0-01 (3)

Henderson Mill Ultimate Canal Hydrology
1333.16.##

Subbasin Parameters	EBRB	EBRT	HC	UTE-1	UTE-2	TP-1	TP-2	TP-3	TP-4	TP-5	TP-6	TP-7	TP-8
Basin Area (ft^2)	25,090,560	45,441,792	17,005,824	45,394,386	4,194,337	14,551,566	15,961,101	15,552,819	10,870,446	17,342,057	7,238,199	12,595,632	7,808,631
Basin Area (mi^2)	0.9000	1.6300	0.6100	1.6283	0.1505	0.5220	0.5725	0.5579	0.3899	0.6221	0.2596	0.4518	0.2801
Watercourse Length (ft)	12,619	13,200	6,600	15,835	3,528	9,293	8,027	7,289	8,161	10,523	3,152	6,070	
Watercourse Length (mi)	2.39	2.50	1.25	3.00	0.67	1.76	1.52	1.38	1.55	1.99	0.60	1.15	
Bottom Elevation (ft)				9,210	8,920	8,920	8,920	8,920	8,920	8,920	8,920	8,920	
Top Elevation (ft)				10,950	9,210	10,686	10,300	10,500	10,765	10,920	9,700	10,180	
Elevation Change (ft)	1,760	2,110	990	1,740	290	1,766	1,380	1,580	1,845	2,000	780	1,260	
Slope (ft/ft)	0.1395	0.1598	0.1500	0.1099	0.0822	0.1900	0.1719	0.2168	0.2261	0.1901	0.2475	0.2076	
Slope (ft/mi)	736.4	844.0	792.0	580.2	434.0	1,003.4	907.7	1,144.5	1,193.7	1,003.5	1,306.6	1,096.0	
Length to Centroid (ft)	4,752	6,494	3,485	5,083	1,942	4,106	3,456	3,385	3,839	5,121	1,068	2,543	
Length to Centroid (mi)	0.90	1.23	0.66	0.96	0.37	0.78	0.65	0.64	0.73	0.97	0.20	0.48	
Bottom Elevation (ft)				9,210	8,920	8,920	8,920	8,920	8,920	8,920	8,920	8,920	
Top Elevation (ft)				9,400	9,040	9,600	9,615	9,465	9,540	9,690	9,145	9,280	
Elevation Change (ft)				190	120	680	695	545	620	770	225	360	
Slope (ft/ft)				0.0374	0.0618	0.1656	0.2011	0.1610	0.1615	0.1504	0.2107	0.1416	
Slope (ft/mi)				197.4	326.3	874.4	1,061.8	850.1	852.7	793.9	1,112.4	747.5	
SCS CN Losses	**Woods, fair condition**												
SCS Curve Number, CN (AMC II)	50	67	65	56	42	43	41	40	40	38	51	48	59
Maximum Retention, S (in)	10.00	5.00	5.28	7.78	14.08	13.49	14.48	14.73	15.04	16.18	9.61	10.95	6.85
Initial Abstractions, I (in)	2.00	1.00	1.06	1.56	2.82	2.70	2.90	2.95	3.01	3.24	1.92	2.19	1.37
Impervious Area (%)	0.2%	5.9%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SCS Unit Hydrograph													
SCS Lag Time (hrs)	1.44	0.91	0.56	1.66	0.84	1.17	1.15	0.96	1.04	1.46	0.35	0.70	
Time Interval (hrs)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Tpeak (hrs)	1.57	1.04	0.68	1.79	0.97	1.30	1.27	1.08	1.17	1.58	0.47	0.82	
Runoff Coefficient	484	484	484	484	484	484	484	484	484	484	484	484	
Qpeak (cfs/in)	278.08	759.96	431.78	440.69	75.10	194.70	217.64	249.45	161.98	190.07	265.71	265.92	
Kinematic Wave Unit Hydrograph													
Overland Flow Length (ft)													680.00
Overland Slope (ft/ft)													0.2000
Overland Roughness													0.1200
Channel Length (ft)													9,300
Channel Slope (ft/ft)													0.0010
Channel Roughness													0.0300
Bottom Width (ft)													6.0
Side Slope													2.0



NOTES:

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6. TWO DROP CULVERT SECTIONS, LOCATED FROM STA. 49+91 TO 54+08 AND FROM 221+72 TO 229+50,WERE CONSTRUCTED WITH SLOPES OF 7.7% AND 1.9%, RESPECTFULLY. USBR BAFFLED OUTLET ENERGY DISSIPATORS ARE LOCATED AT THE DISCHARGE ENDS OF EACH DROP CULVERT.
7. WITH THE DESIGNED CANAL SYSTEM CONFIGURATION, TAILING CAN BE DEPOSITED ON THE DAM UP TO ELEVATION 8905. THE ANTICIPATED ULTIMATE CREST ELEVATION OF THE NO. 1 DAM IS 8900. TO DEPOSIT ADDITIONAL TAILING, ABOVE ELEVATION 8905, A CANAL PIPE CAN BE INSTALLED FROM THE END OF THE DROP CULVERT AT STA. 229+50 TO THE CANAL/PIPE TRANSITION INLET STRUCTURE. THIS WOULD ALLOW TAILING DEPOSITION UP TO ABOUT ELEVATION 8922±.
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- CANAL NODE
- CANAL CULVERT

TYPICAL CANAL SECTION
NOT TO SCALE

NO.	DATE	MADE BY	CKD. BY	REMARKS
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REVISIONS

PRINT RECORD — ISSUED / REV. NO. 1 2 3 4 5 6 7 8 / DRAWING NO.

REFERENCE DWGS — DRAWING NO. / REFERENCE

W. W. Wheeler and Associates, Inc. Water Resources Engineers — Wheeler Dwg. No. 1333.16

Henderson Ultimate Canal System

Flow Diagram

Climax Molybdenum Henderson Mill
Parshall, Colorado

MADE BY	MDS	12/29/05	SCALE: As Noted
ACCEPTED BY	ML	3/24/06	DRAWING NO.
CHECKED BY	SMM	12/29/05	UC-0-01 (3)

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