Montana Resources

600 Shields Ave.
Butte, Montana USA 59701
59701(406) 496-3200
(406) 723-9542 fax
www.montanaresources.com

Atlantic Richfield Company

317 Anaconda Road
Butte, MT 59701
Main (406) 782-9964
Fax (406) 782-9980
A BP affiliated company

August 17, 2015

Certified Mail
Mr. Henry Elsen, Esquire
U.S. EPA Region VIII, Montana Office
Baucus Federal Building
10 West 15th Street, Suite 3200
Helena, Montana 59626

Certified Mail
Mary Capdeville, Esquire
CERCLA Site Attorney
Mine Flooding CERCLA Site
Department of Environmental Quality
Legal Unit (Remediation)
P.O. Box 200901
Helena, Montana 59620-0901

Certified Mail
Mr. Nikia Greene, Remedial Project Manager
US EPA Region VIII, Montana Office
Federal Building
10 West 15th Street, Suite 3200
Helena, Montana 59626

Certified Mail
Mr. Daryl Reed, State Project Officer
Montana Department of Environmental Quality
State of Montana
Phoenix Building, P.O. Box 200901
Helena, Montana 59620-0901

Re: BUTTE MINE FLOODING SITE CD, CV 02-35 Bu-RFC, 2015 Second Quarter Report

Dear Ms. Capdeville, Mr. Elsen, Mr. Greene and Mr. Reed:

The Settling Defendants (Atlantic Richfield Company and the MR Group, as defined in the Consent Decree) continue to implement the remedial action requirements as specified in the Statement of Work to the Consent Decree. The attached report summarizes those activities conducted during the second quarter of 2015. The electronic copy being sent August 17, 2015 will be followed by the hardcopy via certified mail. This second quarter report submittal is deemed timely as approval for this date of submittal was verbally granted.

Please contact us if you would like to schedule a meeting to discuss the implementation of the RA or the BMFOU 2015 Second Quarter Report.

On behalf of the Settling Defendants,

Mark Thompson
Manager of Environmental Affairs
BMFOU Project Manager
Montana Resources, LLP
600 Shields Avenue
Butte, MT 59701

Tim Hilmo, P.E.
Operations Project Manager
BP Atlantic Richfield
Remediation Management
317 Anaconda Road
Butte, MT 59701

ECC: Rebecca Summerville, Esq. Datsopoulos, MacDonald, and Lind P.C.
Rolin P. Erickson, MR
Timothy McHugh, MR
Cord Harris, BP
John Davis, Esq. Poore, Roth and Robinson P.C.
Bill Duffy Esq., Davis Bacon and Stubbs, LLP
Jill Kelley Esq., Kelley Services
Terence E. Duaime, MBMG
Lorri Birkenbuel, AR
Brian Huff, Golder
Steve Walsh, MR

Attachments

SETTLING DEFENDANTS BMFOU QUARTERLY REPORT
CONSENT DECREE FOR THE
BUTTE MINE FLOODING SITE CD, CV 02-35 Bu-RFC
REMEDIAL ACTION – IMPLEMENTATION OF THE REMEDY
QUARTER 2, 2015

Final REPORT

The Settling Defendants[1] continue to implement the remedial action requirements specified in the Statement of Work to the Consent Decree. This report summarizes those activities conducted during the second quarter of 2015 as required under section **X. Reporting Requirements, Paragraphs 31and 35** of the Consent Decree. The headings (a-g) in the following report correspond to the categories identified in paragraph 31. The sections captioned **Issues Encountered and Information about MR Operations** have been added at the request of the EPA.

a) Actions Taken Toward Achieving Compliance with the Consent Decree

To achieve compliance with the Consent Decree, the Settling Defendants conducted remedial action activities under the seven components identified in the Statement of Work for Remedial Design/Remedial Action ("SOW") which is part of the Consent Decree. These seven components and the remedial action activities undertaken by the Settling Defendants (hereinafter referred to as "SDs") in the second quarter of this year include:

1. **Monitoring Program -** The Montana Bureau of Mines and Geology ("MBMG") conducted all monitoring activities as required by the SOW with the exception of the semi-annual Berkeley Pit water quality sampling program. A rotational slump of the highwall in the southeast sector of the Berkeley Pit occurred on February 8, 2013. This slope failure and the potential of continuing slope instability in the eastern sector of the Berkeley Pit has created a safety issue for persons assigned to sample the Berkeley Pit and other components of the Remedial Action. The SDs are evaluating the necessity for near-term water quality sampling of the Berkeley Pit and potential, safe alternative sampling methods and additional migratory waterfowl mitigation efforts. The SDs have entered into an agreement with Montana Tech to investigate and construct a remote "drone" sampling platform for the Berkeley Pit.

[1] The term Settling Defendants as used in this report collectively refers to Atlantic Richfield Company, Montana Resources, Inc., Montana Resources LLP, and Dennis Washington.

STRATA* Geotechnical** consulting firm completed the scope of work for the **BMFOU Berkeley Pit Slope Stability Evaluation** *("Evaluation")* and the Report was submitted to the agencies on August 15, 2014. The SDs received Agency comments on the Evaluation on November 6, 2014. The SDs in conjunction with ***STRATA, are currently preparing answers to the comments as well as making changes to the document as requested by the Agencies. The SD response document will be submitted in Q3 2015. During Q2 2015 no significant slope failures occurred within the Berkeley Pit.

The SDs are continuing to formulate the concepts to safely enable resumed water sampling, and potentially waterfowl hazing and mortality counting, while mitigating risk to sampling personnel. In addition to the agreement with Montana Tech, this Task has been included in the Scope of Work for the HsBWTP Remedial Action Adequacy Review (RAAR) that is currently in progress (please refer to Section 4 of this report).

Normal waterfowl mitigation efforts continue according to plan; only on-water inspections using the pontoon boat have been suspended.

The SDs cooperated with and assisted the MBMG personnel by providing safe access to the on-site sampling locations.

2. **Public Education and Involvement** – The SDs are represented on the Berkeley Pit Public Education Committee which directs the publication of the PITWatch and the website www.PITWATCH.ORG. These are the primary vehicles for educating the public about BMFOU status and activities. The PITWatch committee met during Q2 2015 and the RAAR schedule contained as Attachment 1 was provided.

3. **Horseshoe Bend ("HsB") Inflow Control** – The SOW requires integration of the HsB flow into mine operations and/or release of treated water into Silver Bow Creek. Since the issuance of the ROD in 1994 and integration of treated HsB water into the mining and milling process on April 15, 1996, the flow has become an integral part of the water balance required for efficient active mining and milling operations at Montana Resources, LLP ("MR"). The entire flow of treated HsBWTP water has been integrated into MR's milling water circuit since the HsBWTP was commissioned in November 2003.

During the quarter, there were approximately 45.8 million gallons bypassed to the Berkeley Pit. The majority of the bypasses were due to planned events.

Planned events resulting in bypasses to the pit:

- A planned bypass to lower water levels to inspect the equalization basin prior to a MR mill and WTP shutdown;
- A planned MR mill shutdown requiring a planned WTP shutdown from May 12th thru May 16th;
- Planned power outages;

Other events resulting in bypasses to the pit:

- A transformer failure at the #2 Booster resulted in a mill shutdown and then subsequently forcing a WTP shutdown;
- A slaker malfunction forced a brief WTP shutdown at the same time the precipitation plant pumps were shutdown to change a flow meter;
- Unplanned power outages due to storms;
- Minor overflows and leakage through the HsBWTP diversion structure due to residual high water levels.

At an average inflow rate of approximately 2.5 million gallons per day, the bypass amounts to 18.3 days of normal Berkeley Pit inflow.

Currently, there is no flow measurement device installed in the ditch bypass to the Berkeley Pit. The SDs are investigating flow measurement methods that more accurately quantify flow to the Pit.

The blowers were shut down on April 11th due to a restriction in the Stage 1 Reactor up-well. The blowers remained off for the remainder of the quarter. On May 8th, Stage 2 was taken offline for clean out. The WTP operated in single stage for the remainder of the quarter. The WTP was shut down from May 12th to May 16th due to a scheduled MR mill shut down.

The SDs awarded Swank Enterprises the contract to implement piping maintenance that will increase the WTP flow capacity. This piping maintenance, combined with other minor maintenance planned for 2015, will enable the WTP to reach or exceed its original design flow capacity. The SDs also received variable frequency motor drives for the blower motors and control equipment to distribute blower air between the stages as needed. Additionally, the piping maintenance will include electrically actuated valves to isolate the stages for cleanout purposes.

Significant maintenance activities completed during the quarter include:

- Clean out of 2nd stage clarifier
- Structural System Repair Group (SSRG) inspected the 2nd stage clarifier (see Attachment 2)
- Replaced 4-inch lime return line to north slurry tank
- Replaced 1st stage underflow pump
- Installed rebuilt lime slurry pump on north slurry tank (pump #1)
- Cleaned influent and effluent flow meters
- Rebuilt south slaker (bearings; rebuild shafts)
- Cleaned lime build up from north and south slaker discharge lines
- Cut 6" South slaker line and installed flanges for easier cleaning
- Installed 2 new 4-inch valves and check valves on south slurry pumps
- Installed new 4-inch red pinch valve for lime slurry return on south slurry tank
- Installed new AV-2 valve on north alkalization tank
- Jetted sludge waste line to the pit

Efforts continue to investigate and lower groundwater levels in the vicinity of the HsBWTP. Engineering controls implemented during the second quarter have continued to reduce the groundwater level in the area of the HsBWTP. The engineering controls implemented are intended to reduce the groundwater level beneath the entire footprint of the HsBWTP. A total of ten strategically placed dewatering wells and two piezometers have been installed. Eight of the ten dewatering wells have pumps installed and the remaining two wells will be pumping early in Q3 2015. Please refer to Attachment 3 of this report for the Groundwater Level Reduction Summary Report.

4. **HsB Water Treatment Plant Upgrade/Sludge Repository** – The SDs have initiated the Horseshoe Bend Water Treatment Plant Remedial Action Adequacy Review to ensure that ongoing and future remedial activities will meet the requirements of the CD. The **Draft Site Activity Schedule** for the HsBWTP Remedial Action Adequacy Review ("RAAR") was submitted on June 30, 2014 and approved by the Agencies on September 11, 2014. The Scope of Work ("SoW") for the RAAR was subsequently prepared to evaluate four primary tasks with appropriate subtasks. The comprehensive list of activities in the schedule was identified to meet the milestones required in the CD and also to complete important precursor activities to meet those requirements to ensure continued protectiveness of the remedy. The schedule and scope of work also respond to the issues raised by the Agencies in the February 20,

2014 letter to the SDs regarding the Agencies response to the BMFOU Five-Year Review Issues. The RAAR contractor will periodically update the detailed schedule as needed.

The primary tasks in the RAAR include:

Task 1. HsBWTP O&M Optimization:
- Short term optimization;
- Long term optimization; and,
- Optimization with various source water quality and quantity.

Task 2. BMFOU Site-wide Water Balance Study:
- Base case – current and historical conditions;
- Future conditions – predictive analysis; and,
- Integrate water quality into predictive water balance.

Task 3. Potential Pilot Studies Evaluation:
- Sludge disposal alternatives;
- Alternate influent sources; and,
- Alternative treatment enhancements.

Task 4. Technical Memorandum Preparation.

The SD's selected Golder as the RAAR consulting firm in May 2015 and provided a statement of qualifications to the Agencies of the firm selected. On May 20, 2015, the Agencies approved Golder as a "Supervising Contractor" pursuant to the Consent Decree, Section VI. PERFORMANCE OF THE WORK BY THE SETTLING DEFENDANTS, Paragraph 10, Selection of Supervising Contractors. A RAAR contractor kick off meeting was held with Golder, the SDs, the EPA, the DEQ and the MBMG on May 14, 2015.

The Explanation of Significant Differences, Appendix A to the CD allows for placement of sludge into the Berkeley Pit. During Q2, all of the sludge generated by the HsBWTP was placed into the Berkeley Pit (see Table in Section 7b). The evaluation of sludge disposal in the Berkeley Pit is also included as an activity on the RAAR schedule.

5. **West Camp System** – During the second quarter of 2015, approximately 17.9 million gallons of water were pumped from the West Camp pump station to Lower Area One (LAO) for treatment in the Butte Treatment Lagoons (BTL) system. Operators of the

BTL maintained normal operating levels at the West Camp pump station for the entire quarter. The water level at the end of the quarter was 5421.01 feet.

6. **Waterfowl Mitigation** – During the reporting period, the SDs conducted monitoring, active and passive hazing efforts and reporting as required by the Berkeley Pit Migratory Waterfowl Mitigation Plan, (Exhibit 5 to the CD), but did not perform any on-water activities. The SDs continued to perform waterfowl mitigation efforts under the variance from this requirement of the Waterfowl Mitigation Plan.

   The SDs submitted the March, April and May 2015 **Berkeley Pit Migratory Waterfowl Mitigation Monthly Reports,** which included the Observation and Hazing logs as attachments to the report letters. Please see these reports for a description of the detail of mitigation efforts.

7. **Institutional Controls** – Full SD compliance with this component of the RA SOW was completed by funding provided in 2002 by the SDs past and future cost cash out provisions of the Consent Decree. The Butte Alluvial and Bedrock Controlled Ground Water Area ("BABCGWA") was established by the MT DNRC in October 2009 with Butte-Silver Bow as the petitioner. Implementation and monitoring of the BABCGWA was assigned to the MBMG and funding from the SDs cash out amount that was provided in 2002. The outer perimeter of the area was determined and covers approximately 8.11 square miles. Please see the **Butte Mine Flooding Operable Unit, Water-Level Monitoring and Water-Quality Sampling, 2012 Consent Decree Update, 1982-2012** (MBMG, September 2013) and consult Mr. Terrence E. Duaime, Project Manager of the Montana Bureau of Mines and Geology for more detailed information.

   Access - The SDs have fully complied with the CD requirement to provide access to the Agencies.

   The SDs have fully cooperated with the MBMG Monitoring Program during the reporting period.

b) Summary of all results of sampling and tests and all other data generated in the previous quarter

The following table summarizes the performance of the HsBWTP in Quarter 2 2015 and in total for the year to date:

Period	Influent (MG)	HsB Plant Water[2] (MG)	Sludge Wasted (MG)	Lime Delivered (tons)	Average Influent Flow (MGD)	Average Lime Usage (mg/L)
Quarter 1	455	446	43	5,227	5.1	2,744
Quarter 2	460	437	61	6,037	5.1	3,153
YTD	914	883	104	11,264	5.1	2,948

HsBWTP water is sampled at multiple locations including the HsBWTP influent and, Stage 1 Clarifier overflow, and Plant Water (Mill influent formerly named plant effluent). These data will be utilized in the RAAR HsBWTP Optimization Plant currently ongoing. The testing demonstrates that the current operation of the HsBWTP satisfactorily complies with the requirement of the CD to treat HsB water that is to be incorporated in MR's milling circuit.

In the vicinity of the HsBWTP, engineering controls associated with groundwater monitoring and dewatering to lower the groundwater elevation were implemented. Please see Attachment 3 to this report.

c) <u>Identify all work plans and other deliverables required by this Consent Decree completed and submitted in the previous quarter</u>

The third revised Draft BMFOU HsBWTP Operations and Maintenance Plan/Manual and the Site Specific Health and Safety Plan were submitted to the Agencies on December 12, 2014. In a letter dated February 27, 2015, the agencies provided comment on the Draft BMFOU HsBWTP Operations and Maintenance Plan/Manual, but did not comment on the Site Specific Health and Safety Plan. The final BMFOU HsBWTP Operations and Maintenance Plan/Manual was provided to the agencies on April 30, 2015.

d) <u>Describe all actions, data collection and implementation or work plans that may be required under this CD scheduled for the next quarter and provide other information relating to the progress of the work</u>

[2] The treated HsB water that is used in MR's milling process as required by the CD will be referred to as "HsB Plant Water" instead of the previously used term "effluent." This semantics change has been made to distinguish between effluent that will be treated to the discharge standards stipulated in the CD SOW and plant water that is treated to standards for inclusion into MR's milling process.

RA Activity - The RA activity required in this section is congruent with that reported at the beginning of this document and is aligned with the seven general components of the SOW and RA. The inclusion of an eighth component to follow the Remedial Action Adequacy Review required by the SOW has been added as an additional activity for the next quarter. The third quarter 2015 activity summary is as follows:

1. The Monitoring Plan will continue to be implemented during the next quarter and the SDs will continue to provide access, cooperation and any assistance to the MBMG requested in performing this task. SDs will continue to pursue safe methods of sampling the Berkeley Pit.

2. The SDs will provide information to the Agencies as requested and participate in any public education meetings or activities that the Agencies deem necessary to fulfill this requirement of the CD.

3. The HsBWTP will continue to operate in the next quarter with the goal of capturing and treating all of the flow emanating from the HsB area; however, it is currently anticipated that the HsBWTP will be down for maintenance for several days during Q3 or Q4. The Inflow Control requirement will continue to be met with all of the HsBWTP treated water being integrated into the mining and milling operations. Plans are to submit RAAR Work Plans for the WTP Optimization Study and Water Balance to the Agencies. Operation of the dewatering wells around the HsBWTP will continue and the Stage 1 reactor crack repair and Stage 2 reactor will be reassessed in 2015.

Substantial piping maintenance and upgrades to motor controls will be conducted during Q3 and Q4 of 2015. These activities may require down time of the WTP and could result in the bypass of HsB water to the Berkeley Pit. A schedule for this work and an estimate of the WTP downtime will be provided to the Agencies.

4. Sludge from the HsBWTP will continue to be placed into the Berkeley Pit during the next quarter.

5. Pumping from WCP-1 will continue during Q3 of 2015 to maintain West Camp water levels below the CWL.

6. Waterfowl mitigation efforts will be continued during Q3 as required by the Berkeley Pit Migratory Waterfowl Mitigation Plan, Exhibit 5 to the CD (with the approved exemption from bi-monthly surface inspections) with frequency of

observations commensurate with the migratory season. Monthly reports will continue to be submitted to the Agencies.

7. The Institutional Controls required by the CD will continue to be met with full access provided to the Agencies, the MBMG and all SDs at all reasonable times. MR plans to continue to operate the active mining and milling operation within the 70,000 tpd crushing and concentration of ore and active leaching of dumps at less than 350-acres stipulations of **IX. Access and Institutional Controls** section of the CD.

8. The RAAR Site Activity Schedule will be followed and modified, as needed, with modifications approved by the Agencies. The HsBWTP optimization, BMFOU site-wide water balance update and alternatives study will commence.

9. The Q3 2015 deliverables include:

i. the SDs' Response Document to Agency comments re: **BMFOU Berkeley Pit Slope Stability Evaluation;**
ii. A draft HsBWTP Optimize Work Plan will be submitted for agency comment;
iii. A draft BMFOU Site-Wide Water Balance Work Plan will be submitted for agency comment;

Future Work Plans – The SDs will submit work plans associated with the RAAR as per the detailed schedule.

e) **Include information regarding unresolved delays encountered or anticipated that may affect the future schedule for implementation of the Work.**

Unresolved delays include in part, waterfowl mitigation and water quality sampling of the Berkeley Pit due to safety issues and resumption is contingent upon the completion of the final slope stability evaluation, determination of near term necessity and additional slope stability monitoring and risk assessment study or adoption of alternative sampling monitoring technique. (Please see the discussion in section 1of this report regarding the agreement entered into between the SDs and Montana Tech and inclusion of alternative sampling technique development as part of the SoW for the HsBWTP RAAR. The intention is to identify an appropriate method to safely resume water quality sampling under the specifications in the CD and acquire samples for RAAR testing.)

e) **Include any modifications to the RA or RD Work Plans or other work plans or schedules that Settling Defendants have proposed to EPA or that have been approved by the EPA.**

There are no current, requested modifications to the RA or RD Work Plans or schedules proposed to the agencies.

f) **Describe all activities undertaken in support of the Community Relations Plan during the previous quarter and those to be undertaken in the next quarter**

Please see the response in **Actions Taken Toward Achieving Compliance, 2. Public Education and Involvement** for details to the answers to this reporting requirement.

g) **Issues Encountered**

The current issue that has impacted the mandated BMFOU remedy was the occurrence of slope instability problems in the Berkeley Pit in 2012 and 2013.

h) **Other**

The following information is included in this report at the request of the Agencies and is not part of the BMFOU RA.

MR continued operations during the second quarter in compliance with State-issued permits and the description in the CD that allows for the recovery of ore, crushing, concentration, leaching and the importation of water as needed for mining (**Consent Decree, IX.** ACCESS AND INSTITUTIONAL CONTROLS, part 26b., p. 39).

Attachment 4 is the report titled "Berkeley Pit Slope Stability Quarterly Summary" produced by MR's Engineering Department. The report summarizes activities conducted during the quarter related to monitoring and dewatering of the alluvium in the Concentrator, Southeast Corner and Pittsmont Sectors of the Berkeley Pit.

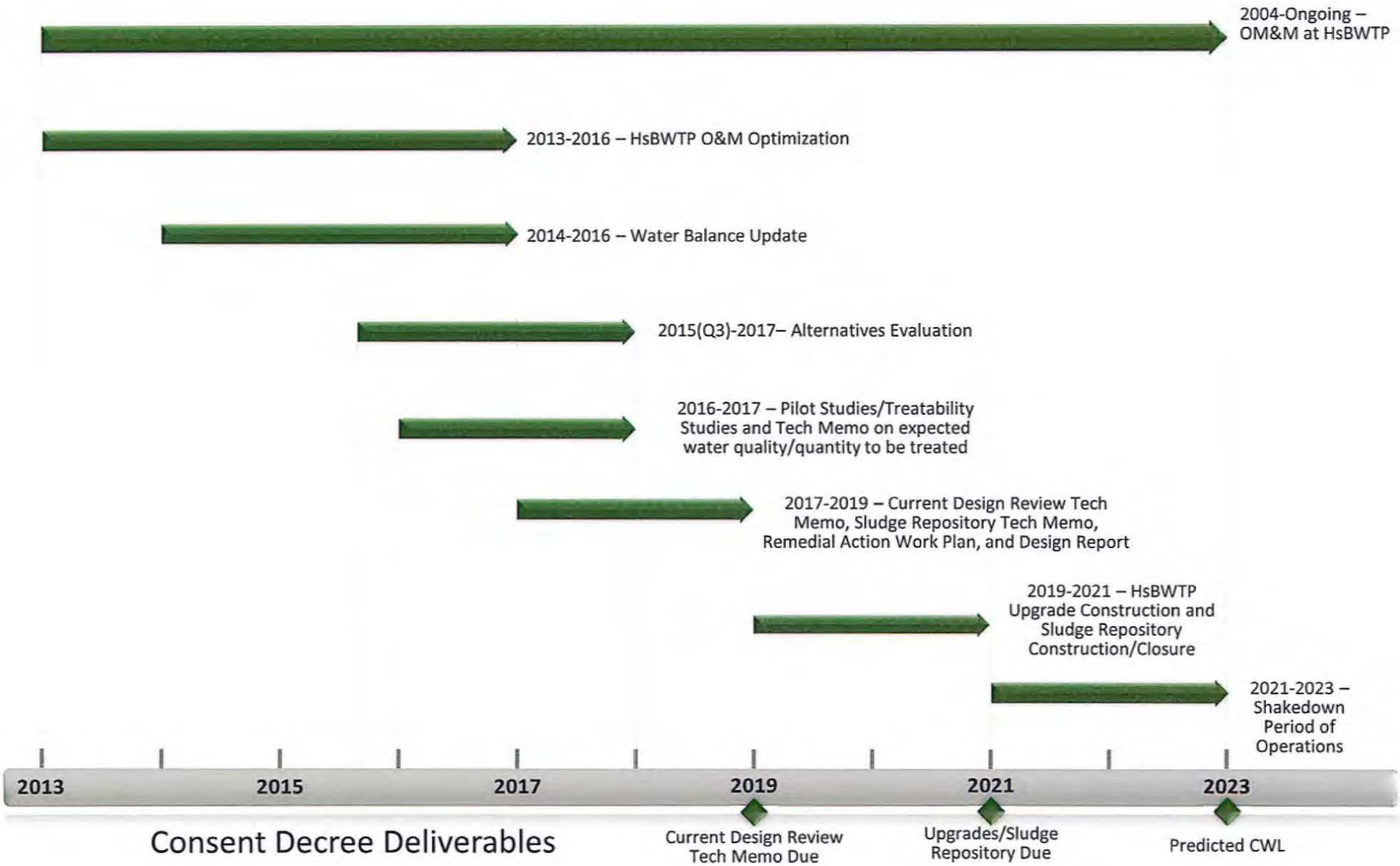
BMFOU QUARTERLY REPORT

Q2 2015

ATTACHMENT 1:

BMFOU 10-yr Schedule

BMFOU 10-yr Schedule



BMFOU QUARTERLY REPORT

Q2 2015

ATTACHMENT 2:

Second Stage Clarifier Structure Assessment

Montana Resources

SSRG
Structural Systems
Repair Group

Horseshoe Bend Water Treatment Plant

Second Stage Clarifier Structure Assessment

[Strengthen. Preserve. Protect.]

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

June 16, 2015
Stephen F. Walsh
Montana Resources, LLP
600 Shields Ave.
Butte, Montana 59701
swalsh@montanaresources.com

Re: Horseshoe Bend Water Treatment Plant
Second Stage Clarifier Assessment

Stephen,

In the following pages you will find our assessment packet.

We appreciate the opportunity to work with Montana Resources, and please contact us with any questions regarding this packet.

Sincerely,

Michael R. Breetz, PE
mbreetz@ssrg.com

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206
phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

TABLE OF CONTENTS

Horseshoe Bend Water Treatment Plant

Second stage Clarifier Assessment

1. Schedule and Observations
2. Repair Recommendations
3. Pictures
4. Ground Penetrating Radar and Impulse Response Scanning Date and Report

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

June 16, 2015
Stephen F. Walsh
Montana Resources, LLP
600 Shields Ave.
Butte, Montana 59701
swalsh@montanaresources.com

Re: Horseshoe Bend Water Treatment Plant
Second Stage Clarifier Assessment

Schedule and Observations

SSRG was requested by Montana Resources to perform an assessment on the Second Stage Clarifier structure. The primary concern of the structure is the integrity of the concrete foundations, concrete slab on grade, and the condition of the subsurface directly under the concrete structure. Due to the high water table, at numerous locations within the water treatment facility, the stability and water tightness of the structure is also a concern.

The following methods were utilized to perform the assessment: sounding the slab by hammer and drag methods, Ground Penetrating Radar, Impulse Response, and visual inspection. These methods utilized will help to determine voids in and beneath the concrete, voids filled with water, delamination of concrete, deterioration of concrete and overall condition of the structure.

Upon arrival on the project site on June 1, 2015, Montana Resources (MR) personnel were in the process of completing the descaling and cleaning of the structure. SSRG worked with MR to isolate quadrants of the structure for assessment; meanwhile, the cleaning process would continue in the other quadrants. The assessment methods were employed, and the onsite inspection was completed on both Monday, June 1 and Tuesday, June 2. On and off thunderstorms were encountered both days.

Observations:

1) Overall condition of the structure is good. No voids or abnormities were found using the nondestructive test methods described above. Refer to attached technical report for the backup data.

2) There were several small locations where the sealant in the slab joints was missing or damaged. Several areas were cut out, primed, and resealed. It is

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206
phone 513.751.7774
fax 513.861.7878
ssrg.com

important to keep the sealant in good condition in order for it to function as designed and protect the structure. One area of the slab appeared to have cracked during or soon after construction. This crack had been previously repaired with what appeared to be an epoxy. The repair looked to be in good condition except for an area that was slightly open. SSRG repaired this small section by gravity feeding epoxy in to the crack.

3) There are areas where the influent water is leaking out of the metal trough and back into the tank. This is only evident when the liquid level is below the bottom of the trough. The seepage seems to occur where the metal upper trough is mounted to the concrete wall. This is keeping a portion of the structures surface wet; however, it is not presenting any structural concerns. Staining is evident at these locations on the interior wall. All the water seepage is internal to the structure. No ground water entering the structure is evident, and all the treatment water seems to be contained within the structure.

4) The top portion or sky facing area of the clarifier wall is showing signs of deterioration with freeze thaw induced cracking. This part of the wall experiences more moisture and free thaw events than the rest of the structure because it is totally exposed to the element. The guard rail is also mounted at this location on the structure. Accelerated deterioration cracking will occur once a crack appears, providing a path for more moisture to enter. If excessive moisture reaches the reinforcing steel, the corrosion process is facilitated.

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

Repair Recommendations

1) Continue monitoring and inspecting the structure during the cleaning events.

2) Inspect the sealant, and make any necessary repairs during cleaning events. In order to make a quality sealant repair, the joint will need to be fully dried out. This may involve re-routing or stopping the water leaking out of the metal trough. Be careful not to damage sealant during cleaning events.

3) Inspect for additional cracks and make necessary repairs. Apply epoxy based crack repair to all cracks.

4) Monitor all areas of the structure to assure the moisture on walls is from the trough and not ground water. Protect metal trough during cleaning, and repair any damage.

5) Repair and seal cracks with epoxy and urethane where appropriate. Treat exposed surface of wall above ground with a silane based penetrating waterproofing material (this work could be accomplished during a future site visit in conjunction with other work).

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

Pictures

Clarifier #2 Cleaning and descaling equipment inside of tank.

Ground Penetrating Radar working along grid lines.

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

Impulse Response method showing the instrumented hammer and geophone.

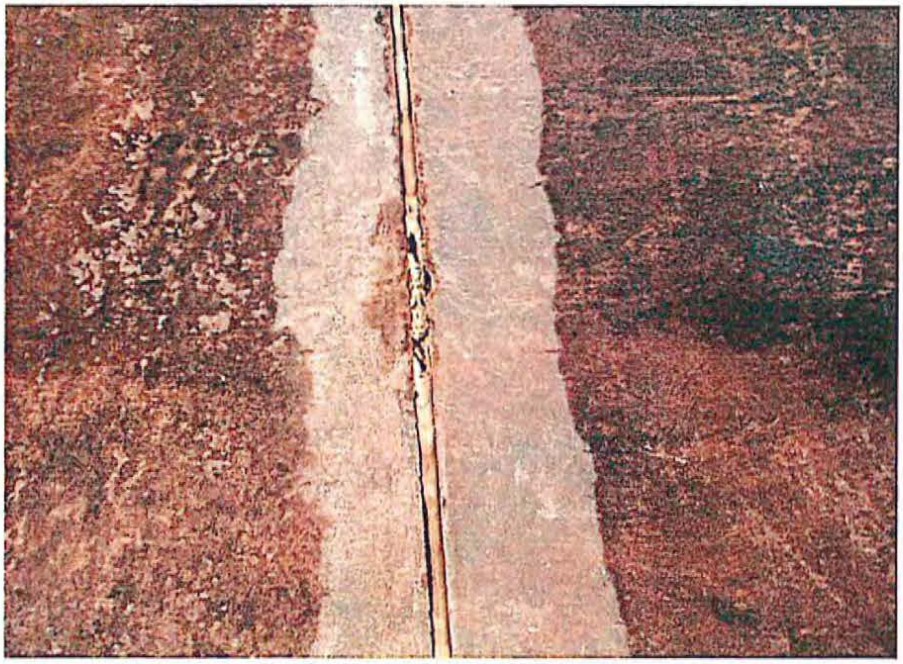
Tank bottom showing existing crack and area of epoxy repair

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

Sealant Damage in tank Floor



Sealant Damage in Tank Floor

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

Sealant Repair in tank Floor

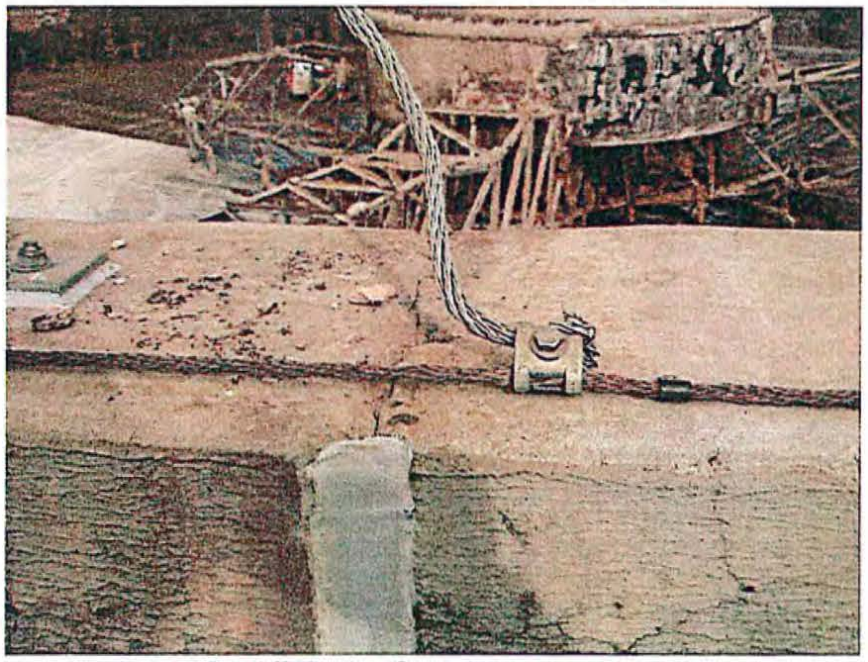
Sealant Repair in Tank Floor

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group

Tank Wall top surface cracking area

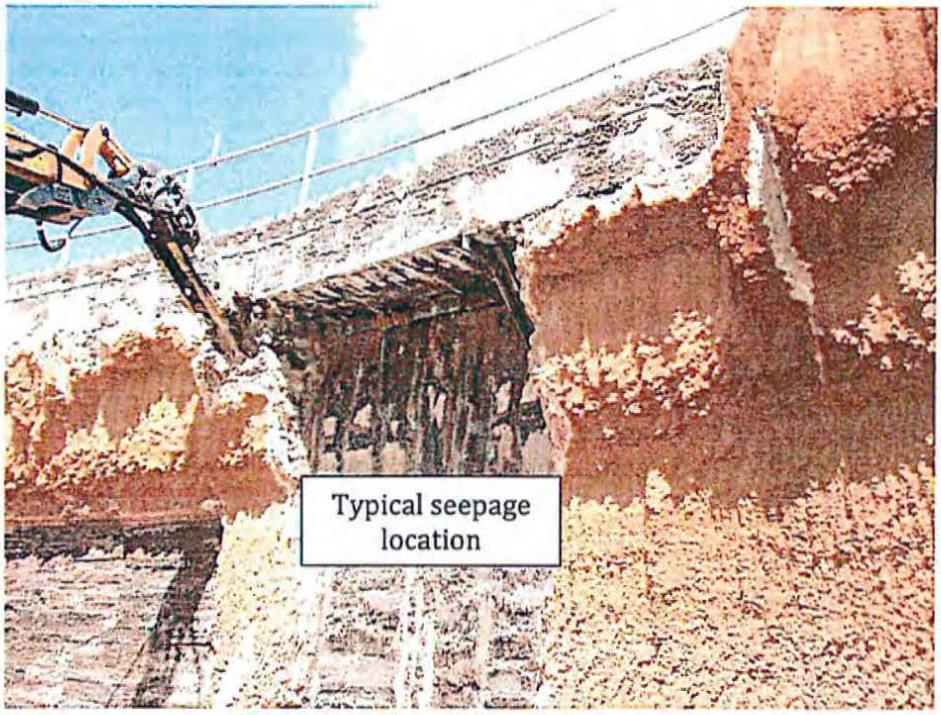


Tank Wall Top surface at construction joint

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

SSRG
Structural Systems
Repair Group



Metal Trough and cleaning operation

Structural Systems Repair Group
2824 Stanton Avenue
Cincinnati, Ohio 45206

phone 513.751.7774
fax 513.861.7878
ssrg.com

UNIVERSAL RADARVIEW
CIVIL STRUCTURAL · GEOPHYSICAL SURVEYS

HOUSTON		
1036 1st St E, Ste A3	DALLAS / FT WORTH	972.432.6666
Humble, TX 77338	SAN ANTONIO / SO. TEXAS	210.775.1637
P 281.446.7363	AUSTIN / WACO	512.551.0336
F 800.516.5732	CHICAGO	847.459.9090
	MIAMI	954.676.4147

TECHNICAL REPORT

TANK FLOOR SLAB CONDITION SURVEY TESTING AND SUBSURFACE GEOPHYSICAL VOID/MOISTURE SURVEY

2ND STAGE CLARIFIER TANK

at

MONTANA RESOURCES

BUTTE, MONTANA

for

STRUCTURAL SYSTEMS REPAIR GROUP

JUNE 1 - 2, 2015

PROJECT NO. RV5303

1 EXECUTIVE SUMMARY

Client:	*Structural Systems Repair Group*	*Project No:*	*RV5303*
Location:	*Montana Resources, Butte, Montana*	*Total Pages:*	12 pages
Client P.O. No:	*Signed Proposal*	*Date:*	June 1 - 2, 2015
Report Title:	*2ND Stage Clarifier Tank:* *Tank Floor Slab Condition Survey Testing and Subsurface Geophysical Void/Moisture Survey*		

Summary:

Radarview was contracted to perform a Tank Floor Slab Condition Survey Testing and Subsurface Geophysical Void/Moisture Survey at Montana Resources located in Butte, Montana. The need for these surveys stem from the need to identify possible void-like conditions below the slab due to suspected leaks and isolated concrete deterioration in the First Stage Reactor Tank. That project was completed previously and prompted the desire to check out the remaining tanks. Radaview's role was to utilize Impulse Response (IR) and Ground Penetrating Radar (GPR) testing methods to identify possible under slab voids as well as condition of the concrete slab (i.e., deterioration and damage in the form of cracking, delaminating concrete).

GPR and IR Results:

Second Stage Clarifier Tank

- **GPR-Voids/Moisture:** Small intermittent void-like conditions were detected throughout but are not larger than the grid matrix
- **IR-Voids/Moisture:** Solid subgrade was detected throughout the area tested
- **Slab Condition:** No indication of damage and/or deterioration was found using IR.

See the remainder of this report for details.

Prepared by *Charles Branch*	*Reviewed by* *Todd Allen*	

CONTENTS

1 EXECUTIVE SUMMARY 2

2 PROJECT OVERVIEW AND OBJECTIVE 4

3 TESTING METHODOLOGY DETAILS 5

3.1 GROUND PENETRATING RADAR (GPR) 5

3.2 IMPULSE RESPONSE (IR) 7

4 PLAN VIEW DRAWING 8

4.1 SECOND STAGE CLARIFIER TANK 8

5 EXAMINATION RESLUTS - GROUND PENETRATING RADAR 9

5.1 SECOND STAGE CLARIFIER TANK 9

5.1.1 Photograph 9

5.1.2 Ground Penetrating Radar Results 10

5.1.3 Ground Penetrating Radar Results - Cross Section 1 11

6 EXAMINATION RESULTS - IR METHOD 12

6.1 SECOND STAGE CLARIFIER TANK 12

2 PROJECT OVERVIEW AND OBJECTIVE

Radarview was contracted to perform a Tank Floor Slab Condition Survey Testing and Subsurface Geophysical Void/Moisture Survey at Montana Resources located in Butte, Montana on the 2nd Stage Clarifier Tank.

The need for these survey stemmed from deterioration, suspect leaks, and isolated concrete deterioration found in the Stage 1 Reactor Tank which was previously examined.

Radarview's role was to utilize Impulse Response (IR) and Ground Penetrating Radar (GPR) testing methods to identify possible under slab voids:

- IR Method: ASTM C1740-10 Standard Practice for Evaluating the Condition of Concrete Plates using the Impulse-Response Mehtod
    - A instrumented hammer, geophone, and a hand-held data collection platform were used to carry out the examination. Data was collected on a 7' by 7' matrix for the Second Stage Clarifier Tank;
- GPR Method: ASTM Standard Guide for using the Surface Ground Penetrating Radar Method for Subsurface Investigation
    - A 900 MHz antenna was utilized to collect the GPR portion of this survey, and collected on a 3' by 3' matrix with approximately 3 - 4 feet of penetration achieved.

Google Earth view of the Montana Resources Horseshoe Bend Water Treatment Facility

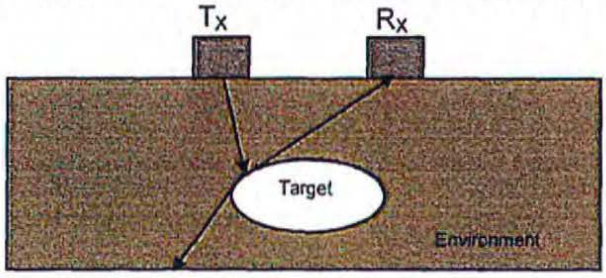
3 TESTING METHODOLOGY DETAILS

3.1 Ground Penetrating Radar (GPR)

Introduction: Ground Penetrating Radar (GPR) is a proven geophysical method for NDT (non destructive testing) surveys. GPR is an electromagnetic based instrument which is capable of detecting any kind of object embedded that is physically different than the surrounding environment.

GPR is a dipole-dipole electromagnetic based array. It has a Transmitter (T_X) and a receiver (R_X) unit and both are dipole. The transmitter unit generates a high frequency and small wavelength beam signal. Signal characteristics are described by a peak frequency (GHz) and wavelength (nm). That signal propagates into the object and travels as deep as the maximum penetration allowable. The penetration depends on the attenuation factor that is an "e" number powered by attenuator factor (e=2.7182818), $A=e^{-\alpha t}$ where α is the attenuator factor (every material has a different factor). The attenuator factor lineally depends on the travel time and that time is the penetration or signal travel time. After the signal has encountered any object which is physically different (*permittivity, density, conductivity, etc.*) than the surrounding environment, a signal energy pack reflects back off the object (*due to optic laws: reflection and refraction see sample 1.*). The rest of the signal travels further into the environment. The rebounded energy pack is received by the antenna's receiver and goes through a cross-correlation by A/D converter thus a digital cross section is generated in real time and plotted on the system's display. This digital cross section is considered the radar image which consists of thousand of traces and those interpolated wave traces support the 2D radar image (cross-section). Every trace is an individual 1D stochastic signal in time mode with amplitude energy peak.

In summary, the transmitter and the receiver are built in one unit, which is referred to as the antenna unit and the antenna is mounted onto a cart with a survey wheel. The survey wheel encodes the offset and gives the X coordinate of the radar cross section.



Sample 1 *Reflection & Refraction phenomena*

Survey steps:

- *Distance calibration*
- *Survey grid set up*
- *Time range set up*
- *Zero level set up*
- *Dielectric constants determination if it is possible*
- *Perform the grid survey*

Data processing steps:

- 2.5D inversion
- Reset zero level
- Low frequency distortion effect minimalization
- Trace interpolation/rasterization
- Consistent anomalies pairing and matching
- Lineal drawing

3.2 Impulse Response (IR)

Introduction to Impulse Response (IR)

IR investigations are usually performed to identify subgrade voids below slabs-on-grade. The method is excellent for evaluating the repair of slab subgrade support conditions before and after repairs. The elements that can be tested include concrete slabs, pavements, runways, spillways, pond and pool bottoms, and tunnel liners. The IR method is often used in conjunction with GPR for subgrade void detection and mapping. In addition, the IR test method can be used on other concrete structures to quickly located areas of delamination or voids in the concrete or masonry, if the damage is relatively shallow. IR can be performed on reinforced and non-reinforced concrete slabs as well as asphalt or asphalt-overlay slabs and even thin stone panels such as marble or granite to find problems with bonding systems used to attach them.

The IR method requires access only to the top (or front) surface for receiver locations and hammer hitting. The receiver is mounted to the test surface adjacent to the impact locations generally 3 - 4 inches away. In an IR investigation, the test surface is impacted with an impulse hammer and the response of the slab is monitored by a geophone placed next to the impact point. The hammer input and the receiver output are recorded.

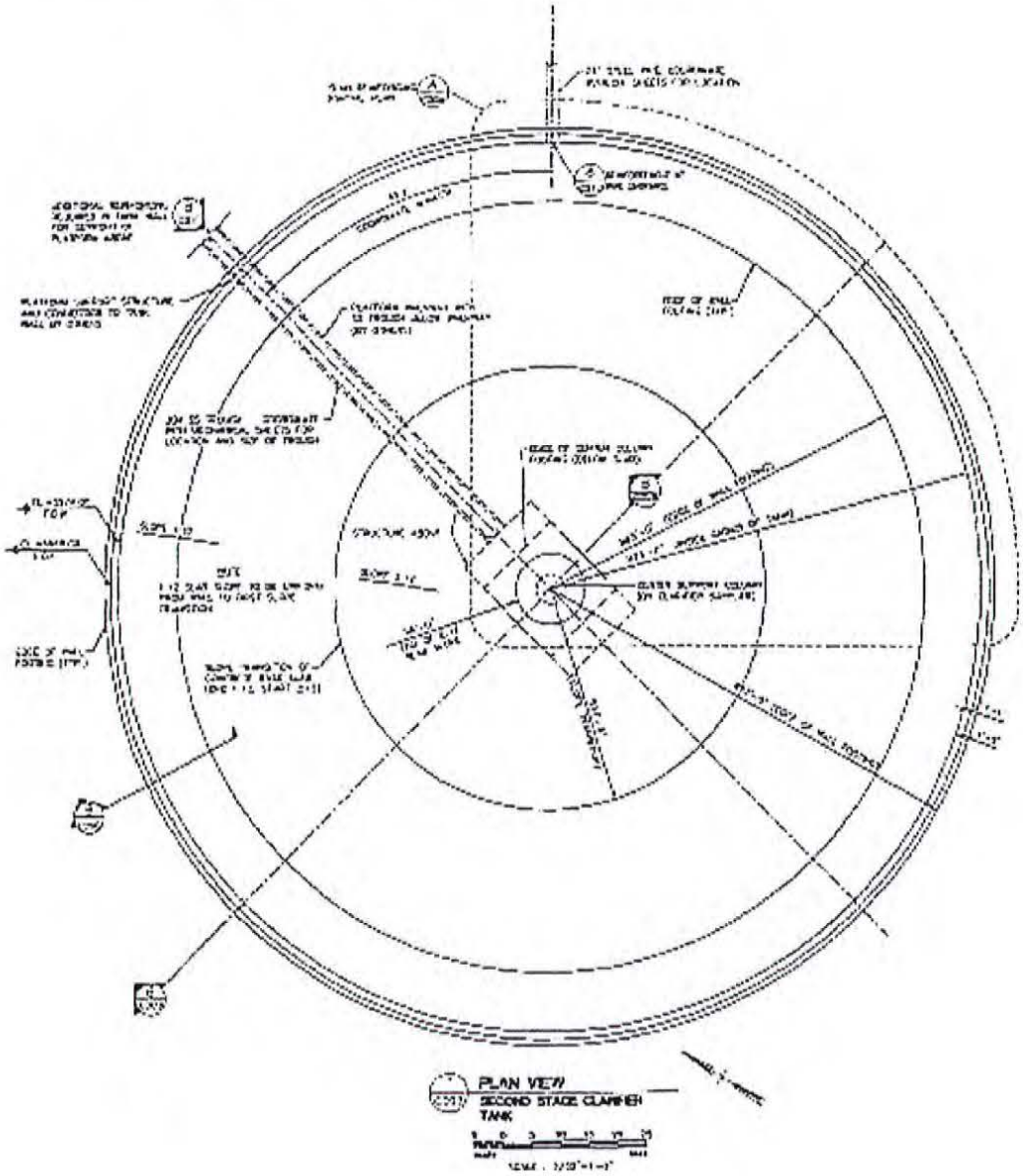
For the processing part, Fast Fourier Transform (FFT) operations performed by the IR software transform the impulse force and vibration velocity response time domain signals to produce a plot mobility (vibration velocity/pounds force). After transformation to the frequency domain, the transfer and coherence curves are automatically generated by the IR software. Analysis of the mobility plot provides information on the subgrade support conditions and/or surface stiffness/mobility within a radius of .5 to 1.0 foot from the test point, depending on the slab thickness.

Support condition evaluation includes two measurement parameters. First, the dynamic stiffness is calculated. The initial slope of the mobility plot indicates the quasi-static flexibility of the system. The steeper the slope the initial part of the mobility plot, the more flexible and less stiff the system is. Second, the shape and/or magnitude of the mobility plot above the initial straight line portion of the curve is an indication of support condition. The response curve is more irregular and has a greater mobility for void versus good support conditions due the decreased damping of the slab vibration response for a void. The presence of a high amplitude, low frequency spike in mobility plot is an additional indication of void conditions

The IR method is used to determine the support conditions of the slab and to map out the areal extent of any void or poor support condition zones, but the method cannot determine the thickness of any voids found. Collecting IR data at multiple, densely-spaced locations can improve the conclusions by mapping relative areas of higher and lower mobility. However, relatively low mobility does not indicate the absence of a subgrade void, but qualitatively indicates that such an area appears to be more solidly supported than an area with relatively high mobility. For thick slabs (thickness > 2 ft), the interpretation the IR data becomes difficult because the stiffness of the system is controlled by the slab itself and not by the support conditions under the slab.

4 PLAN VIEW DRAWING

4.1 Second Stage Clarifier Tank

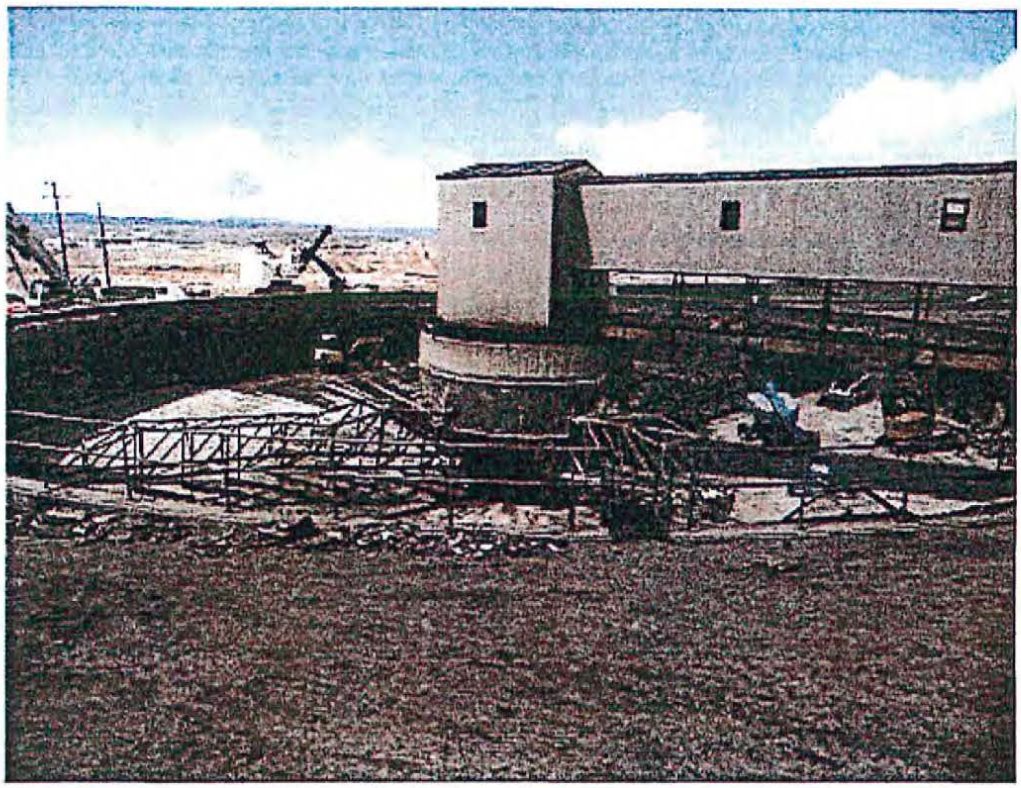


5 EXAMINATION RESLUTS - GROUND PENETRATING RADAR

5.1 Second Stage Clarifier Tank

5.1.1 Photograph

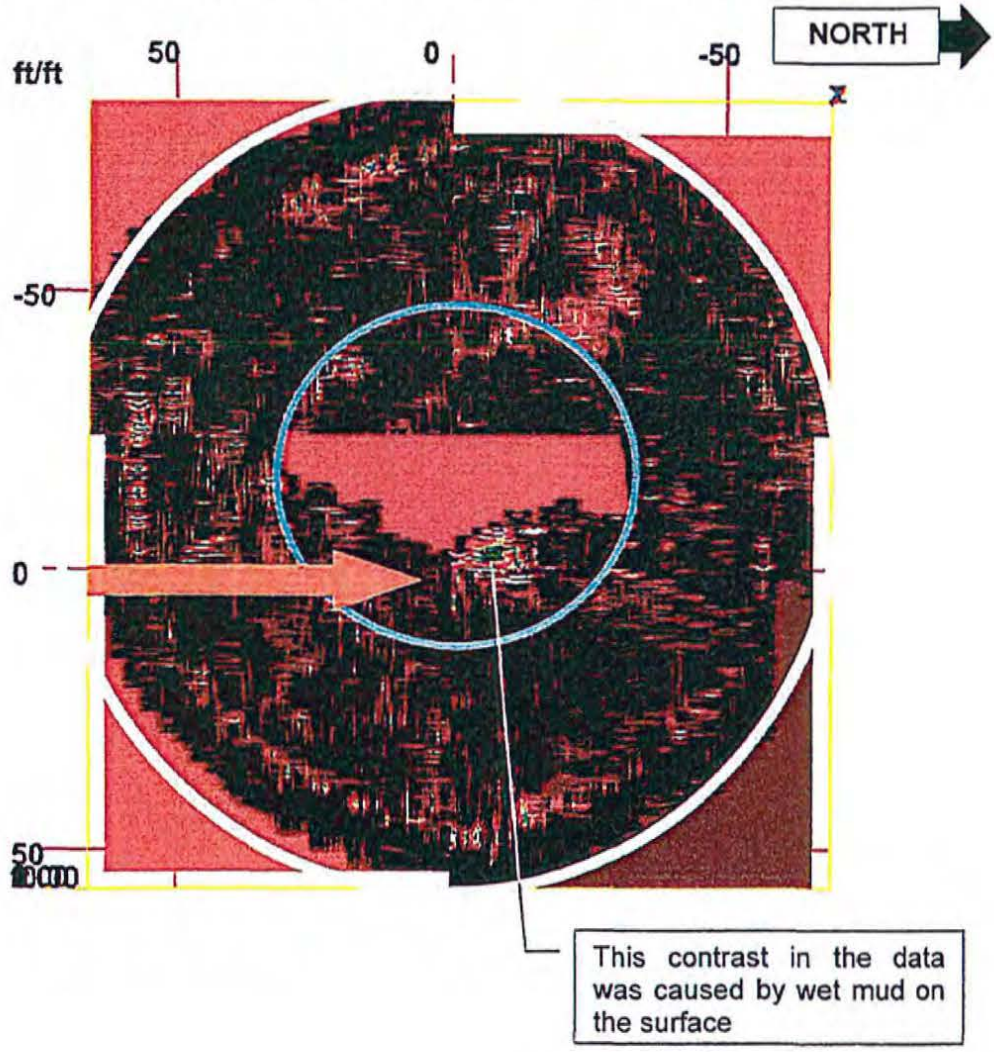
NORTH



5.1.2 Ground Penetrating Radar Results

The clarifier tested well and we found consistent strata and little moisture accumulation evidence. Small intermittent void-like conditions were detected but are not larger than the grid matrix size.

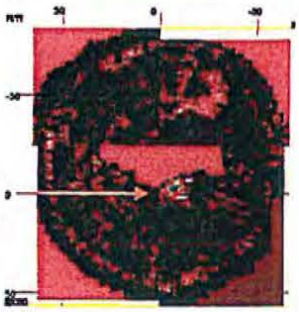
The blue circle indicates the slope transition and the light grey circle is the tank shell/wall. The arrow indicates the cross section sample shown on the next page.



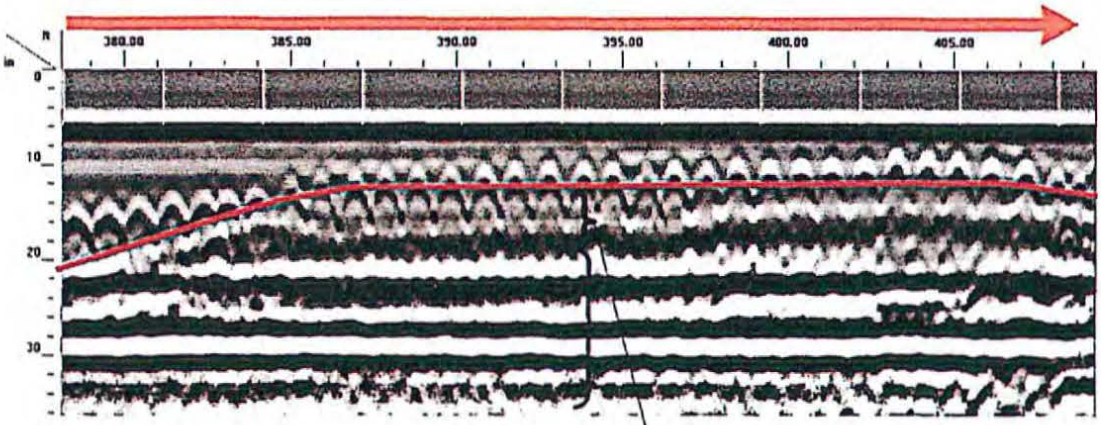
5.1.3Ground Penetrating Radar Results - Cross Section 1

NORTH

This cross section from the Second Stage Clarifier shows the transition from the outer ring thickened slab area to the 14" slab (red line) as well as the reinforcement inside the slab.



Features characteristic of subsurface voids were found, but only in isolated areas and they are of small cross section area.



Brackets outline a normal layer change we typically see under slabs (the tank bottom). Top fill material to other fill/native soil materials

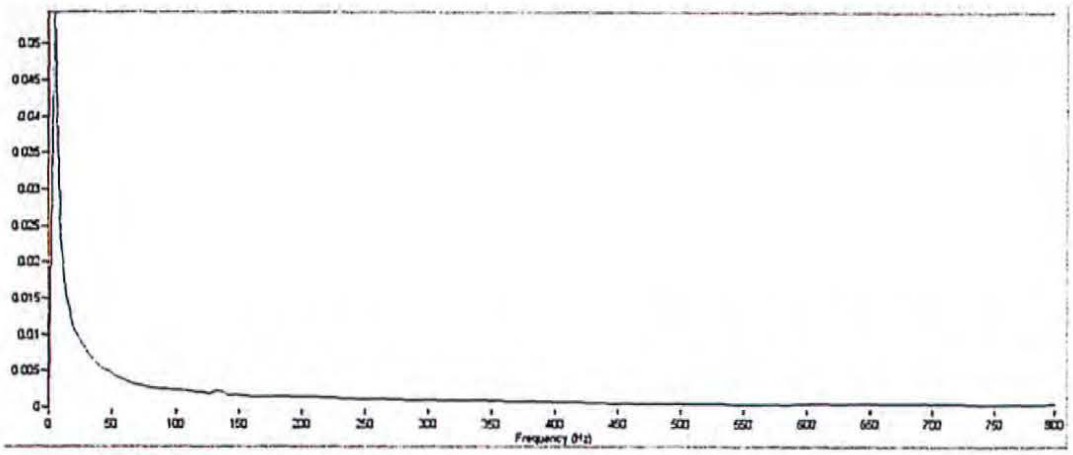
6 EXAMINATION RESULTS - IR METHOD

6.1 Second Stage Clarifier Tank

Data was collected on a 7' by 7' matrix. Approximately 382 readings were collected. Reading data available upon request.

Test Results:

Solid subgrade was detected throughout the test points collected which complements the results of the GPR survey. No suspect deterioration was found.



Typical "Good or Solid Subgrade" reading collected on the Second Stage Clarifier Tank

Average Mobility: The average mobility between 100 - 800 Hz is related directly to the density, elastic modulus, and thickness of the plate element. A reduction in the plate thickness results in an increase in mean mobility. Cracking or honeycombing in the concrete will reduce rigidity resulting in an increase in mean mobility. Finally, changes in slab subgrade support also affect mobility.

Mobility Slope: The mobility of honeycomb concrete increases with increasing frequency over the frequency range of 100-800 Hz; whereas, solid concrete shows a relatively constant mobility over the same frequency range.

Peak to Mean Mobility Ratio: This value is called "Ratio" for short. When this value exceeds about 2.5, loss of support beneath slab on grade is often indicated.

BMFOU QUARTERLY REPORT

Q2 2015

ATTACHMENT 3:

Horseshoe Bend Water Treatment Plant Groundwater Level Reduction Project

Montana Resources

Montana Resources, LLP
600 Shields Ave.
Butte, Montana USA 59701
(406) 496-3200
(406) 723-9542 fax
www.montanaresources.com

MEMORANDUM

TO: Steve Czehura

FROM: Amanda Griffith

DATE: July 22, 2015

SUBJECT: **HsBWTP GWL Reduction-2015 2nd Quarter Summary**

Overview

The pumping wells around the Horseshoe Bend Water Treatment Plant (HsBWTP) have maintained steady pumping levels during the second quarter of 2015, see Figure 1. The wells pumped continuously during the quarter, except for four 3-8 hour intervals in which the power was shut down either to install pumps in new wells or perform work on the plant. Five additional dewatering and monitor wells were installed during the second quarter, four were installed in close proximity to the First Stage Reactor and First Stage Clarifier tanks using a truck mounted auger rig, and the fifth was installed across the road adjacent to H14-1. At this time pumps have been installed and started in two of the five wells, and pumps have been ordered for two more. The water level in H15-9, which was left as a monitor well, and H15-11 which has yet to be completed as a pumping well yet, has dropped 2.69 feet and 1.55 feet respectively, since pumping in H15-7, H15-8, and H15-10 has commenced. The water level continues to decrease.

Second Quarter

Wells H15-8 and H15-9 were drilled and completed using a truck mounted auger rig from April 8, 2015 to April 14, 2015. H15-10 was drilled and completed on May18 and May 19, 2015. H15-11 was drilled and completed on June 18 and June 19, 2015. The wells were drilled through engineered fill consisting of gravel, sand, silt, and clay. A clay rich layer was encountered above the saturated subgrade in all holes The wells were drilled to 49.5 feet, but several feet of H15-8 and H15-9 were lost due to heaving sands during well completion. Detailed well completion logs can be seen in Figures 2-5. H15-12 was completed using a Foremost DR24 on June 25, 2015. The well was drilled through mine dump material and native alluvium. A detailed well completion log can be seen in Figure 6.

Pump tests were completed on all five wells and H15-9 was left as a monitor well due to low flow. The pumps were installed in H15-8 and H15-7 on April 29, 2015. The wiring and

plumbing was completed during the beginning of June and the pumps were turned on June 19, 2015. The pump in H15-10 was installed on June 29, 2015.

The pump in H14-4 was removed and a continuous air surging technique was attempted to develop the well and increase flow on June 10, 2015. The flow increased approximately 1.5 gpm from 3 gpm to 4.5 gpm.

The Static Water Level (SWL) and Pumping Water Level (PWL) elevations of all wells can be seen in Table 2. A graphical plot of the elevations alongside the First Stage Reactor tank foundation and ground level elevation can be seen in Figure 6.

Table 1. Pumping rates for HsBWTP dewatering wells.

Well #	Nominal Pumping Rate
H14-1	40-45 gpm
H14-2	6-10 gpm
H14-4	4-5 gpm
H14-5	2-3 gpm
H14-6	6-10 gpm
H14-7	5-6 gpm
H14-8	8-10 gpm
H14-10	4-5 gpm

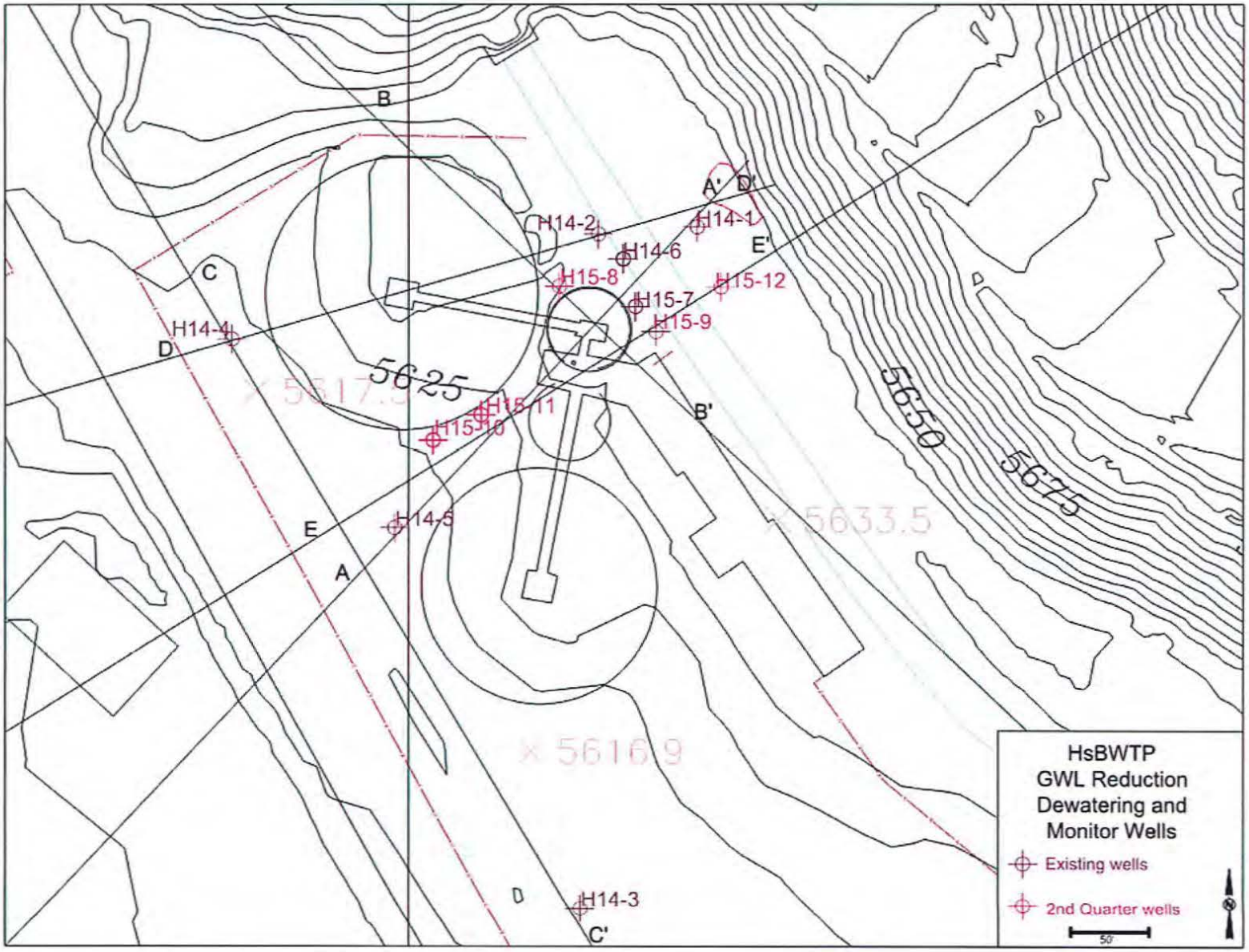


Figure 1. Site map of HsBWTP and surrounding dewatering and monitor wells.

Groundwater Well Installation Report

Page# 1 of 1

Well # H 15-8

Project Horseshoe Bend dewatering Location HsBWTP First Stage Reactor Tank

Installed By O'Keefe Drilling Start Date 04/08/2015 End Date 04/10/2015

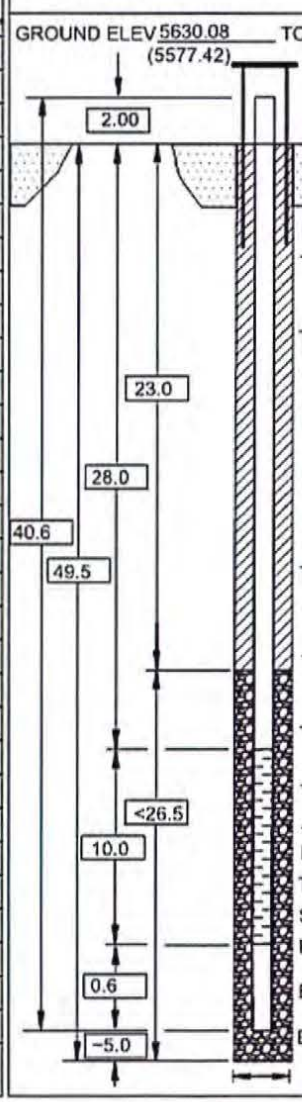
Northing 134835.5 Easting 137697.2 Top of Casing Elev. 5631.76 (5579.13)

Method of Installation Installed with an auger rig. All elevations in ACM (USGS). Drilled to 49.5 but casing set at 38 feet due to heaving sands in saturated interval.

BORING LOG

DEPTH (ft)	DESCRIPTION
0	0-2 ft. lt. brown/orng well graded sand and gravel-looks like mine fill
	2-10 ft. lt.-med. gry, well graded gravel and sand with ~5% fines. Sandy GW to Gravelly SW with silt
10	10-12 lt. brn hard pan of silt and clay over f.g.-c.g. sand. 2-3 layers.
	12-14 ft. lt. gry sub-rounded poorly graded gravel
	14-19 ft. med. brn well graded sand, silt, and little gravel. 1st moisture seen at 14.5 ft.
20	19-23 ft. lt. brown well graded sand and gravel with marked increase in moisture-not saturated.
	23-27.5 ft. brn-gry well sorted sand in fat clay. Pinch to 1-1.5 in. ribbon.
	27.5-32 ft. First H_2O. lt. brown poorly graded sand and silt/low clay. Saturated with H_2O.
30	32-34 ft. silty SW with marked decrease in H_2O.
	34-49.5 ft. lt. brn silty well graded sand. No gravel. Well saturated with no plasticity.
40	
50	TD 49.5 lt.
60	

WELL CONSTRUCTION



TYPE OF WELL

GROUND ELEV 5630.08 (5577.42)

TOP RISER ELEV 5632.15 (5579.52)

Vented Cap

Collar Pipe 5632.15 (5579.52)

Length

ID of Riser Schedule 80 PVC

Type of Pipe

Type of Backfill Around Riser Bentonite chips

Top of Seal Elv 5606.76 (5554.13)

Type of Seal Material 23 ft. Bentonite chips 2 ft. 10/20 silica sand

Top of Filter Elv 5604.76 (5552.13)

Top of Screen Elv 5601.76 (5549.13)

Type of Filter Material Pea gravel

ID of Screen Schedule 80 PVC

Type

Size Openings 0.06 slot

Bottom Screen Elv 5591.76 (5539.13)

Bottom Casing Elv 5591.16 (5538.53)

Bottom Boring Elv 5586.16 (5533.53)

ID of Boring 12 inch

Remarks

Prepared By A. Griffith

Figure 2. Well completion log for H15-8.

Groundwater Well Installation Report

Page# 1 of 1

Well # H 15-9

Project Horseshoe Bend dewatering Location HsBWTP First Stage Reactor Tank

Installed By O'Keefe Drilling Start Date 04/13/2015 End Date 04/14/2015

Northing 134805.7 Easting 137759.6 Top of Casing Elev. 5634.43 (5581.80)

Method of Installation Installed with an auger rig. All elevations in ACM (USGS). Drilled to 49.5 but casing set at 35 feet due to heaving sands in saturated interval.

BORING LOG

DEPTH (ft)	DESCRIPTION
0	0-2 ft. lt. brown/orng well graded sand and gravel-looks like mine fill
	2-12 ft. lt. brn. well graded san and rounded gravel with ~5% fines. SW with silt.
10	12-14 ft. lt. brn hard pan of silt and cly over fining downward sand.
	14-16 ft. med. brn well graded sand, silt, and little gravel. 1st moisture seen at 14 ft.
	16-17 ft. very lt gry sub-rounded gravel.
	17-22 ft. md brn well graded sand and fine gravel with marked increase in high plasticity fines, up to 40%. Clayey SW with gravel
20	22-24 ft. brn-gry well sorted sand in fat clay. Pinch to 1-1.5 in. ribbon.
	24-26 ft. First H_2O. lt. brn well graded sand and silt. Saturated with H_2O.
	26-27 ft. lt. brn well graded sand and silt with high cly. Saturated with H_2O.
30	27-40 ft. lt. brn well graded sand and silt. Saturated with H_2O.
40	40-49.5 ft. lt. brn silty well graded sand. Increase in high plasticity clay.
50	TD 49.5 ft.
60	

WELL CONSTRUCTION

TYPE OF WELL

GROUND ELEV 5631.64 (5579.01)

TOP RISER ELEV 5634.64

Vented Cap (5582.01)

Collar Pipe 5634.43

Length (5581.80)

2.79

ID of Riser 6" Schedule 80 PVC

Type of Pipe

Type of Backfill Around Riser Bentonite chips

23.0

25.0

37.8

49.5

Top of Seal Elv 5632.64 (5580.01)

Type of Seal Material 24 ft. Bentonite chips 2 ft. 10/20 silica sand

Top of Filter Elv 5607.64 (5555.01)

Top of Screen Elv 5606.64 (5554.01)

Type of Filter Material Pea gravel

<25.5

10.0

ID of Screen Schedule 80 PVC

Type

Size Openings 0.06 slot

Bottom Screen Elv 5596.64 (5544.01)

0.6

Bottom Casing Elv 5596.04 (5543.41)

~15.0

Bottom Boring Elv 5582.14 (5529.51)

ID of Boring 12 inch

Remarks

Prepared By A. Griffith

Figure 3. Well completion log for H15-9.

Groundwater Well Installation Report

Page# 1 of 1

Well # H 15-10

Project Horseshoe Bend dewatering Location HsBWTP First Stage Reactor Tank

Installed By O'Keefe Drilling Start Date 05/18/2015 End Date 05/19/2015

Northing 134735.82 Easting 137615.64 Top of Casing Elev. 5622.46 (5569.83)

Method of Installation Installed with an auger rig. All elevations in ACM (USGS). Drilled to 48'; casing set at 47'.

BORING LOG

DEPTH (ft)	DESCRIPTION
0	0-3 ft. lt. gry/brn silty, well graded sand and gravel. Moist from rain
	3-5 ft. wht/gry well graded, sub-angular to well rounded gravel fining downward to coarse sand
	5-10 ft. lt gry/brn well graded sand and fine gravel. fining downward
10	10-18 ft. lt. gry/brn gravelly well graded sand with silt
	15 ft. 3mm thick hard pan layer over sand. ~10 pieces chewed up HDPE
	18-22 ft. lt brn silty well graded sand
20	20 ft. first moisture-not saturated
	22-26 ft. lt. brn/gry fat clay with well graded sand. Increase in moisture
	26-48 ft. lt. brn silty well graded sand and fine gravel. Few clay balls. Saturated
30	
40	
50	TD 48 ft.
60	

WELL CONSTRUCTION

TYPE OF WELL

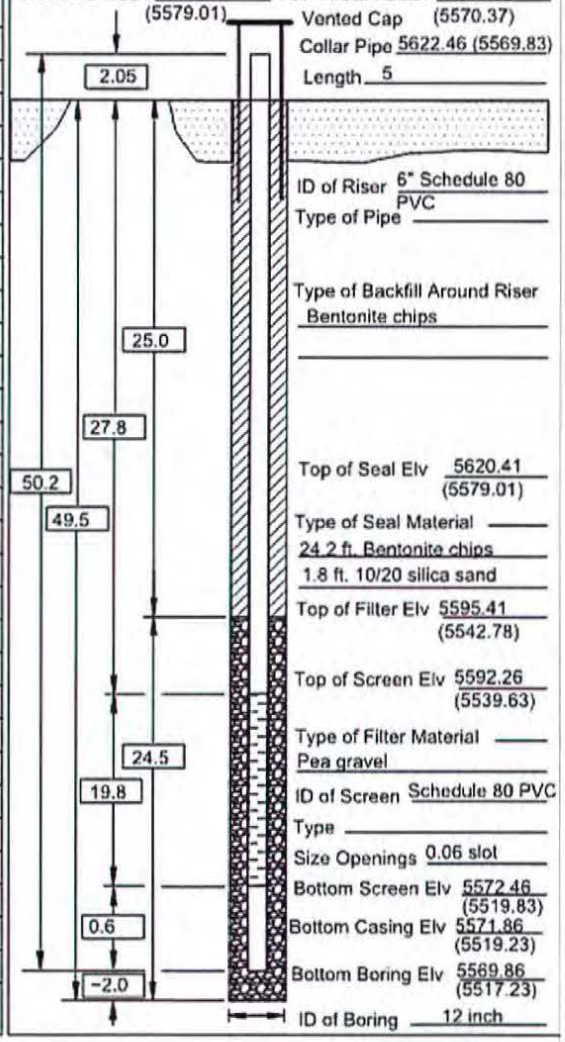
GROUND ELEV 5620.41 (5579.01)

TOP RISER ELEV 5623.00

Vented Cap (5570.37)

Collar Pipe 5622.46 (5569.83)

Length 5



ID of Riser 6" Schedule 80 PVC

Type of Pipe

Type of Backfill Around Riser Bentonite chips

Top of Seal Elv 5620.41 (5579.01)

Type of Seal Material 24.2 ft. Bentonite chips 1.8 ft. 10/20 silica sand

Top of Filter Elv 5595.41 (5542.78)

Top of Screen Elv 5592.26 (5539.63)

Type of Filter Material Pea gravel

ID of Screen Schedule 80 PVC

Type

Size Openings 0.06 slot

Bottom Screen Elv 5572.46 (5519.83)

Bottom Casing Elv 5571.86 (5519.23)

Bottom Boring Elv 5569.86 (5517.23)

ID of Boring 12 inch

Remarks

Prepared By A. Griffith

Figure 4. Well completion log for H15-10.

Groundwater Well Installation Report

Page# 1 of 1

Well # H 15-11

Project Horseshoe Bend dewatering Location HsBWTP First Stage Reactor Tank

Installed By O'Keefe Drilling Start Date 06/18/2015 End Date 06/19/2015

Northing 134751.65 Easting 137646.73 Top of Casing Elev. 5624.65 (5572.02)

Method of Installation Installed with an auger rig. All elevations in ACM (USGS). Drilled to 48'; casing set at 47'.

BORING LOG

DEPTH (ft)	DESCRIPTION
0	0-3 ft. lt. gry/brn gravelly, well graded sand with silt and clay. Moist with overflowing reactor water and sediment
	3-4 ft. wht/gry well graded, sub-angular to well rounded gravel
	4-10 ft. lt gry/brn well graded sand and fine gravel. fining downward
10	10-18 ft. lt. gry/brn gravelly well graded sand with silt
	15 ft. 3mm thick hard pan layer over sand. ~10 pieces chewed up HDPE
	18-22 ft. lt brn silty well graded sand
20	20 ft. first moisture-not saturated
	22-26 ft. lt. brn/gry fat clay with well graded sand. Increase in moisture
	26-48 ft. lt. brn silty well graded sand and fine gravel. Few clay balls. Saturated
30	
40	
50	TD 48 ft.
60	

WELL CONSTRUCTION

TYPE OF WELL

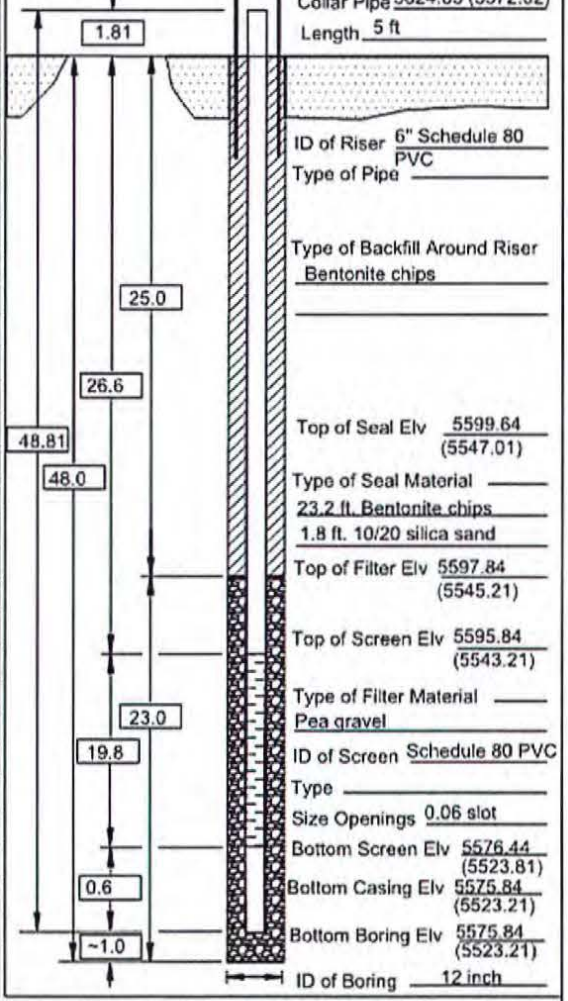
GROUND ELEV 5622.84 (5570.21)

TOP RISER ELEV 5625.34

Vented Cap (5572.71)

Collar Pipe 5624.65 (5572.02)

Length 5 ft



ID of Riser 6" Schedule 80 PVC

Type of Pipe

Type of Backfill Around Riser Bentonite chips

Top of Seal Elv 5599.64 (5547.01)

Type of Seal Material 23.2 ft. Bentonite chips 1.8 ft. 10/20 silica sand

Top of Filter Elv 5597.84 (5545.21)

Top of Screen Elv 5595.84 (5543.21)

Type of Filter Material Pea gravel

ID of Screen Schedule 80 PVC

Type

Size Openings 0.06 slot

Bottom Screen Elv 5576.44 (5523.81)

Bottom Casing Elv 5575.84 (5523.21)

Bottom Boring Elv 5575.84 (5523.21)

ID of Boring 12 inch

Remarks

Prepared By A. Griffith

Figure 5. Well completion log for H15-11.

Groundwater Well Installation Report

Page# 1 of 1

Well # H 15-12

Project Horseshoe Bend dewatering Location HsBWTP First Stage Reactor Tank

Installed By O'Keefe Drilling Start Date 06/25/2015 End Date 06/25/2015

Northing 134834.58 Easting 137801.37 Top of Casing Elev. 5633.34 (5580.71)

Method of Installation Installed with a Foremost DR24 rig. All elevations in ACM (USGS). Drilled to 50'; casing set at 50'.

BORING LOG

DEPTH (ft)	DESCRIPTION
0	0-7 ft. lt. brn/grn cly rich well graded sand and minor fine gravel
	7-11 ft. brn/orng silty sump material. Few clay balls
10	11-16 ft. dk. brn/gry sandy organic layer with silt and clay balls
	16-22 ft. md brn/orng silty moderately graded sand with tr. cly balls
20	18 ft. first moisture. Began injecting water at 22 ft. became too sticky to lift cuttings.
	22-24 ft. lt. brn cly rich well graded sand and gravel. Fat cly pinched to 1". Increase in moisture
	24-32 ft. lt. brn soupy, silty, well graded sand and gravel with tr cly balls. Saturated
30	
	32-38 ft. lt. brn cly rich well graded sand and granitic gravel. orng cly
	38-49 ft. lt. brn/orng cly rich well graded granitic gravel. Increase in water
40	
50	49-50 ft. drilling smoothed (as per driller) large cly ball returned. ~50% cly
	50 ft. TD
60	

WELL CONSTRUCTION

TYPE OF WELL

GROUND ELEV 5631.60 (5578.97)

TOP RISER ELEV 5633.69

Vented Cap (5581.06)

Collar Pipe 5633.34 (5580.71)

Length 5 ft

ID of Riser 6" Schedule 80 PVC

Type of Pipe

Type of Backfill Around Riser Bentonite chips

Top of Seal Elv 5631.60 (5578.97)

Type of Seal Material 15 ft. Bentonite chips

Top of Filter Elv 5616.60 (5563.97)

Top of Screen Elv 5611.80 (5559.17)

Type of Filter Material Pea gravel

ID of Screen Schedule 80 PVC

Type

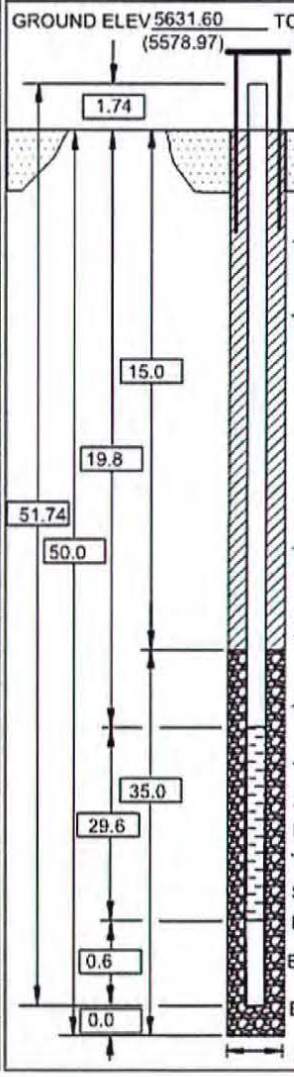
Size Openings 0.07 slot

Bottom Screen Elv 5582.20 (5529.57)

Bottom Casing Elv 5581.60 (5528.97)

Bottom Boring Elv 5581.60 (5528.97)

ID of Boring 12 inch



Remarks

Prepared By A. Griffith

Figure 6. Well completion log for H15-12.

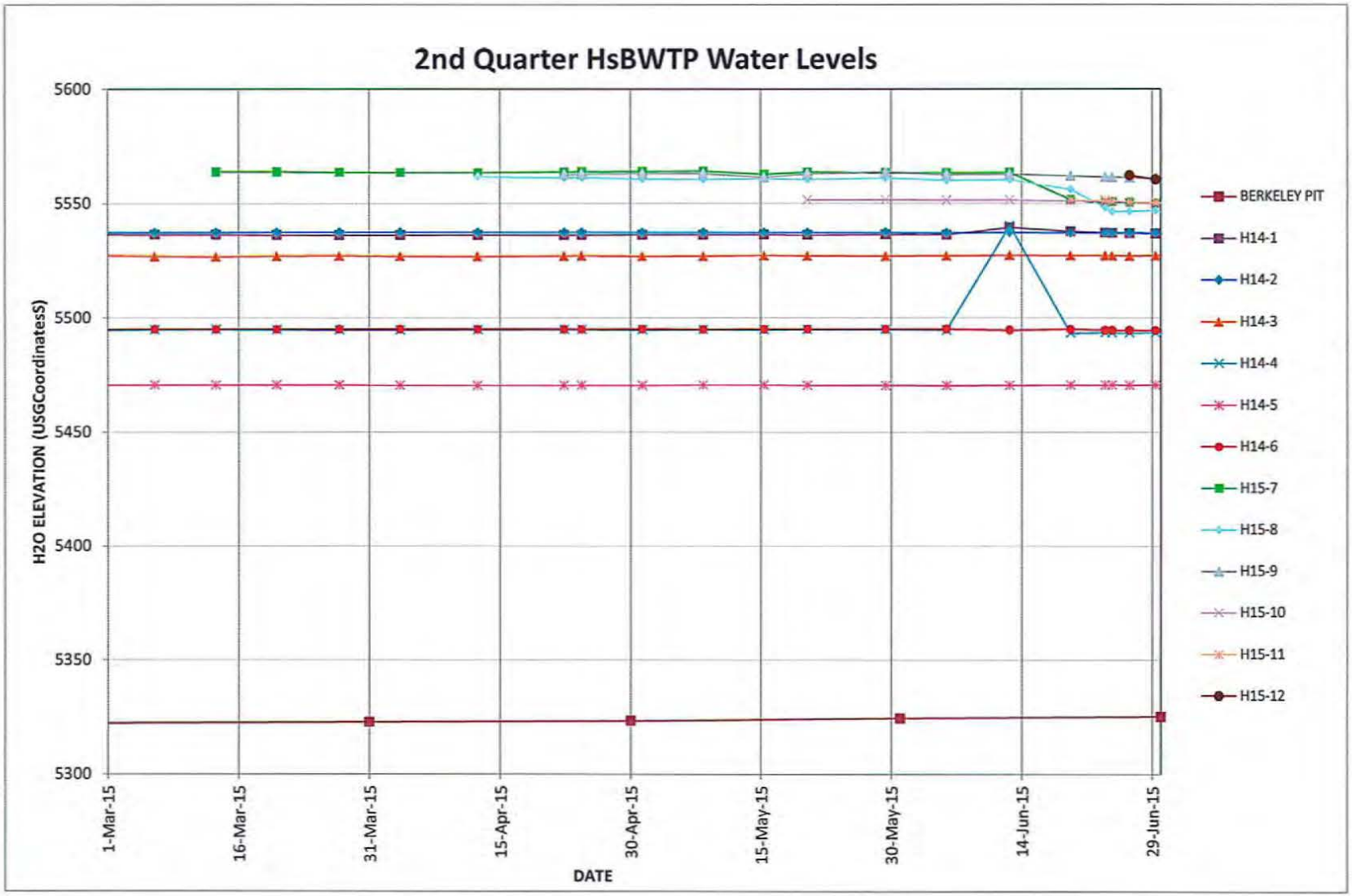


Figure 7. HsBWTP dewatering and monitor well levels for 2nd quarter of 2015.

Table 2. Pumping and static water levels of the HsBWTP dewatering and monitor wells

Well	Water elevation (ACM ft)	Water elevation (USGS ft)	Change from 3/6/2015 or date of installation (ft)	Screened interval (ACM)
H14-1*	5589.40	5536.77	0.30	5562-5582
H14-2*	5589.67	5537.04	-0.20	5561-5581
H14-3	5579.76	5527.13	-0.20	5555-5575
H14-4*	5546.01	5493.38	-1.40	5538-5558
H14-5*	5523.15	5470.52	-0.05	5515-5535
H14-6*	5547.13	5494.50	-0.50	5535-5555
H15-7*	5599.90	5547.27	-16.43	5593-5623
H15-8*	5597.17	5544.54	-17.00	5592-5602
H15-9	5614.41	5561.78	-1.60	5597-5507
H15-10	5600.55	5547.92	-1.61	5572-5592
H15-11	5602.94	5550.31	-0.21	5576-5596
H15-12	5612.99	5560.36	0.00	5582-5612

*** Pumping well**

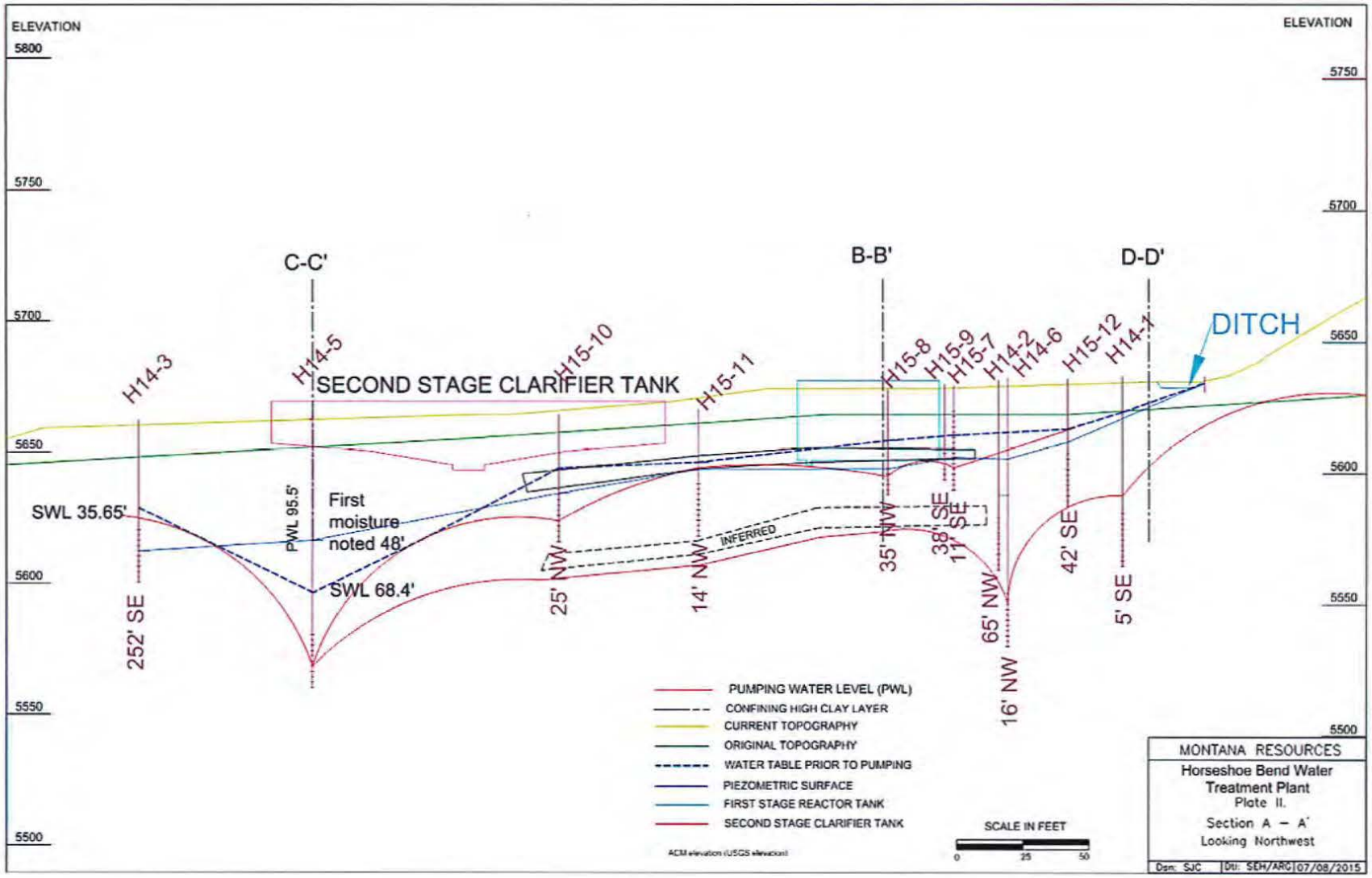


Figure 8. Cross section A-A' showing drawdown beneath the First Stage Reactor tank and the Second Stage Clarifier tank.

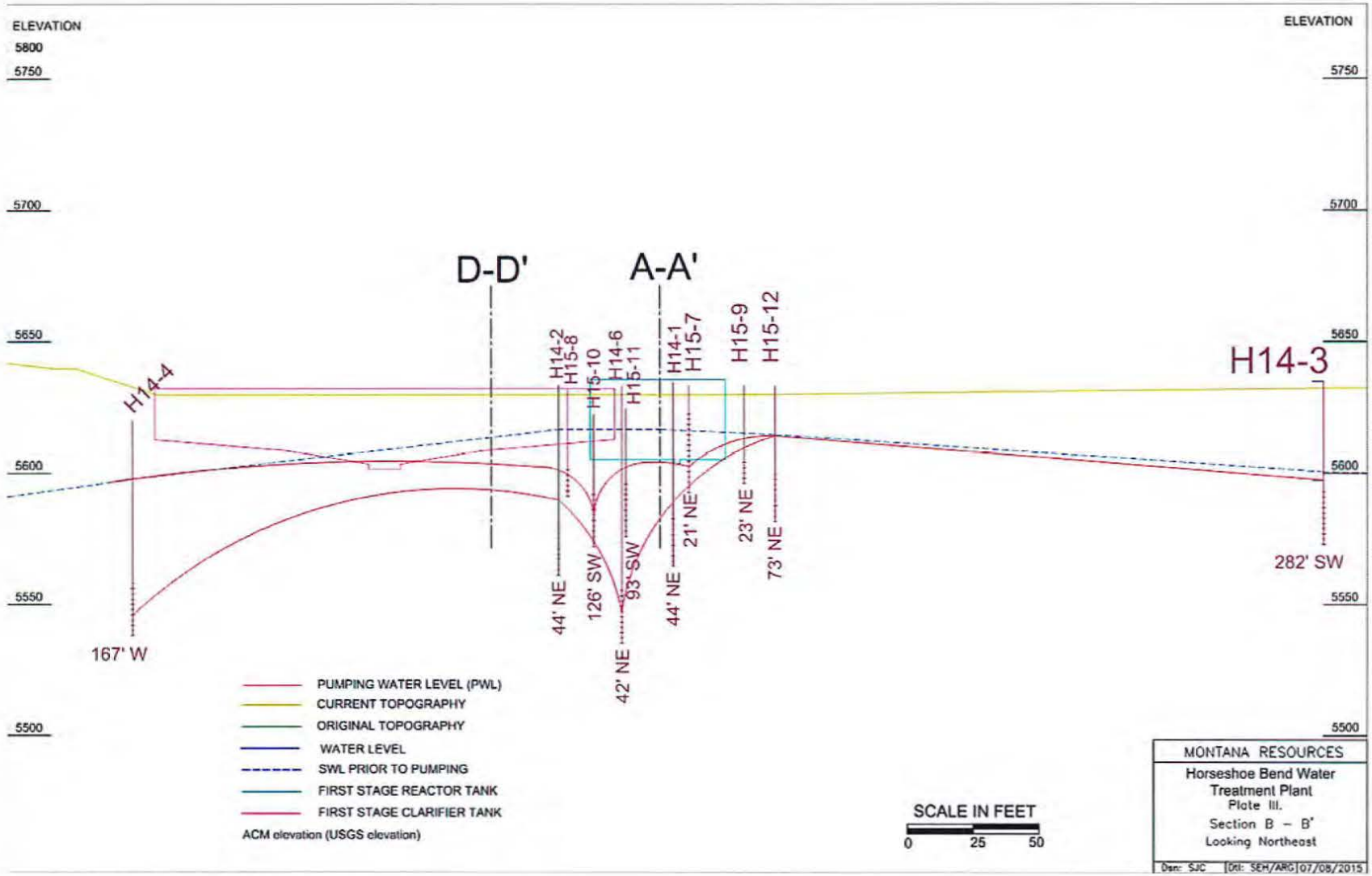


Figure 9. Cross section B-B' showing drawdown beneath the First Stage Reactor tank and the First Stage Clarifier tank.

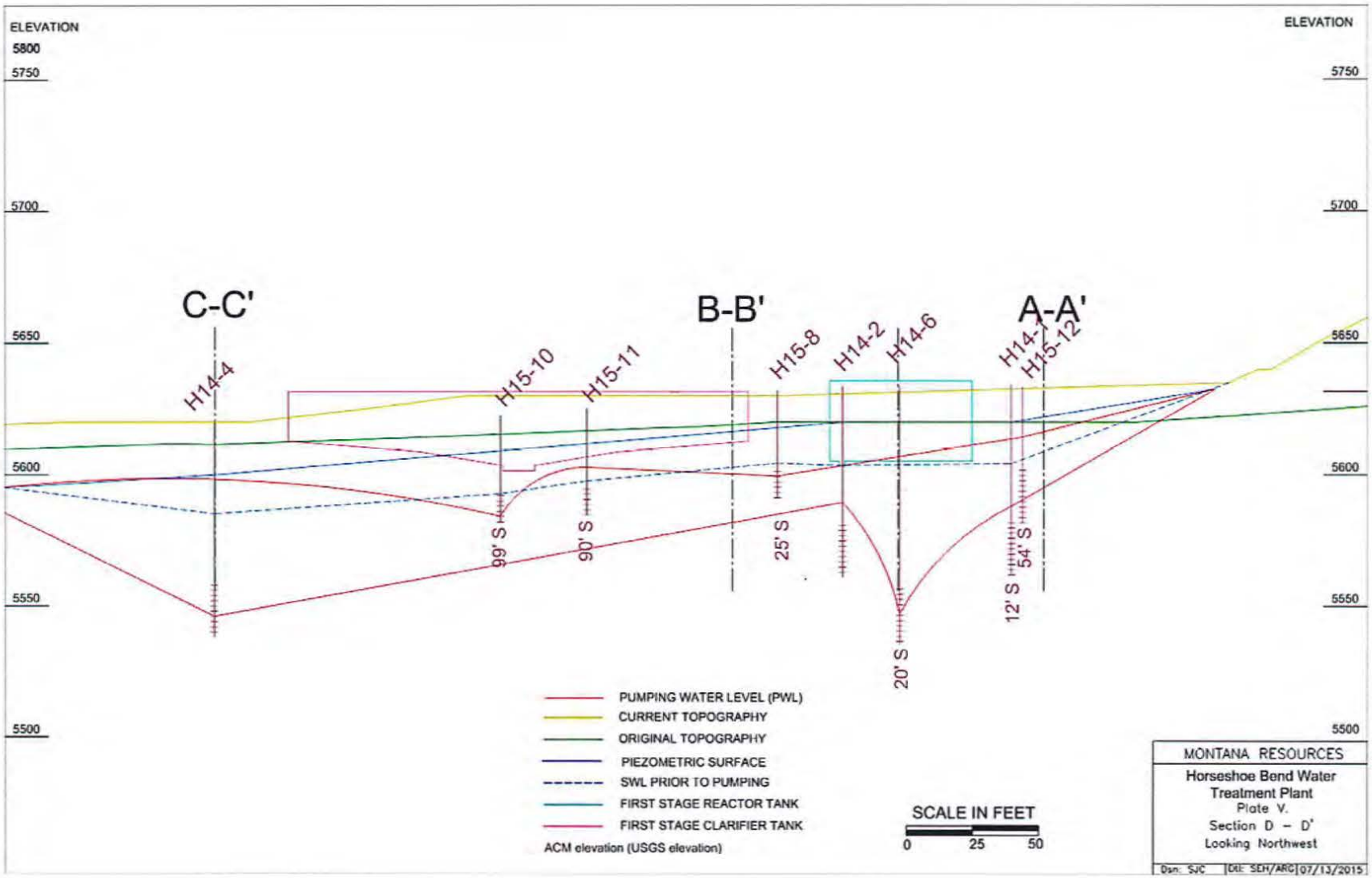


Figure 10. Cross section D-D' showing drawdown beneath the First Stage Reactor tank and the First Stage Clarifier tank.

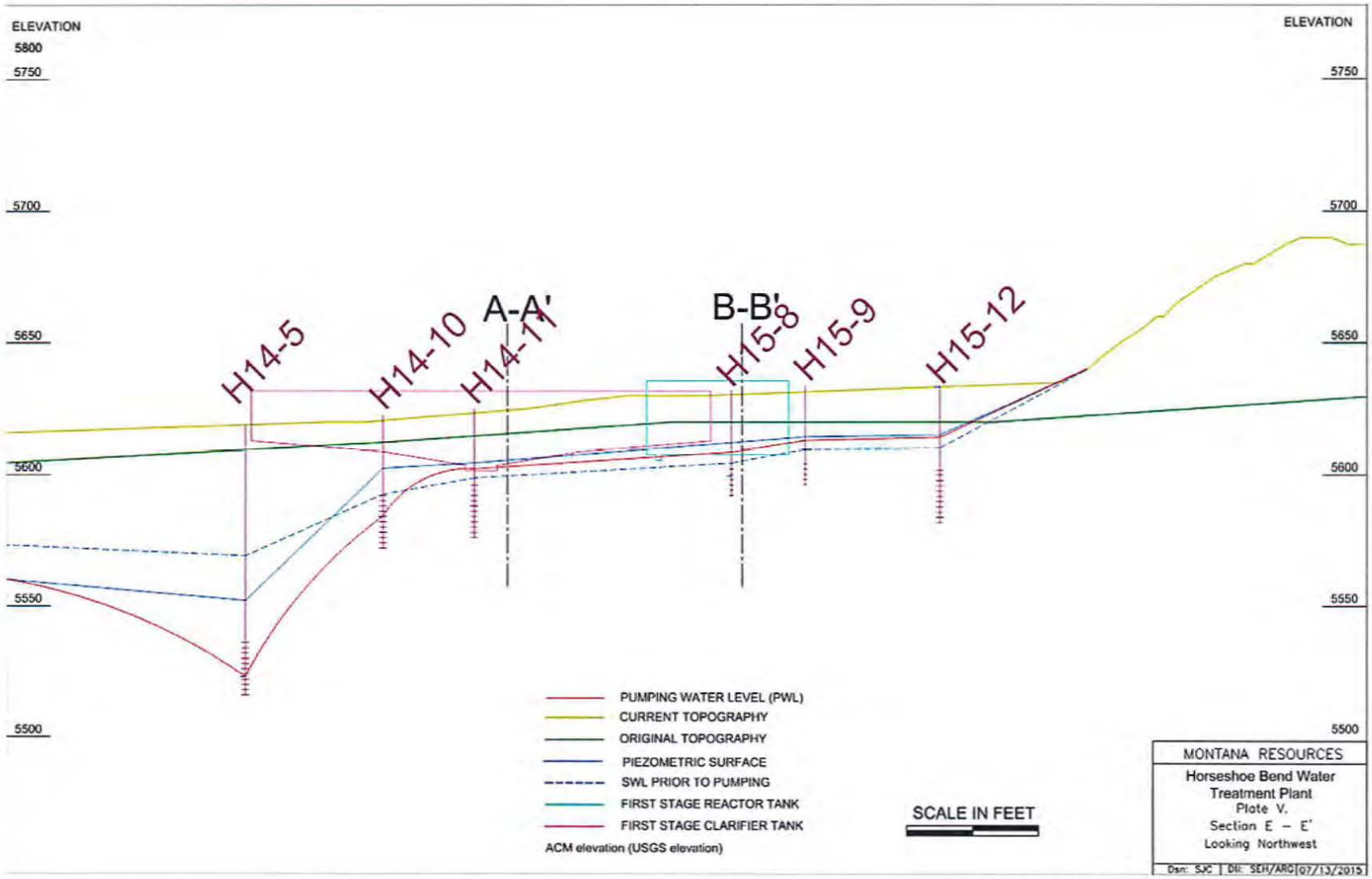


Figure 11. Cross section E-E' showing drawdown beneath the First Stage Reactor tank and the First Stage Clarifier tank.

BMFOU QUARTERLY REPORT

Q2 2015

ATTACHMENT 4:

Berkeley Pit Slope Stability Quarterly Summary

Montana Resources

Montana Resources, LLP
600 Shields Ave.
Butte, Montana USA 59701
(406) 496-3200
(406) 723-9542 fax
www.montanaresources.com

MEMORANDUM

TO: Stephen Walsh

FROM: S. Czehura

COPY: Mark Thompson, MR; Tim Hilmo, ARCO/BP

DATE: July 30, 2015

SUBJECT: **Berkeley Pit Slope Stability Second Quarter Summary 2015**

Monitoring

The existing monitoring network was maintained throughout the quarter. Repairs and adjustments were completed promptly, as needed, to ensure uninterrupted coverage in areas with a high Probability of Instability (POI).

Four survey points in the Bird Watch Sector, four survey points in the Concentrator Sector, seven survey points in the Southeast Sector and three prisms in the Pittsmont Sector were monitored throughout this period. Survey points in the Bird Watch Sector are checked bimonthly. In the Concentrator Sector, the western two survey points were monitored weekly, and the two eastern points were monitored daily during the Second Quarter.

Seven survey points in the Southeast Sector and three prisms in the Pittsmont Sector are monitored daily. Wire extensometers, i.e. Section 2 (West), in the Concentrator Sector, are checked several times per day. Wire extensometers, i.e. Section 1 (East), in the Southeast Sector are instrumented and monitored continuously. All inclinometers are read daily. All TDR wells are read weekly (Figure 1).

Berkeley Pit - Active Sectors

Sector nomenclature for the Berkeley pit is detailed on Plate II (attached).

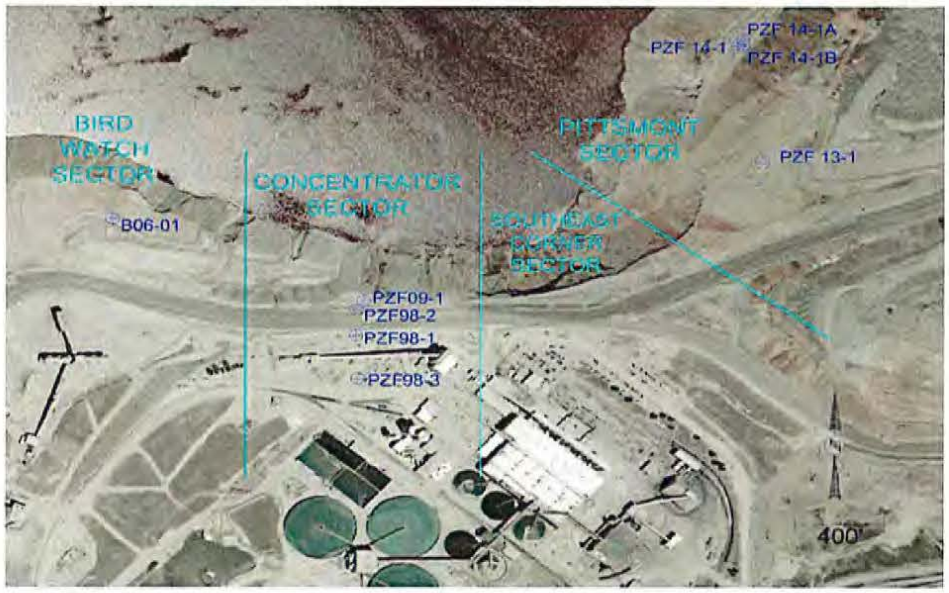


Figure 1. TDR Well locations.

Bird Watch Sector: The four "Bird Watch Sector" monitor points did not exhibit any abnormal movement during the second quarter of 2015. Monitoring of Point A37415 was discontinued on June 12th 2015 because access to the point was unsafe. The point was replaced with a pin further to the southwest (A37154) on June 19, 2015. The three accessible points along with this new point were subsequently surveyed once a week.

Slow displacement of the outer portion of the dump continues at a rate of less than 0.6 inches per month. The TDR cable in Well B06-1 has revealed no progressive distress.

Concentrator Sector: Four survey points were checked in this sector throughout the quarter with "no significant movement" being indicated. Two of the monitor points were surveyed daily, and two of the monitor points were surveyed once a week.

Two of the three extensometers in this sector showed no reportable or progressive movement. However, the middle extensometer (A37456) moved 0.5 inches during the week of May 11th to May 17th 2015 and moved 0.25 inches during the week of May 25th to May 31st. The area was examined each time and movement along the crack in the area in front of the middle extensometer post was visible along with fresh cracking. Rain storms mid-May produced excessive runoff that locally impacted this area. All other movement appeared to be random and not progressive. These extensometers are monitored three times per shift, and minor repairs (wire replacement, etc.) are made as appropriate.

TDR cables were read weekly throughout the Second Quarter in four wells in this sector and no progressive movement was detected.

Southeast Sector: No significant movement was detected with the monitoring array during the Second Quarter 2015.

On April 24th 2015, a cautionary zone was delineated with candlesticks in this sector extending west into the Concentrator Sector. At that time, a mound in the ground water level, near the slope face was determined to be significant. Initial computer models indicated a higher Probability of Instability (POI) than previously thought. Subsequently, modeling has confirmed this area to be at risk with a Probability of Instability (POI) in excess of 50%.

To ensure the safety of operating personnel, MR has restricted haul truck traffic to the southern lane, and inclinometer readings have been curtailed to reduce the exposure for monitoring personnel. For a short time, manual readings of the extensometers by the foreman were also suspended, as all remote instrumentation was functional and online. Readings, however, were resumed on Wednesday, April 29th 2015 during dayshift to provide redundancy and ensure that daily visual inspection was ongoing. Computer modeling for the western "Potential Failure Zone", where the extensometers are situated, indicates a POI in the range of 30% in line with previous estimates.

Although the Southeast Sector extensometers are instrumented, they continue to be inspected three times per shift and readings recorded once a shift. If an automated data collector should go down, manual readings are taken three times per shift concurrent with the inspections.

Only one minor extensometer repair was made during the month:

Overall the survey points monitored during the quarter in the Southeast Sector showed no reportable or progressive movement. None of the monitor points were damaged or replaced during the Second Quarter.

The monitor points being surveyed are as follows:

- A37210,
- A37205,
- A37231,
- A37163,
- A37161,
- A37209, and
- A37233.

Daily monitoring of inclinometers PZF12-4, PZF12-5, and PZF12-8 continues. And to date, there has been no significant movement in any of the wells.

Monitoring of well PZF12-4 is ongoing. However, due to reconfigurations in the "Potential Failure Zones," inclinometer monitoring was suspended for Wells PZF12-5 and PZF12-8 mid-June 2015. PZF12-5 and PZF12-8 now lie inside of a "Potential Failure Zone" with a high POI. Water levels in all wells are still being recorded. The incipient movement, noticed in January 2014 on the B axis of PZF12-4 at 255 feet, remains stable.

Since June 14th 2015, inclinometer readings have not been taken in Well PZF12-4, as both inclinometer reels and probes are being repaired.

All four dewatering pumps in the Southeast Sector ran throughout the quarter as indicated in Table 1.

The pump in well PZF12-1 went down Friday night May 16th 2015 and a new motor was installed mid-day. Pumping resumed within 24-hours. Otherwise, all pumps operated with only minor interruptions due to loss of power.

Three pumping wells were drilled in May and June 2015, and three additional pumping wells were completed along the crest of the highwall, just outside of the expanded "Potential Failure Zone" delineated mid-quarter. Pumps have been ordered for these wells, but none have been installed as of this date.

Table 1. Average flows for dewatering wells (Second Quarter 2015).

Dewatering Well	April		May		June	
	Flow (gpm)	Availability	Flow (gpm)	Availability	Flow (gpm)	Availability
PZF12-1	49.8	99%	49.7	96%	51.7	99%
PZF12-2	35.0	100%	35.0	99%	31.6	99%
PZF12-3	22.0	100%	21.7	99%	22.8	100%
LP-15	42.0	100%	41.8	99%	30.0	100%

Pittsmont Sector: Three prisms on the Pittsmont dump were surveyed once a day, on the average of five days per week during the quarter with a total station. No slope movements were detected during the quarter.

The TDR cables in Wells PZF13-1, PZF14-1A, and PZF14-1B were read weekly during the quarter with no indicated distress.

Hydrographs

Water levels are tracked in all sectors. Hydrographs detailing the piezometric surface in each sector are provided for comparison in Figures 2 through 6. No excursions were noted during the quarter in the Bird Watch, Concentrator, or Pittsmont Sectors.

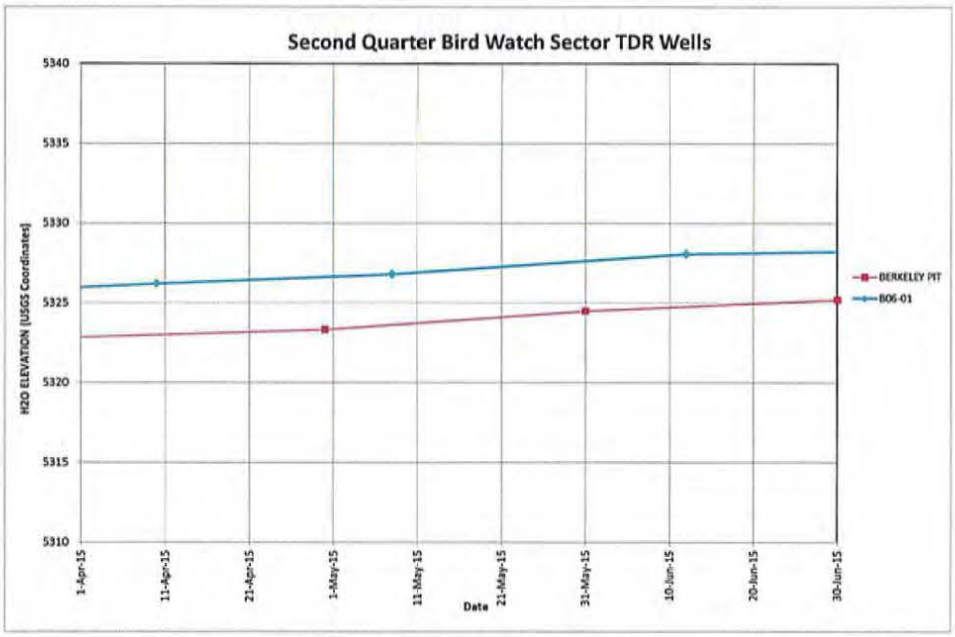


Figure 2. Hydrographs Bird Watch Sector.

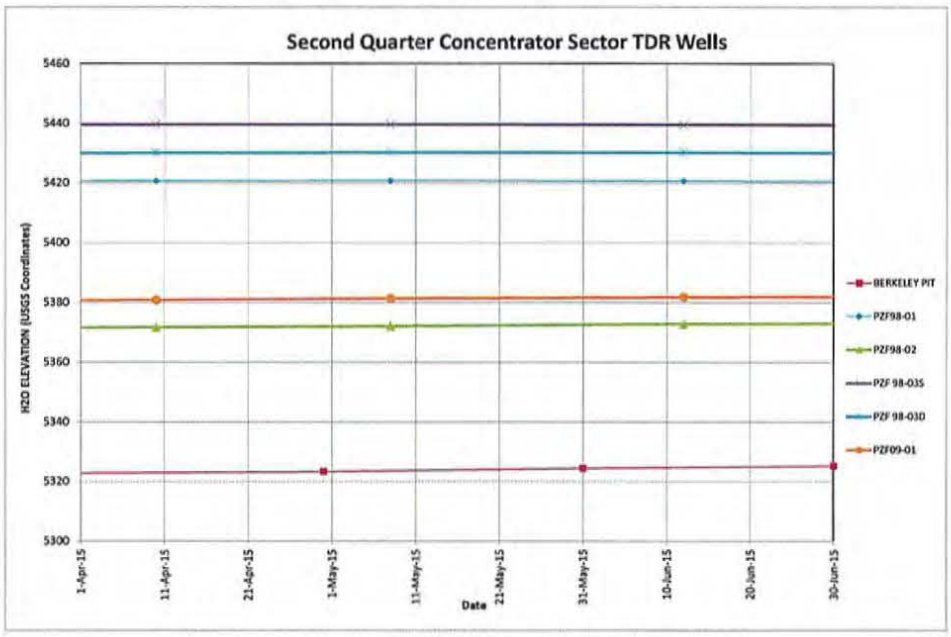


Figure 3. Hydrographs Concentrator Sector.

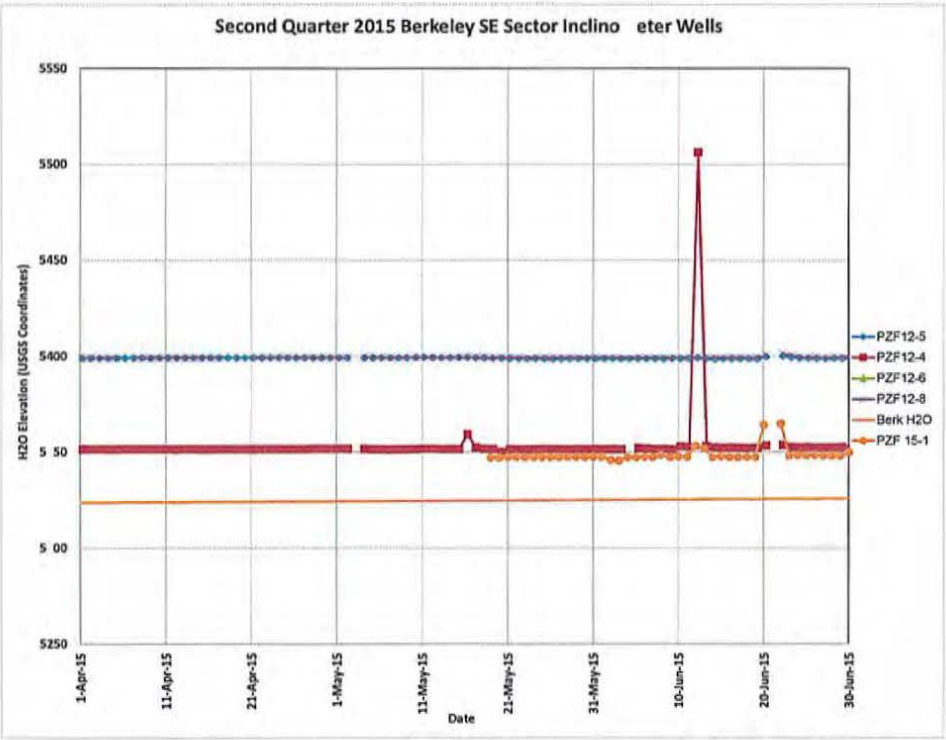


Figure 4. Hydrographs Southeast Sector inclinometer wells.

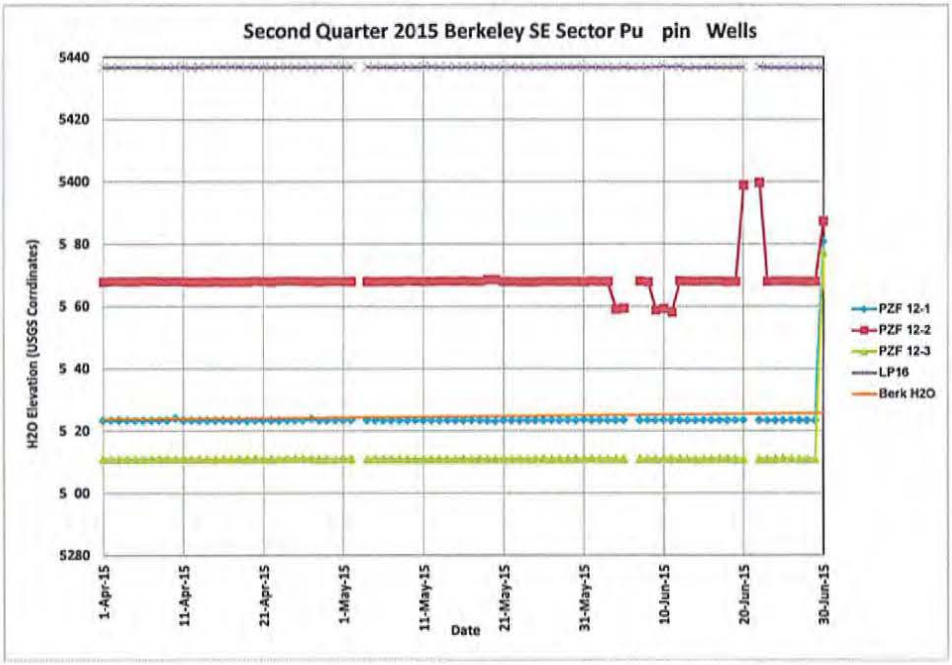


Figure 5. Hydrographs Southeast Sector pumping wells.

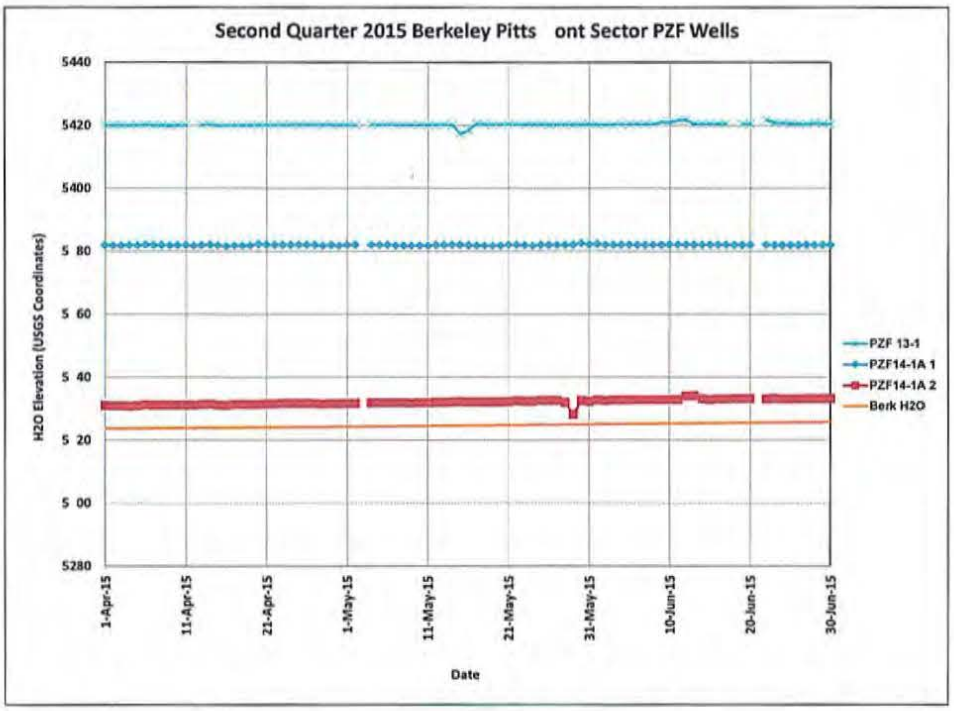
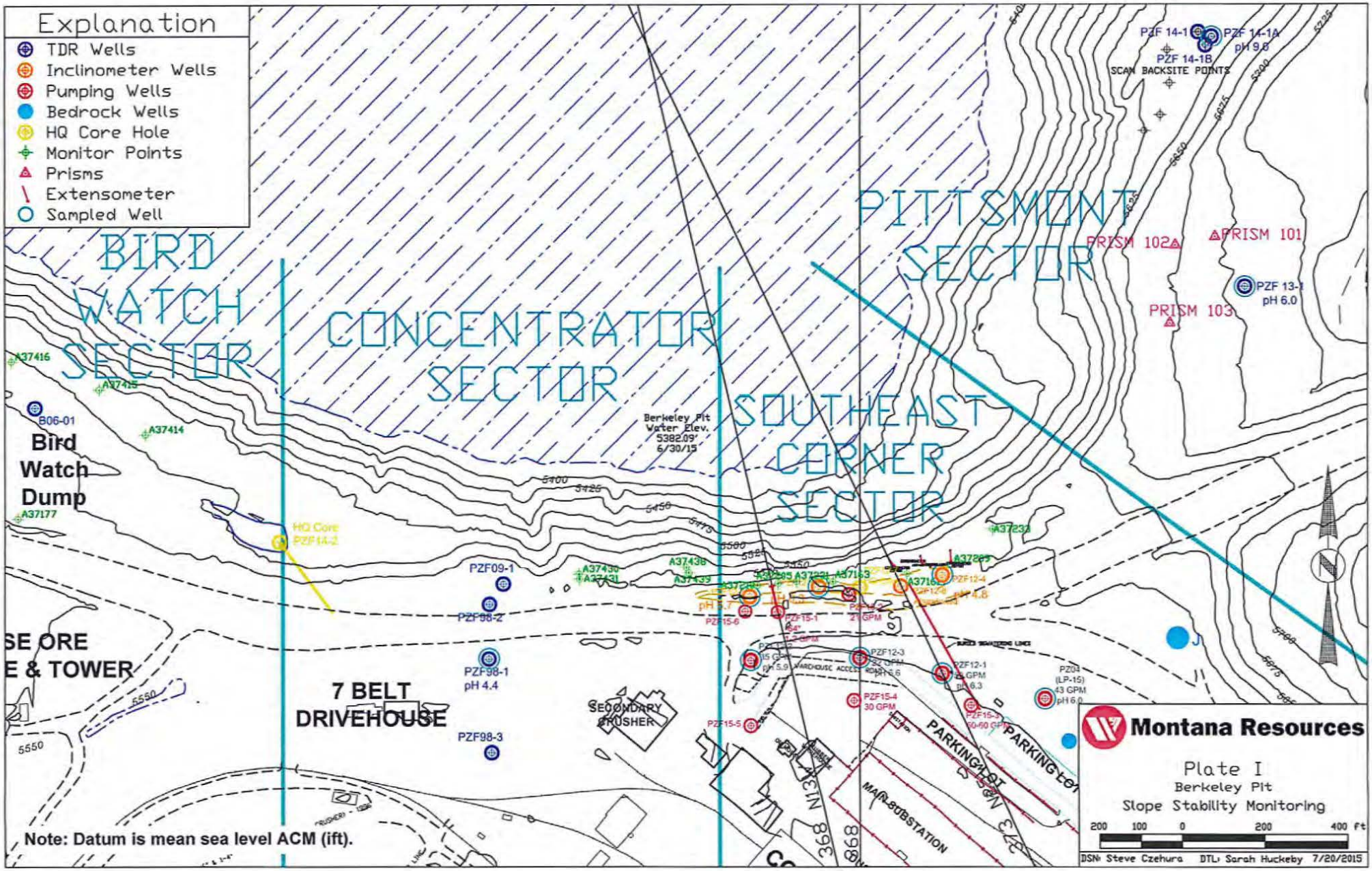
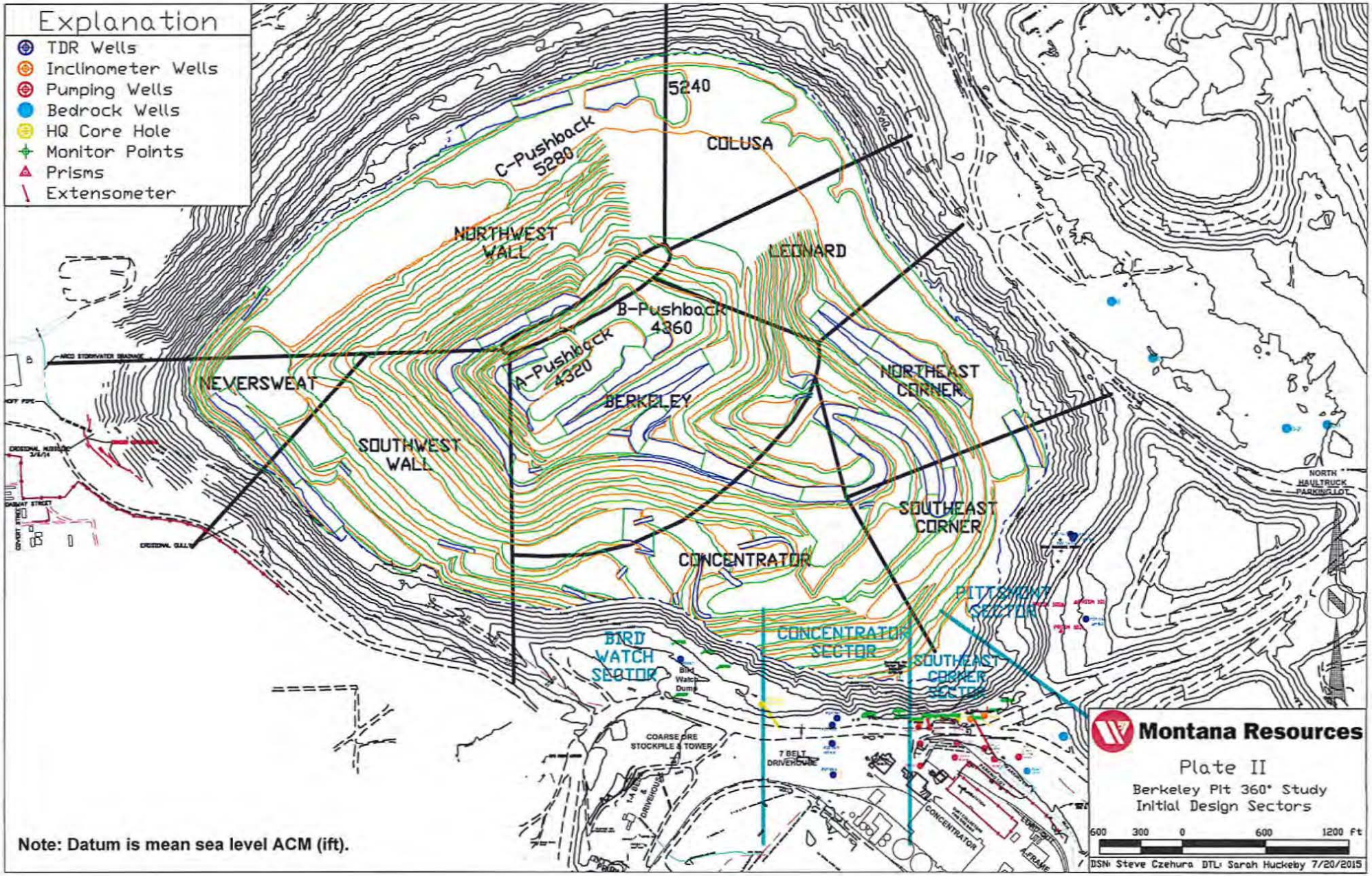


Figure 6. Hydrographs Pittsmont Sector.


Explanation
TDR Wells
Inclinometer Wells
Pumping Wells
Bedrock Wells
HQ Core Hole
Monitor Points
Prisms
Extensometer
Sampled Well
BIRD WATCH SECTOR
CONCENTRATOR SECTOR
SOUTHEAST CORNER SECTOR
PITTSMONT SECTOR
Berkeley Pit Water Elev. 5382.09' 6/30/15
Bird Watch Dump
7 BELT DRIVEHOUSE
SECONDARY CRUSHER
PARKING LOT
MAIN SUBSTATION
PZF 14-1
PZF 14-1A pH 9.8
PZF 14-1B
SCAN BACKSITE POINTS
PRISM 101
PRISM 102
PRISM 103
PZF 13-1 pH 6.0
B06-01
HQ Core PZF14-2
PZF09-1
PZF98-2
PZF98-1 pH 4.4
PZF98-3
PZF15-1
PZF15-4 30 GPM
PZF15-5
PZF12-1
PZF12-3
PZF12-4
PZ04 (LP-15) 43 GPM pH 6.0
Note: Datum is mean sea level ACM (ift).
Montana Resources
Plate I
Berkeley Pit
Slope Stability Monitoring
200 100 0 200 400 ft
DSN: Steve Czehura DTL: Sarah Huckeby 7/20/2015



Note: Datum is mean sea level ACM (ift).