



NWE-2188-4340

Ms. Kimberly D. Bose  
Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

December 15, 2023

Re: NorthWestern Energy filing of License Article 402 2023 Shoreline Erosion Monitoring Report under Project 2188

Dear Secretary Bose,

Per FERC Project 2188 License Order Issued November 26, 2002, NorthWestern Energy (NorthWestern) herein provides the Article 402 shoreline erosion monitoring report for the Missouri-Madison Project titled 2023 Erosion Control Monitoring Surveys. The last shoreline erosion monitoring report for the 2188 Project was filed with the Commission on December 27, 2018 (for years 2014 through 2018). In the filing of the 2018 report, the cover letter had a typographical error on the date on which the next report was planned to be submitted. The letter incorrectly stated 2024 as the next submission date, when in fact 2023 is the correct submission date for the report. This current report filing is intended to satisfy that reporting requirement.

This report documents the shoreline erosion and classification of each previously monitored site on the following reservoirs:

- Morony Reservoir
- Ryan Reservoir
- Cochrane Reservoir
- Rainbow Reservoir
- Black Eagle Reservoir
- Holter Reservoir
- Hauser Reservoir and Lake Helena
- Madison Reservoir (Ennis Lake)
- Hebgen Lake

Each site has been evaluated and erosion at each site has been classified as inactive, minor, moderate, or active by the observed current condition compared to the condition of the site during the previous survey. Shoreline erosion rate and severity may be caused by many factors including reservoir operations, land use, recreational use, and geologic sensitivity. The focus of NorthWestern's shoreline erosion plan is to evaluate shoreline erosion at a landscape scale over time. Therefore, causal factors at individual observed sites have not been determined. Each site was photographed in 2023 and comparisons made between the current photos and those taken in 2018, as well as annual photos taken at sites classified as actively eroding from 2019-2022. A representative photo was selected for each site that best illustrates the site and any documentable erosion. These photos can be found in Appendix A of the report. All

sites/photos have been geo-referenced and their locations identified on the aerial photos found in Appendix B of the report.

A “repaired” site means that measures have been taken to control the erosion of a site. These measures can include riprap embankments and slope modifications. Sites that were labeled as “repaired” in previous evaluations were again labeled as “success” or “partial success” depending on how the repair measure has progressed. Sites that have received some level of repair were labeled as a “partial repair”.

An “inactive” site means that no erosion appears to have occurred since the last evaluation five years ago. An inactive site means that there is little chance of future erosion if the current conditions are maintained. Most areas categorized as inactive are adequately vegetated, thus reducing the possibility of erosion.

Sites categorized as having “minor activity” show little sign of change from the time of last evaluation. A site labeled “moderate activity” shows signs that some erosion has taken place since the last evaluation. An “active” site means that significant erosion has taken place since the last evaluation.

**Table 1** below provides a summary of the shoreline erosion sites displaying moderate or active erosion that were surveyed in 2018 and 2023. There was an increase in the number of moderate erosion sites on Hebgen Reservoir (2 new sites), as well as an increase in the number of active erosion sites on Holter Reservoir (5 sites) and Hauser Reservoir (4 sites). Cochrane and Madison Reservoirs each showed a decrease in the number of active erosion sites since the 2018 monitoring.

**Table 1. Summary and comparison of moderate and active shoreline erosion sites surveyed**

Facility Name	Sites Surveyed	Moderate Sites (2023)	Moderate Sites (2018)	Percent Change <sup>1</sup>	Active Sites (2023)	Active Sites (2018)	Percent Change <sup>1</sup>
Morony	24	2	2	<b>(0%)</b>	0	0	<b>(0%)</b>
Ryan	20	2	2	<b>(0%)</b>	1	1	<b>(0%)</b>
Cochrane	25	8	8	<b>(0%)</b>	2	3	<b>(-23%)</b>
Rainbow	17	0	0	<b>(0%)</b>	0	0	<b>(0%)</b>
Black Eagle	22	0	0	<b>(0%)</b>	0	0	<b>(0%)</b>
Holter	70	14	14	<b>(0%)</b>	15	10	<b>(+150%)</b>
Hauser	95	19	20	<b>(-5%)</b>	8	4	<b>(+200%)</b>
Madison	48	0	0	<b>(0%)</b>	1	2	<b>(-50%)</b>
Hebgen	112	21	19	<b>(+10%)</b>	1	1	<b>(0%)</b>

<sup>1</sup>Numbers in **bold** show no increase or a decrease in the number of shoreline erosion sites

A voluntary nine inch winter drawdown of Hauser Reservoir has been implemented annually with the intent to reduce or eliminate shoreline erosion caused by ice. The increase in the number of active erosional sites on Hauser suggests that the benefit of this drawdown may be offset by changes in surrounding land use and the impacts of heavy recreation use on the reservoir.

The voluntary nine inch drawdown of Holter Reservoir, originally contemplated in 2013 to mitigate ice scouring, was never implemented due to public safety concerns over ice stability for fisherman that frequent the reservoir in the wintertime. NorthWestern will keep this option

available but will not routinely implement it unless deemed safe for public recreationists and necessary at a particular site.

The winter drawdown at Ennis Lake (Madison Project) appears to be effective at reducing ice-caused shoreline erosion on that reservoir.

NorthWestern provided this report to the Montana Department of Environmental Quality, the Montana State Historic Preservation Office, Montana Fish Wildlife and Parks, the US Forest Service, and the US Bureau of Land Management for 30 day review and comment. A record of agency consultation is included with this letter.

Thank you for your consideration of this report. The next five-year monitoring report (2024 through 2028) will be submitted for your review at the end of 2028.

Sincerely,



**Mary Gail Sullivan**

*Director, Environmental and Lands*

Cc: Andy Welch, NWE  
Jordan Tollefson, NWE  
Adam Strainer, FWP  
Eileen Ryce, FWP  
Jake Chaffin, USFS  
Mary Erickson, USFS  
Chris Boone, BLM  
Lindsey Babcock, BLM  
Keenan Storrar, DEQ  
Peter Brown, SHPO

Northwestern Energy has consulted with agencies in the preparation and filing of the License Article 402 Five-Year (2019 through 2023) Shoreline Erosion Monitoring Report. As signed below, the following agencies agree with the content described above and in the attached summary report. The Montana State Historic Preservation Office reviewed the report and commented that there is nothing in the report that pertains to SHPO's expertise and therefore nothing for SHPO to approve with its signature.

By: Keenan Storrar *Keenan Storrar*

Title: 401 WQC coordinator  
Representing Montana Department of Environmental Quality

Date: 12/7/2023

By: *[Signature]* FOR Eileen Ryce  
Title: Habitat Bureau Chief (acting)  
Representing Montana Department of Fish, Wildlife, and Parks

Date: 12.7.2023

By: MARY ERICKSON *[Signature]* Digitally signed by MARY ERICKSON  
Date: 2023.12.14 16:48:11 -07'00'

Title: Forest Supervisor  
Representing U.S. Forest Service

Date: 12/14/2023

By: LINDSEY BABCOCK *[Signature]* Digitally signed by LINDSEY BABCOCK  
Date: 2023.12.15 09:31:32 -07'00'

Title: Butte Field Manager  
Representing U.S. Bureau of Land Management

Date: 12/15/2023

By: \_\_\_\_\_

Title: \_\_\_\_\_  
Representing Montana State Historical Preservation Office

Date: \_\_\_\_\_



## Tollefson, Jordan

---

**From:** Brown, Peter <pebrown@mt.gov>  
**Sent:** Monday, December 4, 2023 10:50 AM  
**To:** Tollefson, Jordan  
**Cc:** Gilk, Samantha  
**Subject:** [EXTERNAL] RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

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Good morning, Jordan. The Montana State Historic Preservation Office (SHPO) reviewed the Shoreline Erosion report you provided and didn't see any reference to cultural resources. Because nothing in the report pertains to SHPO's expertise, there is nothing for SHPO to approve with its signature.

Thank you.

Pete Brown  
State Historic Preservation Officer  
Montana State Historic Preservation Office  
406-444-7718



---

**From:** Tollefson, Jordan <Jordan.Tollefson@northwestern.com>  
**Sent:** Friday, December 1, 2023 10:50 AM  
**To:** Strainer, Adam <astrainer@mt.gov>; jake.chaffin <jake.chaffin@usda.gov>; Chris Boone (ctboone@blm.gov) <ctboone@blm.gov>; 'Babcock, Lindsey G' <lbabcock@blm.gov>; Storrar, Keenan <Keenan.Storrar@mt.gov>; Brown, Peter <pebrown@mt.gov>  
**Cc:** Sullivan, Mary Gail <MaryGail.Sullivan@northwestern.com>; andrew.welch@northwestern.com; Hagengruber, Joseph (Joe) <Joe.Hagengruber@northwestern.com>  
**Subject:** [EXTERNAL] RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report  
**Importance:** High

This is just a friendly reminder that NorthWestern Energy is requesting formal agency approval on the Madison-Missouri Shoreline Erosion Monitoring Report from FWP, USFS, BLM, DEQ, and SHPO by no later than next Thursday, December 7<sup>th</sup>. Attached is the cover letter that we intend to file with the report and submit to FERC, which will need signed approval from each agency representative. The report itself can be downloaded through our FTP site using the following link: <https://send.northwesternenergy.com/link/BBYGN6niBzG5Y79eeUZAS9> [send.northwesternenergy.com]

Thank you for reviewing the report and providing any comments that you may have.

Sincerely,  
Jordan Tollefson

---

**Jordan Tollefson**

*Hydro Compliance Professional*

[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)

**O (406) 443-8907**

**C (406) 565-3879**

208 N Montana Avenue, Suite 200  
Helena, MT 59601



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[\[northwesternenergy.com\]](http://northwesternenergy.com)

---

**From:** Tollefson, Jordan

**Sent:** Monday, November 6, 2023 4:24 PM

**To:** 'Strainer, Adam' <[astrainer@mt.gov](mailto:astrainer@mt.gov)>; Jake Chaffin <[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)>; Chris Boone (<[ctboone@blm.gov](mailto:ctboone@blm.gov)> <[ctboone@blm.gov](mailto:ctboone@blm.gov)>; 'Babcock, Lindsey G' <[lbabcock@blm.gov](mailto:lbabcock@blm.gov)>; Keenan Storrar <[keenan.storrar@mt.gov](mailto:keenan.storrar@mt.gov)>; 'pebrown@mt.gov' <[pebrown@mt.gov](mailto:pebrown@mt.gov)>

**Cc:** Sullivan, Mary Gail <[MaryGail.Sullivan@northwestern.com](mailto:MaryGail.Sullivan@northwestern.com)>; Welch, Andrew <[Andrew.Welch@northwestern.com](mailto:Andrew.Welch@northwestern.com)>; Hagengruber, Joseph (Joe) <[Joe.Hagengruber@northwestern.com](mailto:Joe.Hagengruber@northwestern.com)>

**Subject:** Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

Good afternoon,

NorthWestern Energy recently completed the latest 5-year shoreline erosion monitoring report for the FERC Project 2188 Madison-Missouri Reservoirs under License Article 402. As a part of this effort, we would like to make the report available for your review and comment. The last version of this report was filed with FERC in 2018, so some of you may be new to this and unfamiliar with the history of the shoreline erosion monitoring program. Each one of the eleven NorthWestern managed reservoirs on the Madison and Missouri Rivers is monitored once every 5 years to document shoreline erosion as a part of a long-term monitoring process. This monitoring compares photo-points at each erosion site to previous years to determine if conditions are improving, staying the same, or degrading at that particular site. Annual monitoring is also conducted on the sites that have been identified as actively eroding.

The report is very large due to all of the photos, so I am sending you a link to download the report through our FTP site. Here is the link to download the report:

<https://send.northwesternenergy.com/link/BBYGN6niBzG5Y79eeUZAS9> [[send.northwesternenergy.com](https://send.northwesternenergy.com)]

Once you have had a chance to review the report, please let me know if you have any comments or questions. If you approve the report as your respective agency's representative, please sign in the appropriate signature box in the attached filing letter, and once we receive the signatures from all agency representatives, NorthWestern will file the report with FERC. NorthWestern is respectfully requesting your approval and concurrence by no later than Thursday, December 7<sup>th</sup>. Thank you for taking the time to review the report, and don't hesitate to reach out to me with any questions you may have.

Sincerely,

Jordan Tollefson

---

**Jordan Tollefson**

*Hydro Compliance Professional*

[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)

**O (406) 443-8907**

**C (406) 565-3879**

208 N Montana Avenue, Suite 200

Helena, MT 59601



[\[northwesternenergy.com\]](http://northwesternenergy.com)

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## Tollefson, Jordan

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**Subject:** Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report  
**Attachments:** Article 402 P\_2188 Shoreline Erosion FERC Filing Letter (003).pdf

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**From:** Storrar, Keenan <Keenan.Storrar@mt.gov>  
**Sent:** Thursday, December 7, 2023 8:53 AM  
**To:** Tollefson, Jordan <Jordan.Tollefson@northwestern.com>  
**Subject:** [EXTERNAL] RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

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Here's my digital signature.

Keenan Storrar | 401/318 coordinator  
Water Protection Bureau  
Montana Department of Environmental Quality  
Office: 406-444-2734



How did we do? >>

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**From:** Tollefson, Jordan <[Jordan.Tollefson@northwestern.com](mailto:Jordan.Tollefson@northwestern.com)>  
**Sent:** Monday, November 6, 2023 4:24 PM  
**To:** Strainer, Adam <[astrainer@mt.gov](mailto:astrainer@mt.gov)>; jake.chaffin <[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)>; Chris Boone (<[ctboone@blm.gov](mailto:ctboone@blm.gov)>  
<[ctboone@blm.gov](mailto:ctboone@blm.gov)>; 'Babcock, Lindsey G' <[lbabcock@blm.gov](mailto:lbabcock@blm.gov)>; Storrar, Keenan <[Keenan.Storrar@mt.gov](mailto:Keenan.Storrar@mt.gov)>; Brown, Peter <[pebrown@mt.gov](mailto:pebrown@mt.gov)>  
**Cc:** Sullivan, Mary Gail <[MaryGail.Sullivan@northwestern.com](mailto:MaryGail.Sullivan@northwestern.com)>; [andrew.welch@northwestern.com](mailto:andrew.welch@northwestern.com); Hagengruber, Joseph (Joe) <[Joe.Hagengruber@northwestern.com](mailto:Joe.Hagengruber@northwestern.com)>  
**Subject:** [EXTERNAL] Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

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Sincerely,

Jordan Tollefson

---

**Jordan Tollefson**

*Hydro Compliance Professional*

[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)

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## Tollefson, Jordan

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**From:** Strainer, Adam <astrainer@mt.gov>  
**Sent:** Thursday, December 7, 2023 4:42 PM  
**To:** Tollefson, Jordan  
**Subject:** [EXTERNAL] Signed  
**Attachments:** doc02903920231207165918.pdf

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\*\*\*\*\*

Here you go Jordan.

Sorry for the delay and thanks for your patience.

Adam

-----Original Message-----

**From:** kyocera@mt.gov <kyocera@mt.gov>  
**Sent:** Thursday, December 7, 2023 4:59 PM  
**To:** Strainer, Adam <astrainer@mt.gov>  
**Subject:**

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TASKalfa 3051ci  
[00:17:c8:28:31:79]  
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## Tollefson, Jordan

---

**From:** Chaffin, Jake - FS, MT <jake.chaffin@usda.gov>  
**Sent:** Friday, December 15, 2023 8:05 AM  
**To:** Tollefson, Jordan  
**Subject:** [EXTERNAL] FW: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report  
**Attachments:** Article 402 P\_2188 Shoreline Erosion FERC Filing Letter.pdf

**CAUTION: This Email is from an EXTERNAL source outside of NorthWestern Energy.**

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Sorry for the delay, Jordan. Here you go.

If I don't talk with you, Happy Holidays!

Cheers,



**Jake Chaffin**  
**Watershed Program Manager**  
**Forest Service**

**Custer Gallatin National Forest**

**p: 406-587-6734**

[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)

10 E Babcock St PO Box 130

Bozeman, MT 59715

[www.fs.fed.us](http://www.fs.fed.us)



**Caring for the land and serving people**

---

**From:** Erickson, Mary - FS, MT <mary.erickson@usda.gov>  
**Sent:** Thursday, December 14, 2023 4:49 PM  
**To:** Chaffin, Jake - FS, MT <jake.chaffin@usda.gov>  
**Cc:** O'Connor Card, Jennie - FS, MT <Jennifer.Card@usda.gov>; Stringer, Allison - FS, MT <allison.stringer@usda.gov>; Urie, Wendi - FS, MT <wendi.urie@usda.gov>  
**Subject:** RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

Hi Jake - yes, I recall signing this before. I went ahead and made it a pdf and signed. Hope that works.

Thanks,

Mary



**Mary C Erickson (she/her)**  
**Forest Supervisor**  
**Forest Service**  
**Custer Gallatin National Forest**

p: 406-587-6949  
c: 406-599-9587  
f: 406-587-6758  
[mary.erickson@usda.gov](mailto:mary.erickson@usda.gov)

10 East Babcock  
Bozeman, MT 59718  
[www.fs.fed.us](http://www.fs.fed.us)



**Caring for the land and serving people**

---

**From:** Chaffin, Jake - FS, MT <[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)>

**Sent:** Thursday, December 14, 2023 3:13 PM

**To:** Erickson, Mary - FS, MT <[mary.erickson@usda.gov](mailto:mary.erickson@usda.gov)>

**Cc:** O'Connor Card, Jennie - FS, MT <[Jennifer.Card@usda.gov](mailto:Jennifer.Card@usda.gov)>; Stringer, Allison - FS, MT <[allison.stringer@usda.gov](mailto:allison.stringer@usda.gov)>;  
Urie, Wendi - FS, MT <[wendi.urie@usda.gov](mailto:wendi.urie@usda.gov)>

**Subject:** Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

**Importance:** High

Hi Mary,

Attached is one of Northwest Energy's FERC license cover letters (report link below) with requested agencies signatures. I reviewed the report and see no issues. FERC requires Northwest Energy to issue several reports and have agencies concur every 5 years.

Also attached is the 2018 for reference.

It looks like you signed in 18'. Could you again?

Thanks,



**Jake Chaffin**  
**Watershed Program Manager**  
**Forest Service**

**Custer Gallatin National Forest**

p: 406-587-6734  
[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)

10 E Babcock St PO Box 130  
Bozeman, MT 59715  
[www.fs.fed.us](http://www.fs.fed.us)



**Caring for the land and serving people**



---

**From:** Tollefson, Jordan <[Jordan.Tollefson@northwestern.com](mailto:Jordan.Tollefson@northwestern.com)>  
**Sent:** Friday, December 1, 2023 10:50 AM  
**To:** Strainer, Adam <[astrainer@mt.gov](mailto:astrainer@mt.gov)>; Chaffin, Jake - FS, MT <[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)>; Chris Boone ([ctboone@blm.gov](mailto:ctboone@blm.gov)) <[ctboone@blm.gov](mailto:ctboone@blm.gov)>; 'Babcock, Lindsey G' <[lbabcock@blm.gov](mailto:lbabcock@blm.gov)>; Keenan Storrar <[keenan.storrar@mt.gov](mailto:keenan.storrar@mt.gov)>; [pebrown@mt.gov](mailto:pebrown@mt.gov)  
**Cc:** Sullivan, Mary Gail <[MaryGail.Sullivan@northwestern.com](mailto:MaryGail.Sullivan@northwestern.com)>; Welch, Andrew <[Andrew.Welch@northwestern.com](mailto:Andrew.Welch@northwestern.com)>; Hagengruber, Joseph (Joe) <[Joe.Hagengruber@northwestern.com](mailto:Joe.Hagengruber@northwestern.com)>  
**Subject:** [External Email]RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report  
**Importance:** High

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This is just a friendly reminder that NorthWestern Energy is requesting formal agency approval on the Madison-Missouri Shoreline Erosion Monitoring Report from FWP, USFS, BLM, DEQ, and SHPO by no later than next Thursday, December 7<sup>th</sup>. Attached is the cover letter that we intend to file with the report and submit to FERC, which will need signed approval from each agency representative. The report itself can be downloaded through our FTP site using the following link: <https://send.northwesternenergy.com/link/BBYGN6niBzG5Y79eeUZAS9>

Thank you for reviewing the report and providing any comments that you may have.

Sincerely,  
Jordan Tollefson

---

**Jordan Tollefson**  
*Hydro Compliance Professional*  
[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)  
**O (406) 443-8907**  
**C (406) 565-3879**  
208 N Montana Avenue, Suite 200  
Helena, MT 59601



---

**From:** Tollefson, Jordan  
**Sent:** Monday, November 6, 2023 4:24 PM  
**To:** 'Strainer, Adam' <[astrainer@mt.gov](mailto:astrainer@mt.gov)>; Jake Chaffin <[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)>; Chris Boone ([ctboone@blm.gov](mailto:ctboone@blm.gov)) <[ctboone@blm.gov](mailto:ctboone@blm.gov)>; 'Babcock, Lindsey G' <[lbabcock@blm.gov](mailto:lbabcock@blm.gov)>; Keenan Storrar <[keenan.storrar@mt.gov](mailto:keenan.storrar@mt.gov)>; 'pebrown@mt.gov' <[pebrown@mt.gov](mailto:pebrown@mt.gov)>  
**Cc:** Sullivan, Mary Gail <[MaryGail.Sullivan@northwestern.com](mailto:MaryGail.Sullivan@northwestern.com)>; Welch, Andrew <[Andrew.Welch@northwestern.com](mailto:Andrew.Welch@northwestern.com)>; Hagengruber, Joseph (Joe) <[Joe.Hagengruber@northwestern.com](mailto:Joe.Hagengruber@northwestern.com)>  
**Subject:** Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

Good afternoon,

NorthWestern Energy recently completed the latest 5-year shoreline erosion monitoring report for the FERC Project 2188 Madison-Missouri Reservoirs under License Article 402. As a part of this effort, we would like to make the report available for your review and comment. The last version of this report was filed with FERC in 2018, so some of you may be new to this and unfamiliar with the history of the shoreline erosion monitoring program. Each one of the eleven NorthWestern managed reservoirs on the Madison and Missouri Rivers is monitored once every 5 years to document shoreline erosion as a part of a long-term monitoring process. This monitoring compares photo-points at each erosion site to previous years to determine if conditions are improving, staying the same, or degrading at that particular site. Annual monitoring is also conducted on the sites that have been identified as actively eroding.

The report is very large due to all of the photos, so I am sending you a link to download the report through our FTP site. Here is the link to download the report:

<https://send.northwesternenergy.com/link/BBYGN6niBzG5Y79eeUZAS9>

Once you have had a chance to review the report, please let me know if you have any comments or questions. If you approve the report as your respective agency's representative, please sign in the appropriate signature box in the attached filing letter, and once we receive the signatures from all agency representatives, NorthWestern will file the report with FERC. NorthWestern is respectfully requesting your approval and concurrence by no later than Thursday, December 7<sup>th</sup>. Thank you for taking the time to review the report, and don't hesitate to reach out to me with any questions you may have.

Sincerely,

Jordan Tollefson

---

**Jordan Tollefson**

*Hydro Compliance Professional*

[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)

**O (406) 443-8907**

**C (406) 565-3879**

208 N Montana Avenue, Suite 200

Helena, MT 59601



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## Tollefson, Jordan

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**From:** Babcock, Lindsey G <lbabcock@blm.gov>  
**Sent:** Friday, December 15, 2023 9:36 AM  
**To:** Tollefson, Jordan  
**Cc:** Boone, Christopher T; Sullivan, Mary Gail; Welch, Andrew; Hagengruber, Joseph (Joe); Janzen, Brandy C  
**Subject:** RE: [EXTERNAL] RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report  
**Attachments:** Article 402 P\_2188 Shoreline Erosion FERC Filing Letter signed by BLM.pdf

**CAUTION: This Email is from an EXTERNAL source outside of NorthWestern Energy.**

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If you believe the email to be malicious and/or phishing email, please use the **Report Phish** button.

---

Hi Jordan,  
Apologies this is a little late – here's BLM's signature.

Thanks,

**Lindsey Babcock**  
Butte Field Manager  
Bureau of Land Management | Western Montana District  
406-533-7630 (office)  
509-994-3522 (cell)

---

**From:** Tollefson, Jordan <Jordan.Tollefson@northwestern.com>  
**Sent:** Friday, December 1, 2023 10:50 AM  
**To:** Strainer, Adam <astrainer@mt.gov>; Jake Chaffin <jake.chaffin@usda.gov>; Boone, Christopher T <ctboone@blm.gov>; Babcock, Lindsey G <lbabcock@blm.gov>; Keenan Storrar <keenan.storrar@mt.gov>; pebrown@mt.gov  
**Cc:** Sullivan, Mary Gail <MaryGail.Sullivan@northwestern.com>; Welch, Andrew <Andrew.Welch@northwestern.com>; Hagengruber, Joseph (Joe) <Joe.Hagengruber@northwestern.com>  
**Subject:** [EXTERNAL] RE: Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report  
**Importance:** High

**This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.**

This is just a friendly reminder that NorthWestern Energy is requesting formal agency approval on the Madison-Missouri Shoreline Erosion Monitoring Report from FWP, USFS, BLM, DEQ, and SHPO by no later than next Thursday, December 7<sup>th</sup>. Attached is the cover letter that we intend to file with the report and submit to FERC, which will need signed

approval from each agency representative. The report itself can be downloaded through our FTP site using the following link: <https://send.northwesternenergy.com/link/BBYGN6niBzG5Y79eeUZAS9>

Thank you for reviewing the report and providing any comments that you may have.

Sincerely,  
Jordan Tollefson

---

**Jordan Tollefson**  
*Hydro Compliance Professional*  
[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)  
**O (406) 443-8907**  
**C (406) 565-3879**  
208 N Montana Avenue, Suite 200  
Helena, MT 59601



---

**From:** Tollefson, Jordan  
**Sent:** Monday, November 6, 2023 4:24 PM  
**To:** 'Strainer, Adam' <[astrainer@mt.gov](mailto:astrainer@mt.gov)>; Jake Chaffin <[jake.chaffin@usda.gov](mailto:jake.chaffin@usda.gov)>; Chris Boone <[ctboone@blm.gov](mailto:ctboone@blm.gov)>; 'Babcock, Lindsey G' <[lbabcock@blm.gov](mailto:lbabcock@blm.gov)>; Keenan Storrar <[keenan.storrar@mt.gov](mailto:keenan.storrar@mt.gov)>; 'pebrown@mt.gov' <[pebrown@mt.gov](mailto:pebrown@mt.gov)>  
**Cc:** Sullivan, Mary Gail <[MaryGail.Sullivan@northwestern.com](mailto:MaryGail.Sullivan@northwestern.com)>; Welch, Andrew <[Andrew.Welch@northwestern.com](mailto:Andrew.Welch@northwestern.com)>; Hagengruber, Joseph (Joe) <[Joe.Hagengruber@northwestern.com](mailto:Joe.Hagengruber@northwestern.com)>  
**Subject:** Madison-Missouri Reservoirs - Article 402 Shoreline Erosion 5-Year Monitoring Report

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attached filing letter, and once we receive the signatures from all agency representatives, NorthWestern will file the report with FERC. NorthWestern is respectfully requesting your approval and concurrence by no later than Thursday, December 7<sup>th</sup>. Thank you for taking the time to review the report, and don't hesitate to reach out to me with any questions you may have.

Sincerely,

Jordan Tollefson

---

**Jordan Tollefson**

*Hydro Compliance Professional*

[Jordan.Tollefson@NorthWestern.com](mailto:Jordan.Tollefson@NorthWestern.com)

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# 2023 Erosion Control Monitoring Surveys

**Black Eagle Reservoir  
Cochrane Reservoir  
Hauser Reservoir & Lake Helena  
Hebgen Lake  
Holter Reservoir  
Madison Reservoir  
Morony Reservoir  
Rainbow Reservoir  
Ryan Reservoir**





September 22, 2023

Jordan Tollefson  
Northwestern Energy  
1315 North Last Chance Gulch Helena,  
MT 59601

Dear Jordan:

DJ&A, P.C. has completed the shoreline erosion monitoring survey on all sites for 2023 as requested. This report documents the shoreline erosion and classification of each previously classified site on the following reservoirs:

- Black Eagle Reservoir
- Cochrane Reservoir
- Hauser Reservoir & Lake Helena
- Hebgen Lake
- Holter Reservoir
- Madison Reservoir
- Morony Reservoir
- Rainbow Reservoir
- Ryan Reservoir

Each site has been photographed and comparisons have been made between the current photos and those taken in previous years. A representative photo was selected for each site that best illustrates the site and any documentable erosion. These photos can be found in Appendix A. Numerous changes have been made to the sites this year based on changes in erosion rates and local conditions. All of these changes are illustrated in tables found in Appendix A. All sites / photos have been geo-referenced and their locations identified on the aerial photos found in Appendix B.

A **“repaired”** site means that measures have been taken to control the erosion of a site. These measures include riprap embankments and slope modifications. Sites that were labeled as “repaired” in previous evaluations were again labeled as “success” or “partial success” depending on how the repair measure has progressed. Sites that have received some level of repair but require additional measures were labeled as a “partial repair”.

An **“inactive”** site means that no erosion appears to have occurred since the last evaluation five years ago. An inactive site means that there is little chance of future erosion if the current conditions are maintained. Most areas categorized as inactive are adequately vegetated, thus reducing the possibility of erosion.



Sites categorized as having “**minor activity**” show little sign of change from the time of last evaluation.

A site labeled “**moderate activity**” shows signs that some erosion has taken place since the last evaluation.

An “**active**” site means that significant erosion has taken place since the last evaluation.

For this year’s report, all sites were photographed and analyzed. Below is a summarization of activity for each dam in the 2023 survey:

Black Eagle Reservoir now has a new site categorized as “minor activity”.

- A new site 2A was identified to the west of Site 2. It is categorized as “minor activity”.

Cochrane Reservoir now has two sites categorized as “active”.

- Sites 6 and 7 are still “active” with little change from previous years.
- Site 13 is exposed bed rock and is not an active eroding bank.

Hauser Reservoir has four sites categorized as “active”. In addition, there were 4 newly identified sites with active erosion.

- Site 7.1 is a newly identified site that is actively eroding.
- Site 7.2 is a newly identified site that is actively eroding.
- Sites 9.2 is actively eroding with new trees being recruited into the reservoir from the bank.
- Site 17 has very little change, but is actively eroding.
- Site 20.1 is newly identified site that is actively eroding.
- Site 50 has some vegetation and brush matrix at the toe of the slow which is reducing the impact from wave action. This may have been placed by the land owner?
- Site 50a is a newly identified actively eroding site. It appears to have a vegetation matrix that appears to be similar in placement and mitigation technique as observed at site 50.
- Site 76 is actively eroding with poor grazing management on the property leading to the lack of bank vegetation.

Hebgen Reservoir has a single site categorized as “active”.

- Site 25 remains “active” with little change from 2019 – 2022.

Holter Reservoir has nine sites categorized as “active”. There were also six newly identified sites with active erosion.

- Sites 33, 34, 38, 39, 45, 54, 55, 57, and 59 all remain “active”.
- Sites 28.1, 33.1, 39.1, 46A, 55.1, and 57.1 are newly identified sites that are actively eroding.



Madison Reservoir has a single site categorized as “active”.

- Madison Site 2 is still actively eroding and appears to be retreating at a significant rate towards the county road.
- Madison Site 16 was remediated by the landowner in 2022.

Morony Reservoir has zero sites categorized as “active”.

Rainbow Reservoir has zero sites categorized as “active”.

Ryan Reservoir has one site categorized as “active”.

- Sites 3 remains to be “active” with little change from 2019 – 2022.

Due to technical challenges photos were not captured for the following sites:

- Cochrane Reservoir – 25
- Hauser Reservoir & Lake Helena – 9, 12, 20, 29, 34, 54, 42, 47, 48, 60, and 68
- Hebgen Lake – 71 and 72
- Holter Reservoir – 12, 13, 17, and 46A
- Madison Reservoir – 30
- Morony Reservoir – 3
- Rainbow Reservoir – 4 and 17
- Ryan Reservoir – 19 and 20

Please review the tables, photos, and maps enclosed and please contact me if you have any questions. Thanks again for this opportunity to work with NorthWestern Energy

Sincerely,

A handwritten signature in blue ink that reads 'Ben Sundry'. The signature is stylized with a large, looping 'S' and a long horizontal stroke at the end.

Ben Sundry

## Appendix A

2023 BLACK EAGLE DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION															
	1991	1996	2003	2005	2008	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
2	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
2a																minor activity
3	active	active	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity					minor activity
4	moderate activity	moderate activity	minor-moderate activity	-	minor activity	minor activity					minor activity					minor activity
5	minor activity	minor activity	inactive	-	inactive	inactive					minor activity					minor activity
6	moderate activity	minor activity	inactive	-	inactive	inactive					minor activity					minor activity
7	minor activity	minor activity	inactive	-	inactive	inactive					minor activity					minor activity
8	minor activity	minor activity	inactive	-	inactive	inactive					inactive	inactive	inactive	inactive	inactive	inactive
9	minor activity	minor activity	minor activity	-	inactive	inactive					minor activity					minor activity
10	minor activity	minor activity	inactive	-	inactive	inactive					inactive	inactive	inactive	inactive	inactive	inactive
11	minor activity	minor-moderate - activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
12	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
13	active	active	minor activity	minor activity	minor activity	minor activity					minor activity					minor activity
14	minor activity	minor activity	minor activity	-	repaired-success	repaired-success					repaired-success					repaired-success
15	moderate activity	moderate activity	minor activity	-	repaired-partial success	repaired-partial success					repaired-partial success					repaired-partial success
16	active	moderate activity	minor activity	minor activity	minor activity	minor activity					repaired-success					repaired-success
17	moderate activity	moderate activity	minor activity	-	repaired-success	repaired-success					repaired-success					repaired-success
18	moderate activity	moderate activity	minor activity	-	repaired-success	repaired-success					repaired-success					repaired-success
19	minor activity	minor activity	minor activity	-	minor activity	minor activity					partial repair					partial repair
20	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
21	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
22	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity					minor activity



*Black Eagle 1*



*Black Eagle 2a*



*Black Eagle 2*

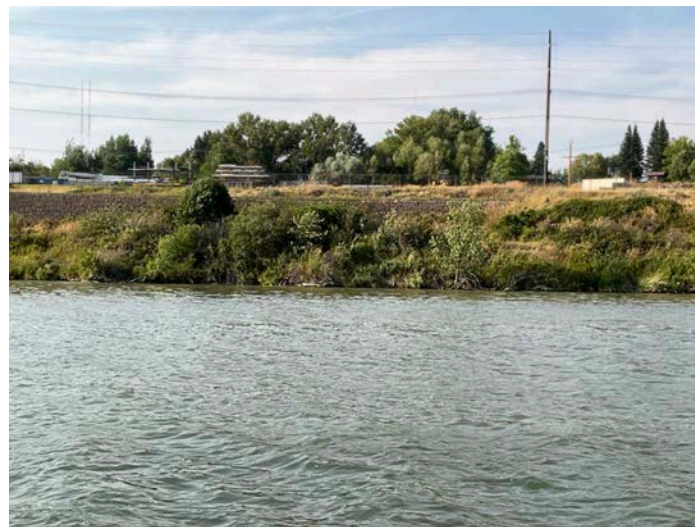


*Black Eagle 3*





*Black Eagle 4*



*Black Eagle 6*



*Black Eagle 5*



*Black Eagle 7*





*Black Eagle 8*



*Black Eagle 10*



*Black Eagle 9*



*Black Eagle 11*



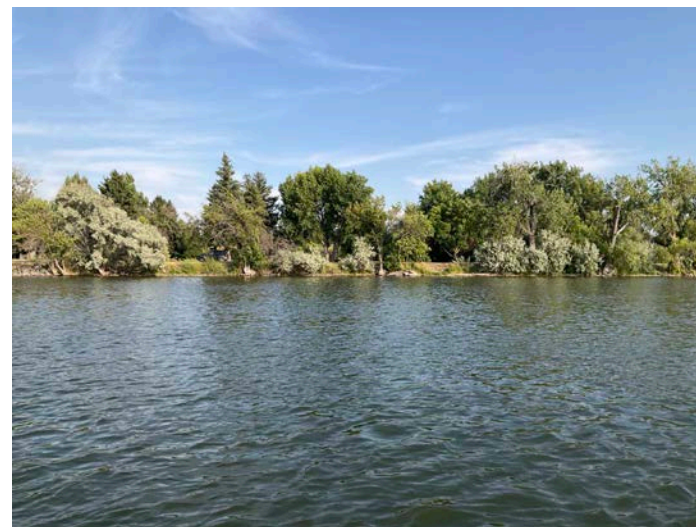
*Black Eagle 12*



*Black Eagle 14*



*Black Eagle 13*



*Black Eagle 15*

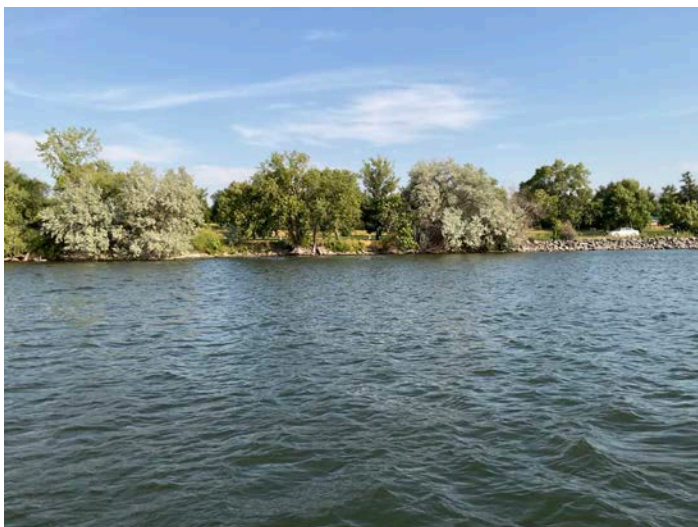




*Black Eagle 16*



*Black Eagle 18*



*Black Eagle 17*



*Black Eagle 19*



*Black Eagle 20*



*Black Eagle 22*



*Black Eagle 21*



2023 COCHRANE DEVELOPMENT

SITE NO.	OBSERVED EROSION CONDITION																		
	1991	1996	2003	2005	2008	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	active	minor-moderate activity	minor activity	minor activity	minor activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
2	minor activity		minor activity	-	minor activity				minor activity		-			minor activity					minor activity
3	active	active	active	active	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity					minor activity
4	active	minor activity	minor activity	minor activity	minor activity				minor activity		-			minor activity					minor activity
5	active	active	active	moderate activity	active	active	active	active	active	active	active	active	active	moderate activity					moderate activity
6	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active
7	active	active	active	moderate activity	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active
8	minor activity	active	active	no photo taken	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
9	moderate activity	minor activity	minor activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
10	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
11	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
12	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity				minor activity
13	moderate activity	minor activity	minor activity	-	minor activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	active	inactive	inactive	inactive	inactive
14	moderate activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
15	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
16	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
17	moderate activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
18	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
19	minor activity	moderate activity	moderate activity	-	minor activity				minor activity					minor activity					minor activity
20	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
21	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
22	minor activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					moderate activity					moderate activity
23	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
24	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
25		minor activity		-					minor activity					minor activity					Photo Missing



*Cochrane 1*



*Cochrane 3*



*Cochrane 2*



*Cochrane 4*





*Cochrane 5*



*Cochrane 7*



*Cochrane 6*



*Cochrane 8*



*Cochrane 9*



*Cochrane 11*



*Cochrane 10*



*Cochrane 12*





*Cochrane 13*



*Cochrane 15*



*Cochrane 14*



*Cochrane 16*



*Cochrane 17*



*Cochrane 19*



*Cochrane 18*



*Cochrane 20*





*Cochrane 21*



*Cochrane 23*



*Cochrane 22*



*Cochrane 24*

2023 HAUSER DEVELOPMENT

SITE NO.	OBSERVED EROSION CONDITION										2015	2016	2017	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2009	2011	2012	2013	2014									
1	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
2	minor activity	minor activity	minor activity	-	moderate activity				minor activity					moderate activity					moderate activity
2.1																			new activity
3	minor activity	minor activity	minor activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity					moderate activity
4	minor activity	minor activity	minor activity	-	minor activity				minor activity					moderate activity					moderate activity
5	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
6	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
7	minor activity	minor activity	minor activity	-	minor activity				minor activity					inactive	inactive	inactive	inactive	inactive	inactive
7.1																			new activity
7.2																			new activity
8	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity					minor activity
9	active	active	active	active	active	active	active	active	active	active	active	active	active	active					Photo Missing
9.2																			active
10	moderate activity	moderate activity	minor-moderate activity	-	no photo taken				moderate activity	moderate activity	moderate activity			minor activity					minor activity
11	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor activity					minor activity
12	minor activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	moderate activity					Photo Missing
12.1																			moderate activity
13	minor activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	moderate activity					moderate activity
13.1																			new activity
13.2																			new activity
14	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
15	minor activity	minor-moderate activity	repaired	-	minor activity				minor activity					minor activity					minor activity
15.1																			new activity
16	minor activity	minor-moderate activity	repaired	-	in-active				in-active					minor activity					minor activity
17	moderate activity	moderate activity	moderate activity	-	active	active	active	active	active	active	active	active	active	active	active	active	active	active	active
18	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
19	moderate activity	moderate activity	moderate activity	-	minor activity				minor activity					moderate activity					moderate activity
20	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					Photo Missing
20.1																			new activity
21	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
22	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
23	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
23.1																			new activity
24	minor activity	minor activity	minor activity	-	minor activity				minor activity					in-active	inactive	inactive	inactive	inactive	inactive
25	minor activity	minor activity	repaired	-	minor activity				minor activity					minor activity					minor activity
26	minor activity	minor activity	minor activity	-	no photo taken				minor activity					minor activity					minor activity
27	minor activity	minor activity	minor activity	-	minor activity				minor activity					inactive	inactive	inactive	inactive	inactive	inactive
28	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
29	moderate activity	minor activity	minor activity	-	minor activity				minor-moderate	minor-moderate	minor-moderate	minor-moderate	minor-moderate	minor-moderate					Photo Missing
30		minor activity	minor activity	-	minor activity				minor activity					minor-moderate					minor-moderate
31	minor activity	minor activity	minor activity	-	minor activity				active	active	active	active	active	moderate activity					moderate activity
32	minor activity	minor activity	minor activity	-	minor activity				minor activity					moderate activity					moderate activity
33	minor activity	minor activity	minor activity	-	minor activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	Partially Repaired					Partially Repaired
34	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					Photo Missing
34.1																			minor activity
35	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
36	minor activity	minor activity	minor activity	-	minor activity				minor activity					Repaired - success					Repaired - success
37	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
38	moderate activity	moderate activity	minor-moderate	-	minor activity				minor activity					minor activity					minor activity
39	moderate activity	moderate activity	moderate activity	-	minor activity				minor-moderate	minor-moderate	minor-moderate	minor-moderate	minor-moderate	minor-moderate					Photo Missing
39.1																			minor-moderate

2023 HAUSER DEVELOPMENT

SITE NO.	OBSERVED EROSION CONDITION										2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2009	2011	2012													
40	active	moderate activity	minor activity	minor activity	repaired-partial success				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity							moderate activity
41	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
41.1																					minor activity
42	moderate activity	minor-moderate activity	minor-moderate	-	inactive				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity						Photo Missing
42.5																					moderate activity
43	minor activity	minor activity	minor activity	-	no photo taken				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity						minor activity
44	minor activity	minor activity	minor activity	-	minor activity				minor activity						moderate activity						moderate activity
45	minor activity	minor activity	minor activity	-	minor activity				minor activity						moderate activity						moderate activity
46	minor activity	minor activity	minor activity	-	minor activity				minor activity						moderate activity						moderate activity
47	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						Photo Missing
47.1																					minor activity
48	minor activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity						Photo Missing
48.4																					moderate activity
49	minor activity	moderate activity	minor-moderate activity	-	minor activity				minor activity						minor activity						minor activity
50	moderate activity	minor activity	minor activity	-	no photo taken				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	active	active	active	active	active	active	active
50a																					active
51	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
52	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
53	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
54	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
55	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
56	minor activity	minor activity	minor activity	-	minor activity				minor activity						inactive	inactive	inactive	inactive	inactive	inactive	inactive
57	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
58	moderate activity	minor activity	inactive	-	minor activity				minor activity						minor activity						minor activity
59	minor activity	minor activity	inactive	-	minor activity				minor activity						minor activity						minor activity
60	moderate activity	minor activity	inactive	-	minor activity				minor activity						minor activity						Photo Missing
60.1																					minor activity
61	minor activity	minor-moderate activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
62	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor activity						minor activity						minor activity
63	minor activity	minor activity	inactive	-	minor activity				minor activity						In-active	inactive	inactive	inactive	inactive	inactive	inactive
64	minor activity	minor activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
65	minor activity	minor-moderate activity	minor activity	-	minor activity				minor activity						minor activity						minor activity
66	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	moderate activity						moderate activity
67	minor activity	minor activity	in-active	-	no photo taken				minor activity						moderate activity						moderate activity
68	moderate activity	minor activity	minor activity	-	minor activity				minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity	minor-moderate activity						Photo Missing
68.2																					minor-moderate activity
69	minor activity	moderate activity	minor activity	-	minor activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	minor activity						minor activity
70	active	active	active	active	moderate activity				minor activity						minor activity						minor activity
71	active	active	active	moderate activity	moderate activity				minor activity						moderate activity						minor activity
72	minor activity	minor activity	minor activity	-	minor activity				minor activity						moderate activity						moderate activity
73	minor activity	minor activity	minor activity	-	minor activity				minor activity						Repaired - success						Repaired - success
74	active	active	moderate activity	minor activity	minor activity				moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity						moderate activity
75	moderate activity	moderate activity	moderate activity	-	minor activity				minor activity						moderate activity						moderate activity
76	active	active	moderate activity	minor activity	minor activity	moderate activity			active	active	active				active	active	active	active	active	active	active





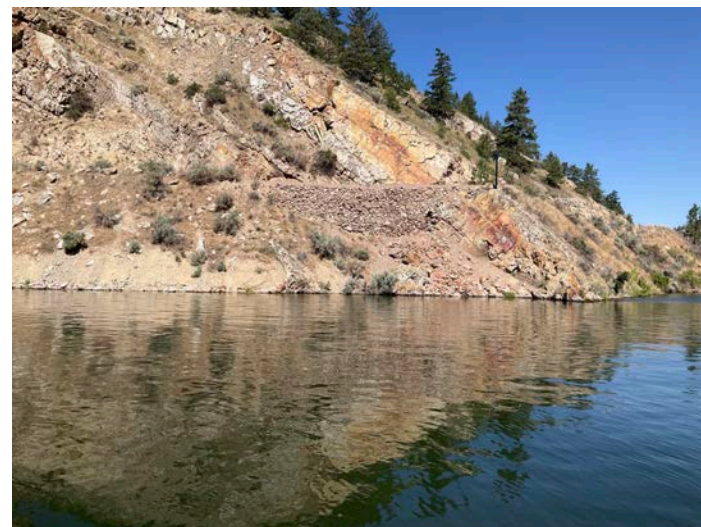
*Hauser 1*



*Hauser 2.1*



*Hauser 2*

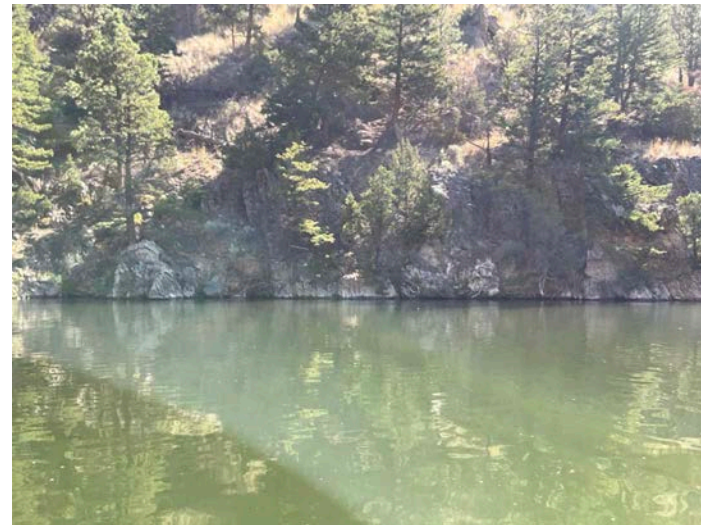


*Hauser 3*





*Hauser 4*



*Hauser 6*



*Hauser 5*



*Hauser 7*





*Hauser 7.1*



*Hauser 8*



*Hauser 7.2*



*Hauser 9.2*





*Hauser 10*



*Hauser 12.1*



*Hauser 11*



*Hauser 13*



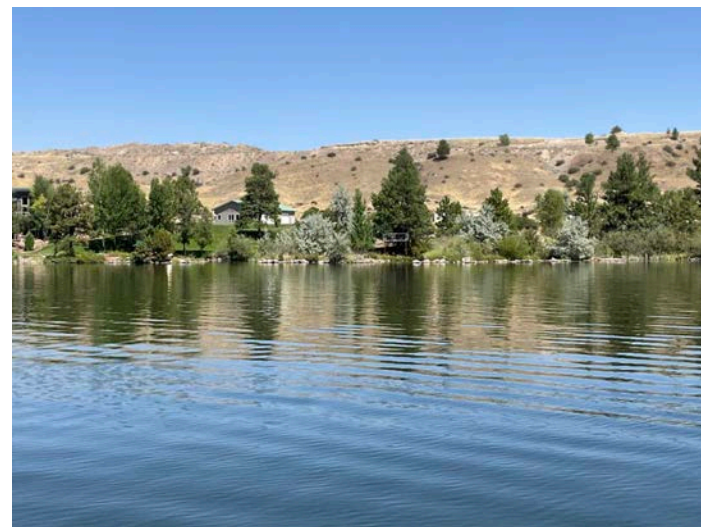
*Hauser 13.1*



*Hauser 14*



*Hauser 13.2*



*Hauser 15*





*Hauser 15.1*



*Hauser 17*



*Hauser 16*



*Hauser 18*





*Hauser 19*



*Hauser 21*



*Hauser 20.1*



*Hauser 22*

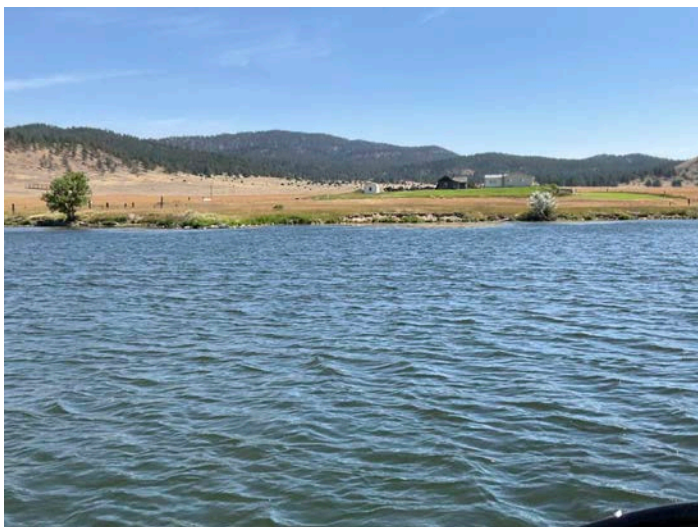




*Hauser 23*



*Hauser 24*



*Hauser 23.1*



*Hauser 25*





*Hauser 26*



*Hauser 28*



*Hauser 27*



*Hauser 30*





*Hauser 31*



*Hauser 33*



*Hauser 32*



*Hauser 34.1*



*Hauser 35*



*Hauser 37*



*Hauser 36*



*Hauser 38*





*Hauser 39.1*



*Hauser 41.1*



*Hauser 40*



*Hauser 42.5*





*Hauser 43*



*Hauser 45*



*Hauser 44*



*Hauser 46*





*Hauser 47.1*



*Hauser 49*



*Hauser 48.4*



*Hauser 50*



*Hauser 50a*



*Hauser 52*



*Hauser 51*



*Hauser 53*





*Hauser 54*



*Hauser 56*



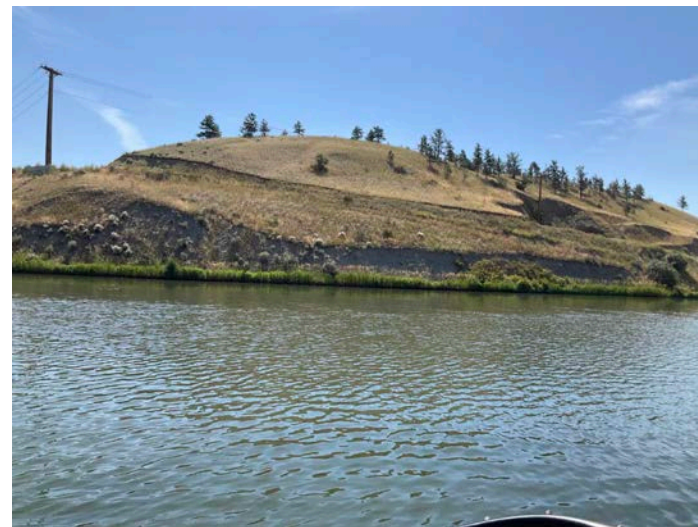
*Hauser 55*



*Hauser 57*



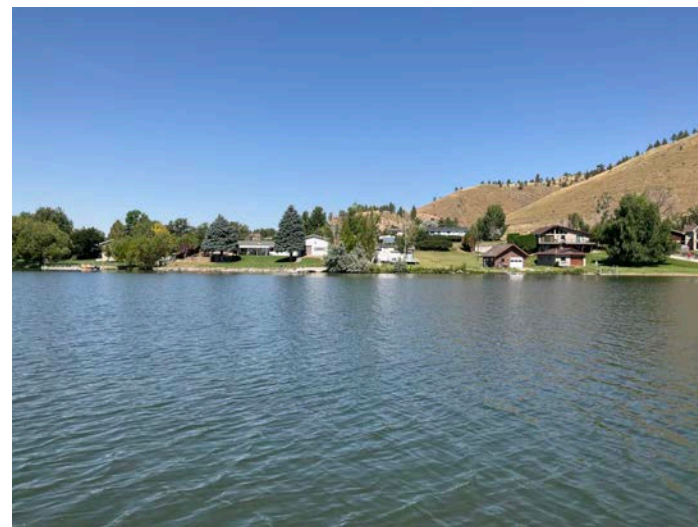
*Hauser 58*



*Hauser 60.1*



*Hauser 59*



*Hauser 61*





*Hauser 62*



*Hauser 64*



*Hauser 63*



*Hauser 65*





*Hauser 66*



*Hauser 68.2*



*Hauser 67*



*Hauser 69*



*Hauser 70*



*Hauser 72*



*Hauser 71*



*Hauser 73*





*Hauser 74*



*Hauser 76*



*Hauser 75*



2023 HEBGEN DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION						2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2013										
1	moderate activity	moderate activity	minor-moderate activity	-	repaired-success	repaired-success					repaired-success					repaired-success
2	active	active	moderate activity	minor activity	repaired-partial success	repaired-partial success					repaired-partial success					repaired-partial success
3	moderate activity	moderate activity	minor activity	-	repaired-success	repaired-success					repaired-success					repaired-success
4	moderate activity	moderate activity	minor activity	-	repaired-partial success	repaired-partial success					repaired-partial success					repaired-partial success
5	active	moderate activity	minor activity	minor activity	minor activity	minor activity					minor activity					minor activity
6	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
7	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
8	moderate activity	moderate activity	minor activity	-	moderate activity	minor-moderate activity					minor activity					minor activity
9	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
10	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
11	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
12	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
13	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
14	moderate activity	moderate activity	minor activity	-	minor activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
14.5																moderate activity
15	moderate activity	moderate activity	minor activity	-	minor activity	minor-moderate activity					minor-moderate activity					minor-moderate activity
16	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
17	moderate activity	moderate activity	minor activity	-	minor activity	minor-moderate activity					moderate activity					moderate activity
18	moderate activity	minor activity	minor activity	-	minor activity	minor-moderate activity					moderate activity					moderate activity
19	moderate activity	moderate activity	minor activity	-	minor activity	minor-moderate activity					moderate activity					moderate activity
20	moderate activity	minor activity	minor activity	-	minor activity	minor-moderate activity					moderate activity					moderate activity
21	moderate activity	minor activity	minor activity	-	minor activity	minor-moderate activity					moderate activity					moderate activity
22	moderate activity	moderate activity	moderate activity	-	minor activity	minor-moderate activity					moderate activity					moderate activity
23	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
24	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
25	active	moderate activity	moderate-active activity	active	moderate activity	moderate activity	moderate activity	moderate activity			active	active	active	active	active	active
26					minor activity	minor activity					moderate activity					moderate activity
27	moderate activity	minor activity	minor activity	-	minor activity	minor activity					moderate activity					moderate activity
28	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
29	minor activity	minor activity	minor activity	-	minor activity	minor activity					inactive	inactive	inactive	inactive	inactive	inactive
30	moderate activity	moderate activity	minor-moderate	-	minor activity	minor activity					minor activity					minor activity
30.6																minor activity
31	minor activity	minor activity	minor activity	-	minor activity	minor activity					inactive	inactive	inactive	inactive	inactive	inactive
31 (2)																minor activity
32	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity	minor activity					minor activity					minor activity
33	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
34	active	moderate activity	minor activity	minor activity	partial repaired	partial repaired					minor activity					minor activity
35	minor activity	minor activity	minor activity	-	inactive	minor-moderate activity					minor activity					minor activity
36	minor activity	minor activity	minor activity	-	minor activity	minor activity					inactive	inactive	inactive	inactive	inactive	inactive
37	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity	minor activity					minor activity					minor activity

2023 HEBGEN DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION															
	1991	1996	2003	2005	2008	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
38	minor activity	minor activity	minor activity	-	minor activity	minor activity					inactive	inactive	inactive	inactive	inactive	inactive
39	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
40	moderate activity	moderate activity	moderate activity	-	minor activity	minor activity					minor activity					minor activity
41	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity	minor activity					minor activity					minor activity
41.15																minor activity
41.6																minor activity
42	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
43	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
43.7																minor-moderate activity
44	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
44.1																minor-moderate activity
45	active	moderate activity	minor-moderate activity	minor activity	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
46	moderate activity	moderate activity	minor-moderate activity	-	minor activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
47	moderate activity	moderate activity	minor-moderate activity	-	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
47.13																minor-moderate activity
48	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
48.5																moderate activity
49	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
50	active	active	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
51											minor-moderate activity					minor-moderate activity
51.5																minor-moderate activity
52	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
53	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
54	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
55	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
56	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
57	moderate activity	moderate activity	moderate activity	-	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
57.3																minor-moderate activity
58	moderate activity	moderate activity	moderate activity	-	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
59	active	active	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
60	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
61	minor activity	minor activity	minor activity	-	minor activity	minor activity					inactive	inactive	inactive	inactive	inactive	inactive
61.6																minor activity
62	moderate activity	moderate activity	minor activity	-	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
63	moderate activity	moderate activity-possibly active	minor-moderate activity	-	minor activity	active	active	active	moderate activity		minor-moderate activity					minor-moderate activity
64	moderate activity	moderate activity-possibly active	moderate activity	-	moderate activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
65	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
66	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
67	active	moderate activity	minor-moderate activity	minor activity	minor activity	minor activity					minor activity					minor activity
68	active	moderate activity	minor-moderate activity	minor activity	minor activity	minor activity					minor activity					minor activity

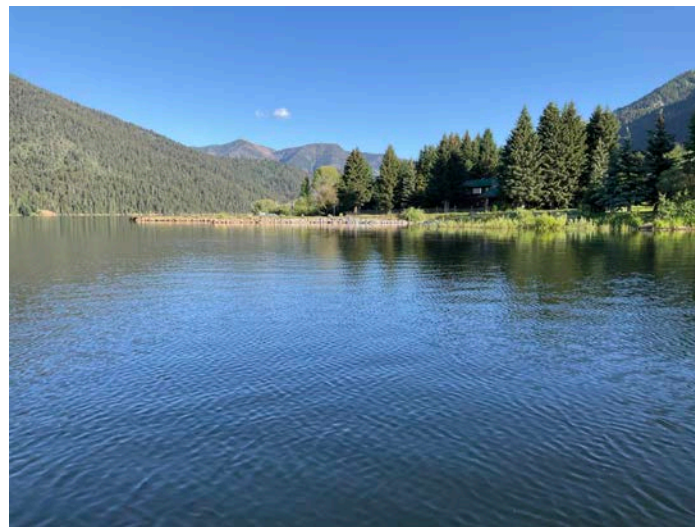
2023 HEBGEN DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION						2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2013										
69	moderate activity	moderate activity	minor-moderate activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
70	active	active	moderate activity	minor activity	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
70.1																minor-moderate activity
71	active	minor-moderate activity	minor-moderate activity	minor activity	minor activity	minor-moderate activity					minor-moderate activity					Photo Missing
72	minor activity	minor activity	repaired with rip-rap	-	success	success					success					Photo Missing
73	active	moderate activity	repaired	repaired	success	success					success					success
74	minor activity	minor activity	repaired	-	success	success					success					success
75	active	moderate activity	minor activity	minor activity	repaired-success	repaired-success					repaired-success					repaired-success
76	active	moderate activity	moderate activity	minor activity	repaired-partial success	partial repair-minor activity					partial repair-minor activity					partial repair-minor activity
77	active	minor-moderate activity	minor-moderate activity	moderate activity	moderate activity	moderate activity	moderate activity	moderate activity			repaired-success					repaired-success
78	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
79	moderate activity	moderate activity	minor-moderate activity	-	minor activity	minor activity					minor activity					minor activity
80	active	moderate activity	minor-moderate activity	minor activity	minor activity	minor-moderate activity					minor activity					minor activity
81	moderate activity	moderate activity	moderate activity	-	minor activity	minor activity					minor activity					minor activity
82	active	active	moderate activity	minor activity	partial repair-minor activity	partial repair-minor activity					minor activity					minor activity
82.1																new activity
83	moderate activity	moderate activity	repaired	-	success	success					success					success
84	moderate activity	moderate activity	minor activity	-	repaired-success	repaired-success					repaired-success					repaired-success
85	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
85.1																new activity
86	active	active	moderate activity	minor activity	minor activity	minor activity					minor activity					minor activity
86.1																new activity
87	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
88	moderate activity	moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
89	active	active	active	moderate activity	moderate activity	moderate activity					minor-moderate activity					minor-moderate activity
90	moderate activity	moderate activity	minor activity	-	minor activity	moderate activity					minor activity					minor activity
91	moderate activity	moderate activity	minor-moderate activity	-	minor activity	moderate activity					minor activity					minor activity
91.5																minor activity
92	moderate activity	moderate activity	minor-moderate activity	-	minor activity	moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
93	minor activity	minor activity	minor activity	-	minor activity	minor activity					inactive	inactive	inactive	inactive	inactive	inactive
94	moderate activity	minor-moderate activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
95	moderate activity	minor-moderate activity	minor activity	-	repaired-success	repaired-success					repaired-success					repaired-success





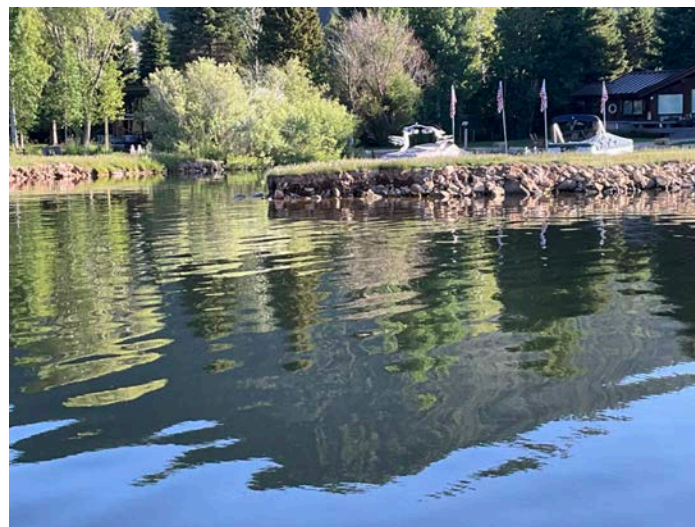
*Hebgen 1*



*Hebgen 3*



*Hebgen 2*



*Hebgen 4*

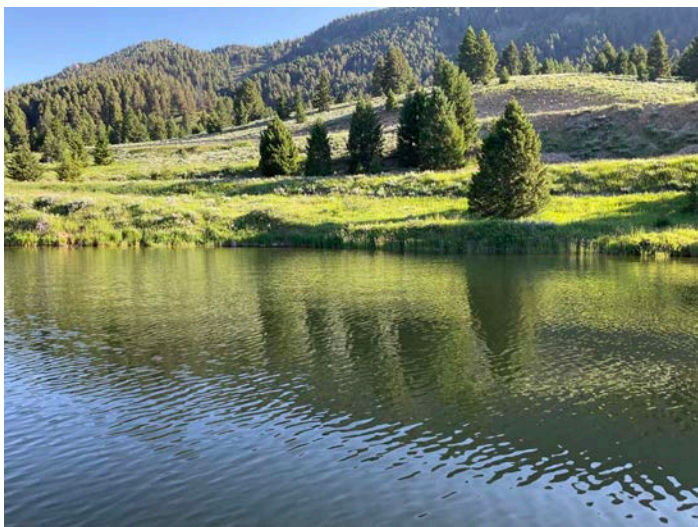




*Hebgen 5*



*Hebgen 7*

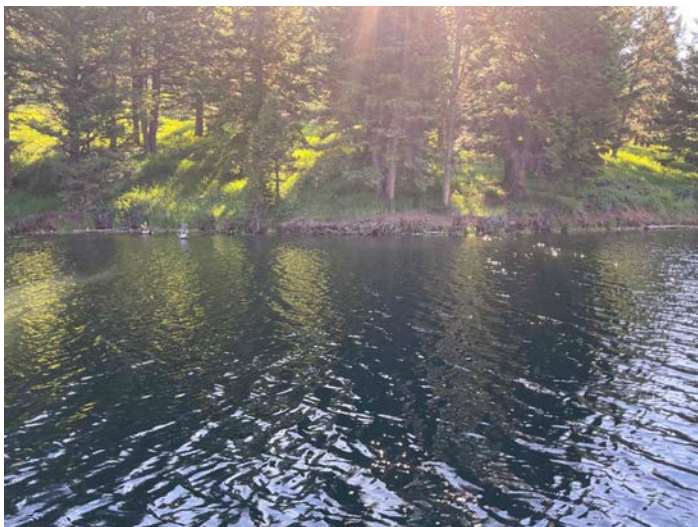


*Hebgen 6*



*Hebgen 8*





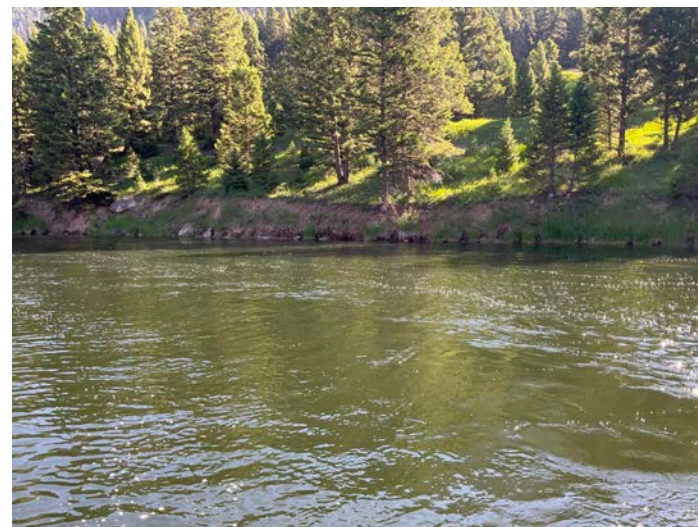
*Hebgen 9*



*Hebgen 11*



*Hebgen 10*



*Hebgen 12*

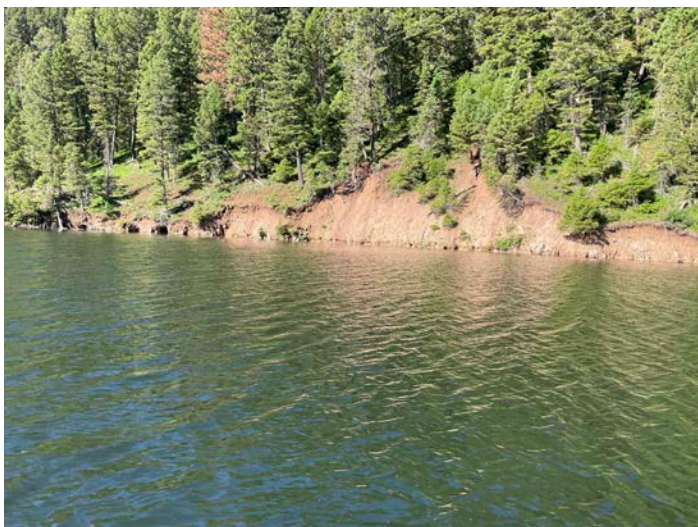




*Hebgen 13*



*Hebgen 14.5*



*Hebgen 14*



*Hebgen 15*

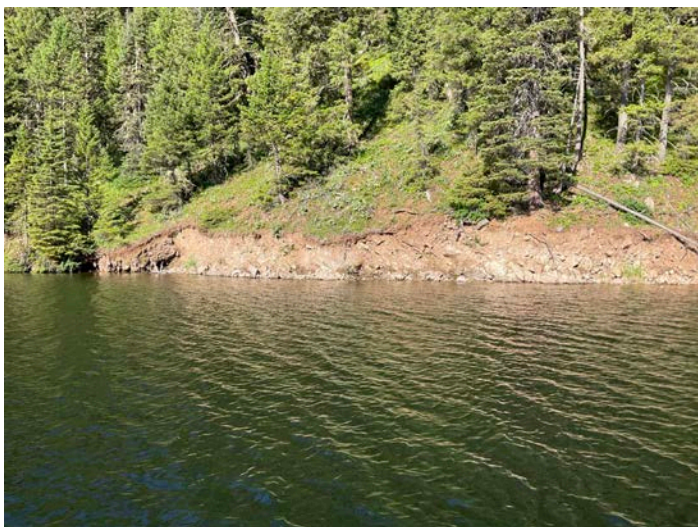




*Hebgen 16*



*Hebgen 18*

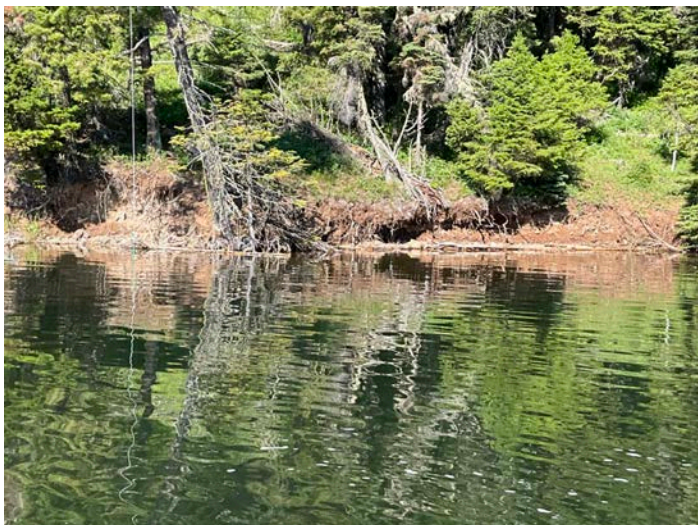


*Hebgen 17*



*Hebgen 19*

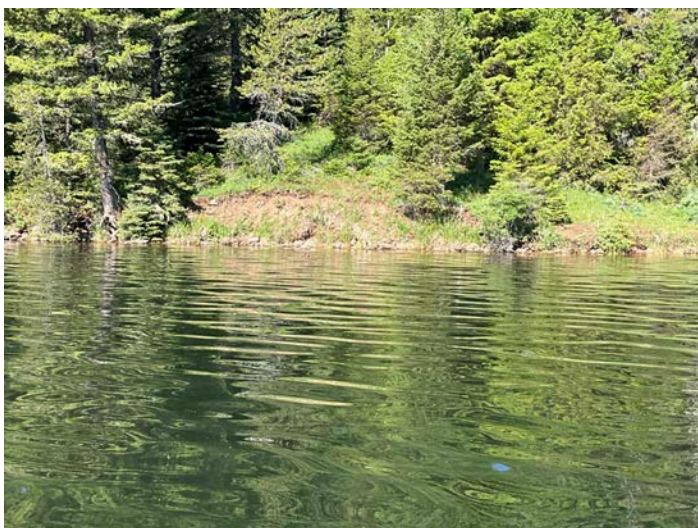




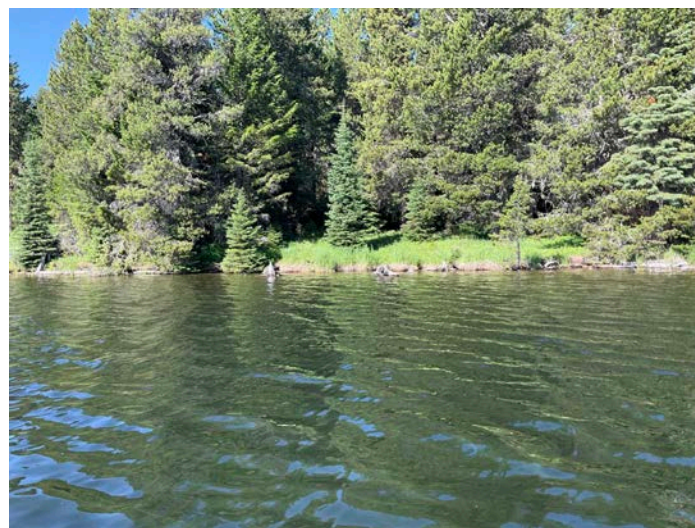
*Hebgen 20*



*Hebgen 22*



*Hebgen 21*



*Hebgen 23*





*Hebgen 24*



*Hebgen 26*



*Hebgen 25*



*Hebgen 27*

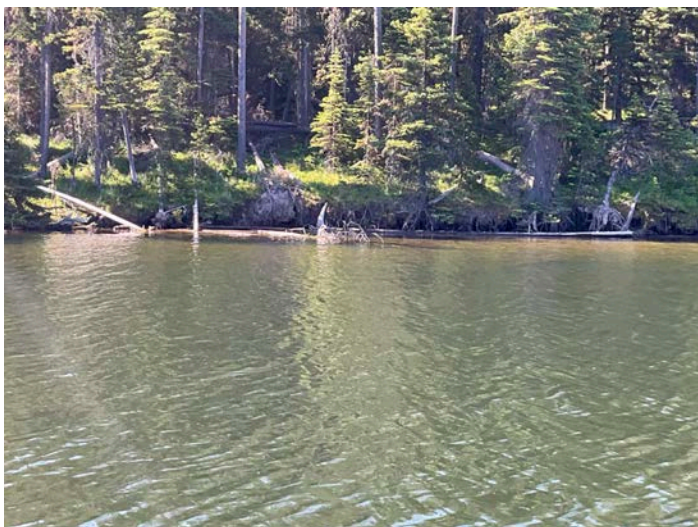




*Hebgen 28*



*Hebgen 30*



*Hebgen 29*

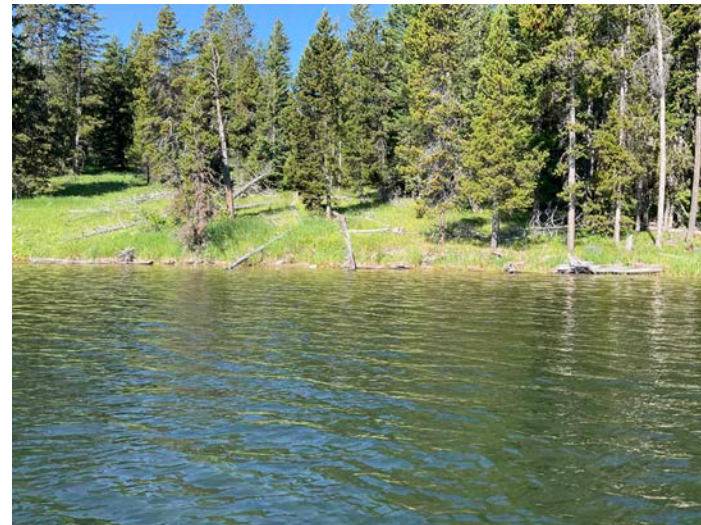


*Hebgen 30.6*





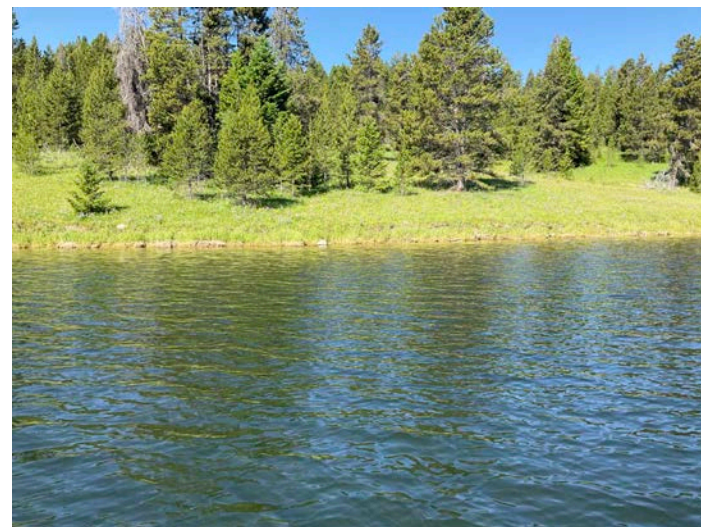
*Hebgen 31*



*Hebgen 32*



*Hebgen 31 (2)*



*Hebgen 33*





*Hebgen 34*



*Hebgen 36*



*Hebgen 35*



*Hebgen 37*





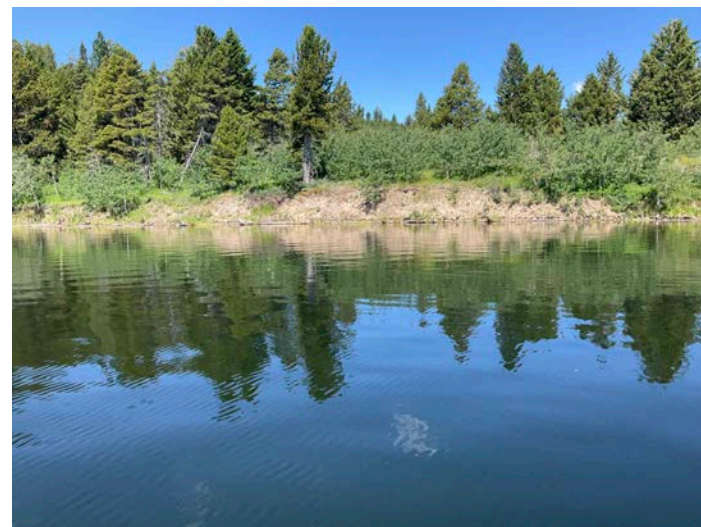
*Hebgen 38*



*Hebgen 40*

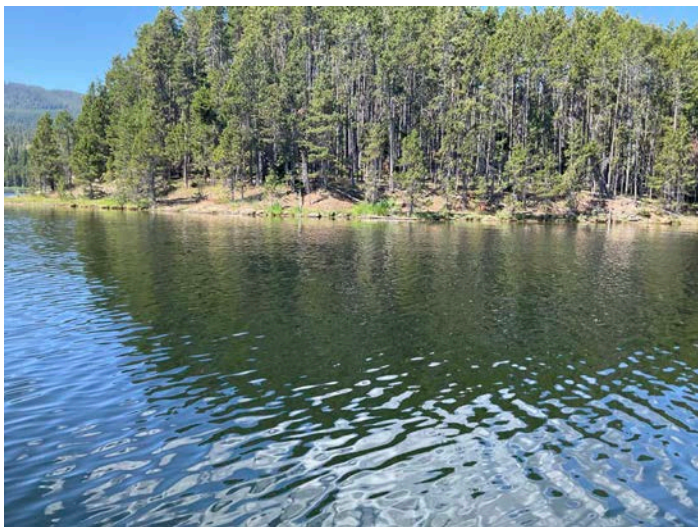


*Hebgen 39*



*Hebgen 41*





*Hebgen 41.15*



*Hebgen 42*



*Hebgen 41.6*



*Hebgen 43*





*Hebgen 43.7*



*Hebgen 45*



*Hebgen 44*

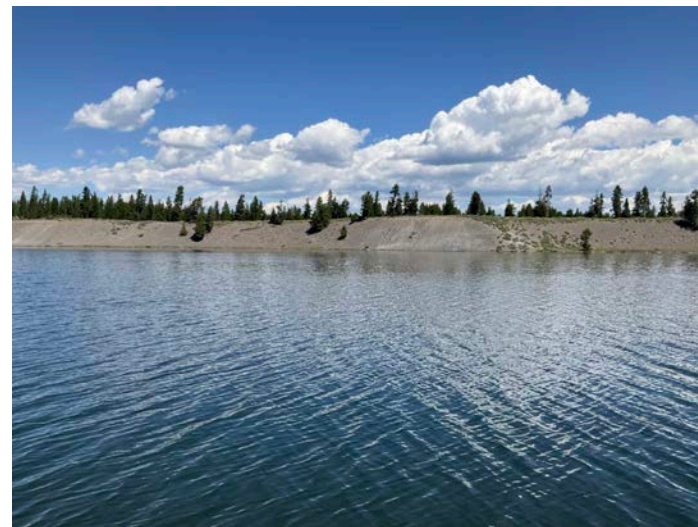


*Hebgen 46*





*Hebgen 47*



*Hebgen 48.5*



*Hebgen 47.13*

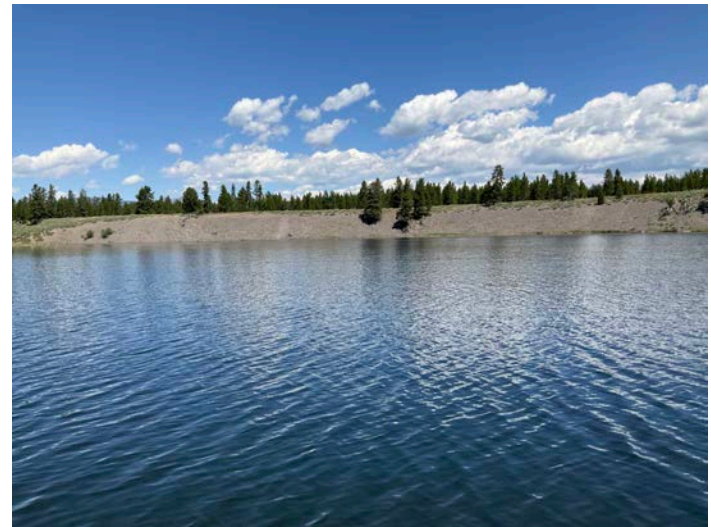


*Hebgen 49*





*Hebgen 50*



*Hebgen 51.5*



*Hebgen 51*



*Hebgen 52*





*Hebgen 53*



*Hebgen 55*

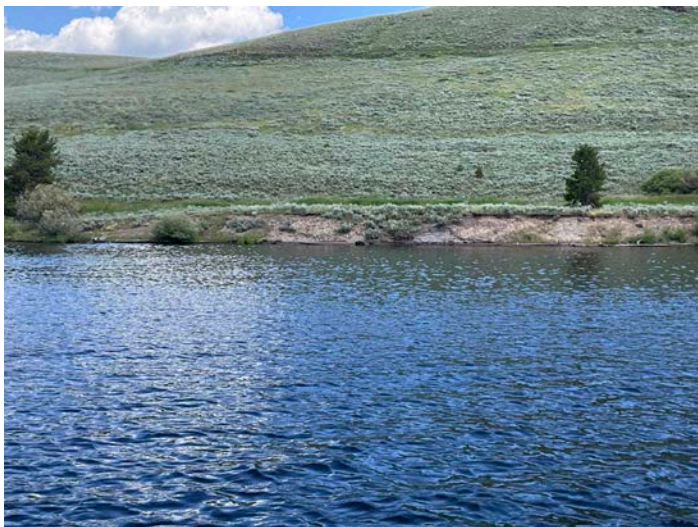


*Hebgen 54*



*Hebgen 56*





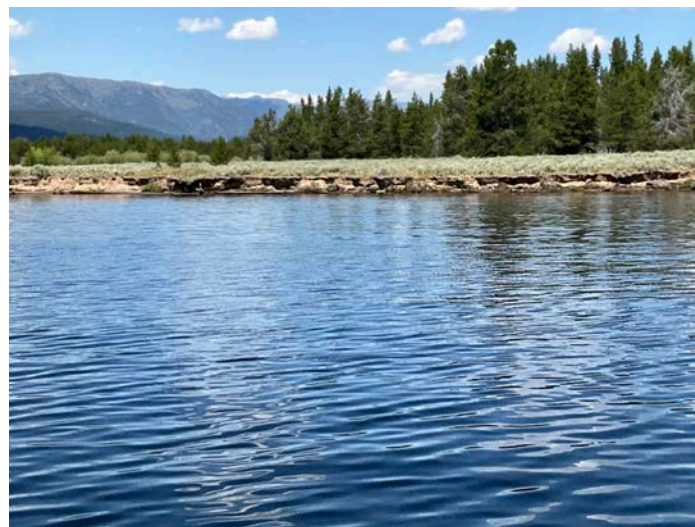
*Hebgen 57*



*Hebgen 58*



*Hebgen 57.3*



*Hebgen 59*

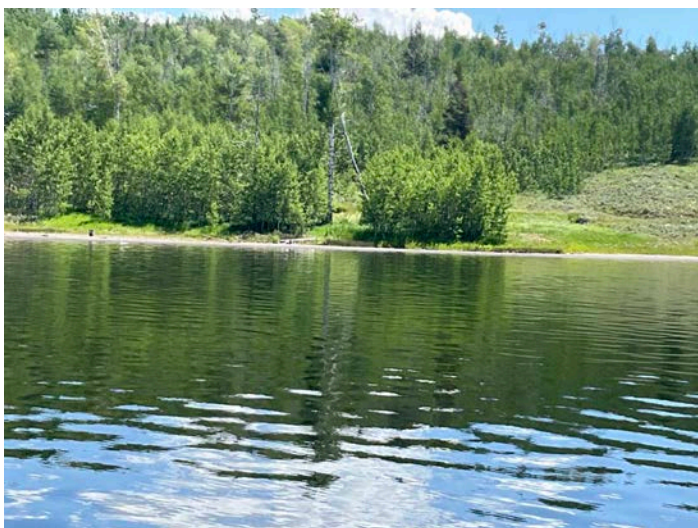




*Hebgen 60*



*Hebgen 61.6*



*Hebgen 61*



*Hebgen 62*

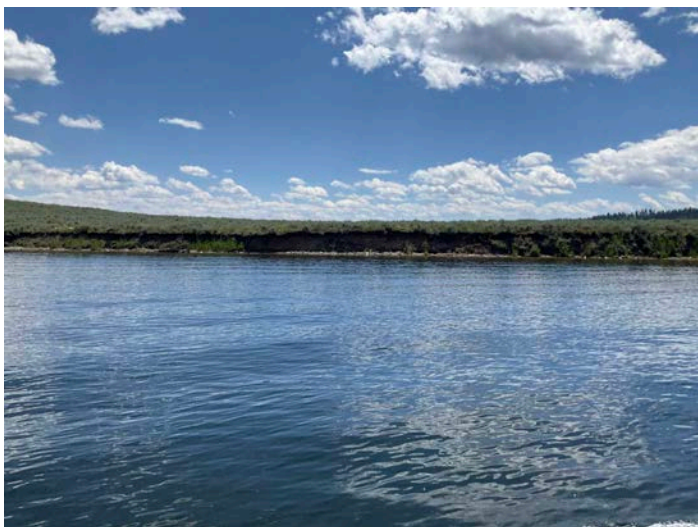




*Hebgen 63*



*Hebgen 65*



*Hebgen 64*



*Hebgen 66*





*Hebgen 67*



*Hebgen 69*



*Hebgen 68*



*Hebgen 70*





*Hebgen 70.1*



*Hebgen 74*



*Hebgen 73*

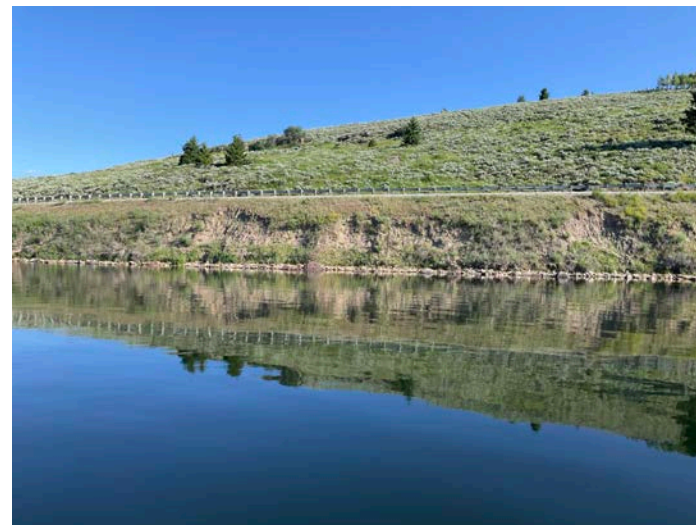


*Hebgen 75*





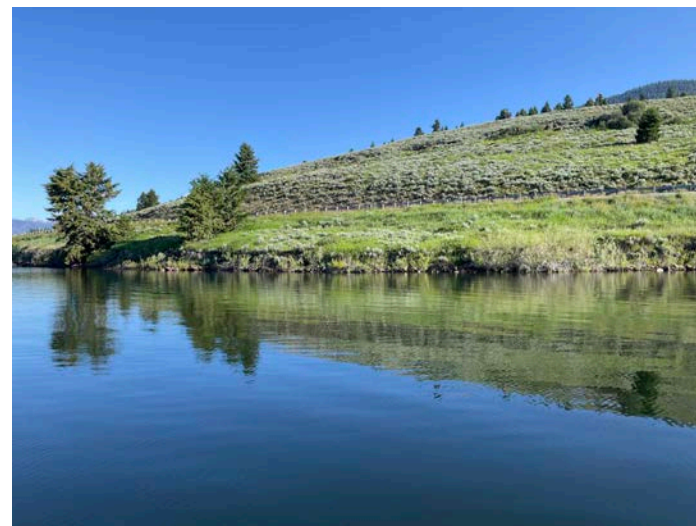
*Hebgen 76*



*Hebgen 78*

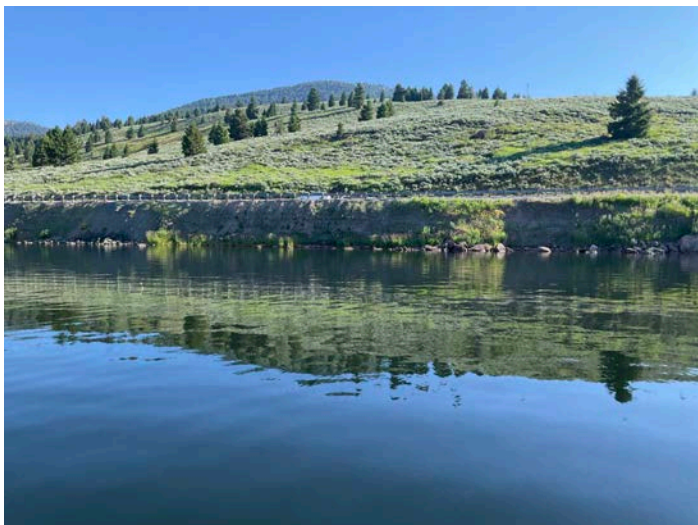


*Hebgen 77*

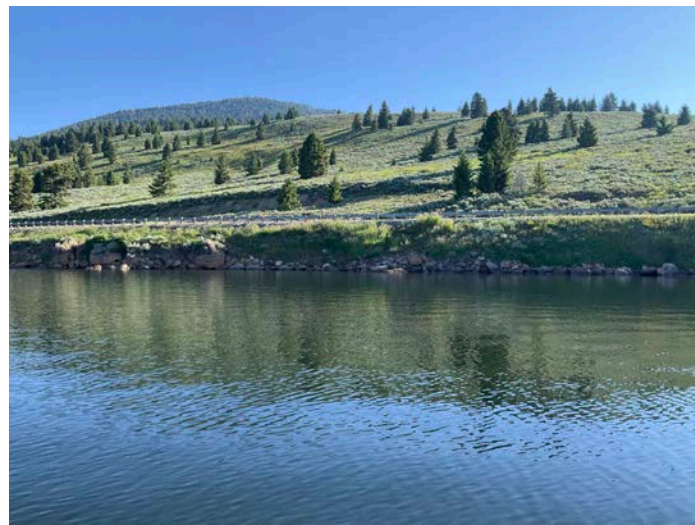


*Hebgen 79*

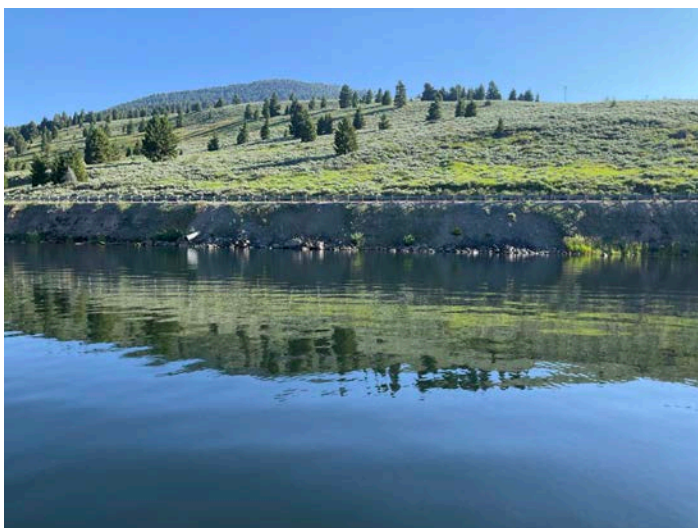




*Hebgen 80*



*Hebgen 82*



*Hebgen 81*

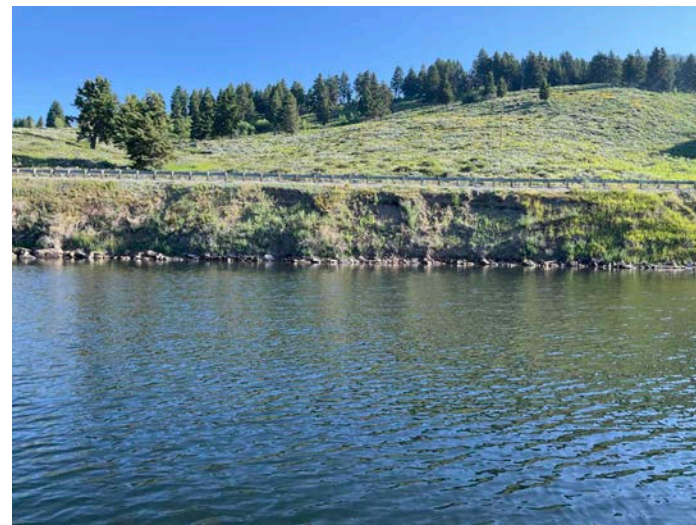


*Hebgen 82.1*

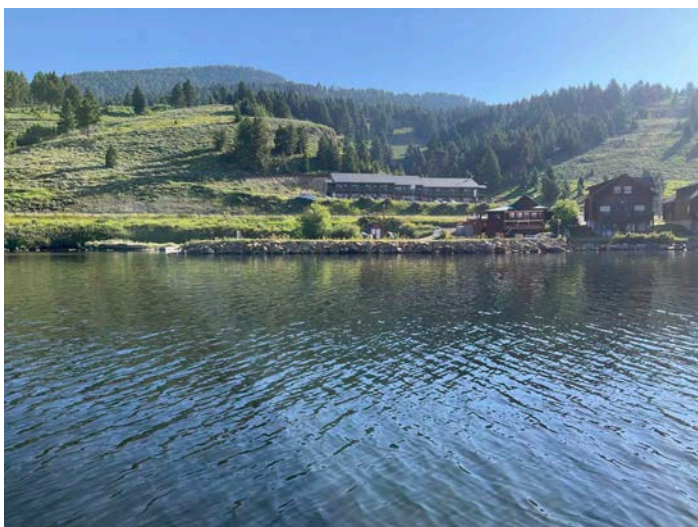




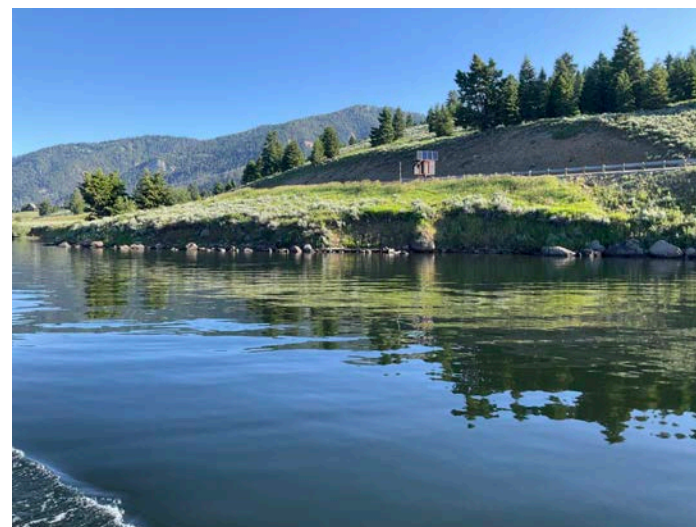
*Hebgen 83*



*Hebgen 85*



*Hebgen 84*



*Hebgen 85.1*

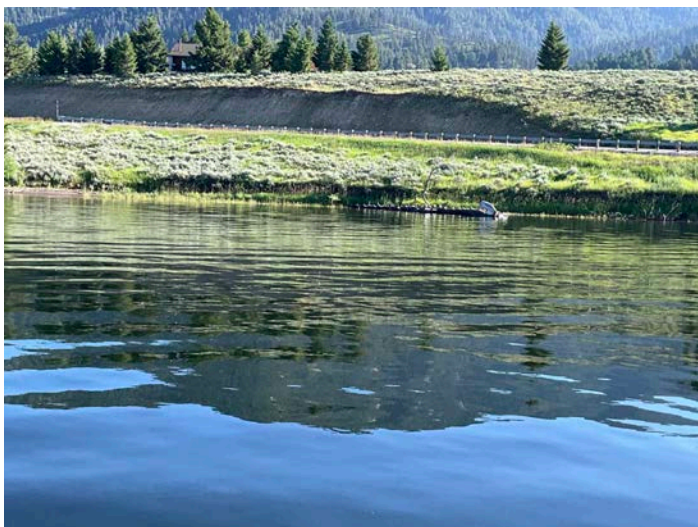




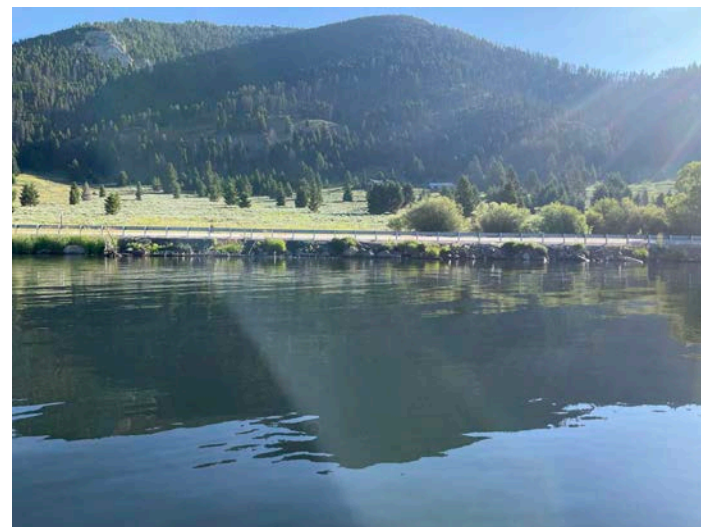
*Hebgen 86*



*Hebgen 87*

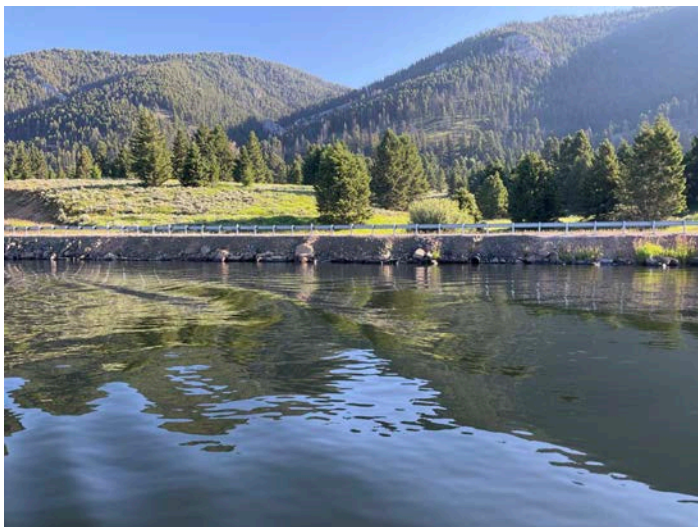


*Hebgen 86.1*

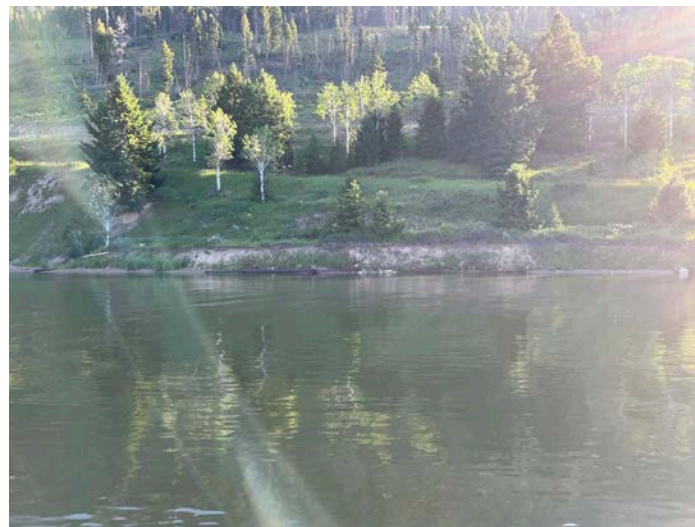


*Hebgen 88*

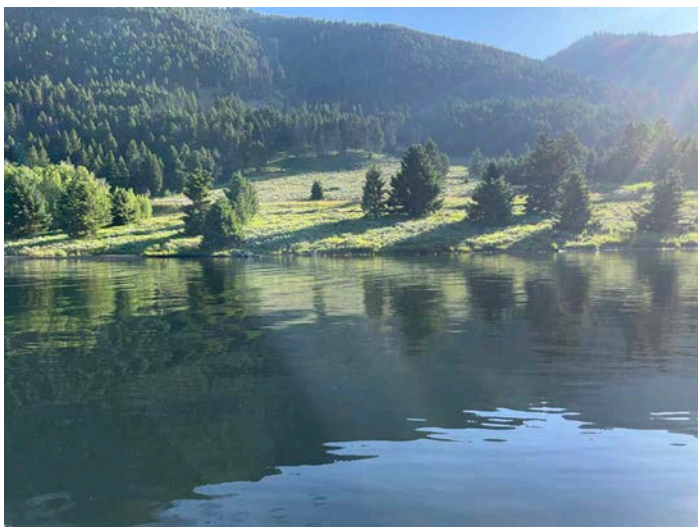




*Hebgen 89*



*Hebgen 91*



*Hebgen 90*



*Hebgen 91.5*

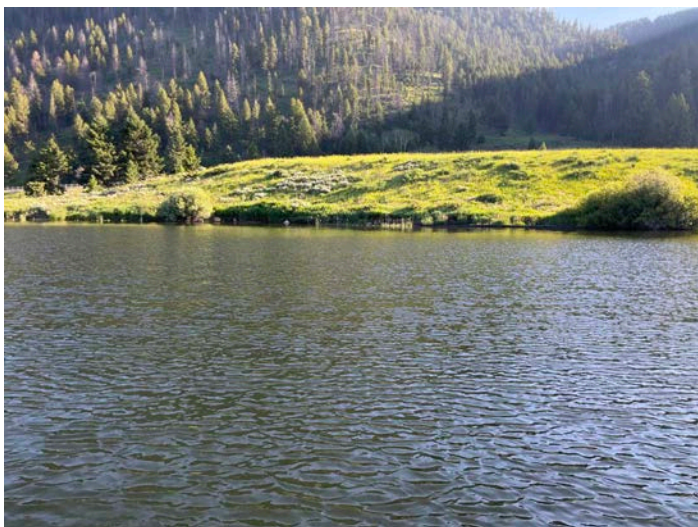




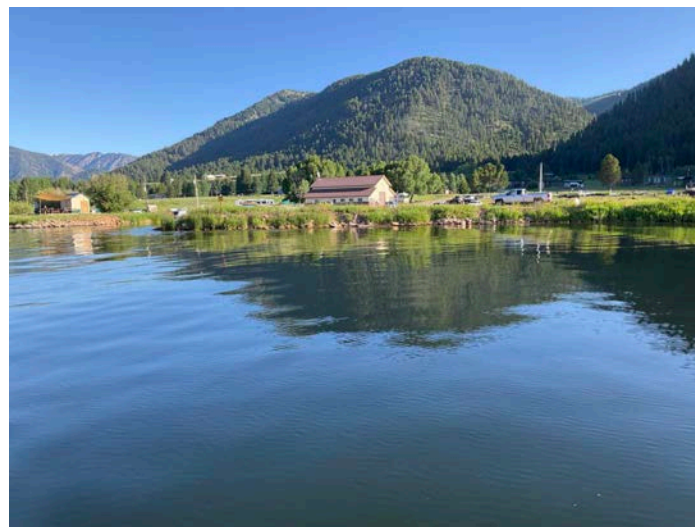
*Hebgen 92*



*Hebgen 94*



*Hebgen 93*



*Hebgen 95*

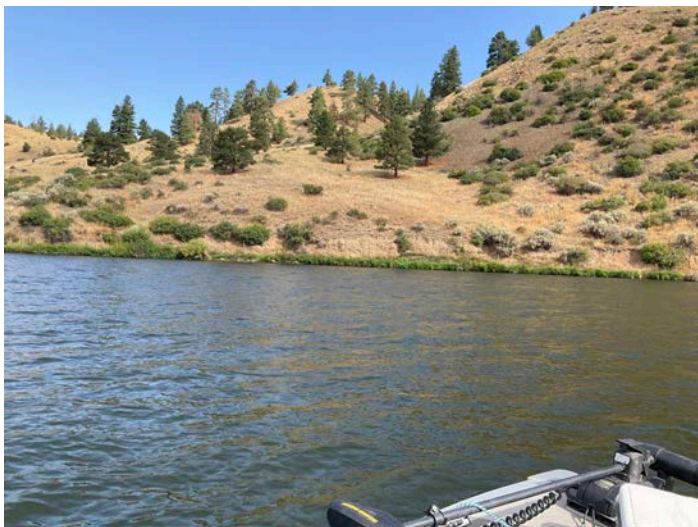
2023 HOLTER DEVELOPMENT

	OBSERVED EROSION CONDITION																		
SITE NO.	1991	1996	2003	2005	2008	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
2	minor activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
3	active	active	moderate activity	moderate activity	moderate activity				moderate activity	moderate activity	moderate activity			minor activity					minor activity
4	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					inactive	inactive	inactive	inactive	inactive	inactive
5	minor activity	moderate activity	minor-moderate activity	-	minor activity				moderate activity	moderate activity	moderate activity			minor activity					minor activity
6	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor activity					minor-moderate activity					minor-moderate activity
7	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
8	moderate activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
8a																			minor activity
9	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					inactive	inactive	inactive	inactive	inactive	inactive
10	minor activity	minor activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
11	moderate activity	moderate activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
12	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor activity					minor-moderate activity					Photo Missing
13	moderate activity	minor-moderate activity	minor activity	-	minor activity				minor activity					minor-moderate activity					Photo Missing
14	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
15	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
16	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					inactive	inactive	inactive	inactive	inactive	inactive
17	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					Photo Missing
18	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
19	moderate activity	minor-moderate activity	moderate activity	-	minor activity				minor activity					minor activity					minor activity
20	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor-moderate activity					minor-moderate activity
21	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
22	moderate activity	moderate activity	moderate activity	-	minor activity				minor activity					minor-moderate activity					minor-moderate activity
23	moderate activity	moderate activity	moderate activity	-	minor activity				minor activity					minor activity					minor activity
24	moderate activity	moderate activity	moderate activity	-	moderate activity				minor-moderate activity					minor-moderate activity					minor-moderate activity
25	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor activity					minor-moderate activity					minor-moderate activity
26	minor activity	moderate activity	minor-moderate activity	-	repaired-success				repaired-success					repaired-success					repaired-success
26a																			minor activity
27	active	moderate activity	active	repaired	repaired-success				repaired-success					Under Construction					Under Construction
27uc																			repaired-success
28	active	active	active	active	active	active	active	active	active	active	active	active		moderate activity					moderate activity
28.1																			new activity
29	active	active	active	active	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
30	moderate activity	moderate activity	moderate activity	-	partial repair-partial success				partial repair-partial success	partial repair-partial success	partial repair-partial success	partial repair-partial success		partial repair-partial success					partial repair-partial success
31	moderate activity	minor-moderate activity	minor-moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
32	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
33	active	active	active	active	active	active	active	active	active	active	active	active		active	active	active	active	active	active
33.1																			new activity
34	active	active	active	active	active	active	active	active	active	active	active	active		active	active	active	active	active	active
35	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
36	moderate activity	moderate activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
37	moderate activity	minor-moderate activity	minor activity	-	minor activity				minor activity					minor activity					minor activity
38	active	moderate activity	moderate activity	-	moderate activity				active	active	active	active		active	active	active	active	active	active



2023 HOLTER DEVELOPMENT

SITE NO.	OBSERVED EROSION CONDITION									2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2009	2011	2012	2013										
39	active	active	active	active	active	active	active	active	active	active	active	active		active	active	active	active	active	active
39.1																			new activity
40	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
41	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
42	minor activity	moderate activity	minor-moderate activity	-	minor activity				minor activity					minor activity					minor activity
43	moderate activity	moderate activity	minor-moderate activity	-	minor activity				minor activity					inactive	inactive	inactive	inactive	inactive	inactive
44	active	moderate activity	moderate activity	moderate activity	minor activity				minor activity					moderate activity					moderate activity
45	active	active	active	active	active	active	active	active	active	active	active	active		active	active	active	active	active	active
46	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			active	active	active	active	active	active
46A			moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					Photo Missing
46.1																			new activity
47	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
48	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			minor-moderate activity					minor-moderate activity
49	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
50	moderate activity	minor-moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
51	moderate activity	minor activity	minor activity	-	minor activity				minor activity					minor-moderate activity					minor-moderate activity
52	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
53	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
54	active	active	active	active	active	active	active	active	active	active	active			active	active	active	active	active	active
55	moderate activity	moderate activity	active	active	active	active	active	active	active	active	active			active	active	active	active	active	active
55.1																			new activity
56	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
57	active	active	active	active	active	active	active	active	active	active	active			active	active	active	active	active	active
57.1																			new activity
58	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity
59	active	active	active	active	active	active	active	active	active	active	active			active	active	active	active	active	active
60	moderate activity	moderate activity	moderate activity	-	moderate activity				moderate activity	moderate activity	moderate activity			moderate activity					moderate activity



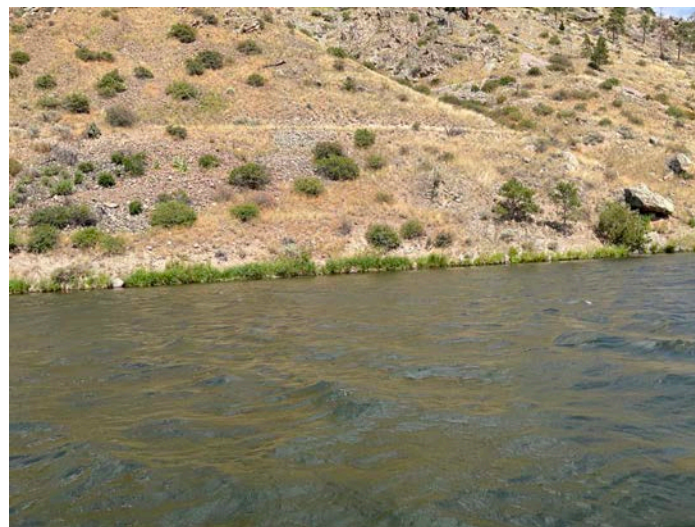
*Holter 1*



*Holter 3*



*Holter 2*



*Holter 4*





*Holter 5*



*Holter 7*



*Holter 6*



*Holter 8*





*Holter 8a*



*Holter 10*



*Holter 9*



*Holter 11*





*Holter 14*



*Holter 16*



*Holter 15*



*Holter 18*





*Holter 19*



*Holter 21*



*Holter 20*



*Holter 22*

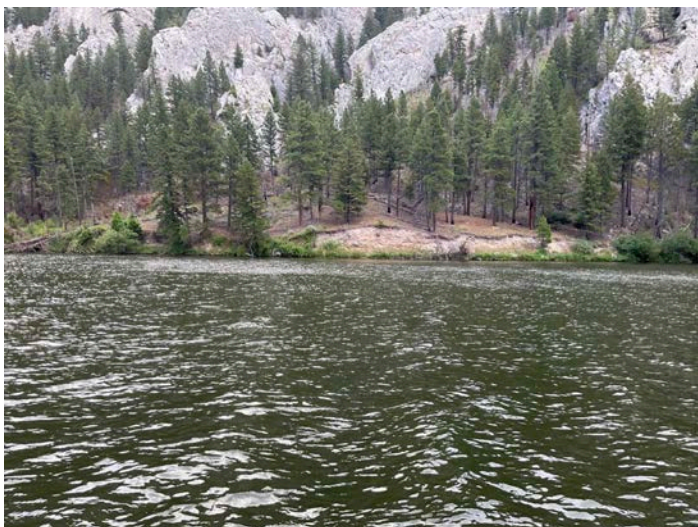




*Holter 23*



*Holter 25*



*Holter 24*



*Holter 26*





*Holter 26a*



*Holter 27uc*



*Holter 27*



*Holter 28*





*Holter 28.1*



*Holter 30*



*Holter 29*



*Holter 31*





*Holter 32*



*Holter 33.1*



*Holter 33*



*Holter 34*





*Holter 35*



*Holter 37*



*Holter 36*

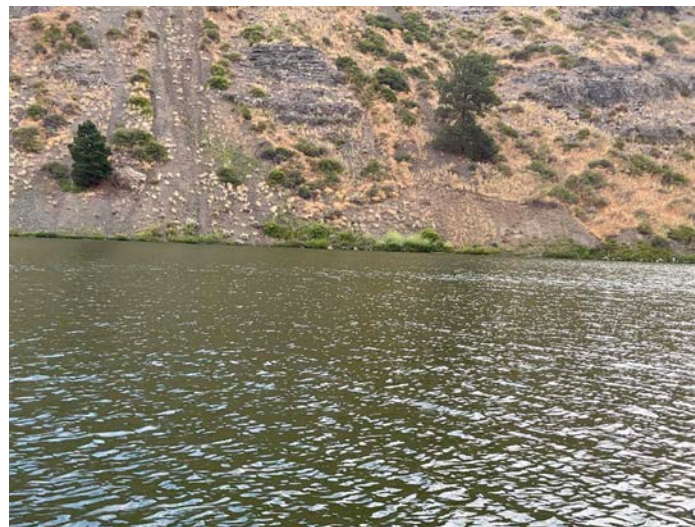


*Holter 38*





*Holter 39*



*Holter 40*



*Holter 39.1*



*Holter 41*





*Holter 42*



*Holter 44*



*Holter 43*



*Holter 45*





*Holter 46*



*Holter 47*



*Holter 46.1*



*Holter 48*





*Holter 49*



*Holter 51*



*Holter 50*



*Holter 52*





*Holter 53*



*Holter 55*



*Holter 54*



*Holter 55.1*





*Holter 56*



*Holter 57.1*



*Holter 57*



*Holter 58*



*Holter 59*



*Holter 60*



## 2023 MADISON DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION						2014	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2013							
1	minor activity	minor activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
2	minor activity	moderate activity	minor activity	-	repair-success	repair-success		active	active	active	active	active	active
3	minor activity	minor activity	minor activity	-	minor activity	minor activity		repair-success					repair-success
4	moderate activity	moderate activity	minor-moderate	-	minor activity	minor activity		minor activity					minor activity
5	active	active	minor activity	inactive	repair-success	repair-success		repair-success					repair-success
6	minor activity	minor activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
7	minor activity	minor activity	minor activity	-	minor activity	minor activity		repair-success					repair-success
8	minor activity	minor activity	minor activity	-	partial repair-success	partial repair-success		repair-success					repair-success
9	moderate activity	minor-moderate activity	minor activity	-	minor activity	minor activity		repair-success					repair-success
10	active	minor activity	repaired	repaired	success	success		repair-success					repair-success
11	active	minor activity	repaired	repaired	success	success		success					success
12	minor activity	minor activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
13	active	active	minor activity	minor activity	minor activity	minor activity		minor activity					minor activity
14	moderate activity	minor-moderate activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
15	moderate activity	minor-moderate activity	minor activity	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
16	active	active	minor activity	minor activity	minor activity	minor activity		active					repair-success
17	minor activity	minor activity	minor activity	-	minor activity	minor activity		minor-moderate					minor-moderate
18	active	active	minor activity	minor activity	partial repair-partial success	partial repair-partial success		repair-success					repair-success
19	active	minor activity	minor activity	minor activity	minor activity	minor activity		minor activity					minor activity
20	minor activity	minor activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
21	minor activity	minor activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
22	moderate activity	moderate activity	minor-moderate	-	minor activity	minor-moderate		minor-moderate					minor-moderate
23	moderate activity	minor activity	minor activity	-	minor activity	minor-moderate		repair-success					repair-success
24	minor activity	minor activity	minor activity	-	minor activity	minor activity		partial repair					partial repair
25	moderate activity	moderate activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
26	moderate activity	moderate activity	minor activity	-	minor activity	minor activity		minor activity					minor activity
27	moderate activity	minor activity	minor-moderate	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
28	varies	minor-moderate	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
29	moderate activity	minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
29 (2)									inactive	inactive	inactive	inactive	inactive
30		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive					Photo Missing
30.1									inactive	inactive	inactive	inactive	inactive

2023 MADISON DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION						2014	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2013							
31		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
31 (2)									inactive	inactive	inactive	inactive	inactive
32		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
33		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
34		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
35		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
36		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
37		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
38		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		inactive	inactive	inactive	inactive	inactive	inactive
39		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
40		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
41		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
42		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
43		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
44		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity
45		minor activity	Lake too shallow - No photos	-	minor activity	minor activity		minor activity					minor activity





*Madison 1*



*Madison 3*

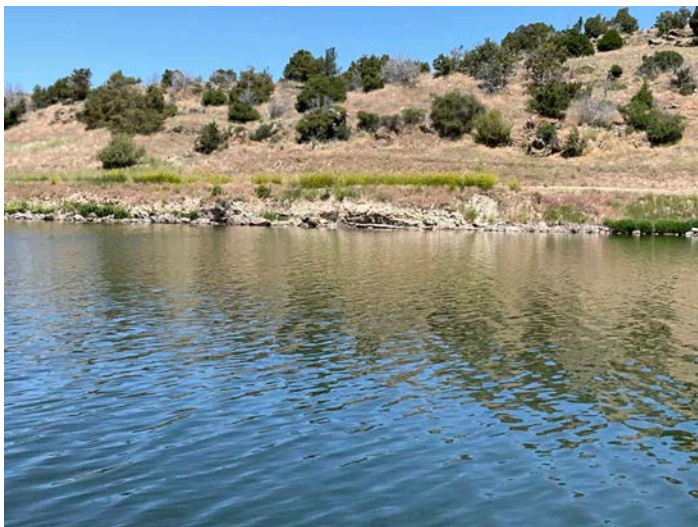


*Madison 2*



*Madison 4*





*Madison 5*



*Madison 7*



*Madison 6*



*Madison 8*

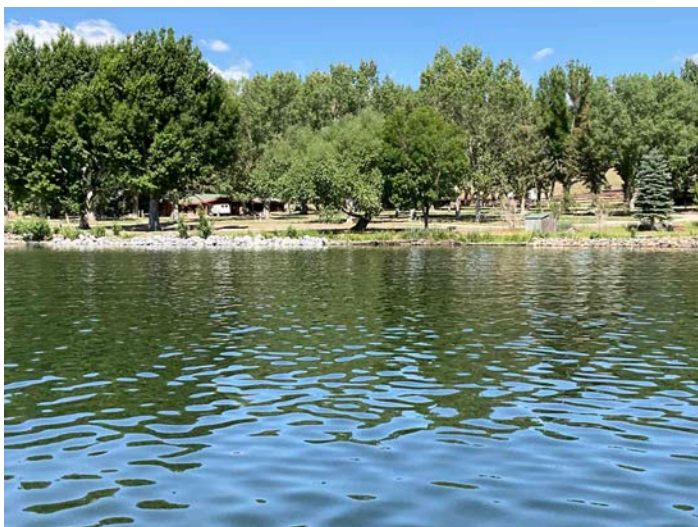




*Madison 9*



*Madison 11*



*Madison 10*



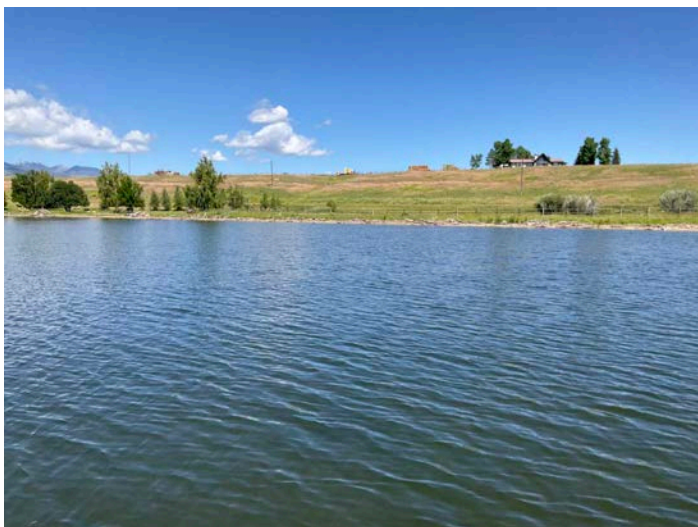
*Madison 12*



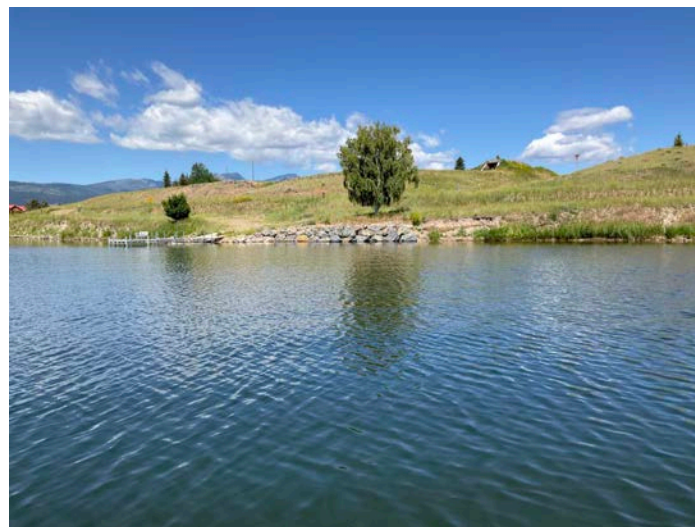
*Madison 13*



*Madison 15*

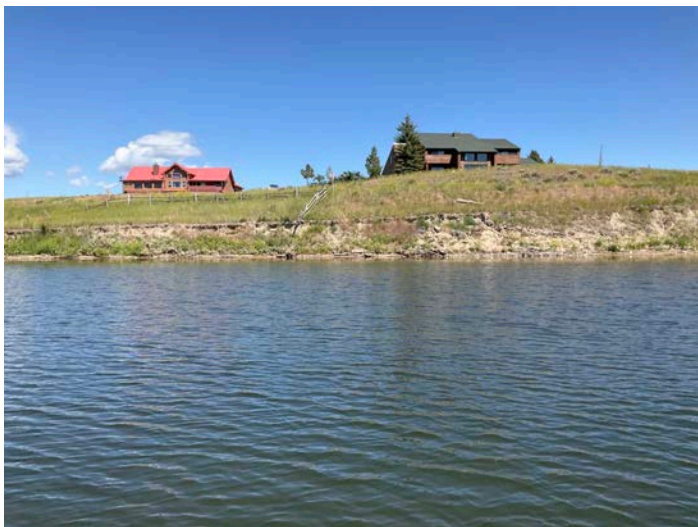


*Madison 14*



*Madison 16*





*Madison 17*



*Madison 19*



*Madison 18*



*Madison 20*





*Madison 21*



*Madison 23*

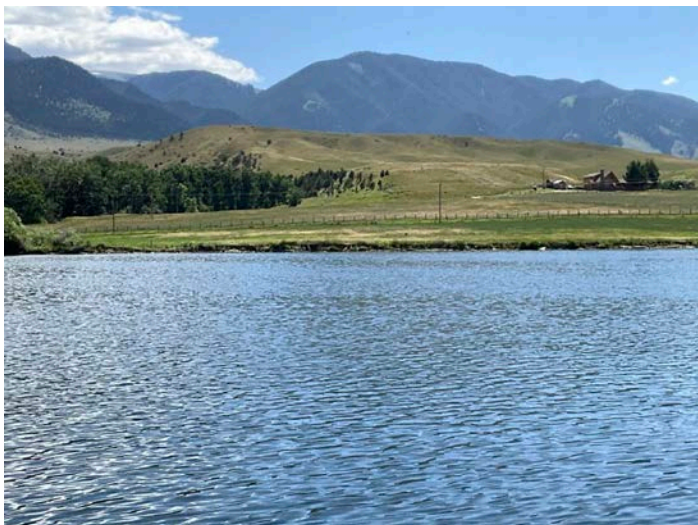


*Madison 22*



*Madison 24*





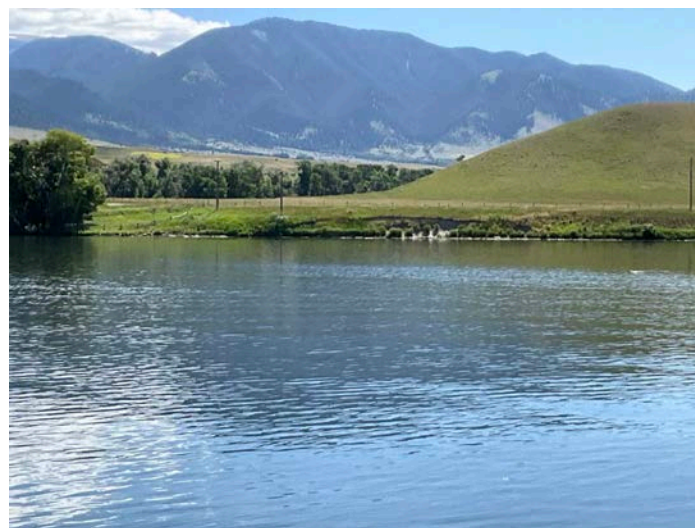
*Madison 25*



*Madison 27*



*Madison 26*



*Madison 28*



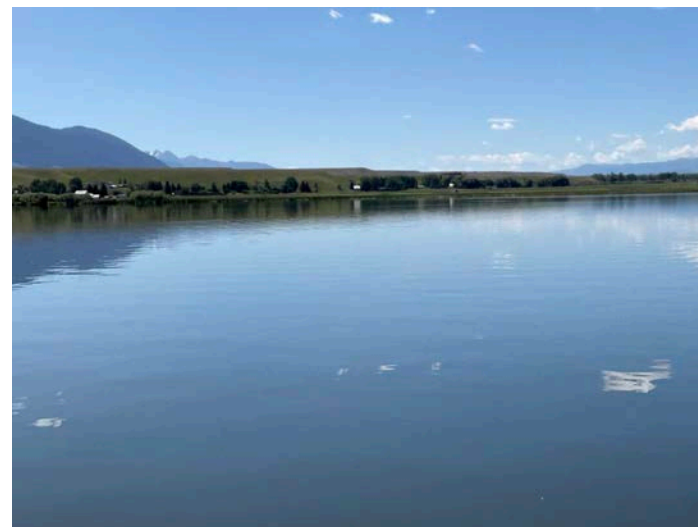
*Madison 29*



*Madison 30.1*



*Madison 29 (2)*

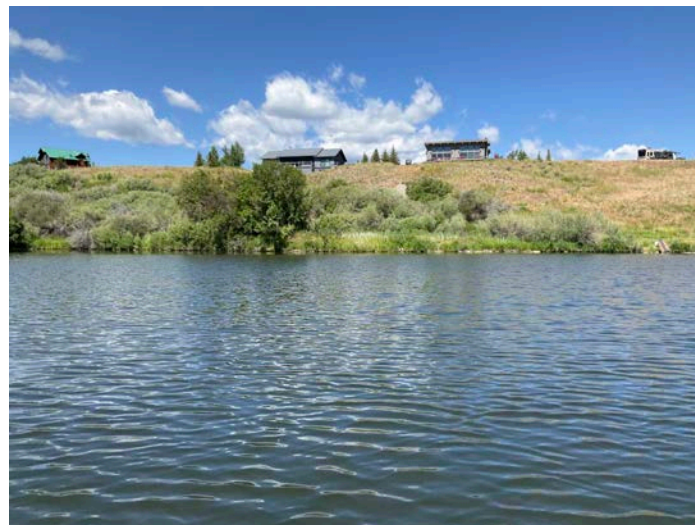


*Madison 31*

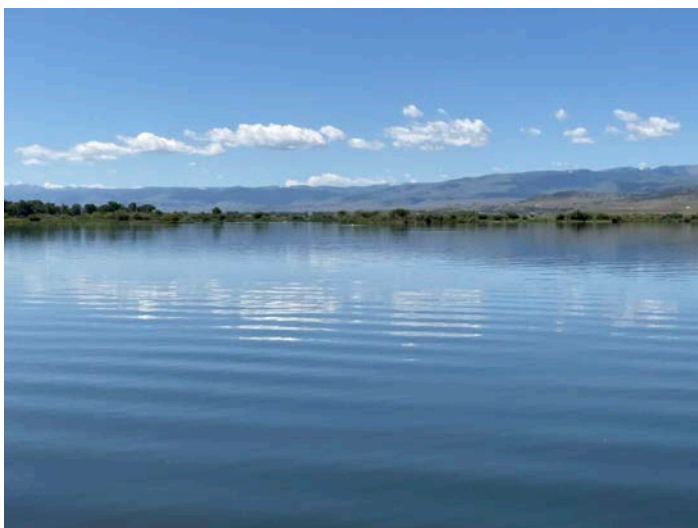




*Madison 31 (2)*



*Madison 33*



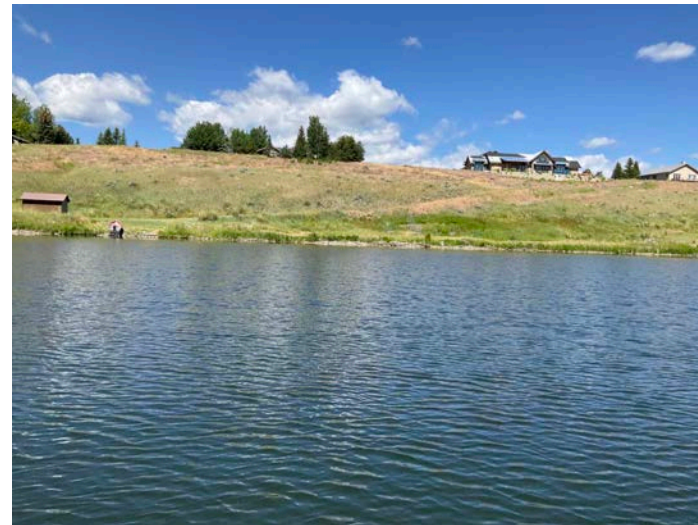
*Madison 32*



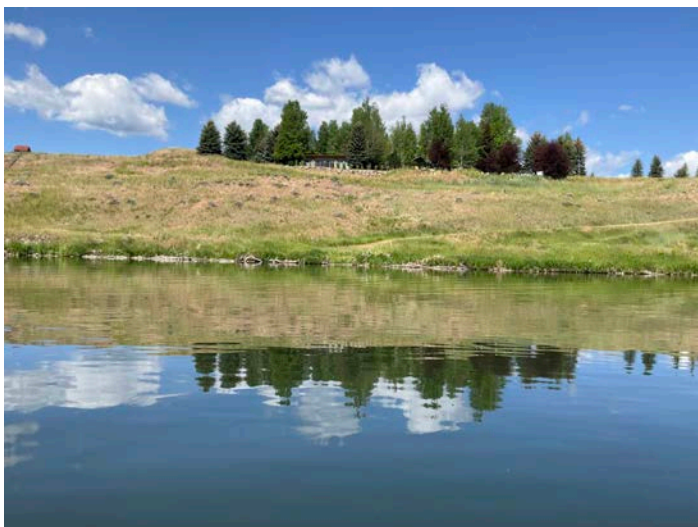
*Madison 34*



*Madison 35*



*Madison 37*



*Madison 36*



*Madison 38*

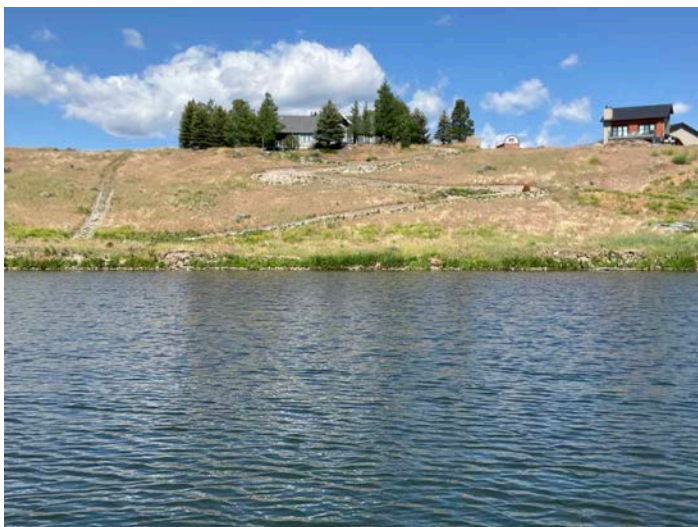




*Madison 39*



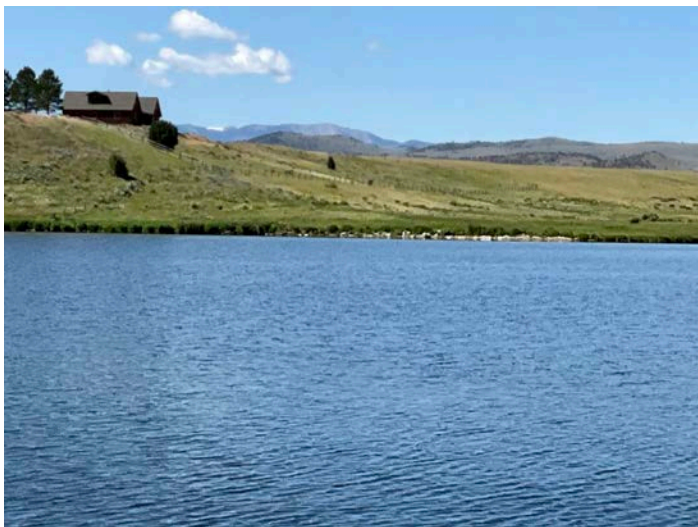
*Madison 41*



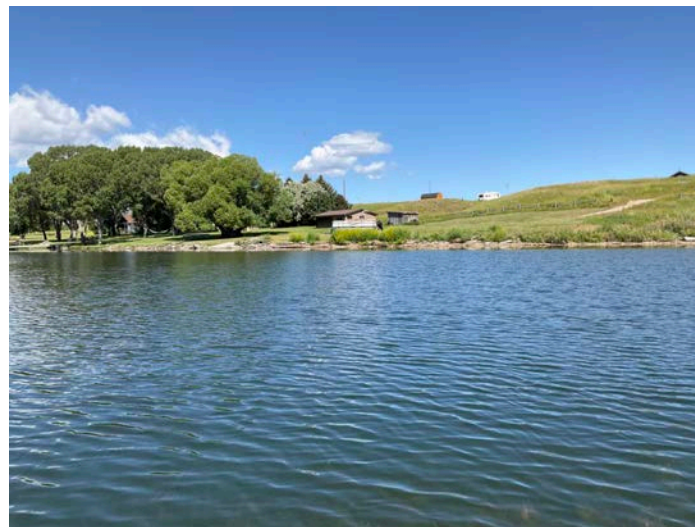
*Madison 40*



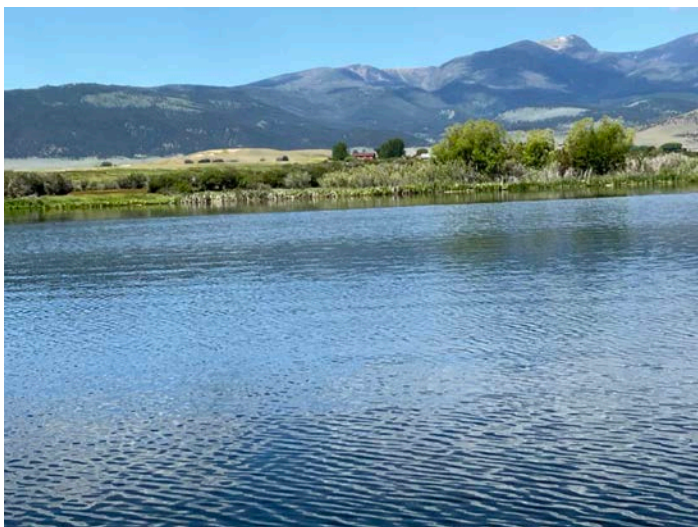
*Madison 42*



*Madison 43*



*Madison 45*



*Madison 44*



2023 MORONY DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION						2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2013										
1	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
2	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
3	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					Photo Missing
4	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
5	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
6	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
7	active	moderate activity	moderate activity	minor activity	minor activity	minor activity					minor activity					minor activity
8	moderate activity	moderate activity	moderate activity	-	minor activity	minor activity					minor activity					minor activity
9	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
10	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity				minor-moderate activity					minor-moderate activity
11	moderate activity	moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity				moderate activity					moderate activity
12	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
13	active	minor-moderate activity	minor-moderate activity	inactive	minor activity	minor activity					minor activity					minor activity
14	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
15	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity	minor activity					moderate activity					moderate activity
16	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
17	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
18	active	moderate activity	minor-moderate activity	minor activity	minor activity	minor activity					minor activity					minor activity
19	moderate activity	moderate activity	moderate activity	-	minor activity	minor activity					minor activity					minor activity
20	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
21	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
22	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
23	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
24	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity



*Morony 1*



*Morony 4*



*Morony 2*



*Morony 5*





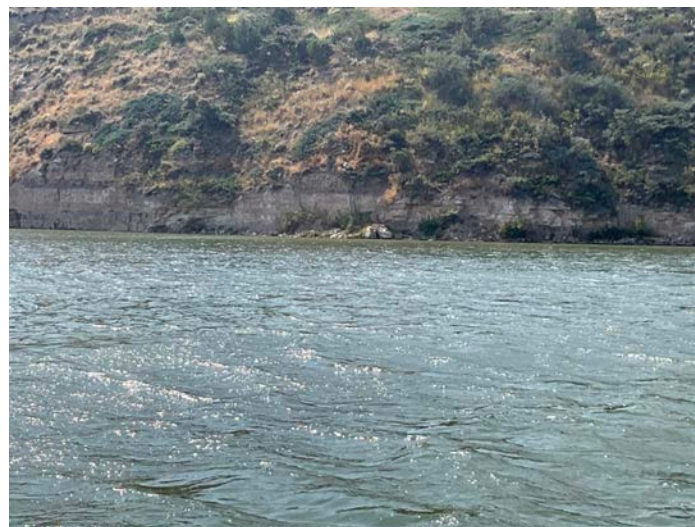
*Morony 6*



*Morony 8*



*Morony 7*



*Morony 9*





*Morony 10*



*Morony 12*



*Morony 11*



*Morony 13*





*Morony 14*



*Morony 16*



*Morony 15*



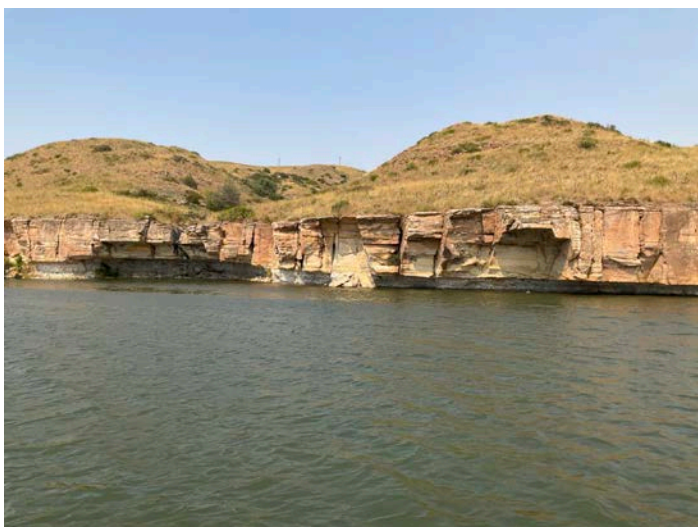
*Morony 18*



*Morony 19*



*Morony 21*



*Morony 20*



*Morony 22*





*Morony 23*



*Morony 24*

2023 RAINBOW DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION						2014	2018	2019	2020	2021	2022	2023
	1991	1996	2003	2005	2008	2013							
1	active	minor-moderate activity	minor activity	minor activity	minor activity	minor activity	minor activity	minor-moderate activity					minor-moderate activity
2	minor activity	minor activity	inactive	-	inactive	minor activity	minor activity	minor-moderate activity					minor-moderate activity
3	minor activity	minor activity	inactive	-	inactive	minor activity	minor activity	minor activity					minor activity
4	minor activity	minor activity	minor activity	-	minor activity	minor activity	minor activity	minor activity					Photo Missing
5	minor activity	minor activity	minor activity	-	minor activity	minor activity	minor activity	minor activity					minor activity
6	minor activity	minor activity	minor activity	-	inactive	minor activity	minor activity	Repaired - succes					Repaired - succes
7	moderate activity	moderate activity	minor-moderate activity	-	minor activity	minor activity	minor activity	minor activity					minor activity
8	minor activity	minor-moderate activity	minor activity	-	no photo taken	minor activity	minor activity	minor activity					minor activity
9	moderate activity	moderate activity	minor activity	-	minor activity	minor activity	minor activity	minor activity					minor activity
10	moderate activity	moderate activity	moderate activity	-	minor activity	minor activity	minor activity	minor activity					minor activity
11	active	moderate activity	moderate activity	minor activity	minor activity	minor activity	minor activity	minor activity					minor activity
12	moderate activity	moderate activity	minor activity	-	minor activity	minor activity	minor activity	minor activity					minor activity
13	active	minor-moderate activity	minor activity	inactive	minor activity	minor activity	minor activity	minor activity					minor activity
14	minor activity	minor activity	minor activity	-	minor activity	minor activity	minor activity	minor-moderate activity					minor-moderate activity
15	moderate activity	minor-moderate activity	minor activity	-	minor activity	minor activity	minor activity	minor-moderate activity					minor-moderate activity
16	moderate activity	minor-moderate activity	minor activity	-	minor activity	minor activity	minor activity	minor-moderate activity					minor-moderate activity
17	moderate activity	moderate activity	minor activity	-	minor activity	minor activity	minor activity	minor activity					Photo Missing





*Rainbow 1*



*Rainbow 3*



*Rainbow 2*



*Rainbow 5*



*Rainbow 6*



*Rainbow 8*



*Rainbow 7*



*Rainbow 9*





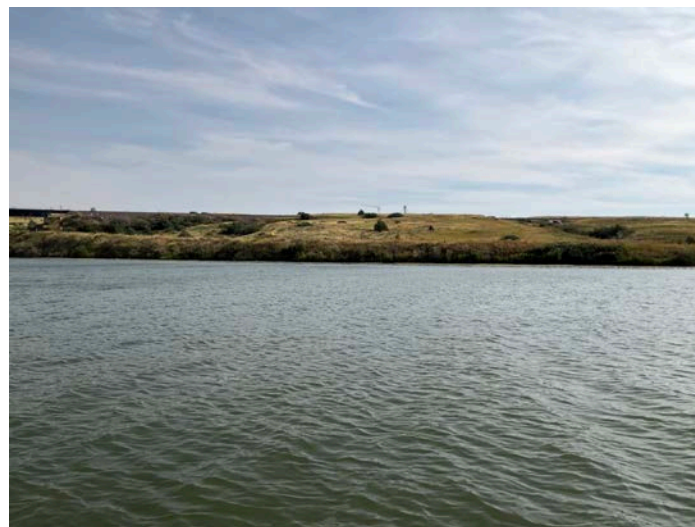
*Rainbow 10*



*Rainbow 12*



*Rainbow 11*



*Rainbow 13*



*Rainbow 14*



*Rainbow 16*



*Rainbow 15*



2023 RYAN DEVELOPMENT

SITE NO.	OBSERVER EROSION CONDITION															
	1991	1996	2003	2005	2008	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
2	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
3	moderate activity	minor activity	minor-moderate activity	-	minor activity	moderate activity	moderate activity			moderate activity	active	active	active	active	active	active
4	minor activity	minor-moderate activity	moderate activity	-	moderate activity	moderate activity	moderate activity			moderate activity	moderate activity					moderate activity
5	minor activity	minor activity	minor-moderate activity	-	minor activity	moderate activity	moderate activity			moderate activity	minor-moderate activity					minor-moderate activity
6	active	minor-moderate activity	minor-moderate activity	moderate activity	moderate activity	moderate activity	moderate activity			moderate activity	moderate activity					moderate activity
7	moderate activity	minor-moderate activity	minor-moderate activity	-	minor activity	minor activity					minor-moderate activity					minor-moderate activity
8	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
9	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
10	minor activity	minor-moderate activity	minor-moderate activity	-	minor activity	minor activity					minor activity					minor activity
11	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
12	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
13	minor activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
14	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
15	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
16	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
17	moderate activity	minor activity	minor activity	-	minor activity	no photo taken					minor activity					minor activity
18	moderate activity	minor activity	minor activity	-	minor activity	minor activity					minor activity					minor activity
19	minor activity	minor activity	minor activity	-	no photo taken	no photo taken					minor activity					Photo Missing
20	minor activity	minor activity	minor activity	-	no photo taken	no photo taken					minor activity					Photo Missing



*Ryan 1*



*Ryan 3*



*Ryan 2*



*Ryan 4*





*Ryan 5*



*Ryan 7*



*Ryan 6*



*Ryan 8*



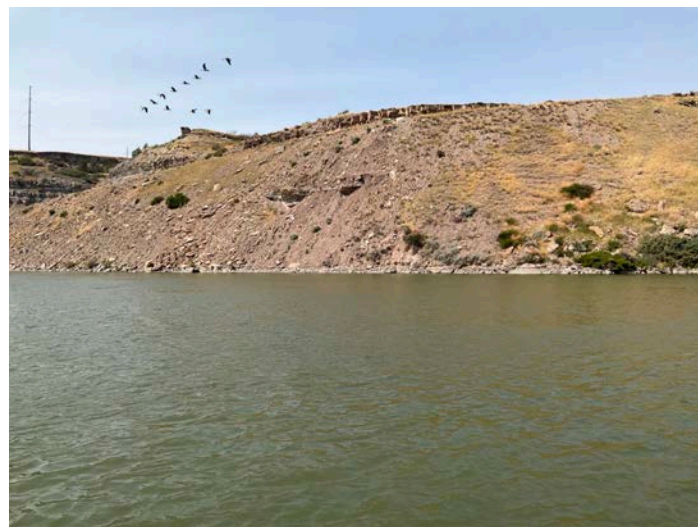
*Ryan 9*



*Ryan 11*



*Ryan 10*



*Ryan 12*





*Ryan 13*



*Ryan 15*



*Ryan 14*



*Ryan 16*



*Ryan 17*



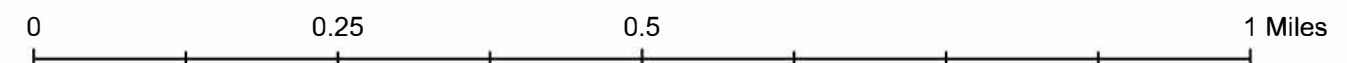
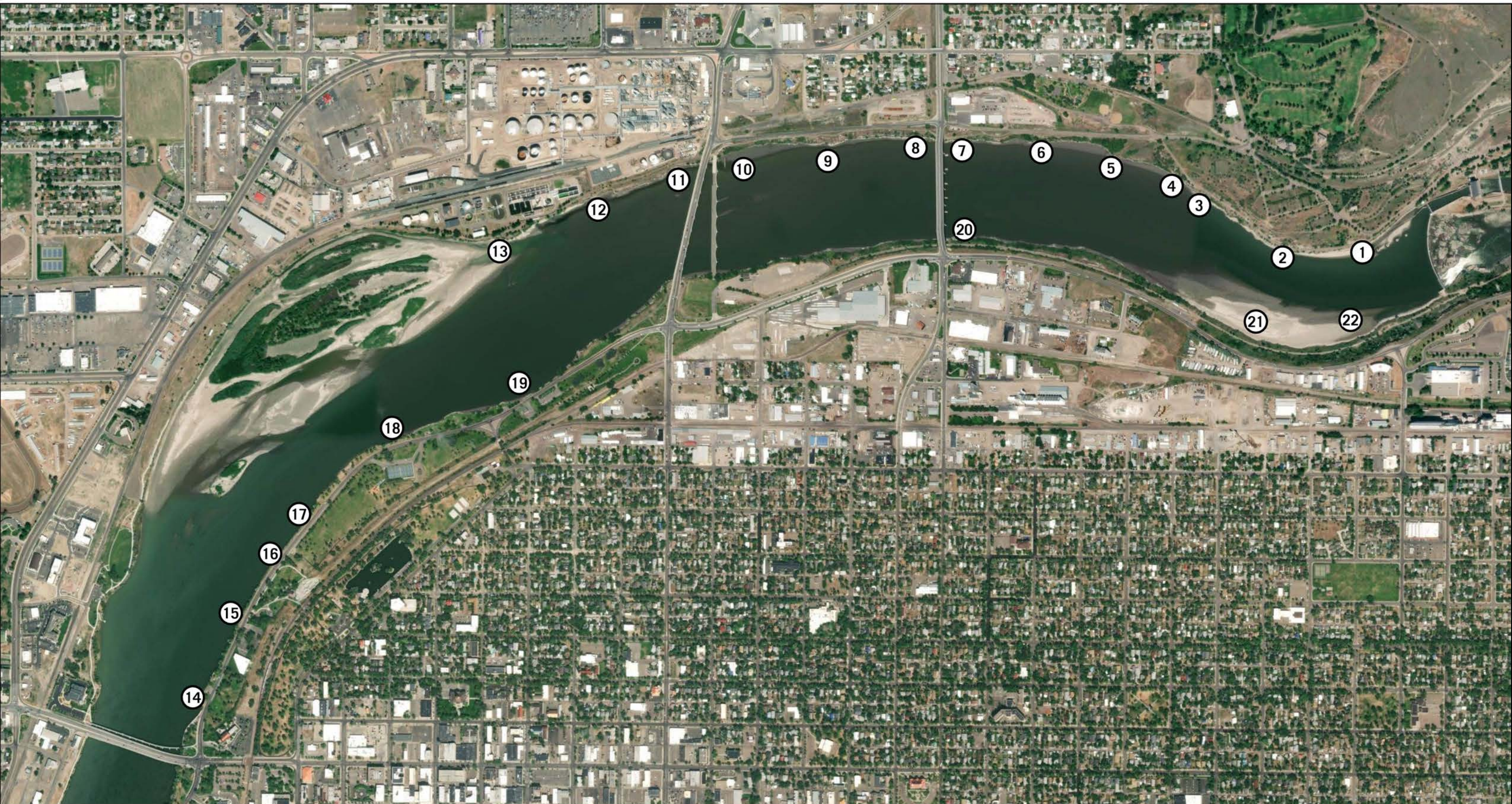
*Ryan 18*



## Appendix B

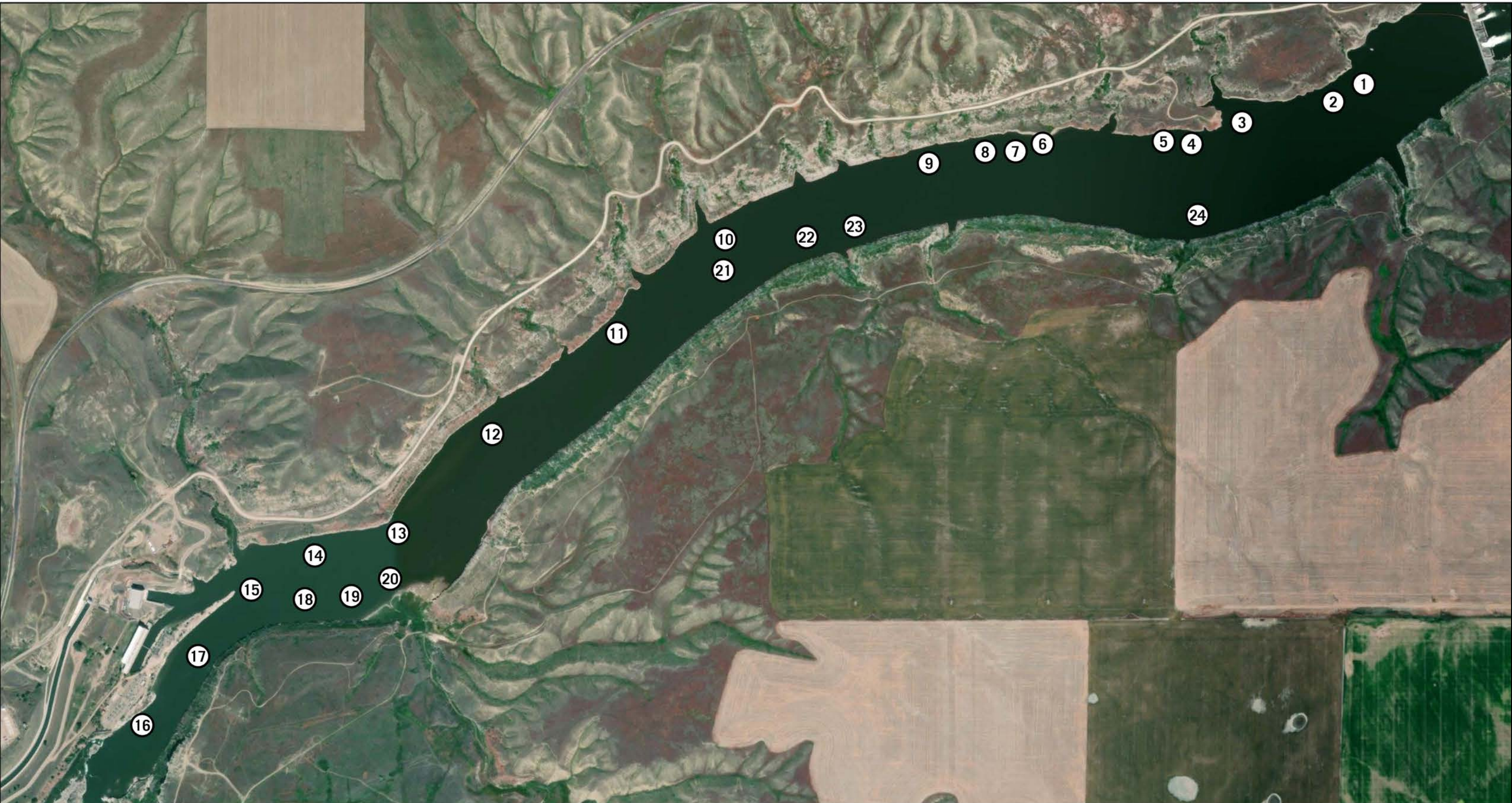


# 2023 NWE Erosion Monitoring Survey: Black Eagle





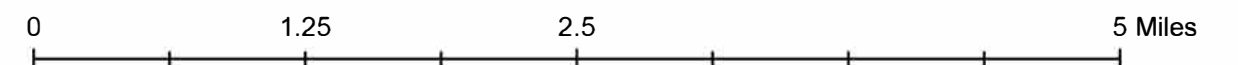
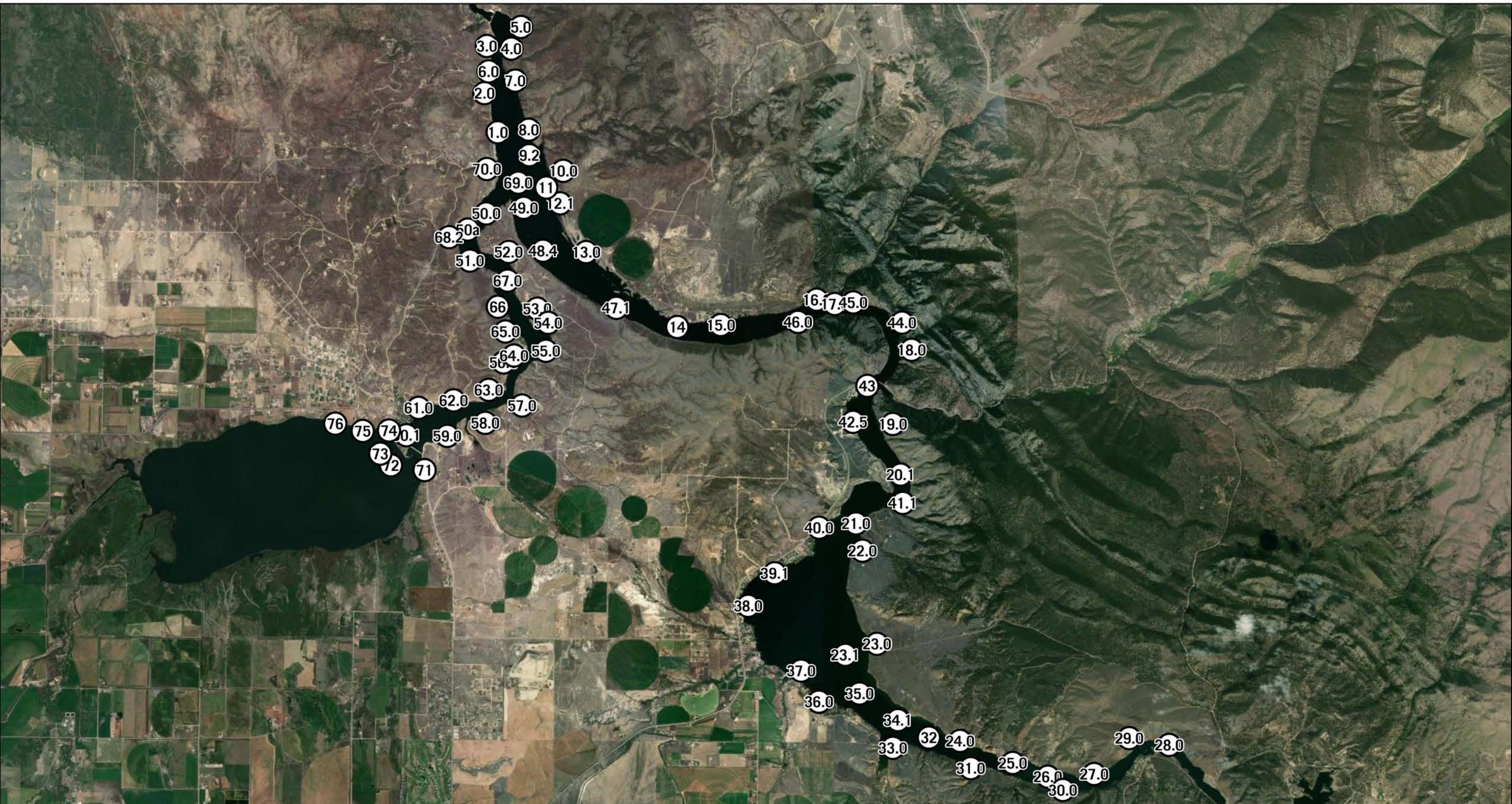
# 2023 NWE Erosion Monitoring Survey: Cochrane



0 0.2 0.4 0.8 Miles

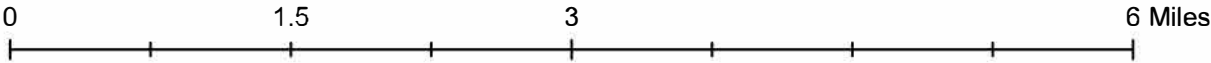
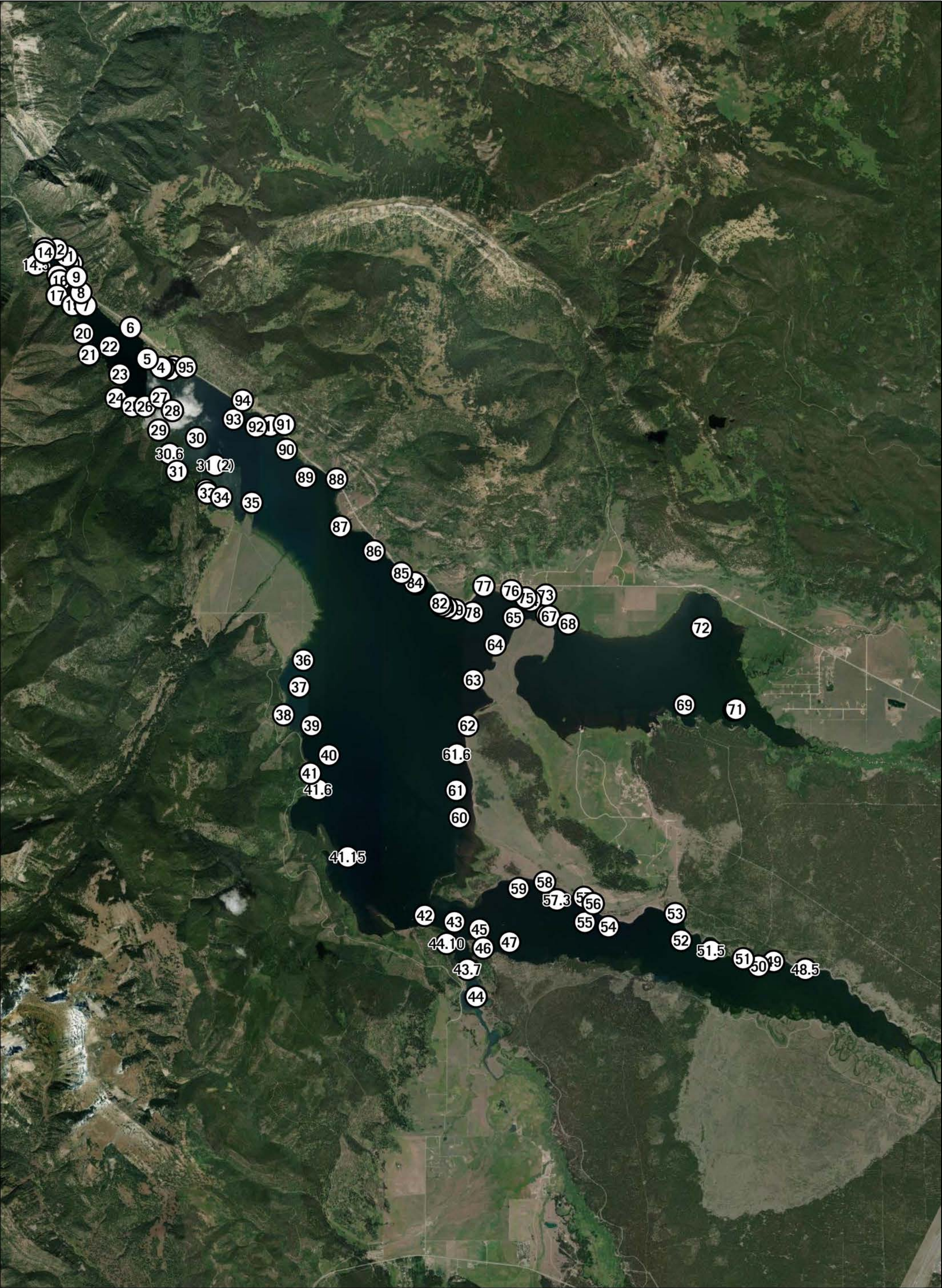


# 2023 NWE Erosion Monitoring Survey: Hauser





# 2023 NWE Erosion Monitoring Survey: Hebgen





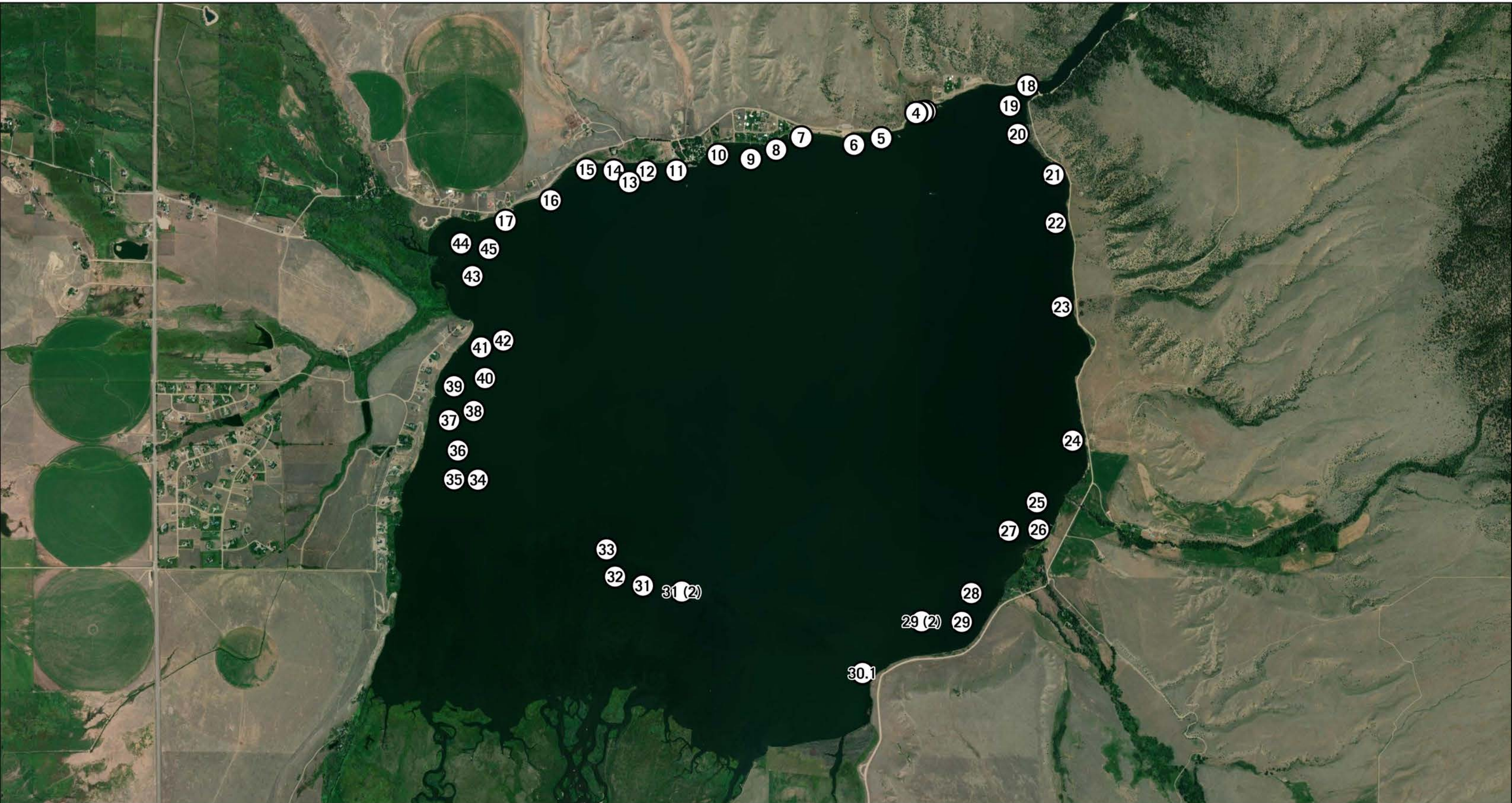
# 2023 NWE Erosion Monitoring Survey: Holter



0 1.5 3 6 Miles

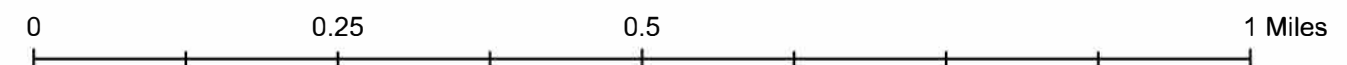
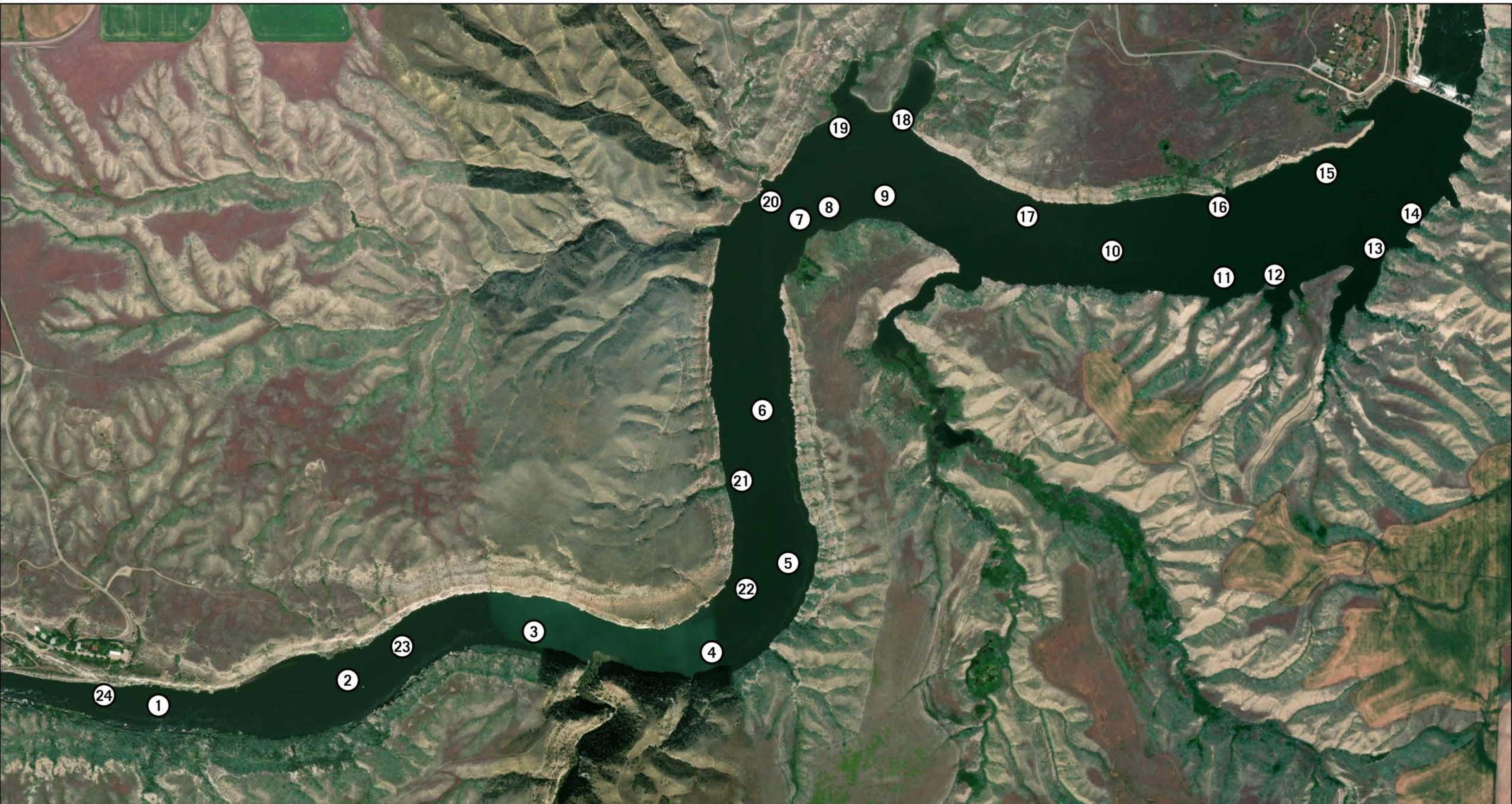


# 2023 NWE Erosion Monitoring Survey: Madison



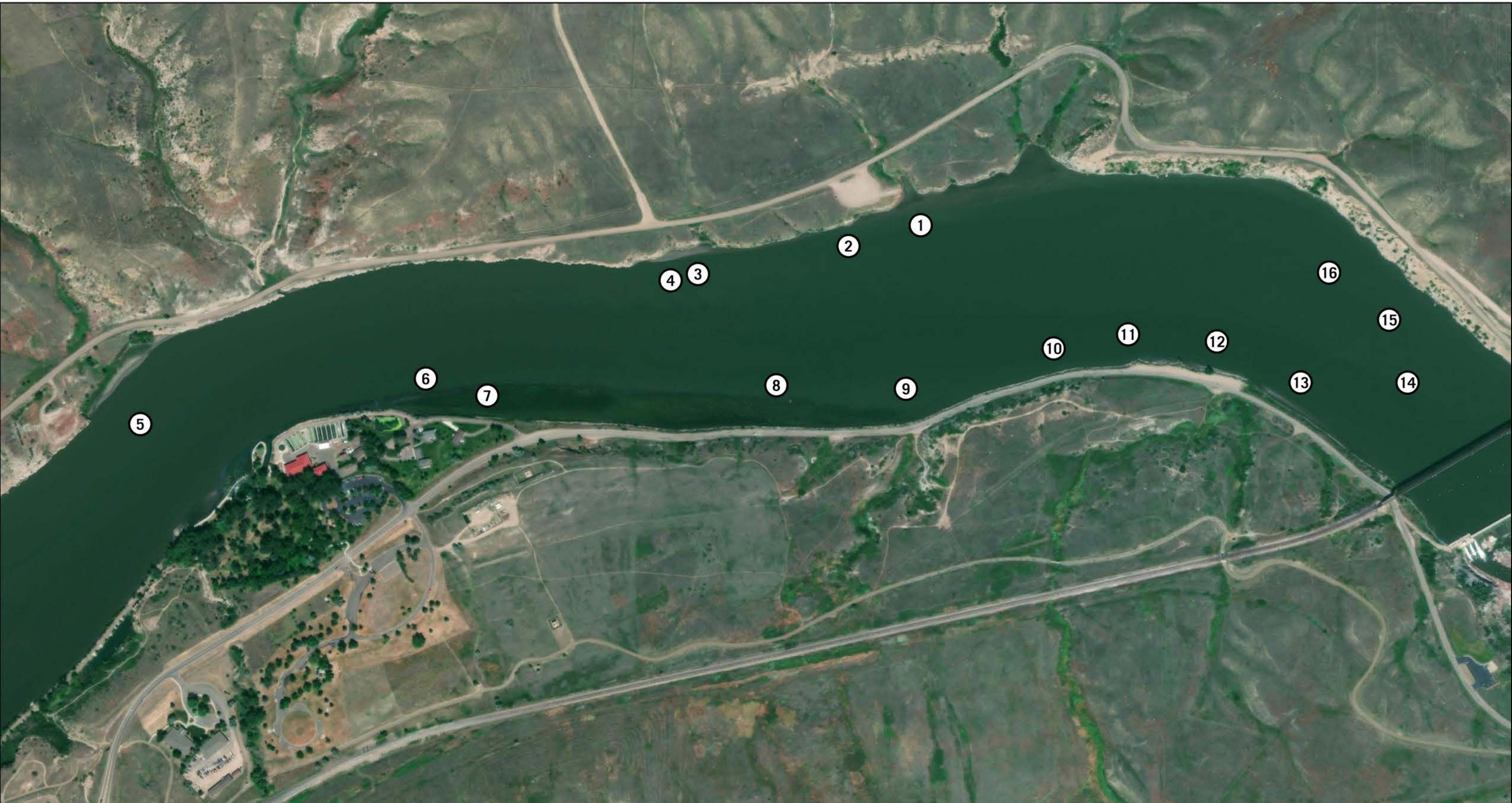


# 2023 NWE Erosion Monitoring Survey: Morony





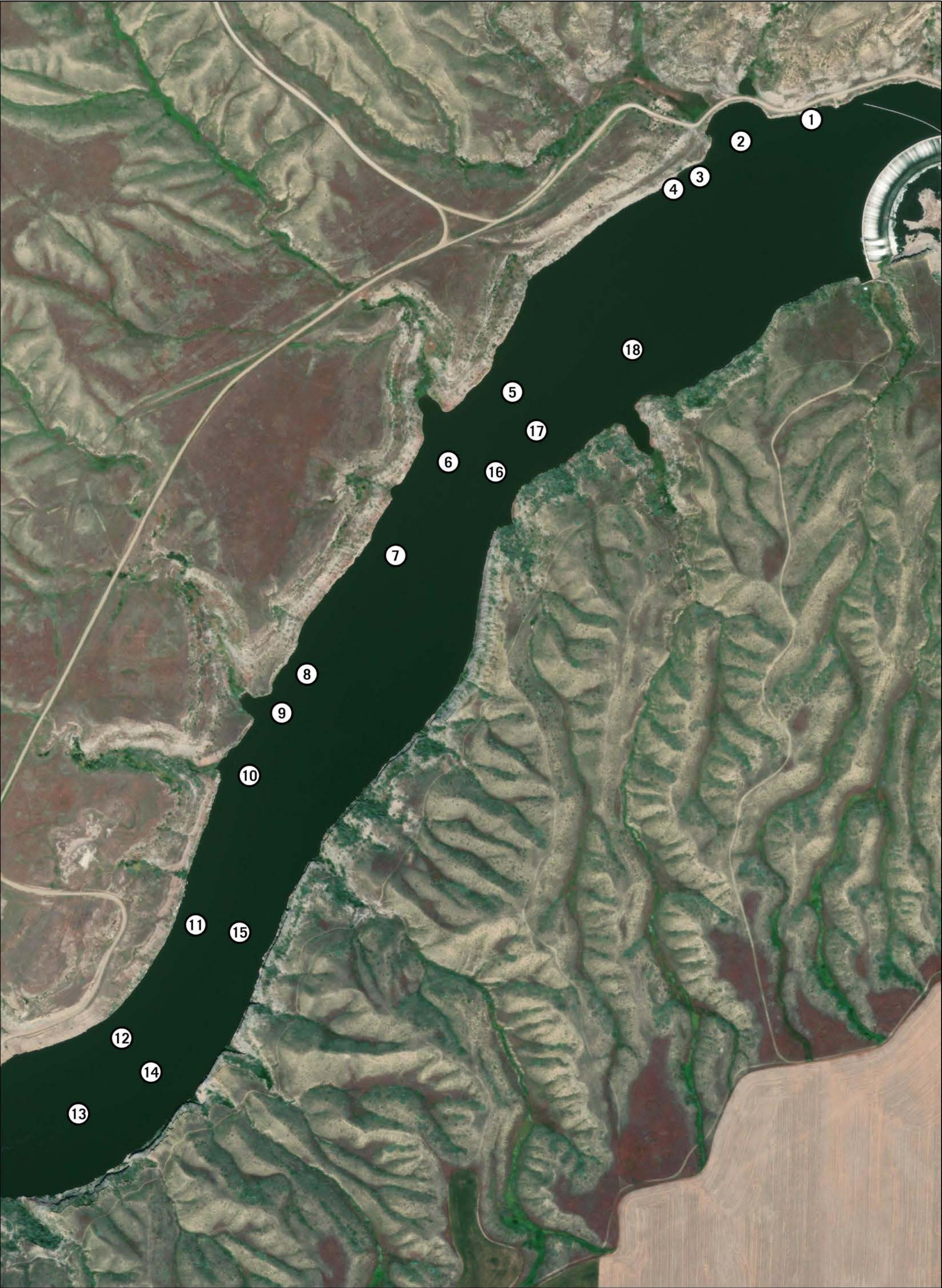
# 2023 NWE Erosion Monitoring Survey: Rainbow



0 0.1 0.2 0.4 Miles



# 2023 NWE Erosion Monitoring Survey: Ryan



0 0.13 0.25 0.5 Miles