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11 June 2018

Sara Edinberg
Waste Management & Remediation Division
Montana Department of Environmental Quality
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Subject: Responses to Comments on Revised Plant Site Remedy Evaluation Report Talen Montana, Colstrip Steam Electric Station, Colstrip, Montana

Dear Sara:

Thank you for reviewing Revised Plant Site Remedy Evaluation Report. As requested in your 12 April 2018 letter, Tables 1 through 4 attached contain Responses to Comments. The Responses to Comments have been incorporated into the Revised Remedy Evaluation Report for the Plant Site. Feel free to call or email us if you have any questions.

Respectfully submitted,

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Attachments:
Table 1 – Response to General Comments
Table 2 – Response to Specific Comments
Table 3 – Response to Comments on Tables and Appendix E
Table 4 – Response to Comments on Appendix D

Copies to:
Aimee Reynolds, MDEQ
Gordon Criswell, Talen Montana
Stephen Christian, Talen Montana
Al Hilty, Hydrometrics
Cam Stringer, NewFields
Marietta Canty, LLC
Hayden Janssen, Weston Solutions

TABLE 1
Response to General Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

General Comment:	Response to General Comment:
12 April 2018 General Comment 1: The following previous comments have not been addressed in the revised report: General Comments 18, 22, 26 (2/13/2017) & Specific Comments 11, 17, 31: Talen stated in RTC that requested evaluations would be provided in this revised report; however, they do not appear to have been addressed.	15 May 2017 and 11 June 2018 Responses: provided below.
13 February 2017 General Comment 18: Talen should evaluate the groundwater table changes at the Plant Site from pre-operation, through the operation history, and to post-operation to evaluate the potential of any residual sources in contact with the groundwater table which may serve as a continued source for site groundwater impacts.	15 May 2017 Response: Acknowledged. The Revised Remedy Evaluation Report will include the requested evaluation. It should be noted that pre-operation data are limited. 11 June 2018 Response: The effects of water level rebound after shutdown of the capture system (in Alternatives 2 and 3) or shutdown of the injection/capture system (in Alternative 4) were evaluated using the model simulations presented in the fate and transport model report[1].
13 February 2017 General Comment 22: When discussing Institutional Controls, please indicate any actions that must be taken regarding access outside of the Colstrip SES property boundary.	15 May 2017 Response: Acknowledged. 11 June 2018 Response: Institutional controls, if needed, would most likely take the form of a controlled groundwater area (CGWA). The Revised Remedy Evaluation Report includes a more detailed discussion of a petition for a CGWA. A petition for a CGWA must be filed by: • a state or local public health agency;

[1] Plant Site Fate and Transport Model Development and Remedial Alternative Analysis (NewFields, December 2017).

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General Comment:	Response to General Comment:
	• a municipality, county, conservation district, or local water quality district formed under Title 7, chapter 13, part 45; or • at least one third of the water right holders in a proposed CGWA. A petition for CGWA requires a list of all landowner names and mailing addresses within a proposed CGWA for notification. Those will be determined at the time the petition is filed.
13 February 2017 General Comment 26: Please discuss how the pond sampling procedures are representative of the pond chemistry, especially with respect to vertical pond profiles.	15 May 2017 Response: As we discussed during the April 21, 2017 meeting, Talen has done some limited vertical composite sampling of the ponds in the past. The results did not differ much between the composite samples and the surface samples as the ponds remain fairly well-mixed due to the volume of water moving through them. Talen agreed to conduct vertical profiling during future pond sampling events. The Revised Remedy Evaluation Report will include a more detailed discussion of vertical pond profiling. 11 June 2018 Response: Talen is in the process of conducting vertical profiling of select ponds. Additional discussion has been added to the Revised Remedy Evaluation Report to indicate new data will be evaluated as they are received.
13 February 2017 Specific Comment 11: Page 5, Section 2.1.2, 4th paragraph: The names of the process wastewater ponds summarized in Table 2-1 do not match the pond names shown on	15 May 2017 Response: Similar to Figures Comment 1 and Tables Comment 1, discrepancies in the names of the process wastewater ponds have been corrected in the Revised Remedy Evaluation Report.

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Colstrip Steam Electric Station
Colstrip, Montana

General Comment:	Response to General Comment:
Figure 2-2. Please edit the report to keep the pond names consistent and avoid confusion.	11 June 2018 Response: Table 2-1 has been re-organized and simplified so that the ponds shown on Figure 2-1 (formerly Figure 2-2) are consistent with the ponds listed on Table 2-1.
13 February 2017 Specific Comment 17: Page 11, Section 2.2.2.3, 3rd full paragraph, 1st sentence: Please define "VSEP".	15 May 2017 Response: The definition of the vibratory shear-enhanced process (VSEP) used in the wastewater treatment system at the Plant Site has been added to Section 2.2.2 of the Revised Remedy Evaluation Report (the first time this process is referenced in the report). 11 June 2018 Response: The text has been modified so that the definition of the VSEP is provided the first time it is referenced in both the Executive Summary and main text (Section 1.2). The VSEP process is explained in Section 5.2.3 Wastewater Treatment Options.
13 February 2017 Specific Comment 31: Page 22, Section 3.5, 1st full paragraph: Please indicate if ICs will be implemented outside of the Plant Site boundary, and if so, how permission(s) will be established. Also see General Comment #22.	15 May 2017 Response: Institutional controls may be implemented to mitigate potential ingestion of impacted groundwater via future domestic wells. Discussion of institutional controls that may be implemented and how permissions will be established has been included in the Revised Remedy Evaluation Report. Options for institutional controls were listed in Tables 5-1 and 6-1. 11 June 2018 Response: See response to General Comment 22 above.
12 April 2018 General Comment 2: It appears that the use of the average boron and sulfate background concentrations for the	11 June 2018 Response: There are limited water quality data for the Surge Pond. Text has been added to the Revised Remedy

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Colstrip, Montana

General Comment:	Response to General Comment:
injection water to be obtained from the Surge Pond is conservative. However, MDEQ requests analytical data be provided to ground-truth these concentrations. This may occur during the design stage, and may also be required for an injection permit.	Evaluation Report to reflect that the Surge Pond will be sampled for parameters that might affect operation and maintenance of the injection system, and injection permitting purposes. Sample locations and analyses will be specified during the remedial design. Dissolved boron was analyzed in one sample collected from the Surge Pond in 2011 and was detected at a concentration of 0.6 mg/L. The injected water in the model simulations for Alternative 4 (the only alternative that included clean water injection) was assumed to have a boron concentration of 0.818 mg/L[2]. Sulfate achieved the PCC in Alternative 2 in the model simulations and so it was not modeled in Alternative 4. As such, an average background sulfate concentration was not used for the injected water in the model simulations. Sulfate was analyzed in four samples collected from the Surge Pond between 1985 and 2011 and concentrations ranged from 107 to 208 mg/L.
12 April 2018 General Comment 3: Talen should develop and provide a schedule for system re-evaluation/verification and performance check. The remedy report should clearly indicate that MDEQ has the authority to require additional measures and/or installation of the PRB contingency plan to ensure	11 June 2018 Response: An evaluation of the injection/capture system will be conducted at regular intervals during its operational lifetime to monitor its performance and progress, and if necessary, to make adjustments. The proposed schedule for AOC remedy implementation (Table 8-1) has been revised

[2] Plant Site Fate and Transport Model Development and Remedial Alternative Analysis (NewFields, 2017).

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Colstrip Steam Electric Station
Colstrip, Montana

General Comment:	Response to General Comment:
protection of groundwater in the event a performance evaluation indicates the remediation systems fail to stop or control impacts to groundwater. Additionally, a PRB should be considered for installation as soon as it is clear that the other proposed methods are not adequate; not just as a replacement for capture/injection systems after 2049/shutdown.	to include system performance evaluations after the first year of operation, bi-annually in the third and fifth years of operation, and then every five years thereafter until the injection/capture system is shut down. We recognize MDEQ's authority to require additional measures and/or installation of the PRB contingency plan based on the results of a remedy performance evaluation; however, we feel this statement is better-suited for the remedy approval letter. Further discussion of the PRB contingency has been added to the Revised Remedy Evaluation Report. A PRB might be considered for installation earlier if it can be demonstrated that: • A PRB would be more effective than continued injection/capture or MNA; • A PRB would address the remaining COIs to the degree needed to attain the PCC; and • A PRB can be installed in the affected areas/depths.
12 April 2018 General Comment 4: The approach of using in-situ flushing with clean water around former Ponds to increase the flux of groundwater constituents to achieve mass removal by the enhanced capture systems over a long period of time is promising. However, potential preferential flow paths for the injected water should be monitoring and evaluated in the system performance check. In addition, a pilot study should be included in the anticipated schedule (Table 8-1 of the report).	11 June 2018 Response: The Revised Remedy Evaluation Report includes a preliminary discussion of monitoring for preferential flow paths during in situ flushing. It is likely that there could be some small-scale preferential pathways arising from stratigraphic heterogeneity, but large-scale pathways are not expected. A more thorough evaluation preferential flow paths is planned for the remedial design and pilot study.

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General Comment:	Response to General Comment:
	Generally speaking, the chemistry of the water that will be injected from the Surge Pond is discernibly different from the chemistry of affected groundwater or background groundwater. Laboratory measurements of specific conductance in four samples collected from the Surge Pond between 1985 and 2011 ranged from 447 to 773 μmhos/cm. Field measurements of specific conductance in two of these four samples were in the same range. Monitoring for changes in specific conductance in monitoring wells during injection operations will be a useful indicator for evaluating the influence of injecting water from the Surge Pond. During the remedial design, the hydrostratigraphy will be studied in the areas and depths where injection is planned to evaluate the potential for preferential flow paths. As part of this process, it may be determined that additional monitoring wells are needed to evaluate preferential flow paths during pilot testing and full-scale implementation. The proposed schedule for AOC remedy implementation (Table 8-1) has been revised to include an injection pilot study.
12 April 2018 General Comment 5: Please discuss the water quality of the Surge Pond, and whether this water requires treatment prior to injection.	11 June 2018 Response: Please refer to response to General Comment #2. The Revised Remedy Evaluation Report includes a discussion about filtering the injected water so that suspended particulates do not clog the injection well screen. Pre-treatment of the injected water may also be necessary if the water is incompatible with the local groundwater around the injection well screen and has the potential to form a mineral scale during mixing in or around the well. A broader discussion of the

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Colstrip Steam Electric Station
Colstrip, Montana

General Comment:	Response to General Comment:
	Surge Pond water quality and injection well permitting criteria will be included in the remedial design.
12 April 2018 General Comment 6: It is unclear whether the Units 3&4 Bottom Ash Ponds, the Units 1&2 Bottom Ash Ponds with Clearwell, and the Units 1&2 B Pond will be dewatered before closure. Since these ponds are designated as significant sources of COIs, dewatering prior to closure should be considered.	11 June 2018 Response: The Revised Remedy Evaluation Report includes a discussion that the process wastewater in those ponds will be, or in some cases have already been, removed after the ponds are taken out of service so they can be filled with solids and support construction of a cap. Generally speaking, the mass discharge evaluation and the fate and transport modeling do not show Units 3&4 Bottom Ash Ponds, the Units 1&2 Bottom Ash Ponds with Clearwell, and the Units 1&2 B Pond as significant sources of CCR constituents to groundwater after the planned source control upgrades/closures are implemented. Additionally, Units 1&2 B Pond and Units 1&2 Bottom Ash Clearwell were constructed with double liners and underdrain collection systems to limit seepage.
12 April 2018 General Comment 7: Based on mass discharge calculations in Appendix I, there appear to be several other ponds that act as significant source areas that may benefit from clean water injection after closure; specifically, the Units 3&4 Bottom Ash Ponds with Clearwell, the Units 1&2 B Pond, and the Cooling Tower Blowdown Ponds. Talen should consider implementing this technology in these additional areas.	11 June 2018 Response: See response to 12 April 2018 General Comment #6.
12 April 2018 General Comment 8: Please discuss the duration of long-term groundwater monitoring after capture system shutdown.	11 June 2018 Response: The Revised Remedy Evaluation Report includes more discussion of long-term groundwater monitoring activities. The duration should be flexible to account for the results obtained after system shut down.

TABLE 1
Response to General Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

General Comment:	Response to General Comment:
12 April 2018 General Comment 9: Additional analysis of the extent of PCC exceedances, as well as fate and transport analysis for lithium, molybdenum, cobalt, and manganese should be performed as more information becomes available.	11 June 2018 Response: Acknowledged, new data will continue to be interpreted as it becomes available.

TABLE 2
Response to Specific Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Specific Comment:	Response to Specific Comment:
12 April 2018 Specific Comment 1: Page ix, Executive Summary, 1st paragraph, 3rd sentence: Please change the citation from "Marietta Canty, 2007" to "Marietta Canty, 2017".	11 June 2018 Response: The citation has been revised as suggested.
12 April 2018 Specific Comment 2: Page x, Executive Summary, Results of Revised Remedy Evaluation, 1st paragraph, last sentence: This sentence states that re-emergence of less mobile constituents is partly due to re-saturation of the vadose/unsaturated zone. However, the role of diffusion should also be considered in the re-emergence of these COIs.	11 June 2018 Response: The effects matrix back diffusion could have on cleanup timeframes and COI concentrations have been evaluated in the saturated zone and found to be negligible. Therefore, it is also likely that matrix back diffusion will be negligible during water level rebound. Enhanced discussion of this analysis has been provided in the Revised Remedy Evaluation Report.
12 April 2018 Specific Comment 3: Page xi, Preferred Remedial Alternative, 3rd paragraph: Please clarify whether the remaining boron mass occurs beneath the ponds.	11 June 2018 Response: A statement has been added to the identified paragraph to provide clarification.
12 April 2018 Specific Comment 4: Page 8, Section 2.2.4, 1st paragraph, 1st sentence: Although manganese was not retained as a COC in the HHRA, it was identified as a COPC for surface water in the CCRA. Please revise this section accordingly.	11 June 2018 Response: Section 2.2.4 has been revised as requested.
12 April 2018 Specific Comment 5: Page 13, Section 2.3.2.1, 1st bullet: This bullet indicates two capture wells are located in the South Sub-Area. However, Figure 2-4 shows at least six capture wells in this sub-area. Please address the inconsistency.	11 June 2018 Response: The inconsistency has been addressed, and Section 2.3.2.2 and Figure 2-4 have been revised as necessary.
12 April 2018 Specific Comment 6: Page 14, Section 2.3.2.3, 1st paragraph, 2nd sentence: The text states the captured groundwater from the WECO well was directed back to the WECO site for dust control. Please indicate whether the captured	11 June 2018 Response: Section 2.3.2.3 of the Revised Remedy Evaluation Report has been revised as suggested. The water is not treated prior to use for dust control. Pumping from this well was not initiated due to water quality concerns. The well is

TABLE 2
Response to Specific Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Specific Comment:	**Response to Specific Comment:**
groundwater from the WECO well is treated before it is used for dust control.	pumping to lower water levels below the WECO coal conveyor. WECO installed the well and operates it for that purpose.
12 April 2018 Specific Comment 7: Page 16, Section 2.3.2.4, 1st paragraph, 2nd sentence: Please provide an explanation for the high seepage rates from B Pond. DEQ understands this seepage is collected by the underdrain systems, but a seepage rate of 34 gpm seems high when considering that B Pond is double-lined with two underdrain collection systems.	11 June 2018 Response: The following text has been added to Section 2.3.2.4 of the Revised Remedy Evaluation Report: The majority of the flow from the underdrain collection systems was from the underdrain collection system for Units 1 & 2 B Pond (32 gpm in 2016). Approximately half of the flow was from the primary collection system (16.7 gpm in 2016), and half from the secondary collection system (15.5 gpm in 2016). Based on constituent concentrations for water samples collected from the underdrain collection systems (Table 2-3, Hydrometrics, 2015a), water that collects in primary collection system more closely resembles process wastewater and water in the secondary collection system more closely resembles groundwater.
12 April 2018 Specific Comment 8: Page 20, Section 2.5.2.3, 2nd paragraph, 1st sentence: The text states that a "…limited number of monitoring wells have been sampled for cobalt, lithium and manganese… as such, these three groundwater constituents have not been fully delineated." Please indicate how the lack of full delineation for extent of contamination for cobalt, lithium and manganese will be addressed. Also see General Comment #9.	11 June 2018 Response: Talen Montana conducts routine groundwater monitoring under the Federal CCR Rule that includes collecting samples for cobalt, lithium and manganese. Additional discussion has been added to the Revised Remedy Evaluation Report to indicate new data for these constituents will be collected under the Federal CCR Rule and evaluated as they are received.
12 April 2018 Specific Comment 9: Page 22, Section 2.6.1, 2nd paragraph, 1st sentence: This sentence states that soils beneath the ponds have not been assessed as a secondary source due to	11 June 2018 Response: This discussion has been moved to the end of Section 2.6.2 and has been revised to reflect this potential.

TABLE 2
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Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Specific Comment:	Response to Specific Comment:
current pond usage or closure in-place. Elevated levels of salts have been identified in soil below the liner at the former Brine Pond (D4). These salts acted as a secondary source for groundwater impacts. As this same scenario is possible at other ponds at the Plant Site, especially ponds that only have a clay liner (such as the Units1&2 A Pond), the report should acknowledge this potential, and indicate that further analysis as well as additional source control and/or remedial actions (such as the contingency PRB) may need to be implemented should a pond area continue to contribute COI(s) to groundwater.	
12 April 2018 Specific Comment 10: Page 22, Section 2.6.2, 1st paragraph, 3rd sentence: Please see Specific Comment #9.	11 June 2018 Response: Please refer to the response provided for Specific Comment #9.
12 April 2018 Specific Comment 11: Page 23, Section 2.6.4, 1st paragraph, 1st sentence: Please adjust this sentence to describe boron's mobility in greater detail; the sentence implies that boron is highly to moderately mobile, which conflicts with the decision to use boron as a less mobile constituent in the fate and transport model.	11 June 2018 Response: The qualitative mobility of boron based on literature is high to moderate; however, boron is the least mobile of the COIs/COPCs that are individual constituent parameters, exhibit high magnitudes of exceedance, and there is good spatial coverage and quantity of downgradient data. Furthermore, groundwater monitoring over time has shown boron to be consistently less mobile than sulfate in groundwater at the Plant Site which is why it was used as the less mobile constituent in fate and transport modeling. Section 2.6.4 has been revised to include more discussion of the mobility of boron in groundwater at the Plant Site.

TABLE 2
Response to Specific Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Specific Comment:	**Response to Specific Comment:**
12 April 2018 Specific Comment 12: Page 26, Section 3.3, 2nd paragraph, last sentence: Please indicate whether mass discharge calculations take dewatering into consideration (in addition to closing and capping). Also see General Comment #6.	11 June 2018 Response: The identified sentence has been revised to indicate whether dewatering is considered in the mass discharge calculations.
12 April 2018 Specific Comment 13: Page 27, Section 3.4, 1st paragraph, 3rd sentence: Please see Specific Comment #12 and General Comment #6.	11 June 2018 Response: Please refer to response provided for General Comment #6. The identified sentence has been revised to indicate whether dewatering is considered in addition to closing and capping.
12 April 2018 Specific Comment 14: Page 30, Section 4.2, Sorption, 2nd paragraph, 11th sentence: Please provide a citation for the Zero Point of Charge (ZPC) values, and indicate whether these values are site-specific. The ZPC may vary based on the specific type of iron oxide mineral.	11 June 2018 Response: The following citation for the Zero Point of Charge (ZPC) values has been added to the list of references in Section 9 of the Revised Remedy Evaluation Report and cited in Section 4.2: Rose, A. W., Hawkes, H. E., Webb, J. S. 1979. “Geochemistry in Mineral Exploration.” Academic Press, New York, NY, p. 198-199. A statement has been added to the text to indicate that the Zero Point of Charge (ZPC) values are not site-specific.
12 April 2018 Specific Comment 15: Page 31, Section 4.2, Precipitation: The updated geochemical assessment suggests the precipitation of new mineral phases, mostly carbonates, likely occurs in the underlying shallow groundwater (Alluvium and Spoils). This is indicated by calculated Saturation Index values, without regard to the mixing ratios. This appears to be driven by high BSL concentrations of several constituents and high ionic	11 June 2018 Response: While analysis of the scalant observed within the capture system wells and piping identified high concentrations of iron oxides and very little carbonate, this does not mean that carbonates may not be precipitating elsewhere (i.e., beneath the ponds) as the geochemical modeling suggests. Iron scaling in pumping wells and associated piping is fairly common as groundwater becomes more oxygenated after it

TABLE 2
Response to Specific Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Specific Comment:	Response to Specific Comment:
strengths in the Alluvium and Spoils samples, and indicates the shallow groundwater at Colstrip is over-saturated with these constituents. This section also indicates the primary scale identified in capture wells and piping is iron oxides. However, the geochemical assessment does not correlate well with field observations. Talen should provide additional information/evidence to confirm the model calculations.	enters the well screen. Text to this effect has been added to the Revised Remedy Evaluation Report.
12 April 2018 Specific Comment 16: Page 44, Section 6.5, 2nd paragraph: Please see General Comment #3.	11 June 2018 Response: Please refer to response provided for General Comment #3.
12 April 2018 Specific Comment 17: Page 48, Section 7.1.1.3, 2nd paragraph, 1st sentence: The underdrain system for Brine Pond D4 is not shown on Figure 1-2. Please include this system on the Figure.	11 June 2018 Response: The sump for the underdrain system for the former Brine Pond D4 has been added to the figures.
12 April 2018 Specific Comment 18: Page 51, Section 7.1.2.1, 4th bullet: Please label the OT-7 Area on one of the Figures.	11 June 2018 Response: The OT-7 Area has been added to one of the figures in the Revised Remedy Evaluation Report.
12 April 2018 Specific Comment 19: Page 53, Section 7.1.2.6, last sentence: It is unclear why these costs are not included in the estimate. At a minimum, water treatment should be included in the cost if it is part of the remedy. Please clarify why these costs were not included.	11 June 2018 Response: The cost estimates have been updated, and further discussion has been added to provide clarity.
12 April 2018 Specific Comment 20: Page 61, Section 7.2.2.6, last sentence: Please see Specific Comment #19.	11 June 2018 Response: Please refer to response provided for Specific Comment #19.
12 April 2018 Specific Comment 21: Page 62, Section 7.3.1.2, last paragraph, last sentence: Please change "Well 155D" to "Well 55D".	11 June 2018 Response: The requested change has been made.

TABLE 2
Response to Specific Comments
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Specific Comment:	**Response to Specific Comment:**
12 April 2018 Specific Comment 22: Page 63, Section 7.3.1.2, 1st paragraph, 1st sentence: Please change “Well 13M” to “Well 113M”.	11 June 2018 Response: The requested change has been made.
12 April 2018 Specific Comment 23: Page 68, Section 7.3.2.6, last sentence: Please see Specific Comment #19.	11 June 2018 Response: Please refer to response provided for Specific Comment #19.
12 April 2018 Specific Comment 24: Page 71, Section 7.4.1.1, 1st paragraph, last sentence: This sentence implies that the PRB would replace portions of the capture system in order to shut down the injection/capture system sooner. This contradicts the statement in Section 6.5, which indicates that the PRB may be considered after the capture system is shut down in 2049. Please clarify. Also see General Comment #3.	11 June 2018 Response: Please refer to the response provided for Specific Comment #9.
12 April 2018 Specific Comment 25: Page 72, Section 7.4.1.3, 3rd paragraph, 6th sentence: This sentence states that the former Brine Ponds D1-D4 are no longer sources of COIs; however, this contradicts the statement in Section 7.4.1.1 and 7.4.2.7 that the Brine Ponds are one of the two strongest sources at the Plant Site. Please clarify.	11 June 2018 Response: The identified sections have been revised as necessary to provide clarity.
12 April 2018 Specific Comment 26: Page 80, Section 7.4.2.6, last sentence: Please see Specific Comment #19.	11 June 2018 Response: Please refer to response to General Comment #19.

TABLE 3
Response to Comments on Tables and Appendix E[1]
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Comment:	Response to Comment:
Tables	
12 April 2018 Specific Comment 1: Tables 7-2, 7-4, 7-5 and 7-6: The discount rate of 7% used to calculate financial assurance for the remedy is not approved by DEQ. Please refer to DEQ's comments on the Closure Plans, and the approved financial assurance example for the Golden Sunlight Mine. In addition, DEQ may consider other factors when calculating a discount rate for the AOC phases. DEQ understands that further discussion regarding this topic will be required.	11 June 2018 Response: As discussed with DEQ, the cost estimates detailed in Table 7-2, 7-4, 7-5, and 7-6 have been revised.
Appendix E	
12 April 2018 Specific Comment 31: Page 8, 3rd paragraph: Please change the units from 6,800 mg/L to 6,800 ug/L for the 2014 maximum groundwater concentration for Boron in the Sub-McKay.	11 June 2018 Response: The units on Page 8 have been revised as suggested.
12 April 2018 Specific Comment 32: Figures 11 &12: Please double check that the text in the right-most arrow on each of these Figures corresponds to the true starting year of back diffusion. The graph and the arrow text do not appear to agree.	11 June 2018 Response: Figures 11 and 12 have been revised as necessary to correct this incongruity.

[1] See Table 4 for Response to Comments on Appendix D. There were no specific comments on the figures or other tables and appendixes.

TABLE 4
Response to Comments on Appendix D
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Comment:	Response to Comment:
General Comments	
12 April 2018 General Comment 2: The flow model used in the revised fate & transport modeling was updated to use the most recent capture system flow rates and revised pond seepage rates (Section 3). This included the addition of new capture wells to the model, as well as relatively large increases in the seepage rate from two of the ponds. Please discuss in a response to this comment whether the model was calibrated following these changes.	11 June 2018 Response: The numerical model was not calibrated following these updates, doing so would require development of targets, and full documentation of the calibration process. Talen agreed with MDEQ that the numerical model presented in the Plant Site Model Update Report[1] would be used to support the remedy evaluation. Therefore, the adaptations made including adjusting pumping rates were done assuming that the model is calibrated such that it reasonably simulates conditions due to these changing stresses. We anticipate the next calibration of the numerical model will occur during remedial design.
12 April 2018 General Comment 3: If the model was not re-calibrated, please indicate how these changes impacted the model output (heads), and whether any differences are considered significant enough to alter the overall flow (and transport) across the model domain.	11 June 2018 Response: The changes to the flow field from adjusting pumping rates resulted in slightly different cones of depression in close proximity to capture wells, but no change in the general flow field. Although, the seepage at Units 1 & 2 B Pond and Units 1 & 2 Bottom Ash Clear Well increased in comparison to the previous seepage estimates; the new rates (3.6 GPM and 0.4 GPM respectively) are a tiny fraction of the calculated seepage from other sources. Therefore, this change in simulated seepage did not result in a noticeable change to the flow field.
Specific Comments	

[1] Plant Site Groundwater Conceptual Model and Numerical Model Update (NewFields, July 2015).

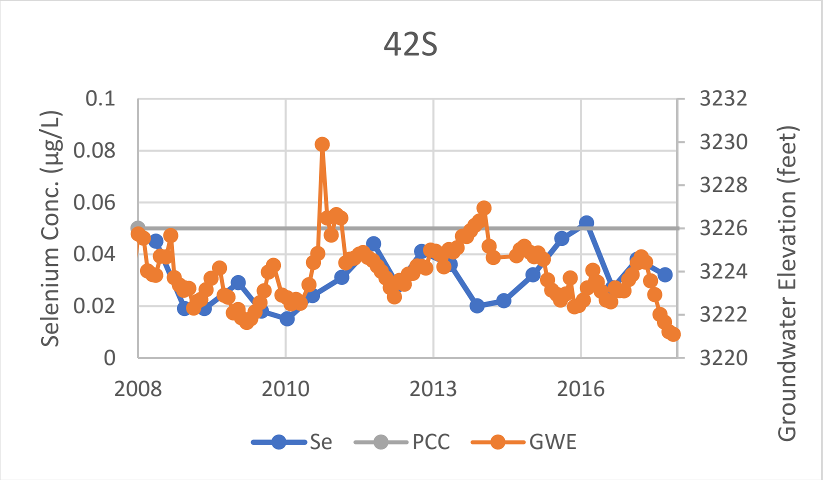
TABLE 4
Response to Comments on Appendix D
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Comment:	Response to Comment:
12 April 2018 Specific Comment 4: Page i, 3rd paragraph, 1st sentence: Please add a note that for cobalt, lithium, manganese and molybdenum, the only available data is from CCR wells, which are currently restricted to the edges of the ponds. Therefore, the plumes shown in these maps may not represent the full extent of the plumes. These figures should be updated as more information becomes available. Also see General Comment #9.	11 June 2018 Response: The requested text has been added. Plume maps will be updated when more data becomes available.
12 April 2018 Specific Comment 5: Page i, 5th paragraph, 4th sentence: Please clarify if the upward vertical gradients are caused by operation of the capture wells, or if this is the natural aquifer condition at this location. If these gradients are a result of the capture wells, it is possible that COIs may have migrated to the deep aquifer prior to initiation of pumping.	11 June 2018 Response: Upward gradients would be the natural aquifer condition at this location near the stream. Natural gradients are downward away from the stream. However, pumping of capture wells often creates upward gradient near capture wells. While it is possible that COIs may have migrated deeper into the aquifer in some areas, it is unlikely based on concentrations less than the PCC in several other deep wells at the Plant Site (e.g., 55D-P, 1D, 17D, 34D). Text has not been edited.
12 April 2018 Specific Comment 6: Page 4, Section 2.1.1.1, 3rd paragraph: Wells 63S and 104A are located either west or southwest of the Plant Site. Please correct the first sentence, which indicates these wells are southeast of the Plant Site.	11 June 2018 Response: The requested correction has been made.
12 April 2018 Specific Comment 7: Page 4, Section 2.1.1.1, 3rd paragraph, last sentence: Please indicate the magnitude of exceedance for selenium observed in April 2016. Water levels may be higher in April versus October, which may indicate that selenium concentrations in this area are a function of water	11 June 2018 Response: Magnitude of exceedance was added to text. The charts below show that there is no relationship between water levels and selenium concentration in these wells. The April 2016 concentration in 42S was the first exceedance of selenium in this well since 2002. The April 2016 concentration in 47S was the first exceedance ever detected in

TABLE 4
Response to Comments on Appendix D
Revised Plant Site Remedy Evaluation

Colstrip Steam Electric Station
Colstrip, Montana

Comment:	**Response to Comment:**
levels. Also, please indicate if April 2016 is the only time these wells have exceeded the PCC.	this well and appear to be anomalous. The cause of this anomaly is unknown. Language discussing apparent anomalies in the April 2016 data for these wells has been added to the text. 

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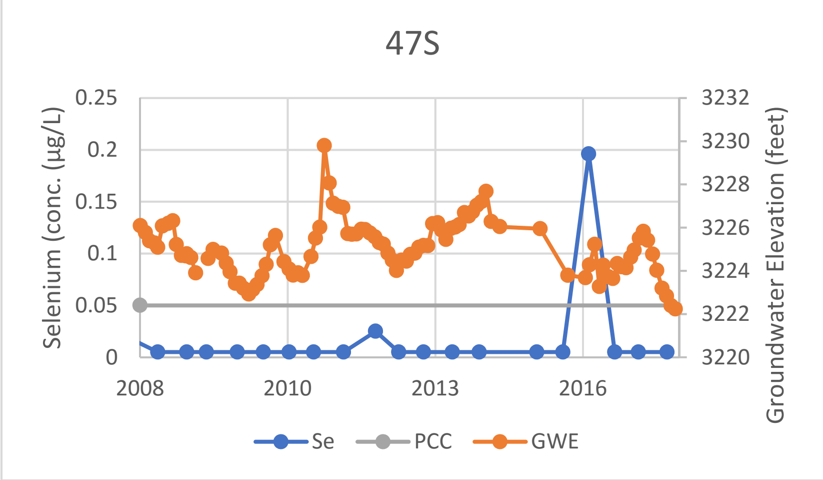
Comment:	Response to Comment:
	
12 April 2018 Specific Comment 8: Page 5, Section 2.1.1.3, 1st paragraph, last sentence: Please see Specific Comment #33 above. (MDEQ clarified during a call on 10 May 2018 that this is related to Specific Comment #7 above).	11 June 2018 Response: Selenium detected in the September 2016 sample from this well is not thought to be a function of seasonal water level changes. The sample result mentioned was for Dissolved Selenium and is the only sample form this well that has exceeded the PCC. The same sample had a Total Recoverable Selenium concertation below the PQL of 0.002 mg/L. The last sentence in this paragraph was replaced by the following text: "Although the selenium concentration in the sample from well 151M-CCR that was collected in December 2016 was below the PCC,

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Comment:	Response to Comment:
	a sample from this well collected in September 2016 contained a dissolved selenium concentration (0.066 mg/L) that exceeds the PCC. However, the September 2016 sample had a Total Recoverable Selenium concertation below the reporting limit (0.002 mg/L.) According to Hydrometrics, the discrepancy is thought to be a function of sampling technique."
12 April 2018 Specific Comment 9: Page 7, Section 2.3.1, last paragraph, last sentence: Although the upward flow direction toward well 55D indicates that contamination is not moving downward, the fact that this well exceeds PCC indicates that the source of boron may be deeper than well 55D, since groundwater is moving upward. Please indicate how a potential deeper source of COIs may be delineated.	11 June 2018 Response: Well 55D is a capture well and therefore can pull water and contaminants from above, below and laterally. The ultimate source of contaminants throughout the Plant Site area is process ponds at the surface or in near-surface unconsolidated sediments or fill material. In addition, well 55D is the deepest well in the area with constituent concentrations exceeding PCC. Deeper wells in the area do not exceed PCC, and data do not indicate there are deeper sources of constituents of concern at the Plant Site.
12 April 2018 Specific Comment 10: Page 20, Section 6.2.2, 2nd set of bullets (Units 1&2 B Pond): This is the only place in the report that indicates that B Pond will be dewatered prior to closure. Please clarify if the pond will be dewatered. Also see General Comment #6.	11 June 2018 Response: Text has been revised to clarify that process wastewater in Units 1 & 2 B Pond will be removed after it is taken out of service so it can be closed in 2023 by filling with solids and capping.
12 April 2018 Specific Comment 11: Page 23, Section 6.2.2, 1st paragraph, 1st sentence: Please clarify why the lowest BSL values were selected for concentrations in this area. The BSL values for whichever hydrostratigraphic unit the ponds were constructed in (i.e., alluvium, spoils, etc.) should be used.	11 June 2018 Response: The 3 & 4 Bottom Ash Ponds overlie spoils and the former Drain Collection Pond overlies mostly spoils with a small amount of Rosebud Coal or overburden (coal related). Spoils have the lowest boron BSL (0.818 mg/L), and the coal related BSL is 1.1 mg/L. Coal-Related has the lowest sulfate BSL (2,061 mg/L), the spoils BSL is 3,045 mg/L. The difference between the two boron BSLs is so small it

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Comment:	Response to Comment:
	would not result in a noticeable change to the predictions if 1.1 mg/L was used rather than 0.818 mg/L. If the sulfate BSL for spoils was used at the 3 & 4 Bottom Ash Ponds it is possible that a small difference would be noticeable in the first couple years, however, the seepage through these ponds declines to zero by 2023 so any minor change early on would become unnoticeable by 2049.
12 April 2018 Specific Comment 12: Page 23, Section 6.2.2, 1st paragraph, 5th sentence: It is unclear which ponds "all remaining ponds with source material" refers to. Please clarify.	11 June 2018 Response: Text has been revised to include the list of ponds in this sentence: With the exception of the North and South Cooling Tower Blowdown Pond C, all remaining ponds with source material **(Units 1 & 2 A Pond, Units 1 & 2 B Pond, Units 1 & 2 Bottom Ash Pond, Units 1 & 2 Bottom Ash Clear Well, and Units 3 & 4 Bottom Ash Ponds with Clear Well)**, will be removed from service, free water above the ash will be removed, and the ponds will be capped.
12 April 2018 Specific Comment 13: Page 23, Section 6.2.2, 1st paragraph, 6th sentence: This sentence indicates that material may be excavated if Pond C (North and South) proves to be a continuing source of COIs above the PCC. However, this should be the case for all ponds that do not have GSC liners or underdrain collection systems.	11 June 2018 Response: Ponds will be closed in accordance with the Facility Closure Plan[2].
12 April 2018 Specific Comment 14: Page 24, Section 6.2.3.3: The last two bullets on this page, for Alternative 4, indicate two new vertical wells are to be installed northeast of the Sediment Retention Pond. However, Figure 6-4 appears to present three;	11 June 2018 Response: th furst of these bullets was edited to read: "three new vertical wells are to be installed northeast of the Sediment Retention Pond." The second bullete was inaccurate and was deleted.

[2] Colstrip Wastewater Facility Closure Plan, Plant Site (Geosyntec, January 2018).

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Comment:	Response to Comment:
and one new vertical well is to be installed west of Former Units 1 & 2 A Pond. However, Figure 6-4 does not appear to present a new well in this area. Please address this inconsistency.	
12 April 2018 Specific Comment 15: Page 27, Section 6.4.4: The second sentence in the second paragraph of this section indicates 98 gpm, in 2022, is the maximum additional pumping rate from new capture wells. It is unclear, based on Table 6-12, how this value was calculated. Please clarify and edit the text as appropriate to justify this statement. The last sentence of the second paragraph in this section indicates a range of 94 to 136 gpm. Based on Table 6-12, the low end of this range may be 87 gpm. Please verify and correct the text and/or Table, as appropriate.	11 June 2018 Response: 98 GPM is the combination of new horizontal capture wells and vertical capture wells in 2022. Text has been edited to clarify. DEQ is correct the range should be listed as 87 to 136 GPM.
12 April 2018 Specific Comment 16: Page 30, Section 7.1.1: The second paragraph indicates a time of 20 years was chosen for evaluation of mass discharge following capture system shut-down. The basis for this is appropriate, as the goal is to allow the flow system to recharge to a near steady state condition. However, a 20-year timeframe appears to be an excessively long time to wait for this evaluation. Please consider conducting this evaluation at 5, 10, and 15 year periods after the system has been shut down. If groundwater flow at these proposed timeframes is still rebounding and is not perpendicular to the transects, or if there is another reason to not evaluate mass flux at these times, please provide supporting reasoning for such a determination.	11 June 2018 Response: In addition to choosing a period when flow fields were the same, we also wanted to evaluate which of these alternatives was most effective at cleaning up groundwater even after the capture system is shut down. Model simulations indicate that boron plumes reemerge following capture system shut down for Alternatives 2 and 3; and 20 years after shut down these plumes have begun migrating offsite past Transects A-A', B-B' and D-D'. Earlier post shutdown times (e.g. 10 years after shut down) plumes have only migrated past Transect B-B'. Therefore, this 20-year post shutdown time period is the best time to evaluate conditions following capture system shutdown.
12 April 2018 Specific Comment 17: Page 30, Section 7.1.2: This paragraph indicates mass removal for boron and sulfate are	11 June 2018 Response: Yes, this should only be 2029 and 2049, all capture wells are off in 2069. Text has been edited.

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Comment:	Response to Comment:
presented on Figures 7-3 through 7-11 for years 2029, 2049 and 2069. However, year 2069 data is not presented. Please edit the text and/or Figures for consistency.	
12 April 2018 Specific Comment 18: Page 32, Section 7.1.2: The last sentence of this section indicates wells will remove 20 percent of the total mass in 2029. However, our calculation results in 18% removal. Please verify and edit the text accordingly.	11 June 2018 Response: The values add up to 0.7 kg/d out of 3.47 kg/d (20 %). No edits are required.
12 April 2018 Specific Comment 19: Page 33, Section 7.3: The fourth bullet under boron is not entirely factual. The mass of boron in 2029 in Alternative 4 is greater than the mass of boron in 2029 in Alternative 3. Please revise the text accordingly.	11 June 2018 Response: Text will be revised to add this caveat.
12 April 2018 Specific Comment 20: Page 34, Section 8.1, 1st paragraph, 2nd sentence: Please clarify if the variations in source concentrations from the ponds could also result from variations in vertical pond profiles.	11 June 2018 Response: Hydrometrics depth integrated pond chemistry analysis will be evaluated when it becomes available. No edits were made.
12 April 2018 Specific Comment 21: Page 35, Section 8.1: The last paragraph of this section states, “Though the higher boron and sulfate source concentration results in a slightly increased extent of groundwater exceeding the PCC, results indicate cleanup goals would still generally be achieved by 2049.” However, Figure 8-2 presents areas of sulfate above PCC which are obviously greater than the simulated results, and these are arguably not contained within the POC. The statement that goals are “generally achieved” is misleading, as this goal either is or is not achieved. Please reword this sentence to indicate whether	11 June 2018 Response: Text has been editedto address this comment. The bullet referenced in Section 10 was not edited as it is not necessary..

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Comment:	Response to Comment:
PCC have been met outside the POC. This comment also impacts the analogous bullet in Section 10, Conclusions.	
12 April 2018 Specific Comment 22: Page 36, Section 8.3: The four zones where K is changed can be found in the Modeling report; however, the Remedy Report will benefit from the addition of a Figure showing the extent of these four zones. Please include a Figure of the entire model domain and identify the four zones that were altered during sensitivity analysis.	11 June 2018 Response: Appendix H that included figures showing K zones and a able of zone values has been added and referenced.
12 April 2018 Specific Comment 23: Page 39, Section 10, 2nd bullet: Please see General Comment #9.	11 June 2018 Response: This will be done in the future.
12 April 2018 Specific Comment 24: Page 40, Section 10, 3rd bullet: Please add a statement that clarifies that the remaining 7% of PCC exceedances are beneath the ponds, which is within the point of compliance (POC).	11 June 2018 Response: A statement has been added as requested.
Figures	
12 April 2018 Specific Comment 25: Figure 2-12: This Figure should present the “approximate extent of McKay” as opposed to the alluvial and spoils extents. Please revise the Figure.	11 June 2018 Response: The figure has been revised.
Tables	
12 April 2018 Specific Comment 26: Table 6-7: The last four wells in this Table have a “type” of Converted. Please consider changing this to be “Converted to Injection.”	11 June 2018 Response: Table 6-7 has been edited as requested.
12 April 2018 Specific Comment 27: Table 6-7: Please clarify if the additional capture wells proposed for Alternative 3 will also be added for Alternative 4. Table 6-1 in the main report indicates that Alternative 4 utilizes the same vertical capture system as	11 June 2018 Response: Table 1 in the main report has be revised to make it clear that the wells are not all the same in Alternatives 3 and. For clarification, the capture wells listed on Table 6-6 (Alternative 3) and Table 6-7 (Alternative 4) were

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Alternative 3, but adds horizontal capture wells. However, it is unclear from Table 6-7 if this is the case.	numbered the same as the capture wells shown on Figure 6-3 (Alternative 3) and Figure 6-4 (Alternative 4), respectively.
12 April 2018 Specific Comment 28: Table 7-7: In the last row of this Table there is a "0%" in Alternative 3 at the end of 2029. This is likely a typo and should be 72%. Please revise the Table accordingly.	11 June 2018 Response: The table has been revised accordingly.
12 April 2018 Specific Comment 29: Table 8-1: Please revise the title of this Table to include sulfate.	11 June 2018 Response: The table has been revised accordingly.
12 April 2018 Specific Comment 30: Table 6-2: This Table presents the seepage rates for the North Cooling Tower Blowdown Pond C, but it does not present seepage rates for the South Cooling Tower Blowdown Pond C. Please provide the rationale for not including this data and revise this Table, as appropriate. Furthermore, the modeled seepage rates for the North Cooling Tower Blowdown Pond C are significantly different than the estimated seepage rates. Please provide an explanation for the significant differences in these values.	11 June 2018 Response: The table has been revised to include the missing seepage rates. The estimated seepage rates are based on available information regarding pond construction and the assumed head inside the pond. The model seepage rates are based on assumed aquifer characteristics and measured heads outside the pond.
Appendix E	
12 April 2018 Specific Comment 33: Cross Section Figures: The depictions of the equipotential lines in the immediate vicinity of capture wells appear to be visually misleading. They show flow is toward the capture wells. However, a cone of depression would be expected to form surrounding the wells, as opposed to what might be described as a sphere of depression (see 55D on O-O'). MDEQ recommends re-drawing the equipotential lines to show a realistic representation of the capture zones and the effects on the	11 June 2018 Response: We respectfully disagree with this recommendation. A "sphere" of depression will often form in a stratigraphically layered system. Drawdown spreads laterally through more permeable zones and is restricted vertically by less permeable zones. In these cases, drawdown does not propagate to the water table. For example, the groundwater elevation in Well 55D was 3,196 ft amsl while groundwater elevations in the two shallow wells (SRP-4 and 49S) completed almost directly above Well 55D were 3,224 and 3,226 ft amsl,

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Comment:	Response to Comment:
overall water table. Consider combining capture zones that are in close proximity to one another (on O-O', R-R', and S-S').	respectively. Most of the drawdown occurs in the shallow SubMcKay bedrock and gradients are downward from the alluvium to the shallow SubMcKay bedrock. The cross sections do not depict capture zones specifically; they are simply equipotential lines that were drawn based on the head measured in each well. The lines shown are interpolated from all head values on the cross-section. Therefore, we have not revised these contours.
Appendix F	
12 April 2018 Specific Comment 34: Talen states the concentrations of sulfate, TDS, and selenium in spoils near well 38SP are not from the process ponds at the Plant Site based on the groundwater elevation changes over time. It may be too early to draw such a conclusion since it is possible the high groundwater elevation was in contact with spoils in this area, which could act as a source for COIs. MDEQ recommends continued monitoring of well 38SP and the collection of additional data to confirm there is a true offsite source.	11 June 2018 Response: These wells will be monitored over time as recommended. However, the conclusion in the text will not be changed. The text concludes that process ponds are not the source in this well. The well is screened from 30 to 55 feet bgs. At this location, spoils occur from ground surface to a depth of 51 feet bgs. It is not clear why increased water levels would cause constituent concentrations to increase. Such a response has not been observed in other spoils wells in the area. Regardless, if such a phenomenon did occur, the conclusion that process pond water is not the source of increased concentrations would still be valid.