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**From:** Tara Ousley [Ousley.Tara@azdeq.gov]  
**Sent:** 6/1/2018 5:06:05 PM  
**To:** Wagner, Kenneth [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=048236ab99bc4d5ea16c139b1b67719c-Wagner, Ken]; Brightbill, Jonathan (ENRD) [Jonathan.Brightbill@usdoj.gov]; Wheeler, Andrew R. [Andrew.Wheeler@FaegreBD.com]; Torres, Tomas [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b2f42bb7a684e199190092e3a2e7520-TTORRES]; Aguirre, Hector [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=496957db32074f0087b7cb288bffc3ca-HAGUIR02]; Nishida, Jane [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=65e465e683c54e1b825f1bad32dcb099-Nishida, Jane]; Stoker, Michael B. [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=dcb64b4e7edf48aabe8ef43996a4652e-Stoker, Mic]; Miller, Amy [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=40bb39f199a74c5cb3956d35d6f468df-AMILLE06]; Cheatham-Strickland, Latonia [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e0153e074b9640f1b6aa32cfda4f4bf9-Strickland,]  
**CC:** pincognito@azwifa.gov; Cabrera.misael@azdeq.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=cbf9ba26e08a46c58363714abf679bbc-Cabrera.mis]; Bret Parke [Parke.Bret@azdeq.gov]; Trevor Baggione [Baggione.Trevor@azdeq.gov]; Mary Zanga [Zanga.Mary@azdeq.gov]; stone.amanda@azdeq.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=dba970a897894c688d9b9151c98d355d-stone.amanda@azdeq.gov]; Edna A. Mendoza [Mendoza.Edna@azdeq.gov]; Hans J. Huth [Huth.Hans@azdeq.gov]; Raymond D. Morgan [Morgan.Raymond@azdeq.gov]; Hunter Moore [hmoore@az.gov]; 'Jill Metzinger' [jmetzinger@az.gov]; ymendoza@azwifa.gov [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6ebf1f5710bf4cc58b1a0b8b40b7d8d7-ymendoza@azwifa.gov]  
**Subject:** RE: Meeting in Arizona - June 13, 2018  
**Attachments:** Hotels in Phoenix.pdf; Parking Directions.jpg; Sacks Menu.pdf; 171122\_IOI\_NIWTP\_Priority\_Matrix.pdf

I apologize but I inadvertently left off two documents.

1. Nogales SSO and Pretreatment Priority Matrix (attached and prints best on 11"x17" paper)
2. Arizona-Sonora Environmental Strategic Plan 2017-2021 – link to report  
[http://static.azdeq.gov/pub/obep\\_strat\\_plan.pdf](http://static.azdeq.gov/pub/obep_strat_plan.pdf)

Thank you,  
*Tara Ousley*  
Executive Assistant to Director Misael Cabrera, P.E.  
Arizona Department of Environmental Quality  
Office: (602) 771-4406  
[Ousley.tara@azdeq.gov](mailto:Ousley.tara@azdeq.gov)

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**From:** Tara Ousley  
**Sent:** Friday, June 01, 2018 9:47 AM  
**To:** Wagner, Kenneth <wagner.kenneth@epa.gov>; Brightbill, Jonathan (ENRD) <Jonathan.Brightbill@usdoj.gov>; Wheeler, Andrew R. <Andrew.Wheeler@FaegreBD.com>; Torres, Tomas <Torres.Tomas@epa.gov>; Aguirre, Hector <Aguirre.Hector@epa.gov>; Nishida, Jane <Nishida.Jane@epa.gov>; Stoker, Michael B. <stoker.michael@epa.gov>; Miller, Amy <Miller.Amy@epa.gov>; Cheatham-Strickland, Latonia <Cheatham-Strickland.Latonia@epa.gov>  
**Cc:** pincognito@azwifa.gov; Misael Cabrera <Cabrera.Misael@azdeq.gov>; Bret Parke <Parke.Bret@azdeq.gov>; Trevor Baggione <Baggione.Trevor@azdeq.gov>; Mary Zanga <Zanga.Mary@azdeq.gov>; Amanda E. Stone <Stone.Amanda@azdeq.gov>; Edna A. Mendoza <Mendoza.Edna@azdeq.gov>; Hans J. Huth <Huth.Hans@azdeq.gov>;

Raymond D. Morgan <Morgan.Raymond@azdeq.gov>; Hunter Moore <hmoore@az.gov>; 'Jill Metzinger' <jmetzinger@az.gov>; Yolanda Mendoza <ymendoza@azwifa.gov>

**Subject:** RE: Meeting in Arizona - June 13, 2018

Good morning,

Thank you so much for the email confirming our upcoming meeting on Wednesday, June 13, 2018, 12:00 – 4:00 p.m., that includes a working lunch. Below is a list of participants that will be attending the meeting from WIFA and ADEQ, please reply back with your list of attendees, titles, and email addresses for our logistical conference room planning. I have attached a list of hotels near our office and I am happy to work with your assistants to help them with your travel arrangements. Attached is the lunch menu, please reply back to me with your lunch choice by 6/11/18. We are looking forward to the meeting and please feel free to reach out to me for any assistance. Thank you, Tara Ousley

- Trish Incognito, Executive Director, Water Infrastructure Finance Authority of Arizona (WIFA)
  - Misael Cabrera, Director, ADEQ
  - Bret Parke, Deputy Director of Operations, ADEQ
  - Trevor Baggione, Water Quality Division Director, ADEQ
  - Amanda Stone, Chief Policy and Legislative Affairs Officer, ADEQ
  - Edna Mendoza, Border Environmental Manager, ADEQ
  - Hans Huth, Environmental Associate Hydrogeologist, ADEQ
- 
- **Date:** Wednesday, June 13, 2018
  - **Time:** 12:00-4:00 pm (Includes Working Lunch)
  - **Topic:** Issues and Potential Solutions for the International Outfall Interceptor (IOI)
  - **Location:** ADEQ, 1110 West Washington Street, 6<sup>th</sup> Floor, Conf. Room #6100B, Phoenix, AZ 85007
  - **Parking:** Free visitor parking in the first floor of the parking garage (entrance on north side of Washington Street, west of 10<sup>th</sup> Avenue). ADEQ building is directly behind the Evans Historical House.
  - **Sign-In:** Sign in at the ADEQ receptionist's office on the 1<sup>st</sup> floor and obtain a visitor's badge. Have receptionist call Tara Ousley at 602-771-4406 to escort you to the conference room.
  - [Directions to ADEQ >](#)  
[Parking at ADEQ >](#)

Thank you,

*Tara Ousley*

Executive Assistant to Director Misael Cabrera, P.E.

Arizona Department of Environmental Quality

1110 West Washington Street

Phoenix, AZ 85007

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[Ousley.tara@azdeq.gov](mailto:Ousley.tara@azdeq.gov)

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**From:** Wagner, Kenneth [<mailto:wagner.kenneth@epa.gov>]

**Sent:** Tuesday, May 29, 2018 3:27 PM

**To:** Misael Cabrera <[Cabrera.Misael@azdeq.gov](mailto:Cabrera.Misael@azdeq.gov)>; Bret Parke <[Parke.Bret@azdeq.gov](mailto:Parke.Bret@azdeq.gov)>; Tara Ousley <[Ousley.Tara@azdeq.gov](mailto:Ousley.Tara@azdeq.gov)>; Brightbill, Jonathan (ENRD) <[Jonathan.Brightbill@usdoj.gov](mailto:Jonathan.Brightbill@usdoj.gov)>; Wheeler, Andrew R.

<Andrew.Wheeler@FaegreBD.com>; Torres, Tomas <Torres.Tomas@epa.gov>; Aguirre, Hector  
<Aguirre.Hector@epa.gov>; Nishida, Jane <Nishida.Jane@epa.gov>; Stoker, Michael B. <stoker.michael@epa.gov>;  
Miller, Amy <Miller.Amy@epa.gov>  
**Cc:** Cheatham-Strickland, Latonia <Cheatham-Strickland.Latonia@epa.gov>  
**Subject:** Meeting in Arizona - June 13, 2018

All:

This email is in anticipation of our June 13, 2018 meeting between Arizona Department of Environmental Quality (ADEQ), US Department of Justice (DOJ), and US Environmental Protection Agency (EPA) to be held from 12:00pm to 4:00pm in the Phoenix office of the ADEQ. We will plan on eating lunch together (menu to be circulated) to visit as we set the tone for what, we all hope, will be a productive meeting around the issues and potential solutions for the International Outfall Interceptor (IOI). A few general ground rules before we start; Most importantly, we need to recognize that this is not part of the formal litigation process and, while the solutions discussed may have an impact, it is not intended to settle the litigation. With this in mind, we ask concurrence with the following:

1. While this is not a formal mediation, we all agree that the discussions held, statements made, documents used or agreements reached shall not be admissible in court for any reason in the current Litigation between the United States (IBWC) and the State of Arizona (Litigation). This requirement will encourage frank and open discussion about how to fix the problems without fear of prejudicing anyone's legal position in the Litigation.
2. We need to focus on solutions rather than the merits (or weakness) of either side's case in the Litigation. We need to reinforce and encourage creative solutions to funding improvements of the IOI, including all federal, state, local and foreign investment possibilities, while openly and honestly discussing the impediments or challenges to implementing these solutions.
3. ADEQ will have available its sister agency (WIFA) available to join to talk about state revolving funds for clean water infrastructure.
4. EPA will have Office of Water Finance; Office of International & Tribal Affairs and other potential program stakeholders available.
5. Please circulate a list of attendees from your respective agency.

Again, we are looking forward to a positive and productive meeting with parties who all have a significant stake in seeing the success of the water treatment for Arizona through the IOI. Please review the forgoing and let us know if there are additional points for agreement and, if agreeable, indicate your concurrence with these points for the meeting.

Let me know if you have any further questions.

Ken

**Kenneth E. Wagner**  
*Senior Advisor to the Administrator*  
*Regional and State Affairs*  
**U.S. EPA**  
1200 Pennsylvania Avenue NW  
Washington, DC 20004  
(202)564-1988 office  
(202) **Ex. 6**  
[wagner.kenneth@epa.gov](mailto:wagner.kenneth@epa.gov)

Message

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**From:** Duaime, Ted [TDuaime@mtech.edu]  
**Sent:** 4/18/2018 2:47:08 PM  
**To:** John Hammen [john.hammen@metalsus.com]; Mark Thompson [MThompson@montanaresources.com]  
**CC:** Dreed@mt.gov; Chapin Storrar [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user608fc9ab]; Greene, Nikia [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=32a08a414a4f40199b557c0819eb7d0b-Greene, Nikia]; Tim Hilmo - BP (Tim.Hilmo@bp.com) [Tim.Hilmo@bp.com]; Kelly, Albert [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=08576e43795149e5a3f9669726dd044c-Kelly, Albe]; Duaime, Ted [TDuaime@mtech.edu]  
**Subject:** RE: New Tech for Cleaning up the Berkeley Pit  
**Attachments:** PitQW-Nov-9-17.pdf

John:  
Attached are the water quality results from last November's Berkeley Pit sampling event. Results of this spring's sampling are not yet available, however, I will be happy to provide those once they are complete. As you will notice both dissolved and total recoverable fractions were analyzed.

The State of MT has stipulated that any large quantities of water collected and shipped from the Berkeley Pit can only be sent to a lab/entity that has an EPA Hazardous Waste ID number, this number is obtained through the state where the lab/test facility etc. is usually located. Once you provide that ID number to me we can then discuss the quantity of water necessary for your testing and the best shipping method. Below is the language from our current Sampling and Analysis Plan (MBMG 2017):

### Collection of Bulk Water Samples for Treatability Studies

The MBMG periodically receives requests for the collection of bulk Berkeley Pit water samples for treatability studies from vendors and researchers. The MBMG performs this work as part of the 2002 CD monitoring/sampling program under the guidance of EPA and DEQ. The MBMG collects and ships quantities up to 20 gallons at no cost to the requestor; special arrangements are necessary for larger quantities to cover personnel and shipping costs. Per requirements of the DEQ-Hazardous Waste Program (RCRA), the requestor must provide the appropriate EPA Hazardous Waste ID number for the receiving facility that will be performing the treatability test. No Berkeley Pit bulk water samples will be collected or shipped without the proper EPA ID number.

Feel free to contact me directly to discuss either the water quality data or bulk water sample needs; I can be reached by phone at Personal Matters. The MBMG provided 5 gallons of pit surface water to your father, Dr. Richard Hammen, Chromatochem, in 1994 (?). I believe I visited with him when he came to Tech a short time later to talk about his metals recovery process a short time later. I don't have any record of providing more recent water samples or data to your company, so you will notice some changes in the pit chemistry (i.e. iron, copper, and pH) since then.

Thanks,  
Ted

TED DUAIME  
Hydrogeologist



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OFFICE PHONE

Personal Matters /  
Ex. 6

**From:** John Hammen <john.hammen@metalsus.com>

**Sent:** Wednesday, April 18, 2018 12:30 AM

**To:** Mark Thompson <MThompson@montanaresources.com>

**Cc:** Dreed@mt.gov; Chapin Storrar <storrarcs@cdmsmith.com>; Greene, Nikia <Greene.Nikia@epa.gov>; Tim Hilmo - BP (Tim.Hilmo@bp.com) <Tim.Hilmo@bp.com>; Duaine, Ted <TDuaine@mtech.edu>; kelly.albert@epa.gov

**Subject:** Re: New Tech for Cleaning up the Berkeley Pit

Mr. Thompson,

We look forward to working with you to advance the best solution for the Butte community and state of Montana. The Metals US team, and other friends and partners of ours, have invested significant time and interest in understanding the Berkeley Pit situation, chemistry, and possible solutions because we are concerned about the ongoing and possibly escalating impact of the site. We believe our technology could be the missing link that could enable a best possible outcome for everyone, and we feel it is our responsibility as citizens to do what we can to help out. On that basis, we have put together a preliminary plan that I think is feasible, and we would like to engage in a straightforward process to see if it is the right answer. Since every application and solution is different, any advance projections of costs and values is an approximation, no matter how established or well used a technology may be. No doubt you have had to refine your process and therefore costs and economics for the current precipitation process over the course of your ongoing development work.

We work with a number of Fortune 500 companies to provide solutions to problems otherwise difficult to address with conventional technologies. Initial modeling may be done with established rubrics to see if the costs are within the range of feasibility. We have done this with the Berkeley Pit with our internal costing models, and the results are reflected in the document provided. However, since providing very detailed modeling and costing for complicated projects like the Berkeley Pit can take many months of time cost up to hundreds of thousands of dollars in engineering cost and assessment, serious clients generally prefer to first establish that the technology can in fact meet water treatment goals, at least at smaller scale, through basic test work. This provides direct results with the target solution which not only proves technical feasibility, but also provides a framework for more accurate projections. We have always found our clients to be quite willing to provide us solutions for testing, and support our efforts to demonstrate the efficacy of our technology to provide them more options for solving their problem. That is a win/win for everyone.

Our ability to provide real demonstration of not only the effectiveness of the technology, but use those results to justify compelling economics, sets us apart from nearly all of our competition, and I imagine most of the technology providers you have spoken to. We have not contacted any potential purchasers of the zinc metal product. It seems a bit premature to do so, given that we do not yet have zinc production at the Pit, nor do we have a request to build a facility, nor do we even yet, it seems, have a willingness from you to provide small water samples. However, given the fact that zinc is one of the most traded and sought after commodities in the modern metals market, I do not expect surprises as regards either salability or price.

I know that Montana Resources, and other collaborating parties, have worked tirelessly to provide the Best Available Technology solution or the Berkeley Pit, and other environmental impact issues in the area. We are concerned, as I know you are, that any water discharged from the Pit meet or beat all regulatory standards, and, if possible, the water level on the Pit be drawn down so that it does not provide an ongoing threat of seepage into the surrounding water, soil, and air. I think these goals are very obtainable! We appreciate your team's deep pool of knowledge and experience with treating the Pit, and look forward to engaging you in a process that is

clear, straightforward, and transparent to determine if Solid Phase Extraction may be the BAT for at least some aspects of the water processing and solids management.

You mentioned that you and the MBMG have developed protocols for evaluating new proposals and emerging technologies. Could you provide me this written documentation, so that I can better understand your process? Also, if Mr Duaime could provide the most recent analyses from the Pit, that would be most helpful. Thank you for your assistance! Also, our team would look forward to meeting in the near future with your team to further discuss our collaboration. Best Regards,

-John

On Thu, Apr 12, 2018 at 4:14 PM, Mark Thompson <[MThompson@montanaresources.com](mailto:MThompson@montanaresources.com)> wrote:

Mr. Hammen,

As you would expect, we receive numerous proposals to "mine" and/or treat the Berkeley Pit water. With the assistance of the Montana Bureau of Mines and Geology (MBMG), we have developed protocols to evaluate new proposals and emerging technologies. Please contact Mr. Ted Duaime at the MBMG and request the latest sampling results from the B. Pit to ensure that you are working with the most recent water quality information. Then with more detail than the proposal provide to Mr. Greene, explain your recovery and treatment train using the latest WQ results and provide detailed cost analysis. If you propose to offset treatment costs with recovered metal value, please describe in detail the form that the metal is recovered (e.g. elemental Zn, ZnS, ZnO, etc.) and a description of where and how it is marketable. Ultimately we will need written commitment from purchasers of the metals to ensure that the produced products are in fact marketable. Your proposal states that your technology has previously been demonstrated to treat B. Pit water. Could you provide this information? You also state that your technology is in production at other locations. Could you provide references?

The appropriate stakeholders will review these detailed proposals and other information. Assuming that the detailed proposals demonstrate technical merit, we will require that the technology be tested off site at bench scale. Under certain conditions, Mr. Duaime can provide the water for testing. If bench testing is successful, we may allow pilot testing on site at your expense.

Thank you for your interest.

Mark

Mark Thompson

Vice President of Environmental Affairs

**Montana Resources, LLP**

**600 Shields Ave.**

**Butte, Montana 59701**

Phone:

Personal Matters / Ex.  
6

Cell:



**Montana Resources**

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**From:** Greene, Nikia [<mailto:Greene.Nikia@epa.gov>]  
**Sent:** Thursday, April 12, 2018 10:08 AM  
**To:** Mark Thompson; Tim Hilmo - BP ([Tim.Hilmo@bp.com](mailto:Tim.Hilmo@bp.com))  
**Cc:** [Dreed@mt.gov](mailto:Dreed@mt.gov); Chapin Storrar  
**Subject:** FW: New Tech for Cleaning up the Berkeley Pit

Mark and Tim,

Mr. Hammen caught me after the ROCC/CTEC meeting yesterday and I explained that if MR and AR were interested EPA is interested. So, could you take a look at this and let me know if you are interested in pursuing this technology further or why you would not be.

Thanks,

Nikia Greene

Remedial Project Manager

U.S. EPA, Region 8

(406)-457-5019

[greene.nikia@epa.gov](mailto:greene.nikia@epa.gov)

**From:** John Hammen [mailto:[john.hammen@metalsus.com](mailto:john.hammen@metalsus.com)]  
**Sent:** Wednesday, April 11, 2018 7:26 PM  
**To:** Greene, Nikia <[Greene.Nikia@epa.gov](mailto:Greene.Nikia@epa.gov)>  
**Subject:** New Tech for Cleaning up the Berkeley Pit

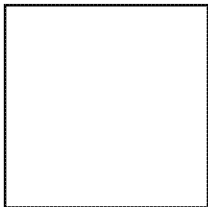
Dear Nikia:

It was a pleasure to touch bases with you today at the forum about our new technology for remediation of the Pit and surrounding areas. Let me say I admire the balance, compassion, and fortitude you bring to managing this very challenging project, while at the same time working with and bringing along the understandably frustrated Butte community. We have developed the core basis for our Solid Phase Extraction Technology (SPE) - the key part of our remediation strategy, over a few decades, and spent the last several years bringing it to commercialization. Our long vision has been to develop a technology foundation that enables us to help with projects that really have large impact on people and communities. While we have many projects with good profit margins, we have always been particularly interested in the Berkeley Pit because of its significance to Montana and the whole nation. I also believe our experience not only in technology development, but also process testing and implementation, enables us to put together a "whole package" from the science fundamentals to the facility, operations, and big picture impact that most technology imagineers lack. Our Total Metal Recovery/Zero Discharge methodology was developed because it both provides the most economic way to operate the plant, and also is the only way to provide a clean water output without large waste byproducts. I have attached our white paper on the Berkeley Pit, and I hope you find this embodied in the document. It is our hope that we can work with you and others in the EPA, the Butte community, and other related parties, to provide a solution that realizes the best possible environmental and human impact outcome, while also being economically viable and sustainable in the long run. I appreciate any thoughts you may have, and look forward to working together as things advance. With Best Regards,

-John

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John Hammen | Chief Executive Officer



(4) Personal Matters / Ex. 6

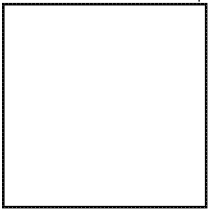
[www.metalsus.com](http://www.metalsus.com)

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John Hammen | Chief Executive Officer



Personal Matters /  
[www.metal-sus.com](http://www.metal-sus.com)



Nogales SSO and Pretreatment Priority Matrix

| Distinct Problem   | Root Cause   | Ranked Recommendations   | Recommendation<br>Rough Cost Estimate <sup>5</sup>   | Relationship to MOU / ASEP  |
|--|--|--|--|---|
| <p><b>Sanitary Sewer Overflows (SSOs):</b> Sanitary sewer overflows (SSOs) occur frequently in Ambos Nogales, primarily due to severe flooding during the summer monsoons. In addition to microbial contamination, SSOs sometimes contain pollutants from poorly treated industrial discharges.</p> <p><b>Rough estimate of Arizona current costs:</b> \$109,170 in FY2018.</p>  | <p>Numerous factors, including insufficient number, operation and maintenance of flood control structures in Nogales, Sonora; Mexico’s practice of using the IOI to mitigate flood events, and unplanned development in the floodplain in Nogales, Sonora. The result is releases of untreated sewage into residential and business neighborhoods in the City of Nogales and the Santa Cruz River watershed.</p>   | <p>1. <b>Build stormwater structures in Nogales, Sonora.</b><br/>Recommendations are outlined studies commissioned by the International Boundary and Water Commission <sup>1,2</sup> which focus on the construction of tributary detention basins for flood damage reduction in Nogales, Sonora. The city already has 11 detention basins; limited maintenance is provided. The Nogales, Sonora Institute for Municipal Planning and Research (IMIP) has proposed building an additional 9 basins at specific sites to assist with flood mitigation<sup>3</sup>. Site selection is based on new studies commissioned by the city given development at basin sites recommended in 2005<sup>4</sup>.</p>  | <p>\$2,400,000<br/>(Includes SOW + Construction)<br/>(MXN original estimates converted to US Dollars, 19 pesos to the dollar exchange rate)</p> <p>+50% = <b>\$3,600,000</b></p> | <p>Arizona/Sonora Environmental Strategic Plan (ASESP). Priority Water Projects - Pages 7, 9, 21, 22: This project aims to support maintenance of existing gabions and promote new stormwater gabions as appropriate, and evaluate other formal flood-control alternatives. The goal is to protect the residents of Ambos Nogales and secure its municipal assets by strengthening the region’s stormwater management infrastructure while reducing the risk of stormwater-induced sanitary sewer overflows (SSOs).</p> |
|  |  | <p>2. <b>Maintain existing (and new) stormwater structures in Sonora.</b><br/>The USGS<sup>2</sup> study highlights the need for continuous maintenance to ensure basins can operate at full capacity over time.</p>   | <p>Annual: \$128,000<br/>(MXN original estimates converted to US Dollars, 19 pesos to the dollar exchange rate)</p> <p>+ 50% = <b>\$192,000</b></p>                              |   |
| <p><b>Industrial Contaminants in the Santa Cruz River:</b> On average, 200 lbs. of metal (nickel) are discharged to the Santa Cruz River each month. The Nogales, Sonora Municipal Pretreatment Program regulates the quality of wastewater discharged by maquiladoras. These discharges are treated in Arizona. Sonoran oversight of industrial discharges meets Mexico’s minimum federal requirements (NOM-002), but is insufficient to detect and respond to dumps of industrial contaminants when they occur. These impact U.S. infrastructure and the operation of the Nogales International Wastewater Treatment Plant, threaten Arizona’s groundwater resources, and impair the Santa Cruz River.</p> <p><b>Rough estimate of Arizona current costs:</b> legal case to address this issue is \$1,166,923 (to date).</p> | <p>Additional resources are required for Nogales, Sonora to provide the necessary oversight to meet U.S. standards for environmental protection in Arizona. Solicitations to both Mexico’s Federal Department of Water Resources (CONAGUA) and the International Boundary and Water Commission (IBWC) by both ADEQ and Nogales, Sonora have been inconsequential. Minor support has been facilitated through the EPA Border 2020 program, but is far short of what is needed for sustainability.</p> | <p>3. <b>Stand-up the Nogales, Sonora Pretreatment Program in matters that go above and beyond Mexico’s NOM-002 requirements.</b> (i.e. collection-system source characterization via monitoring, followed by specific outfall monitoring). Current monitoring is on a one-time annual basis. Additional monitoring is needed to ensure compliance on a continuous basis. Increased monitoring requires additional funding for equipment, personnel, and sample analyses in Mexican-certified labs to ensure there is continuous detection and regulatory response to dumping. Updates summarizing respective activities and results will be shared at quarterly Binational Technical Committee meetings already hosted by IBWC.</p> <p><b>Ongoing Support.</b> Sustainability will require ongoing support of equipment, staff, and water quality analyses to support activities not required under NOM-002</p> | <p>One time: \$269,000</p> <p>+50% = <b>\$403,500</b></p> <p>Annual: \$241,000</p> <p>+50% = <b>\$361,500</b></p>  | <p>Priority Water Projects - Pages 7, 9, 21, 25: This project aims to leverage federal resources to strengthen institutional pretreatment processes in Nogales, Sonora so that contaminant loadings can be mitigated at their source. Respective processes include wastewater monitoring in the binational conveyance for source characterization, information exchange with the regulated community, and support of Mexico’s Industrial Wastewater Discharge Limits (NOM-002) where needed.</p>                        |
| <p><b>Nogales Wash Bank Erosion Leading to IOI and Manhole Damage:</b> Because reaches of the IOI are aligned in the open channel of Nogales Wash, the sewer pipe and manholes are subject to damage and rupture due to bank erosion.</p> <p><b>Rough estimate of Arizona costs:</b> included in SSO estimate for ADEQ. Other State agencies have costs associated with this problem.</p>  | <p>Poorly selected IOI alignment and lack of bank stabilization and stormwater detention along the Nogales Wash.</p>   | <p>4. <b>Bank Protection and Wash Crossing Reinforcement.</b> Protect current alignment by reinforcing Nogales Wash Banks and IOI crossings.</p>   | <p>One time: \$17M – \$32M</p> <p>+50% = <b>\$26M – \$48M</b></p>  | <p>Not in ASEP</p>  |
|  |  | <p>5. <b>Implement the Santa Cruz County Master Plan.</b> The Ephraim, Mariposa, Portrero Creek detention basins will assist with bank protection for the alignment of the IOI in the Nogales Wash, <u>but only for storms that fall on the west side of the watershed</u>. The Baffert detention basin will assist with bank protection for storms that fall in the urban area of Ambos Nogales, and may also provide the added benefit of trapping solid waste. <u>These projects will do very little to address existing SSO and Industrial contaminants in the Santa Cruz originating from Sonora, but may help prevent a future failure of the IOI in Arizona.</u></p>  | <p>Provided by others</p>  |   |

Nogales SSO and Pretreatment Priority Matrix

NOTES

- <sup>1</sup> U.S. Army Corps of Engineers, Los Angeles District. *Ambos Nogales Special Flood Damage Reduction Study Nogales, Sonora, Mexico Prepared for the International Boundary and Water Commission*. Revised September 2005.
- <sup>2</sup> U.S. Geological Survey Open-File Report 2010-1262, 112 p. *Nogales flood detention study*: <http://pubs.usgs.gov/of/2010/1262/>
- <sup>3</sup> Prevención y Control de inundaciones en Nogales, Sonora – Resumen Técnico (July 12, 2016)
- <sup>4</sup> Telephone and email communication with IMIP (November 17, 2017)
- <sup>5</sup> Rough cost estimates were developed using available information over a short period of time. A 50% contingency was added consistent with the Association for the Advancement of Cost Engineering (AACE) guidelines for rough order of magnitude (ROM) cost estimates.

FIGURES

Figure 1: Recommendations for placement of Stormwater Detention Features (ACE/IBWC Study, 2005) (Area in purple polygon, Figure 4)

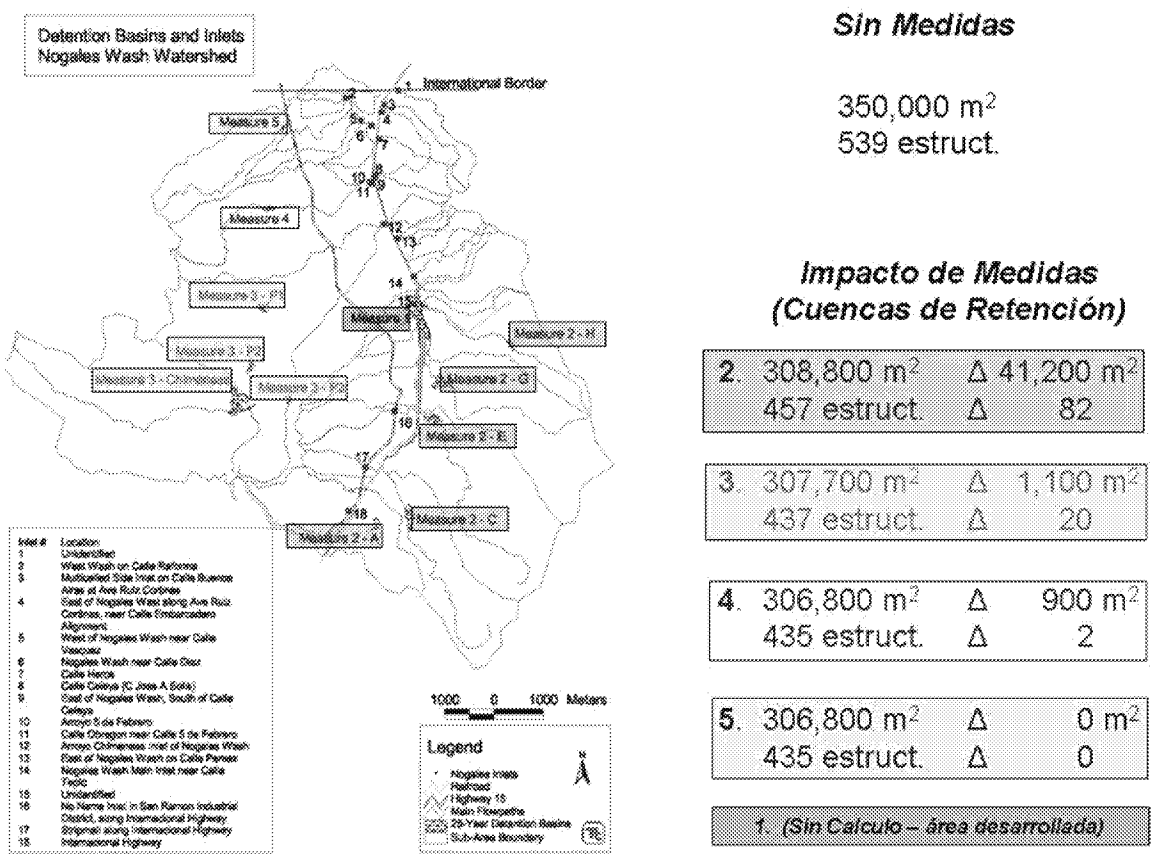
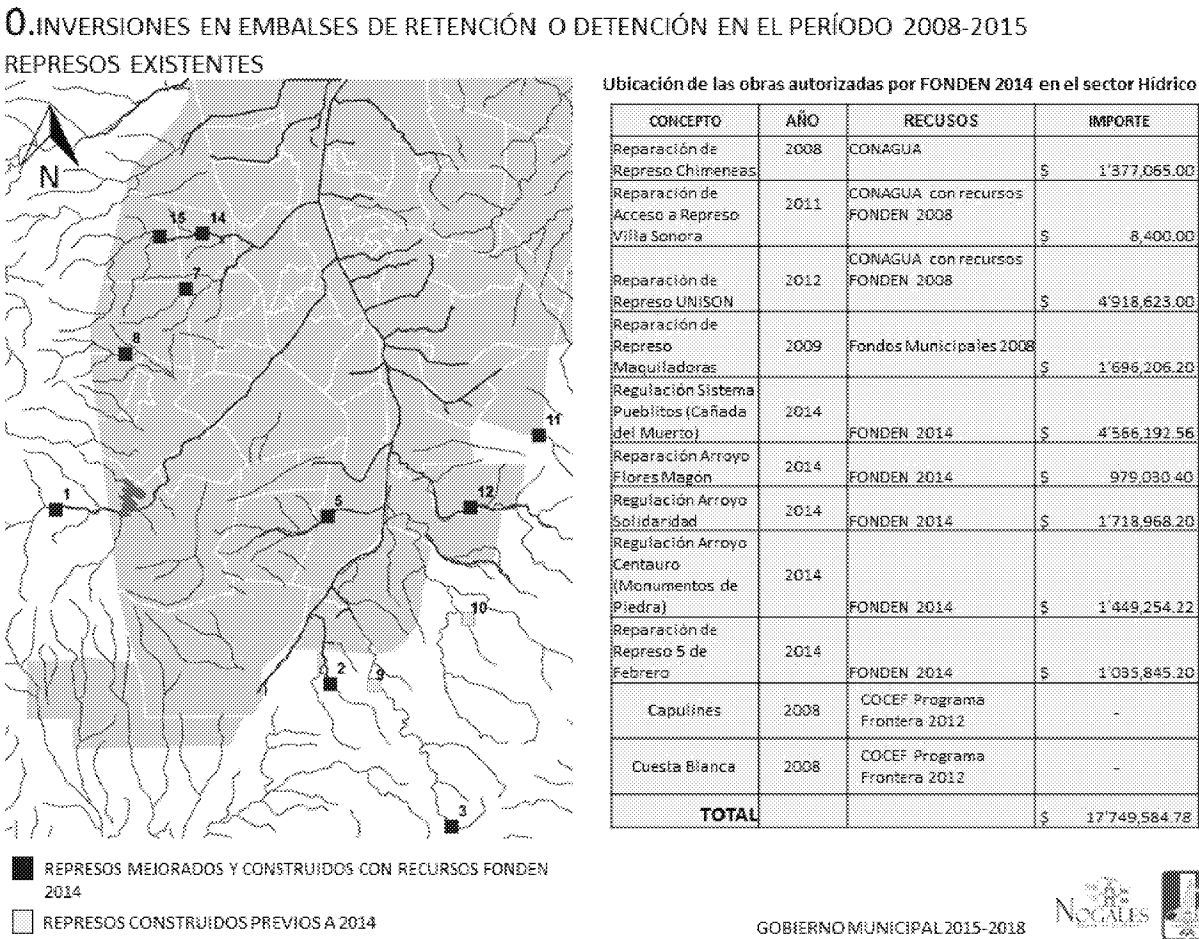


Figure 2: Existing Stormwater Detention Features in Nogales, Sonora (Area in purple polygon, Figure 4)



Nogales SSO and Pretreatment Priority Matrix

Figure 3: City of Nogales, Sonora Recommendations for Placement of New Stormwater Detention Features (2016)  
(Area in purple polygon, Figure 4)

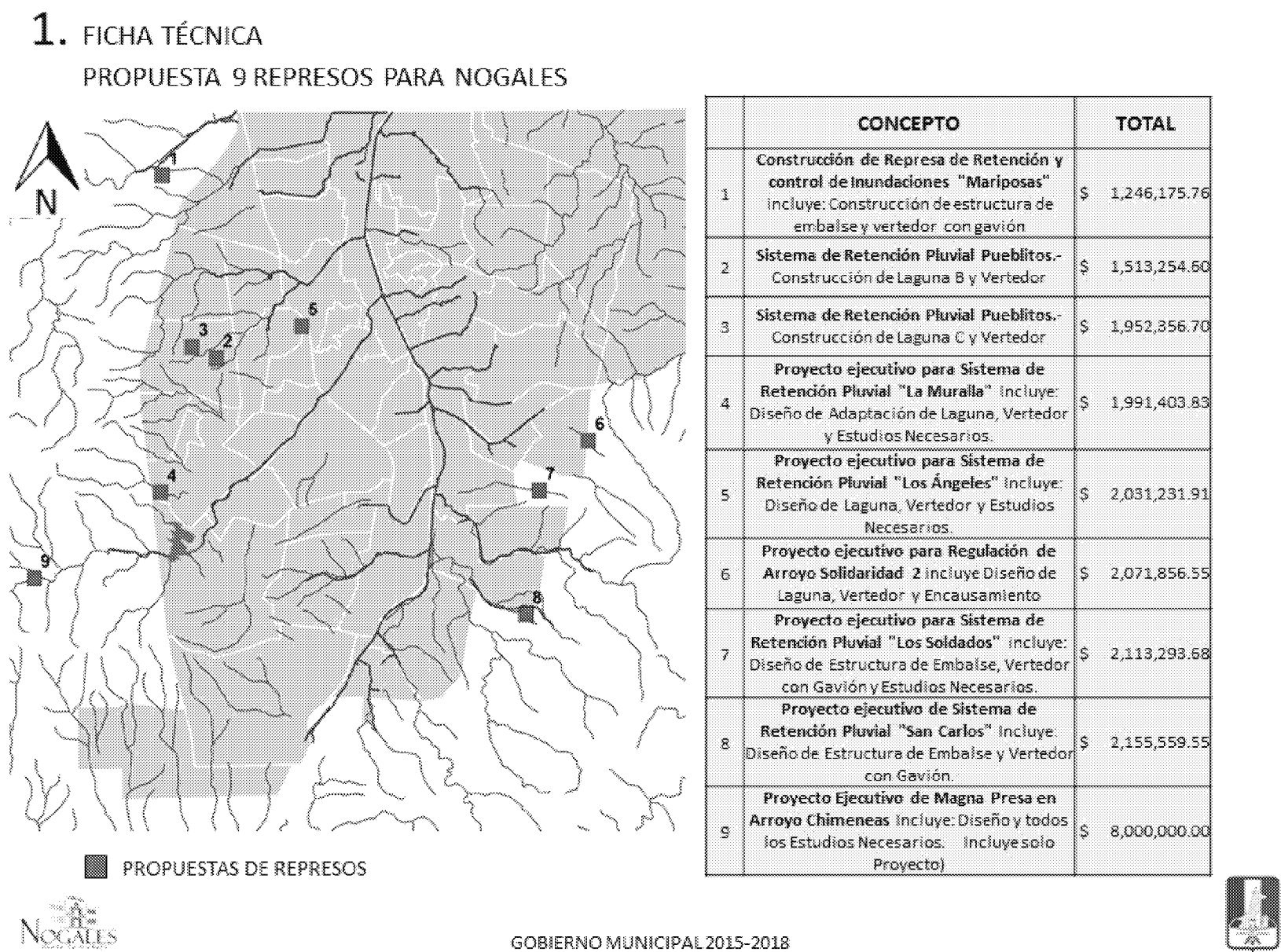


Figure 4: Santa Cruz County Master Plan Detention Features (green triangles)

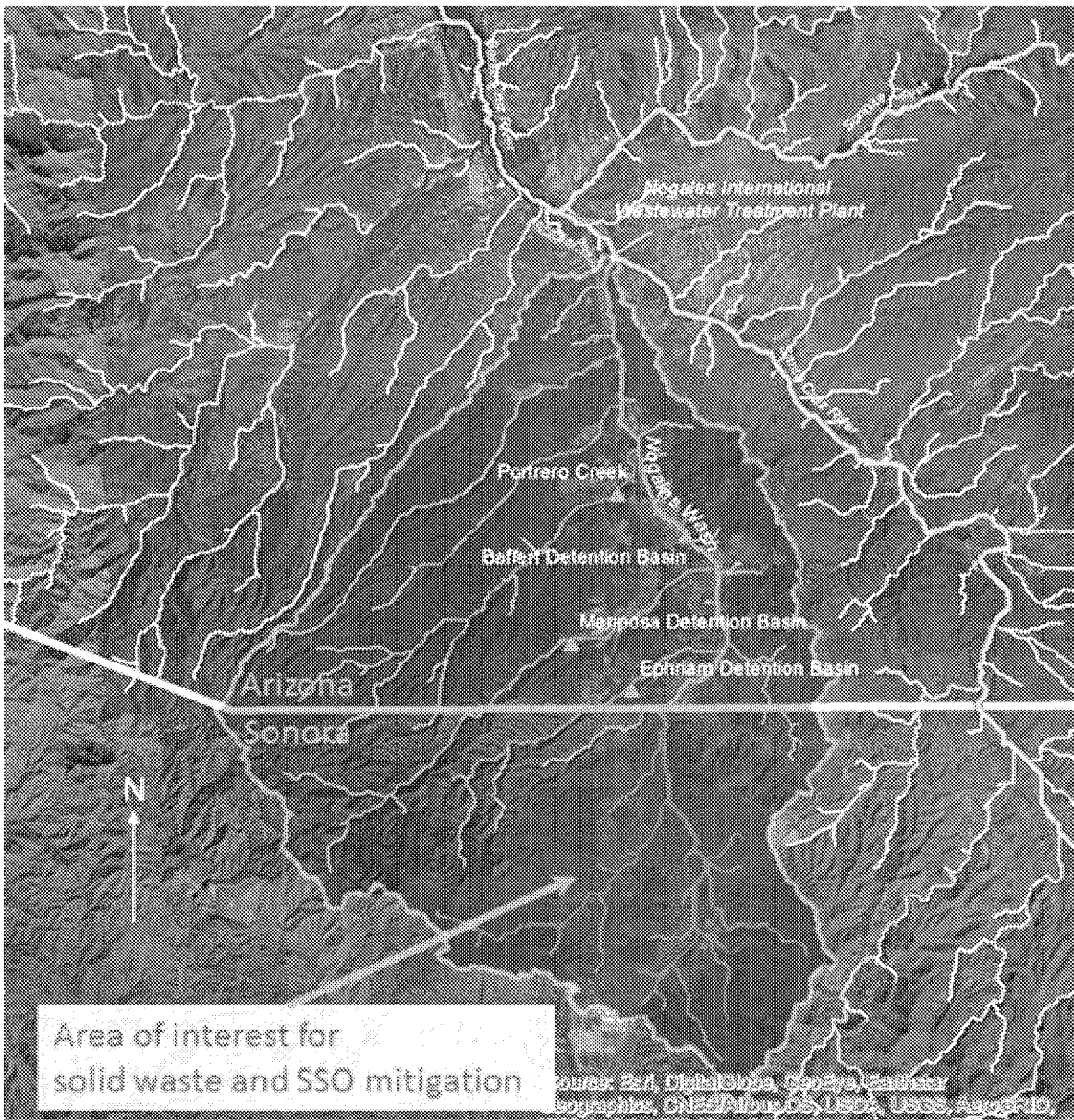
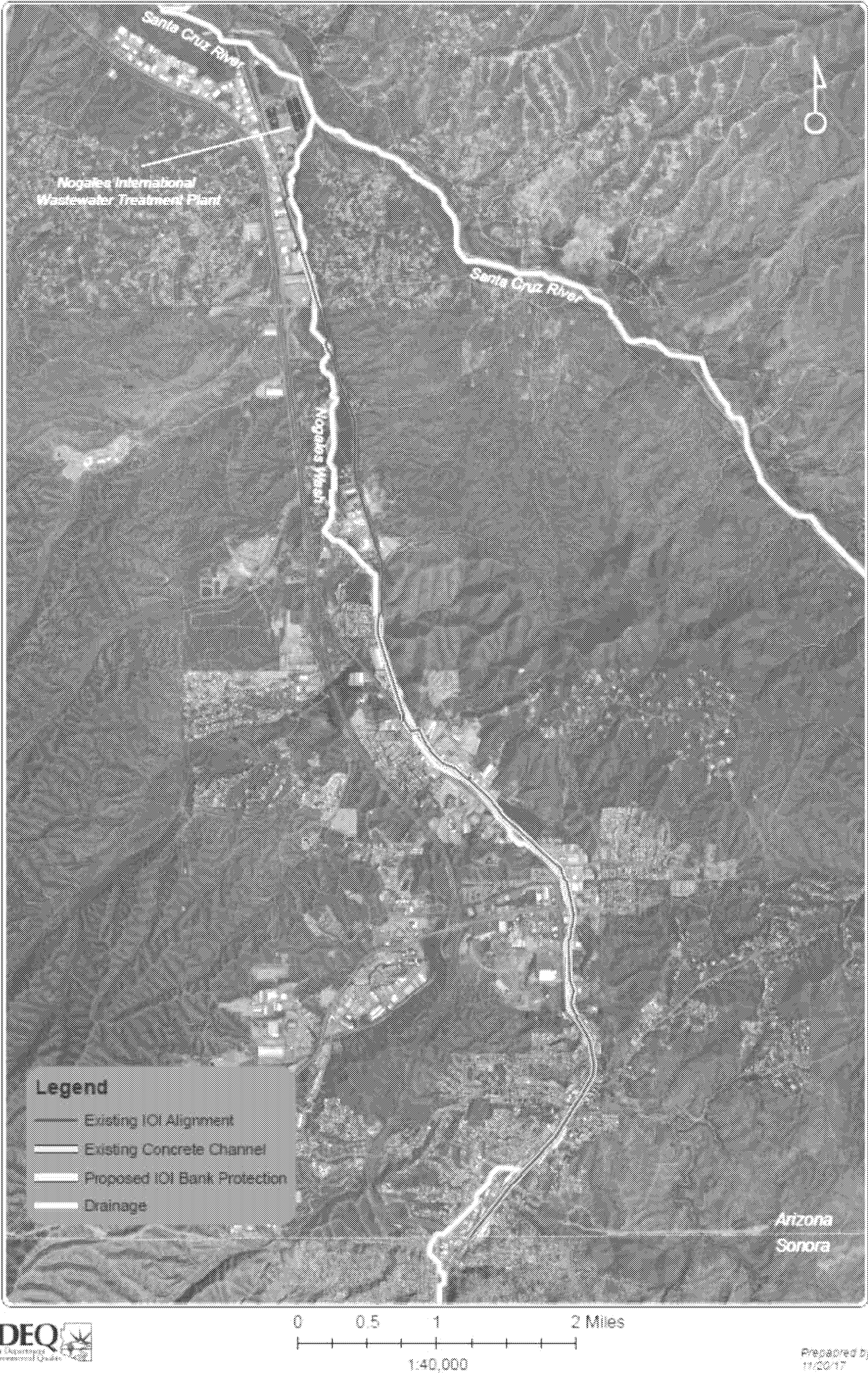




Figure 5 – Conceptual Bank and Crossing Protection

*International Outfall Interceptor*  
*Proposed Bank Protection*



## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225208 / 120678

Sample Date: 11/9/2017 12:55:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 3 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:56 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1

Site Type: MINE

Procedure Type: DISSOLVED

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                            | mg/L    | meq/L   |                                 | mg/L      | meq/L   |
|----------------------------|---------|---------|---------------------------------|-----------|---------|
| Calcium (Ca)               | 468.920 | 23.399  | Bicarbonate (HCO <sub>3</sub> ) | 0.000     | 0.000   |
| Magnesium (Mg)             | 623.530 | 51.310  | Carbonate (CO <sub>3</sub> )    | 0.000     | 0.000   |
| Sodium (Na)                | 76.110  | 3.311   | Chloride (Cl)                   | 18.060    | 0.509   |
| Potassium (K)              | 9.590   | 0.245   | Sulfate (SO <sub>4</sub> )      | 6,932.000 | 144.394 |
| Iron (Fe)                  | 1.887   | 0.068   | Nitrate (as N)                  | 0.270     | 0.019   |
| Manganese (Mn)             | 263.350 | 9.586   | Fluoride (F)                    | 46.720    | 2.459   |
| Silica (SiO <sub>2</sub> ) | 121.200 |         | Orthophosphate (as P)           | <0.100 U  | 0.000   |
| <b>Total Cations</b>       |         | 142.560 | <b>Total Anions</b>             |           | 147.382 |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 310,925.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 4.790 J   | Strontium (Sr): | 1,079.860   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 10.660     | Nickel (Ni):       | 1,211.740 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 4.460       | Cobalt (Co):    | 1,609.770  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 24.440      |
| Barium (Ba):    | 7.470       | Copper (Cu):    | 56,055.650 | Neodymium (Nd):    | 340.080   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 67.390      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 23.730    | Titanium (Ti):  | 101.980     |
| Boron (B):      | 34.690      | Lanthanum (La): | 234.680    | Praseodymium (Pr): | 78.590    | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | <50.000 U   | Lead (Pb):      | 22.640     | Rubidium (Rb):     | 52.640    | Uranium (U):    | 630.100     |
| Cadmium (Cd):   | 1,834.290   | Lithium (Li):   | 272.380    | Silver (Ag):       | <1.000 U  | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 766.260     | Mercury (Hg):   | NR         | Selenium (Se):     | 18.900    | Zinc (Zn):      | 597,500.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | <1.000 U    |

## Field Chemistry and Other Analytical Results

|                                     |         |   |           |  |           |
|-------------------------------------|---------|---|-----------|--|-----------|
| **Total Dissolved Solids (mg/L):    | 9525.93 | Field Hardness as CaCO <sub>3</sub> (mg/L):   | NR        | Ammonia (mg/L):                          | NR        |
| **Sum of Diss. Constituents (mg/L): | 9525.93 | Hardness as CaCO <sub>3</sub> :               | 3737.34   | T.P. Hydrocarbons (µg/L):                | NR        |
| Field Conductivity (µmhos):         | 7300    | Field Alkalinity as CaCO <sub>3</sub> (mg/L): | NR        | PCP (µg/L):                              | NR        |
| Lab Conductivity (µmhos):           | 7511    | Alkalinity as CaCO <sub>3</sub> (mg/L):       | 0         | Phosphorus, TD (mg/L):                   | <0.300 U  |
| Field pH:                           | 3.93    | Ryznar Stability Index:                       | 13.688    | Field Nitrate (mg/L):                    | NR        |
| Lab pH:                             | 3.87    | Sodium Adsorption Ratio:                      | 0.5409    | Field Dissolved O <sub>2</sub> (mg/L):   | 9.220     |
| Water Temp (°C):                    | 3.1     | Langlier Saturation Index:                    | -4.909    | Field Chloride (mg/L):                   | NR        |
| Air Temp (°C):                      | NR      | Nitrite (mg/L as N):                          | <0.050 U  | Field Redox (mV):                        | 653       |
| Nitrate + Nitrite (mg/L as N)       | NR      | Hydroxide (mg/L as OH):                       | 0.000     | Lab, Dissolved Organic Carbon (mg/L):    | NR        |
| Total Kjeldahl Nitrogen (mg/L as N) | NR      | Lab, Dissolved Inorganic Carbon (mg/L):       | NR        | Lab, Total Organic Carbon (mg/L):        | NR        |
| Total Nitrogen (mg/L as N)          | NR      | Acidity to 4.5 (mg/L CaCO <sub>3</sub> )      | 1,192.000 | Acidity to 8.3 (mg/L CaCO <sub>3</sub> ) | 3,532.000 |
| As(III) (ug/L)                      | NR      | As(V) (ug/L)                                  | NR        | Total Susp Solids (mg/L)                 | NR        |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.02 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO<sub>3</sub>, CO<sub>3</sub>, SO<sub>4</sub>, Cl, SiO<sub>2</sub>, NO<sub>3</sub>, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

## Disclaimer

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225209 / 120678

Sample Date: 11/9/2017 1:22:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 20 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:56 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1

Site Type: MINE

Procedure Type: DISSOLVED

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                      | mg/L    | meq/L          |                       | mg/L      | meq/L          |
|----------------------|---------|----------------|-----------------------|-----------|----------------|
| Calcium (Ca)         | 472.180 | 23.562         | Bicarbonate (HCO3)    | 0.000     | 0.000          |
| Magnesium (Mg)       | 626.720 | 51.573         | Carbonate (CO3)       | 0.000     | 0.000          |
| Sodium (Na)          | 74.680  | 3.249          | Chloride (Cl)         | 23.180    | 0.654          |
| Potassium (K)        | 9.810   | 0.251          | Sulfate (SO4)         | 7,025.000 | 146.331        |
| Iron (Fe)            | 1.824   | 0.065          | Nitrate (as N)        | 0.280     | 0.020          |
| Manganese (Mn)       | 267.250 | 9.728          | Fluoride (F)          | 32.800    | 1.727          |
| Silica (SiO2)        | 122.540 |                | Orthophosphate (as P) | <0.100 U  | 0.000          |
| <b>Total Cations</b> |         | <b>143.376</b> | <b>Total Anions</b>   |           | <b>148.731</b> |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 312,175.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 4.670 J   | Strontium (Sr): | 1,140.910   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 11.760     | Nickel (Ni):       | 1,272.940 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 3.970 J     | Cobalt (Co):    | 1,704.830  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 27.640      |
| Barium (Ba):    | 8.110       | Copper (Cu):    | 59,900.660 | Neodymium (Nd):    | 357.600   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 69.410      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 24.350    | Titanium (Ti):  | 114.200     |
| Boron (B):      | 33.080      | Lanthanum (La): | 217.640    | Praseodymium (Pr): | 100.520   | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | <50.000 U   | Lead (Pb):      | 16.280     | Rubidium (Rb):     | 55.890    | Uranium (U):    | 716.090     |
| Cadmium (Cd):   | 2,061.150   | Lithium (Li):   | 288.250    | Silver (Ag):       | <1.000 U  | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 965.050     | Mercury (Hg):   | NR         | Selenium (Se):     | 20.680    | Zinc (Zn):      | 599,000.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | 12.820      |

## Field Chemistry and Other Analytical Results

|                                      |         |   |           |                                       |           |
|--------------------------------------|---------|---|-----------|---------------------------------------|-----------|
| **Total Dissolved Solids (mg/L):     | 9627.98 | Field Hardness as CaCO3 (mg/L):         | NR        | Ammonia (mg/L):                       | NR        |
| **Sum of Diss. Constituents (mg/L):  | 9627.98 | Hardness as CaCO3:                      | 3758.61   | T.P. Hydrocarbons (µg/L):             | NR        |
| Field Conductivity (µmhos):          | 7360    | Field Alkalinity as CaCO3 (mg/L):       | NR        | PCP (µg/L):                           | NR        |
| Lab Conductivity (µmhos):            | 7540    | Alkalinity as CaCO3 (mg/L):             | 0         | Phosphorus, TD (mg/L):                | <0.300 U  |
| Field pH:                            | 3.92    | Ryznar Stability Index:                 | 13.712    | Field Nitrate (mg/L):                 | NR        |
| Lab pH:                              | 3.84    | Sodium Adsorption Ratio:                | 0.5323    | Field Dissolved O2 (mg/L):            | 8.850     |
| Water Temp (°C):                     | 3.82    | Langlier Saturation Index:              | -4.936    | Field Chloride (mg/L):                | NR        |
| Air Temp (°C):                       | NR      | Nitrite (mg/L as N):                    | <0.050 U  | Field Redox (mV):                     | 657       |
| Nitrate + Nitrite (mg/L as N):       | NR      | Hydroxide (mg/L as OH):                 | 0.000     | Lab, Dissolved Organic Carbon (mg/L): | NR        |
| Total Kjeldahl Nitrogen (mg/L as N): | NR      | Lab, Dissolved Inorganic Carbon (mg/L): | NR        | Lab, Total Organic Carbon (mg/L):     | NR        |
| Total Nitrogen (mg/L as N):          | NR      | Acidity to 4.5 (mg/L CaCO3):            | 1,239.000 | Acidity to 8.3 (mg/L CaCO3):          | 3,644.000 |
| As(III) (ug/L):                      | NR      | As(V) (ug/L):                           | NR        | Total Susp Solids (mg/L):             | NR        |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.06 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225210 / 120678

Sample Date: 11/9/2017 1:55:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 60 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:56 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1

Site Type: MINE

Procedure Type: DISSOLVED

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                            | mg/L    | meq/L          |                                 | mg/L      | meq/L          |
|----------------------------|---------|----------------|---------------------------------|-----------|----------------|
| Calcium (Ca)               | 467.120 | 23.309         | Bicarbonate (HCO <sub>3</sub> ) | 0.000     | 0.000          |
| Magnesium (Mg)             | 621.500 | 51.143         | Carbonate (CO <sub>3</sub> )    | 0.000     | 0.000          |
| Sodium (Na)                | 72.630  | 3.159          | Chloride (Cl)                   | 19.380    | 0.547          |
| Potassium (K)              | 10.270  | 0.263          | Sulfate (SO <sub>4</sub> )      | 7,010.000 | 146.018        |
| Iron (Fe)                  | 1.606   | 0.058          | Nitrate (as N)                  | 0.260     | 0.019          |
| Manganese (Mn)             | 268.750 | 9.783          | Fluoride (F)                    | 47.510    | 2.501          |
| Silica (SiO <sub>2</sub> ) | 123.440 |                | Orthophosphate (as P)           | <0.100 U  | 0.000          |
| <b>Total Cations</b>       |         | <b>142.612</b> | <b>Total Anions</b>             |           | <b>149.084</b> |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 312,125.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 4.480 J   | Strontium (Sr): | 1,114.470   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 12.100     | Nickel (Ni):       | 1,232.450 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 4.590       | Cobalt (Co):    | 1,687.510  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 26.550      |
| Barium (Ba):    | 8.290       | Copper (Cu):    | 57,715.950 | Neodymium (Nd):    | 378.690   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 75.900      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 24.140    | Titanium (Ti):  | 107.120     |
| Boron (B):      | 39.790      | Lanthanum (La): | 252.690    | Praseodymium (Pr): | 97.900    | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | <50.000 U   | Lead (Pb):      | 17.500     | Rubidium (Rb):     | 55.000    | Uranium (U):    | 701.280     |
| Cadmium (Cd):   | 2,018.940   | Lithium (Li):   | 290.120    | Silver (Ag):       | <1.000 U  | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 943.460     | Mercury (Hg):   | NR         | Selenium (Se):     | 21.670    | Zinc (Zn):      | 599,750.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | <1.000 U    |

## Field Chemistry and Other Analytical Results

|                                     |         |   |           |  |           |
|-------------------------------------|---------|---|-----------|--|-----------|
| **Total Dissolved Solids (mg/L):    | 9612.21 | Field Hardness as CaCO <sub>3</sub> (mg/L):   | NR        | Ammonia (mg/L):                          | NR        |
| **Sum of Diss. Constituents (mg/L): | 9612.21 | Hardness as CaCO <sub>3</sub> :               | 3724.49   | T.P. Hydrocarbons (µg/L):                | NR        |
| Field Conductivity (µmhos):         | 7350    | Field Alkalinity as CaCO <sub>3</sub> (mg/L): | NR        | PCP (µg/L):                              | NR        |
| Lab Conductivity (µmhos):           | 7518    | Alkalinity as CaCO <sub>3</sub> (mg/L):       | 0         | Phosphorus, TD (mg/L):                   | <0.300 U  |
| Field pH:                           | 3.95    | Ryznar Stability Index:                       | 13.711    | Field Nitrate (mg/L):                    | NR        |
| Lab pH:                             | 3.85    | Sodium Adsorption Ratio:                      | 0.5205    | Field Dissolved O <sub>2</sub> (mg/L):   | 7.640     |
| Water Temp (°C):                    | 4.2     | Langlier Saturation Index:                    | -4.931    | Field Chloride (mg/L):                   | NR        |
| Air Temp (°C):                      | NR      | Nitrite (mg/L as N):                          | <0.050 U  | Field Redox (mV):                        | 663       |
| Nitrate + Nitrite (mg/L as N)       | NR      | Hydroxide (mg/L as OH):                       | 0.000     | Lab, Dissolved Organic Carbon (mg/L):    | NR        |
| Total Kjeldahl Nitrogen (mg/L as N) | NR      | Lab, Dissolved Inorganic Carbon (mg/L):       | NR        | Lab, Total Organic Carbon (mg/L):        | NR        |
| Total Nitrogen (mg/L as N)          | NR      | Acidity to 4.5 (mg/L CaCO <sub>3</sub> )      | 1,120.000 | Acidity to 8.3 (mg/L CaCO <sub>3</sub> ) | 3,399.000 |
| As(III) (ug/L)                      | NR      | As(V) (ug/L)                                  | NR        | Total Susp Solids (mg/L)                 | NR        |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.03 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO<sub>3</sub>, CO<sub>3</sub>, SO<sub>4</sub>, Cl, SiO<sub>2</sub>, NO<sub>3</sub>, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

## Disclaimer

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

Compare to Water Quality Standards

## Location Information

Sample Id/Site Id: 225211 / 120678

Sample Date: 11/9/2017 2:28:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 200 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:56 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1

Site Type: MINE

Procedure Type: DISSOLVED

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                            | mg/L    | meq/L          |                                 | mg/L      | meq/L          |
|----------------------------|---------|----------------|---------------------------------|-----------|----------------|
| Calcium (Ca)               | 463.930 | 23.150         | Bicarbonate (HCO <sub>3</sub> ) | 0.000     | 0.000          |
| Magnesium (Mg)             | 617.820 | 50.840         | Carbonate (CO <sub>3</sub> )    | 0.000     | 0.000          |
| Sodium (Na)                | 74.510  | 3.241          | Chloride (Cl)                   | 24.180    | 0.682          |
| Potassium (K)              | 10.430  | 0.267          | Sulfate (SO <sub>4</sub> )      | 7,012.000 | 146.060        |
| Iron (Fe)                  | 1.320   | 0.047          | Nitrate (as N)                  | 0.260     | 0.019          |
| Manganese (Mn)             | 272.200 | 9.908          | Fluoride (F)                    | 47.890    | 2.521          |
| Silica (SiO <sub>2</sub> ) | 124.560 |                | Orthophosphate (as P)           | <0.100 U  | 0.000          |
| <b>Total Cations</b>       |         | <b>142.408</b> | <b>Total Anions</b>             |           | <b>149.282</b> |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 311,650.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 4.480 J   | Strontium (Sr): | 1,128.130   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 11.190     | Nickel (Ni):       | 1,290.790 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 4.170       | Cobalt (Co):    | 1,718.350  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 25.760      |
| Barium (Ba):    | 7.990       | Copper (Cu):    | 59,811.790 | Neodymium (Nd):    | 360.070   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 77.600      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 24.370    | Titanium (Ti):  | 114.710     |
| Boron (B):      | 29.860      | Lanthanum (La): | 220.280    | Praseodymium (Pr): | 103.540   | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | <50.000 U   | Lead (Pb):      | 14.720     | Rubidium (Rb):     | 55.450    | Uranium (U):    | 717.920     |
| Cadmium (Cd):   | 2,085.290   | Lithium (Li):   | 293.780    | Silver (Ag):       | <1.000 U  | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 983.600     | Mercury (Hg):   | NR         | Selenium (Se):     | 21.140    | Zinc (Zn):      | 601,200.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | <1.000 U    |

## Field Chemistry and Other Analytical Results

|                                     |         |   |           |  |           |
|-------------------------------------|---------|---|-----------|--|-----------|
| **Total Dissolved Solids (mg/L):    | 9621.41 | Field Hardness as CaCO <sub>3</sub> (mg/L):   | NR        | Ammonia (mg/L):                          | NR        |
| **Sum of Diss. Constituents (mg/L): | 9621.41 | Hardness as CaCO <sub>3</sub> :               | 3701.38   | T.P. Hydrocarbons (µg/L):                | NR        |
| Field Conductivity (µmhos):         | 7350    | Field Alkalinity as CaCO <sub>3</sub> (mg/L): | NR        | PCP (µg/L):                              | NR        |
| Lab Conductivity (µmhos):           | 7471    | Alkalinity as CaCO <sub>3</sub> (mg/L):       | 0         | Phosphorus, TD (mg/L):                   | <0.300 U  |
| Field pH:                           | 4       | Ryznar Stability Index:                       | 13.697    | Field Nitrate (mg/L):                    | NR        |
| Lab pH:                             | 3.87    | Sodium Adsorption Ratio:                      | 0.5364    | Field Dissolved O <sub>2</sub> (mg/L):   | 6.230     |
| Water Temp (°C):                    | 4.15    | Langlier Saturation Index:                    | -4.914    | Field Chloride (mg/L):                   | NR        |
| Air Temp (°C):                      | NR      | Nitrite (mg/L as N):                          | <0.050 U  | Field Redox (mV):                        | 661       |
| Nitrate + Nitrite (mg/L as N)       | NR      | Hydroxide (mg/L as OH):                       | 0.000     | Lab, Dissolved Organic Carbon (mg/L):    | NR        |
| Total Kjeldahl Nitrogen (mg/L as N) | NR      | Lab, Dissolved Inorganic Carbon (mg/L):       | NR        | Lab, Total Organic Carbon (mg/L):        | NR        |
| Total Nitrogen (mg/L as N)          | NR      | Acidity to 4.5 (mg/L CaCO <sub>3</sub> )      | 1,120.000 | Acidity to 8.3 (mg/L CaCO <sub>3</sub> ) | 3,535.000 |
| As(III) (ug/L)                      | NR      | As(V) (ug/L)                                  | NR        | Total Susp Solids (mg/L)                 | NR        |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.03 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO<sub>3</sub>, CO<sub>3</sub>, SO<sub>4</sub>, Cl, SiO<sub>2</sub>, NO<sub>3</sub>, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225212 / 120678

Sample Date: 11/9/2017 2:50:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 450 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:56 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1

Site Type: MINE

Procedure Type: DISSOLVED

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                      | mg/L    | meq/L   |                       | mg/L      | meq/L   |
|----------------------|---------|---------|-----------------------|-----------|---------|
| Calcium (Ca)         | 465.900 | 23.248  | Bicarbonate (HCO3)    | 0.000     | 0.000   |
| Magnesium (Mg)       | 620.170 | 51.034  | Carbonate (CO3)       | 0.000     | 0.000   |
| Sodium (Na)          | 70.340  | 3.060   | Chloride (Cl)         | 24.400    | 0.688   |
| Potassium (K)        | 10.190  | 0.261   | Sulfate (SO4)         | 7,027.000 | 146.372 |
| Iron (Fe)            | 1.150   | 0.041   | Nitrate (as N)        | 0.260     | 0.019   |
| Manganese (Mn)       | 268.400 | 9.770   | Fluoride (F)          | 32.790    | 1.726   |
| Silica (SiO2)        | 123.010 |         | Orthophosphate (as P) | <0.100 U  | 0.000   |
| <b>Total Cations</b> |         | 142.176 | <b>Total Anions</b>   |           | 148.805 |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 311,300.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 5.170     | Strontium (Sr): | 1,130.590   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 11.370     | Nickel (Ni):       | 1,247.940 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 5.670       | Cobalt (Co):    | 1,670.890  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 25.940      |
| Barium (Ba):    | 8.400       | Copper (Cu):    | 57,794.470 | Neodymium (Nd):    | 375.160   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 76.680      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 25.070    | Titanium (Ti):  | 110.860     |
| Boron (B):      | 39.590      | Lanthanum (La): | 259.410    | Praseodymium (Pr): | 98.410    | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | <50.000 U   | Lead (Pb):      | 15.020     | Rubidium (Rb):     | 55.850    | Uranium (U):    | 702.310     |
| Cadmium (Cd):   | 2,094.120   | Lithium (Li):   | 292.570    | Silver (Ag):       | <1.000 U  | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 963.160     | Mercury (Hg):   | NR         | Selenium (Se):     | 21.290    | Zinc (Zn):      | 598,250.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | 3.020 J     |

## Field Chemistry and Other Analytical Results

|                                     |         |   |           |                                       |           |
|-------------------------------------|---------|---|-----------|---------------------------------------|-----------|
| **Total Dissolved Solids (mg/L):    | 9609.41 | Field Hardness as CaCO3 (mg/L):         | NR        | Ammonia (mg/L):                       | NR        |
| **Sum of Diss. Constituents (mg/L): | 9609.41 | Hardness as CaCO3:                      | 3715.97   | T.P. Hydrocarbons (µg/L):             | NR        |
| Field Conductivity (µmhos):         | 7370    | Field Alkalinity as CaCO3 (mg/L):       | NR        | PCP (µg/L):                           | NR        |
| Lab Conductivity (µmhos):           | 7574    | Alkalinity as CaCO3 (mg/L):             | 0         | Phosphorus, TD (mg/L):                | <0.300 U  |
| Field pH:                           | 4.02    | Ryznar Stability Index:                 | 13.693    | Field Nitrate (mg/L):                 | NR        |
| Lab pH:                             | 3.87    | Sodium Adsorption Ratio:                | 0.4996    | Field Dissolved O2 (mg/L):            | 6.250     |
| Water Temp (°C):                    | 4.15    | Langlier Saturation Index:              | -4.912    | Field Chloride (mg/L):                | NR        |
| Air Temp (°C):                      | NR      | Nitrite (mg/L as N):                    | <0.050 U  | Field Redox (mV):                     | 665       |
| Nitrate + Nitrite (mg/L as N)       | NR      | Hydroxide (mg/L as OH):                 | 0.000     | Lab, Dissolved Organic Carbon (mg/L): | NR        |
| Total Kjeldahl Nitrogen (mg/L as N) | NR      | Lab, Dissolved Inorganic Carbon (mg/L): | NR        | Lab, Total Organic Carbon (mg/L):     | NR        |
| Total Nitrogen (mg/L as N)          | NR      | Acidity to 4.5 (mg/L CaCO3)             | 1,203.000 | Acidity to 8.3 (mg/L CaCO3)           | 3,496.000 |
| As(III) (ug/L)                      | NR      | As(V) (ug/L)                            | NR        | Total Susp Solids (mg/L)              | NR        |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.07 MG/L

Lab Remarks:

## Notes

**Explanation:** mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC**Qualifiers:** A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.**Disclaimer**

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225213 / 120678

Sample Date: 11/9/2017 12:55:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 3 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:57 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:0 ra:1 fu:0 fa:0

Site Type: MINE

Procedure Type: TOTAL RECOVERABLE

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-  
ACTIVE-ECBED

## Major Ion Results

|                      | mg/L    | meq/L          |                       | mg/L | meq/L        |
|----------------------|---------|----------------|-----------------------|------|--------------|
| Calcium (Ca)         | 465.040 | 23.205         | Bicarbonate (HCO3)    | NR   | 0.000        |
| Magnesium (Mg)       | 600.260 | 49.395         | Carbonate (CO3)       | NR   | 0.000        |
| Sodium (Na)          | 73.830  | 3.212          | Chloride (Cl)         | NR   | 0.000        |
| Potassium (K)        | 10.050  | 0.257          | Sulfate (SO4)         | NR   | 0.000        |
| Iron (Fe)            | 2.552   | 0.091          | Nitrate (as N)        | NR   | 0.000        |
| Manganese (Mn)       | 281.100 | 10.232         | Fluoride (F)          | NR   | 0.000        |
| Silica (SiO2)        | NR      |                | Orthophosphate (as P) | NR   | 0.000        |
| <b>Total Cations</b> |         | <b>142.790</b> | <b>Total Anions</b>   |      | <b>0.000</b> |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 320,800.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 5.240     | Strontium (Sr): | 1,114.880   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 12.460     | Nickel (Ni):       | 1,283.490 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 6.870       | Cobalt (Co):    | 1,681.030  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 25.590      |
| Barium (Ba):    | 7.960       | Copper (Cu):    | 57,205.060 | Neodymium (Nd):    | 371.420   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 70.860      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 23.770    | Titanium (Ti):  | 105.490     |
| Boron (B):      | 51.500      | Lanthanum (La): | 245.460    | Praseodymium (Pr): | 94.510    | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | NR          | Lead (Pb):      | 27.240     | Rubidium (Rb):     | 55.760    | Uranium (U):    | 679.990     |
| Cadmium (Cd):   | 1,969.320   | Lithium (Li):   | 285.570    | Silver (Ag):       | NR        | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 909.680     | Mercury (Hg):   | NR         | Selenium (Se):     | 22.590    | Zinc (Zn):      | 617,750.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | <1.000 U    |

## Field Chemistry and Other Analytical Results

|                                     |      |   |         |                                       |          |
|-------------------------------------|------|---|---------|---------------------------------------|----------|
| **Total Dissolved Solids (mg/L):    | NR   | Field Hardness as CaCO3 (mg/L):         | NR      | Ammonia (mg/L):                       | NR       |
| **Sum of Diss. Constituents (mg/L): | NR   | Hardness as CaCO3:                      | 3631.88 | T.P. Hydrocarbons (µg/L):             | NR       |
| Field Conductivity (µmhos):         | 7300 | Field Alkalinity as CaCO3 (mg/L):       | NR      | PCP (µg/L):                           | NR       |
| Lab Conductivity (µmhos):           | NR   | Alkalinity as CaCO3 (mg/L):             | NR      | Phosphorus, TD (mg/L):                | <0.300 U |
| Field pH:                           | 3.93 | Ryznar Stability Index:                 | 17.565  | Field Nitrate (mg/L):                 | NR       |
| Lab pH:                             | NR   | Sodium Adsorption Ratio:                | 0.5343  | Field Dissolved O2 (mg/L):            | 9.220    |
| Water Temp (°C):                    | 3.1  | Langlier Saturation Index:              | -8.783  | Field Chloride (mg/L):                | NR       |
| Air Temp (°C):                      | NR   | Nitrite (mg/L as N):                    | NR      | Field Redox (mV):                     | 653      |
| Nitrate + Nitrite (mg/L as N)       | NR   | Hydroxide (mg/L as OH):                 | NR      | Lab, Dissolved Organic Carbon (mg/L): | NR       |
| Total Kjeldahl Nitrogen (mg/L as N) | NR   | Lab, Dissolved Inorganic Carbon (mg/L): | NR      | Lab, Total Organic Carbon (mg/L):     | NR       |
| Total Nitrogen (mg/L as N)          | NR   | Acidity to 4.5 (mg/L CaCO3)             | NR      | Acidity to 8.3 (mg/L CaCO3)           | NR       |
| As(III) (ug/L)                      | NR   | As(V) (ug/L)                            | NR      | Total Susp Solids (mg/L)              | NR       |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.02 MG/L

Lab Remarks:

## Notes

**Explanation:** mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

**Qualifiers:** A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225214 / 120678

Sample Date: 11/9/2017 1:22:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 20 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:57 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:0 ra:1 fu:0 fa:0

Site Type: MINE

Procedure Type: TOTAL RECOVERABLE

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                      | mg/L    | meq/L          |                       | mg/L | meq/L        |
|----------------------|---------|----------------|-----------------------|------|--------------|
| Calcium (Ca)         | 470.870 | 23.496         | Bicarbonate (HCO3)    | NR   | 0.000        |
| Magnesium (Mg)       | 608.070 | 50.038         | Carbonate (CO3)       | NR   | 0.000        |
| Sodium (Na)          | 73.830  | 3.212          | Chloride (Cl)         | NR   | 0.000        |
| Potassium (K)        | 10.310  | 0.264          | Sulfate (SO4)         | NR   | 0.000        |
| Iron (Fe)            | 2.142   | 0.077          | Nitrate (as N)        | NR   | 0.000        |
| Manganese (Mn)       | 287.850 | 10.478         | Fluoride (F)          | NR   | 0.000        |
| Silica (SiO2)        | NR      |                | Orthophosphate (as P) | NR   | 0.000        |
| <b>Total Cations</b> |         | <b>144.913</b> | <b>Total Anions</b>   |      | <b>0.000</b> |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 325,950.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 5.320     | Strontium (Sr): | 1,142.820   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 13.680     | Nickel (Ni):       | 1,308.780 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | NR          | Cobalt (Co):    | 1,728.980  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 29.260      |
| Barium (Ba):    | 8.320       | Copper (Cu):    | 58,654.760 | Neodymium (Nd):    | 370.870   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 76.640      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 26.200    | Titanium (Ti):  | 111.510     |
| Boron (B):      | 45.100      | Lanthanum (La): | 258.750    | Praseodymium (Pr): | 98.590    | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | NR          | Lead (Pb):      | 20.540     | Rubidium (Rb):     | 56.970    | Uranium (U):    | 722.510     |
| Cadmium (Cd):   | 2,074.970   | Lithium (Li):   | 296.080    | Silver (Ag):       | <1.000 U  | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 955.760     | Mercury (Hg):   | NR         | Selenium (Se):     | 21.940    | Zinc (Zn):      | 628,650.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | 3.990 J     |

## Field Chemistry and Other Analytical Results

|                                     |      |   |         |                                       |          |
|-------------------------------------|------|---|---------|---------------------------------------|----------|
| **Total Dissolved Solids (mg/L):    | NR   | Field Hardness as CaCO3 (mg/L):         | NR      | Ammonia (mg/L):                       | NR       |
| **Sum of Diss. Constituents (mg/L): | NR   | Hardness as CaCO3:                      | 3678.58 | T.P. Hydrocarbons (µg/L):             | NR       |
| Field Conductivity (µmhos):         | 7360 | Field Alkalinity as CaCO3 (mg/L):       | NR      | PCP (µg/L):                           | NR       |
| Lab Conductivity (µmhos):           | NR   | Alkalinity as CaCO3 (mg/L):             | NR      | Phosphorus, TD (mg/L):                | <0.300 U |
| Field pH:                           | 3.92 | Ryznar Stability Index:                 | 17.554  | Field Nitrate (mg/L):                 | NR       |
| Lab pH:                             | NR   | Sodium Adsorption Ratio:                | 0.5309  | Field Dissolved O2 (mg/L):            | 8.850    |
| Water Temp (°C):                    | 3.82 | Langlier Saturation Index:              | -8.777  | Field Chloride (mg/L):                | NR       |
| Air Temp (°C):                      | NR   | Nitrite (mg/L as N):                    | NR      | Field Redox (mV):                     | 657      |
| Nitrate + Nitrite (mg/L as N)       | NR   | Hydroxide (mg/L as OH):                 | NR      | Lab, Dissolved Organic Carbon (mg/L): | NR       |
| Total Kjeldahl Nitrogen (mg/L as N) | NR   | Lab, Dissolved Inorganic Carbon (mg/L): | NR      | Lab, Total Organic Carbon (mg/L):     | NR       |
| Total Nitrogen (mg/L as N)          | NR   | Acidity to 4.5 (mg/L CaCO3)             | NR      | Acidity to 8.3 (mg/L CaCO3)           | NR       |
| As(III) (ug/L)                      | NR   | As(V) (ug/L)                            | NR      | Total Susp Solids (mg/L)              | NR       |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.06 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225215 / 120678

Sample Date: 11/9/2017 1:55:00 PM

Location (TR5): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 60 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:57 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:0 ra:1 fu:0 fa:0

Site Type: MINE

Procedure Type: TOTAL RECOVERABLE

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

## Major Ion Results

|                      | mg/L    | meq/L   |                       | mg/L | meq/L |
|----------------------|---------|---------|-----------------------|------|-------|
| Calcium (Ca)         | 475.620 | 23.733  | Bicarbonate (HCO3)    | NR   | 0.000 |
| Magnesium (Mg)       | 626.850 | 51.583  | Carbonate (CO3)       | NR   | 0.000 |
| Sodium (Na)          | 74.490  | 3.240   | Chloride (Cl)         | NR   | 0.000 |
| Potassium (K)        | 10.250  | 0.262   | Sulfate (SO4)         | NR   | 0.000 |
| Iron (Fe)            | 1.846   | 0.066   | Nitrate (as N)        | NR   | 0.000 |
| Manganese (Mn)       | 284.950 | 10.372  | Fluoride (F)          | NR   | 0.000 |
| Silica (SiO2)        | NR      |         | Orthophosphate (as P) | NR   | 0.000 |
| <b>Total Cations</b> |         | 147.529 | <b>Total Anions</b>   |      | 0.000 |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 331,175.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 5.140     | Strontium (Sr): | 1,221.970   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 12.900     | Nickel (Ni):       | 1,375.150 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 5.020       | Cobalt (Co):    | 1,790.410  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 28.630      |
| Barium (Ba):    | 8.310       | Copper (Cu):    | 60,238.380 | Neodymium (Nd):    | 377.050   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 78.550      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 24.310    | Titanium (Ti):  | 110.620     |
| Boron (B):      | 37.280      | Lanthanum (La): | 261.910    | Praseodymium (Pr): | 100.870   | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | NR          | Lead (Pb):      | 18.550     | Rubidium (Rb):     | 57.060    | Uranium (U):    | 724.840     |
| Cadmium (Cd):   | 2,096.750   | Lithium (Li):   | 296.630    | Silver (Ag):       | NR        | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 967.320     | Mercury (Hg):   | NR         | Selenium (Se):     | 22.510    | Zinc (Zn):      | 638,150.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | <1.000 U    |

## Field Chemistry and Other Analytical Results

|                                      |      |   |         |                                       |          |
|--------------------------------------|------|---|---------|---------------------------------------|----------|
| **Total Dissolved Solids (mg/L):     | NR   | Field Hardness as CaCO3 (mg/L):         | NR      | Ammonia (mg/L):                       | NR       |
| **Sum of Diss. Constituents (mg/L):  | NR   | Hardness as CaCO3:                      | 3767.74 | T.P. Hydrocarbons (µg/L):             | NR       |
| Field Conductivity (µmhos):          | 7350 | Field Alkalinity as CaCO3 (mg/L):       | NR      | PCP (µg/L):                           | NR       |
| Lab Conductivity (µmhos):            | NR   | Alkalinity as CaCO3 (mg/L):             | NR      | Phosphorus, TD (mg/L):                | <0.300 U |
| Field pH:                            | 3.95 | Ryznar Stability Index:                 | 17.545  | Field Nitrate (mg/L):                 | NR       |
| Lab pH:                              | NR   | Sodium Adsorption Ratio:                | 0.5246  | Field Dissolved O2 (mg/L):            | 7.640    |
| Water Temp (°C):                     | 4.2  | Langlier Saturation Index:              | -8.773  | Field Chloride (mg/L):                | NR       |
| Air Temp (°C):                       | NR   | Nitrite (mg/L as N):                    | NR      | Field Redox (mV):                     | 663      |
| Nitrate + Nitrite (mg/L as N):       | NR   | Hydroxide (mg/L as OH):                 | NR      | Lab, Dissolved Organic Carbon (mg/L): | NR       |
| Total Kjeldahl Nitrogen (mg/L as N): | NR   | Lab, Dissolved Inorganic Carbon (mg/L): | NR      | Lab, Total Organic Carbon (mg/L):     | NR       |
| Total Nitrogen (mg/L as N):          | NR   | Acidity to 4.5 (mg/L CaCO3):            | NR      | Acidity to 8.3 (mg/L CaCO3):          | NR       |
| As(III) (µg/L):                      | NR   | As(V) (µg/L):                           | NR      | Total Susp Solids (mg/L):             | NR       |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.03 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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## Ground-Water Information Center Water Quality Report

Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE

[Compare to Water Quality Standards](#)

## Location Information

Sample Id/Site Id: 225216 / 120678

Sample Date: 11/9/2017 2:28:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 200 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:57 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:0 ra:1 fu:0 fa:0

Site Type: MINE

Procedure Type: TOTAL RECOVERABLE

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-  
ACTIVE-ECBED

## Major Ion Results

|                      | mg/L    | meq/L          |                       | mg/L | meq/L        |
|----------------------|---------|----------------|-----------------------|------|--------------|
| Calcium (Ca)         | 474.230 | 23.664         | Bicarbonate (HCO3)    | NR   | 0.000        |
| Magnesium (Mg)       | 635.900 | 52.328         | Carbonate (CO3)       | NR   | 0.000        |
| Sodium (Na)          | 72.510  | 3.154          | Chloride (Cl)         | NR   | 0.000        |
| Potassium (K)        | 10.580  | 0.271          | Sulfate (SO4)         | NR   | 0.000        |
| Iron (Fe)            | 1.649   | 0.059          | Nitrate (as N)        | NR   | 0.000        |
| Manganese (Mn)       | 283.400 | 10.316         | Fluoride (F)          | NR   | 0.000        |
| Silica (SiO2)        | NR      |                | Orthophosphate (as P) | NR   | 0.000        |
| <b>Total Cations</b> |         | <b>147.939</b> | <b>Total Anions</b>   |      | <b>0.000</b> |

## Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 330,700.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 4.620 J   | Strontium (Sr): | 1,240.710   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 13.030     | Nickel (Ni):       | 1,367.660 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 5.540       | Cobalt (Co):    | 1,788.970  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 26.060      |
| Barium (Ba):    | 8.250       | Copper (Cu):    | 61,158.250 | Neodymium (Nd):    | 375.840   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 74.880      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 24.120    | Titanium (Ti):  | 111.740     |
| Boron (B):      | 42.200      | Lanthanum (La): | 265.540    | Praseodymium (Pr): | 103.790   | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | NR          | Lead (Pb):      | 19.120     | Rubidium (Rb):     | 57.250    | Uranium (U):    | 728.420     |
| Cadmium (Cd):   | 2,146.160   | Lithium (Li):   | 314.680    | Silver (Ag):       | NR        | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 997.800     | Mercury (Hg):   | NR         | Selenium (Se):     | 23.620    | Zinc (Zn):      | 634,850.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | <1.000 U    |

## Field Chemistry and Other Analytical Results

|                                      |      |   |         |                                       |          |
|--------------------------------------|------|---|---------|---------------------------------------|----------|
| **Total Dissolved Solids (mg/L):     | NR   | Field Hardness as CaCO3 (mg/L):         | NR      | Ammonia (mg/L):                       | NR       |
| **Sum of Diss. Constituents (mg/L):  | NR   | Hardness as CaCO3:                      | 3801.52 | T.P. Hydrocarbons (µg/L):             | NR       |
| Field Conductivity (µmhos):          | 7350 | Field Alkalinity as CaCO3 (mg/L):       | NR      | PCP (µg/L):                           | NR       |
| Lab Conductivity (µmhos):            | NR   | Alkalinity as CaCO3 (mg/L):             | NR      | Phosphorus, TD (mg/L):                | <0.300 U |
| Field pH:                            | 4    | Ryznar Stability Index:                 | 17.548  | Field Nitrate (mg/L):                 | NR       |
| Lab pH:                              | NR   | Sodium Adsorption Ratio:                | 0.5152  | Field Dissolved O2 (mg/L):            | 6.230    |
| Water Temp (°C):                     | 4.15 | Langlier Saturation Index:              | -8.774  | Field Chloride (mg/L):                | NR       |
| Air Temp (°C):                       | NR   | Nitrite (mg/L as N):                    | NR      | Field Redox (mV):                     | 661      |
| Nitrate + Nitrite (mg/L as N):       | NR   | Hydroxide (mg/L as OH):                 | NR      | Lab, Dissolved Organic Carbon (mg/L): | NR       |
| Total Kjeldahl Nitrogen (mg/L as N): | NR   | Lab, Dissolved Inorganic Carbon (mg/L): | NR      | Lab, Total Organic Carbon (mg/L):     | NR       |
| Total Nitrogen (mg/L as N):          | NR   | Acidity to 4.5 (mg/L CaCO3):            | NR      | Acidity to 8.3 (mg/L CaCO3):          | NR       |
| As(III) (ug/L):                      | NR   | As(V) (ug/L):                           | NR      | Total Susp Solids (mg/L):             | NR       |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.05 MG/L

Lab Remarks:

## Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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Ground-Water Information Center Water Quality Report  
Report Date: 12/4/2017

Site Name: BUTTE MINE FLOODING OU BERKELEY PIT LAKE  
Compare to Water Quality Standards

#### Location Information

Sample Id/Site Id: 225217 / 120678

Sample Date: 11/9/2017 2:50:00 PM

Location (TRS): 03N 07W 18 AABC

Agency/Sampler: MBMG / ICOPINI, GARY/MCGRATH, STEVE

Latitude/Longitude: 46° 1' 1" N 112° 30' 48" W

Field Number: BERKELEY PIT 450 FT

Datum: NAD83

Lab Date: 12/2/2017 1:11:57 PM

Altitude: 4615

Lab/Analyst: MBMG / TIMMER, JACKIE

County/State: SILVER BOW / MT

Sample Method/Handling: GRAB / ru:0 ra:1 fu:0 fa:0

Site Type: MINE

Procedure Type: TOTAL RECOVERABLE

Geology: 211BDBT

Total Depth (ft): NR

USGS 7.5' Quad: BUTTE NORTH

SWL-MP (ft): NR

PWS Id:

Depth Water Enters (ft): NR

Project: MINEFLO, MINEFLO\_2002CDMP, MINEFLO-ACTIVE-ECBED

#### Major Ion Results

|                      | mg/L    | meq/L          |                       | mg/L | meq/L        |
|----------------------|---------|----------------|-----------------------|------|--------------|
| Calcium (Ca)         | 469.360 | 23.421         | Bicarbonate (HCO3)    | NR   | 0.000        |
| Magnesium (Mg)       | 627.520 | 51.639         | Carbonate (CO3)       | NR   | 0.000        |
| Sodium (Na)          | 73.890  | 3.214          | Chloride (Cl)         | NR   | 0.000        |
| Potassium (K)        | 10.840  | 0.277          | Sulfate (SO4)         | NR   | 0.000        |
| Iron (Fe)            | 2.250   | 0.081          | Nitrate (as N)        | NR   | 0.000        |
| Manganese (Mn)       | 280.050 | 10.194         | Fluoride (F)          | NR   | 0.000        |
| Silica (SiO2)        | NR      |                | Orthophosphate (as P) | NR   | 0.000        |
| <b>Total Cations</b> |         | <b>146.241</b> | <b>Total Anions</b>   |      | <b>0.000</b> |

#### Trace Element Results (µg/L)

|                 |             |                 |            |                    |           |                 |             |
|-----------------|-------------|-----------------|------------|--------------------|-----------|-----------------|-------------|
| Aluminum (Al):  | 326,225.000 | Cesium (Cs):    | <1.000 U   | Molybdenum (Mo):   | 5.110     | Strontium (Sr): | 1,216.170   |
| Antimony (Sb):  | <1.000 U    | Chromium (Cr):  | 13.050     | Nickel (Ni):       | 1,381.140 | Thallium (Tl):  | <1.000 U    |
| Arsenic (As):   | 7.760       | Cobalt (Co):    | 1,750.640  | Niobium (Nb):      | <1.000 U  | Thorium (Th):   | 27.480      |
| Barium (Ba):    | 8.500       | Copper (Cu):    | 59,653.430 | Neodymium (Nd):    | 373.220   | Tin (Sn):       | <1.000 U    |
| Beryllium (Be): | 76.740      | Gallium (Ga):   | <1.000 U   | Palladium (Pd):    | 26.590    | Titanium (Ti):  | 111.280     |
| Boron (B):      | 40.240      | Lanthanum (La): | 259.900    | Praseodymium (Pr): | 99.120    | Tungsten (W):   | <1.000 U    |
| Bromide (Br):   | NR          | Lead (Pb):      | 17.330     | Rubidium (Rb):     | 56.480    | Uranium (U):    | 703.850     |
| Cadmium (Cd):   | 2,082.500   | Lithium (Li):   | 303.880    | Silver (Ag):       | NR        | Vanadium (V):   | <1.000 U    |
| Cerium (Ce):    | 955.250     | Mercury (Hg):   | NR         | Selenium (Se):     | 21.010    | Zinc (Zn):      | 628,750.000 |
|                 |             |                 |            |                    |           | Zirconium (Zr): | 4.060 J     |

#### Field Chemistry and Other Analytical Results

|                                      |      |   |         |                                       |          |
|--------------------------------------|------|---|---------|---------------------------------------|----------|
| **Total Dissolved Solids (mg/L):     | NR   | Field Hardness as CaCO3 (mg/L):         | NR      | Ammonia (mg/L):                       | NR       |
| **Sum of Diss. Constituents (mg/L):  | NR   | Hardness as CaCO3:                      | 3754.86 | T.P. Hydrocarbons (µg/L):             | NR       |
| Field Conductivity (µmhos):          | 7370 | Field Alkalinity as CaCO3 (mg/L):       | NR      | PCP (µg/L):                           | NR       |
| Lab Conductivity (µmhos):            | NR   | Alkalinity as CaCO3 (mg/L):             | NR      | Phosphorus, TD (mg/L):                | <0.300 U |
| Field pH:                            | 4.02 | Ryznar Stability Index:                 | 17.557  | Field Nitrate (mg/L):                 | NR       |
| Lab pH:                              | NR   | Sodium Adsorption Ratio:                | 0.5255  | Field Dissolved O2 (mg/L):            | 6.250    |
| Water Temp (°C):                     | 4.15 | Langlier Saturation Index:              | -8.778  | Field Chloride (mg/L):                | NR       |
| Air Temp (°C):                       | NR   | Nitrite (mg/L as N):                    | NR      | Field Redox (mV):                     | 665      |
| Nitrate + Nitrite (mg/L as N):       | NR   | Hydroxide (mg/L as OH):                 | NR      | Lab, Dissolved Organic Carbon (mg/L): | NR       |
| Total Kjeldahl Nitrogen (mg/L as N): | NR   | Lab, Dissolved Inorganic Carbon (mg/L): | NR      | Lab, Total Organic Carbon (mg/L):     | NR       |
| Total Nitrogen (mg/L as N):          | NR   | Acidity to 4.5 (mg/L CaCO3):            | NR      | Acidity to 8.3 (mg/L CaCO3):          | NR       |
| As(III) (ug/L):                      | NR   | As(V) (ug/L):                           | NR      | Total Susp Solids (mg/L):             | NR       |

Sample Condition: CLEAR

Field Remarks: SAMPLES COLLECTED WITH DRONE BOAT; FE(II) = 0.07 MG/L

Lab Remarks:

#### Notes

**Explanation:** mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

**Qualifiers:** A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; \* = Duplicate analysis not within control limits; \*\* = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

#### Disclaimer

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted.