REVIEW COMMENTS

PROJECT: BLM Red Devil Mine **DOCUMENT:** Draft FS, v3

DATE: 9/17/15 **REVIEWER:** ADEC Solid Waste **PHONE:** (907) 269-1099

Item No.	Location (page, par., sen.)	COMMENTS	BLM Response
1.		General comments provided verbally during October 13, 2015 comment resolution meeting.	General Response: Please see the attached document for responses to the general comments provided on October 13, 2015.
2.	2.2.2	If the lateral extent of sediment contamination is not fully delineated, how much confidence is there in the proposed additional 25%. How will the uncertainty in this estimate be expressed monetarily in the proposed alternatives? There is no Figure 2-3 included as referenced.	The referenced language is a relic of previous Kuskokwim River sediments discussion. The last two sentences of this section will be deleted. The reference to 2-3 will be deleted.
3.	2.5.1.5	Please acknowledge that with the excavation/dredging and onsite repository remedial option there will still yet be contaminated material that requires offsite disposal. This will add costs due to the remoteness of the site and volume of material requiring offsite disposal.	Section 2.5 identifies and screens individual remedial technologies. Material that may have to be disposed of off-site is addressed in Section 2.5.1.6. In Sections 3 and 4, off-site disposal is incorporated into the Alternative development, as appropriate. Additionally, cost associated with off-site disposal has been incorporated into alternative cost estimate. No change to the text is proposed.
4.	3.1.3.1, pg 3-4	For Alternative 3a, why is only the upper 5 feet of contaminated soils and sediment being considered when there is documented contamination much greater than 5ft.	Material excavation will be performed to the depths as indicted in Figure 3-1. The reference to 5 feet will be deleted.
5.	3.1.3.1, pg 3-5	How will treatment effectiveness be demonstrated?	For excavations, it is stated on page 3-6 that XRF screening and laboratory analysis will be performed. For solidification, the following will be added to the “Onsite Consolidation and Solidification” subsection, “Confirmation TCLP arsenic analysis will be performed to determine whether the solidified material has passed the criteria, additional treatment is warranted or off-site disposal is needed.”
6.	3.1.3.1, pg 3-5	Please describe what would be done with material that could not be effectively treated.	BLM would evaluate the nature of any material that cannot be treated initially and will decide on how to handle that material based on the characteristics of the material in question. No change to the text is proposed.

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7.	3.1.3.1, pg 3-5	Assuming that extracted groundwater encountered during excavation would not require treatment is not a conservative assumption and may therefore bias costs low for the 3a Alternative.	BLM acknowledges that groundwater treatment may be necessary. However, dewatering is associated with all the alternatives that require excavation. Given the uncertainties associated with the actual depths of excavation, the soil permeability and associated groundwater infiltration rates, and the duration that dewatering efforts will actually be performed at a given location, it is difficult to estimate a cost associated with treatment of extracted groundwater. Given these uncertainties and that all the alternatives that have excavation as a component will have the same costs associated with them, inclusion of these costs would not affect the comparison of these alternatives. The text will be changed to indicate that the remedial design will consider whether dewatering is needed, and that suitable onsite treatment will be developed.
8.	3.1.3.1, pg 3-6	The cut sheets provided for the concrete cloth as provided in Appendix A do not demonstrate the adequacy of this product for the proposed use as cover material for Monofill #2.	E & E conducted research into the concrete cloth's ability to perform as an adequate cover material for Monofill #2. Material characteristics including strength, flexibility, permeability, and freeze-thaw effects were evaluated. E & E engineers determined from this research that concrete cloth is suitable as a cover material for Monofill #2 and confirmed these conclusions with vendors. In addition, it should be noted that Monofill #2 contains a low permeability containment layer (i.e. the "burrito") and the concrete cloth would be placed to add further protection and run-on/runoff control. Finally, the concrete cloth cover would be inspected regularly and its effectiveness would be evaluated during 5-year reviews.
9.	Page 3-6, Monofill 2	The Concrete cloth proposed for capping Monofill #2 has not been established as an appropriate cap material. ADEC would recommend using a geomembrane liner. The predicted lifespan is significantly lower that than that of a geomembrane; the information does not discuss hydraulic conductivity, which must be less that $1x10^{-5}$cm/sec; and, the information does not discuss performance in sub-arctic climate. For a remote projects with extreme conditions, use of this untested material would not be appropriate	See response to comment 7.

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10.	3.1.3.1, pg 3-9	Where will excavated material be staged?	This comment addresses important considerations in the design of potential remedies at the site. However, it is engineering design-level detail that has little to no effect on the analysis of alternatives at the FS stage of decision making. No change to the text is proposed.
11.	3.1.3.1, pg 3-9	How will placing untreated contaminated material into the repository reduce the volume of contaminated material?	Additional clarification for this comment is requested.
12.	3.1.3.1, pg 3-9	Please explain why only 15% of the total excavated volume is assumed to require treatment. How was this determined? Does this take into consideration the oversized material that cannot effectively be treated?	Based on a review of the data and the area encompassed by the number of samples that failed TCLP arsenic, an estimate of 15% was developed and used in the FS. Oversized material was not accounted for in the 15% estimate and is not assumed to constitute a significant portion of the excavated material. No change to the text is proposed.
13.	3.1.3.1, pg 3-9	ADEC disagrees that a bottom liner would not be necessary under Alternative 3a. Regulations require that an industrial waste landfill must be designed and constructed with a liner and leachate collection system that meet the standards in 18 AAC 60.330(b).	The intent is to have alternatives that don't include a liner to compare against alternatives with a liner. No change to the text is proposed.
14.	Page 3-10, para 2	Repository Side Slopes – The suggested 2.5H:1V are excessively steep. Regulations require that the slopes are less than a 3H:1V grade, and best management practices, particularly for a remote site, using a geomembrane, and where post closure monitoring will be limited, would indicate slopes no steeper than 4H:1V. Also, a static and seismic stability analysis should be performed for the final cap design.	This comment addresses important considerations in the design of potential remedies at the site. However, it is engineering design-level detail that has little to no effect on the analysis of alternatives at the FS stage of decision making. No change to the text is proposed.
15.	Page 3-11	Drainage controls should be designed to contain and control the run-off from a 24-hour, 25-year storm	Text will be added that these considerations will be part of the design effort.
16.	3.1.3.1, pg 3-11	What is the regulatory basis of the proposed groundwater monitoring considering groundwater will be considered in a separate plan?	The comprehensive site groundwater monitoring plan has not yet been developed. The intent of adding groundwater monitoring to the alternatives was to demonstrate that monitoring is an integral part of the O&M associated with the alternative. No change to the text is proposed.
17.	3.1.3.2	Assuming that extracted groundwater encountered during excavation would not require treatment is not a conservative assumption and may therefore bias costs low for the 3b Alternative.	See response to Comment 6.

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18.	3.1.3.3, 3-16	Text states that some debris removed from Monofill #2 would not be suitable for disposal in the repository and would be decontaminated before offsite disposal. How do you propose to decontaminate porous materials such as wood?	This comment addresses important considerations in the design of potential remedies at the site. However, it is engineering design-level detail that has little to no effect on the analysis of alternatives at the FS stage of decision making. No change to the text is proposed.
19.	3.1.3.3, 3-17	ADEC disagrees that removal of Monofill #2 would eliminate the need for groundwater monitoring. What about exiting groundwater contamination? Discussion of groundwater monitoring should be included in the forthcoming groundwater monitoring plan.	The remedial actions proposed in this FS are expected to reduce potential contaminant migration into the groundwater. Once a remedy is implemented, groundwater can be further studied to develop an appropriate groundwater remedy. The BLM will establish a baseline groundwater monitoring network for the site once the remedial action is complete. The network will include wells located downgradient of the current Monofill 2 location. The text will be modified to clarify this point.
20.	3.1.4	Assuming that extracted groundwater encountered during excavation would not require treatment is not a conservative assumption and may therefore bias costs low for the 3c Alternative.	See response to Comment 6.
21.	3.1.4, pg 3-18	It should be noted that some material will require offsite disposal for all of the proposed alternatives except Alternatives 1 & 2. No estimates of waste volumes or associated offsite disposal costs were provided which would have to take into consideration out of state disposal.	Waste volumes and associated costs for material to be transported off-site was provided in the cost appendices. A brief summary will be added to the alternative text, as appropriate, summarizing the estimated off-site disposal volume.
22.	3.1.4, 3-18	Assuming that extracted groundwater encountered during excavation would not require treatment is not a conservative assumption and may therefore bias costs low for Alternative 4.	See response to Comment 6.

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23.	Figure 3-1	The approximate depth of excavation for the Main Processing Area is presented as "Various" in the figure legend, but with the area (ft^2) & approximate volume (yd^3) presented, the approximate depth would be 13.8ft. However, according to the RI and Figures 2-1 & 2-2, contamination within the Main Processing Area extends to >20ft in some areas and is not fully delineated elsewhere. Using an estimated depth of contamination of 20ft would have provided a more conservative estimate albeit possibly still an underestimation of waste volume.	The average depth of contamination used to develop the volume estimate is 13.8 feet as noted by the commenter. This depth reflects an average over the Main Processing Area and is based on the depth figures in FS Table 2-5, which presents conservative estimates of RG exceedances in tailings and subsurface soil. Using an average depth of 20 feet would likely over-estimate the volume of material requiring excavation. The primary reason for establishing an average depth of excavation is to support an FS cost estimate. The same average depth was used for all remediation alternatives that involve excavation. Shifting the average depth of excavation would only shift the cost of alternatives 3A-D and 4 by the same amount. No change to the text is proposed.
24.	Figure 3-2	Cover System – the design is conceptual, and would require more information to make a thorough evaluation, but it should meet the cover requirement to minimize infiltration and maintain stability on the appropriate slopes once vegetation is established. • The geofabric directly on top of the geomembrane will not provide for adequate drainage; the final design should include and engineered drainage layer on top of the geomembrane. • The performance of PVC liner should be evaluated for sub-arctic conditions; typical liner is either HDPE or LLDPE; in addition, consideration should be given to using a textured liner. • The final design must include a QA/QC plan for installation. Where we have seen liner failures, most were due to improper installation, not poor design. • This cover design would also be more appropriate for Monofill #2 than the concrete cloth.	This comment addresses important considerations in the design of potential remedies at the site. However, it is engineering design-level detail that has little to no effect on the analysis of alternatives at the FS stage of decision making. No change to the text is proposed.

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25.	Table 4-1	Existing site conditions combined with Alternative 2 do not comply with Solid Waste regulations listed. • 18 AAC 60.217 Separation from groundwater • 18 AAC 60.233(1) minimum 50ft separation between waste management area and property line; • 18 AAC 60.007(b) Solid waste excluded as fill • 18 AAC 60.010(a) Accumulation, storage, and treatment • 18 AAC 60.015 Transport • 18 AAC 60.025 (b)(4) Polluted soil disposal – petroleum contaminated soil • 18 AAC 60.410 Location standards for monofills	The text in the ARAR compliance column of Table 4-1 will be changed to "would not comply" for the Alaska solid waste regulations listed in the comment.
26.	Appendix B	Hydrologic Analysis – HELP and VS2DT were run with a scenario of the repository with no bottom liner and a geomembrane cover. • Anchorage used for comparison – precipitation is about 10 % higher in Red Devil. Bethel would be more comparable data for the model • Surface slope assumed at 20% - design indicates a 3% top slope, which would produce significantly less run off and more infiltration. To factor in the side slopes, the area impacted by each must be considered. • Does the model consider the leachate head that will exist on the liner during the years of construction and operation? • I am not familiar with the VS2DT model and cannot comment on the inputs.	• Red Devil has a mean annual precipitation of 18.8 inches per year, only 4% higher than Anchorage. The model used does not contain a weather database for Bethel, and a 4% difference in precipitation should not cause significant changes in the model output. No change to the text is proposed. • An overall average slope for the entire repository area was used in the model. While a shallower slope can increase the water ponding time on the surface, it also would increase the rate of evapotranspiration, lessening the potential infiltration. Cap model input parameters such as permeability and # of holes would have a greater impact on the infiltration rates. No change to the text is proposed. • The model was used to simulate leachate generation in the repository with no bottom liner. The volume of water the commenter states would pond on the liner is, in fact, the volume of water that infiltrated into the subsurface under the modeled scenario.

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27.	Appendix B, 2.2	How have the uncertainties associated with the underground mine workings influences to groundwater movement been addressed?	Such uncertainties have not been specifically addressed as part of the model. However, it is likely that the presence of the workings in fairly close proximity to the southern part of the repository would result in a lower water table and a tendency for a southward gradient/flow direction in that area. A lower water table would also increase the unsaturated zone travel times. No change in the text is proposed.
28.	Appendix B, 3.2.1 & 3.2.4	Why use Anchorage as a representative city for weather data? The HELP model includes Annette, Bethel, and Fairbanks as reference cities of which Bethel might be considered more representative than Anchorage. Alternatively, site specific weather data could have been manually entered into the model.	The average precipitation for the Red Devil site is 18.8 inches per year, and the average precipitation for Anchorage is 18 inches per year. Anchorage was selected because it most closely matches the site and was available in the default model settings. No change to the text is proposed.
29.	Appendix B, 3.2.2	How was hydraulic conductivity determined for repository contents considering the oversized material that would be placed inside?	Oversized material that may be excavated and segregated prior to onsite consolidation and solidification would be mixed with the other excavated material that would not be treated via consolidation/solidification. The amount of oversize material has not been quantified, but is expected to comprise a small fraction of the total amount of material to be placed in the repository. Mixing of this small amount of oversized material with the large volume of excavated material that would not be treated (estimated to be 85 percent of all excavated material for the purpose of the FS) is not expected to have a significant effect on the hydraulic conductivity of the contents at the scale of the repository.
30.	Appendix B, 3.2.3	Why were weighted average contaminant concentrations used rather than an upper confidence limit (UCL) on the mean? Assuming a uniform contaminant concentration throughout the 51ft of repository contents may not be appropriate considering the untreated oversized material.	When the waste materials are excavated, they would be mixed and placed in the repository in layers. The model evaluated the effects over the entire unsaturated zone; therefore, weighted average concentrations are believed to be more representative than a UCL on the mean. Additionally, the model results show the simulated leachate concentration reaches a very low level due to natural attenuation well before it migrates to the water table. Therefore any differences between UCLs and weighted average concentrations would not be expected to change the modeling conclusions.

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31.	Appendix B, Table 1	Table indicates 1.6ft of fill, but text in section 2.5 states that an 18-inch (1.5ft) think vegetated layer of fill/topsoil would overlay the protective geotextile underlay and geomembrane.	The table will be modified to 1.5 ft.
32.	Appendix B, Table 1	Table lists depth to groundwater from top of cap as 85.6ft, but considering the previous comment it should be 85.5ft.	The depth to groundwater will be changed to 85.5 ft.
33.	Concrete cloth	The report includes a proposal to cap the existing monofill with a product called a Concrete Cloth, manufactured by Milliken. There are several issues with this proposal: • This product has a design life of 25 years. Non-exposed geomembranes, such as high density polyethylene (HDPE) have estimate lifespans that are significantly longer (upwards of 17 times longer). (GRI White Paper #6 - Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions, Geosynthetic Institute, 2/8/2011) • Milliken's information indicates use for relatively short-term surface applications, such as bank stabilization, ditch lining, etc., where the alternative may be poured concrete. There is no mention of the material use as a landfill cover. • The listed information contains no information on hydraulic conductivity. • The available information does not indicate any uses in an extreme sub-arctic climate, which would be faced in Red Devil. • A remote remedial action project, under such conditions, does not seem to be an appropriate location to perform a trial of a product that is untested for this application.	• The concrete cloth cover would be inspected regularly and its effectiveness will be evaluated during 5-year reviews. The design life listed is a conservative threshold for product reliability and is not an empirical estimate based on long-term testing such as the GRI white paper for geomembranes. • E & E engineers conducted research into the product's suitability as a cover material for Monofill #2 and determined it would be effective at protecting the monofill and for run-on/runoff control. This was confirmed with vendor input. • A new cut sheet will be added to Appendix A indicating the product's permeability characteristics. • E & E engineers researched the performance of the product in subarctic conditions extensively. See page 2 and 3 of Appendix A. In addition, there are case studies of concrete cloth performing effectively at Pogo Mine, Alaska and several sites in interior British Columbia, Canada. • BLM disagrees this would be a trial of an unproven product. Concrete cloth has been used extensively for run-on/runoff management, as a slope stabilizer, and as secondary containment in multiple previous applications.

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34.	Proposed Sideslopes, pg 3-6	Monofill side slopes – although this appears conceptual, on Page 3-6, the assumption listed assumes 2:1 (2 foot horizontal : 1 foot vertical) side slopes. In general, such a side slope is concerning for a landfill. As presented, this side slope would only extend 4 feet about ground surface. While such a short slope probably would not pose a major issue regarding slope stability, there is concern about its ability to hold a vegetative cover. Although the concrete cloth cover may help stabilize the slope, it is not deemed suitable as a landfill cover.	This comment addresses important considerations in the design of potential remedies at the site. However, it is engineering design-level detail that has little to no effect on the analysis of alternatives at the FS stage of decision making. No change to the text is proposed.
35.	Repository Slope, Pg 3-10	Repository side slopes – on Page 3-10, the assumed side slopes for the repository is listed as 2.5:1. Based on Figure 3-2, with an assumed slope length of 50 feet, the vertical rise of such a slope would be 20 feet. The plan involves using a geomembrane cover system. This slope is excessively steep for a geomembrane system. DEC Solid Waste in general does not allow a side slope that exceeds 3:1, and the slope requirement in 18 AAC 60.485(c) states that this is the maximum allowed cover slope for an Industrial Waste Monofill, which the proposed repository would likely be classified as under 18 AAC 60. A sideslope of 2.5:1 is steeper than any slope that has been allowed by DEC for a cover slope at a large landfill. This is a particularly bad idea for a remote site, as there will be reduced opportunity to monitor the slope. Such a slope has an increased risk of slope failure, and is much more likely to have trouble holding a vegetative cover system. It is recommended that: • Side slopes that are much less steep be chosen for the facility; and, • A static and seismic slope stability analysis be conducted for the proposed slope.	As part of the final design, the slope of the repository will be finalized. Should the design engineer determine that a different slope be utilized, then it will be incorporated into the design. It should be noted that this is an FS, and seismic slope stability analysis is beyond the scope of this document. It is agreed that as part of the final design, slope stability analysis should be conducted. No change to the text is proposed.

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36.	Cover system for repository Figure 3-2	Cover system for repository – Figure 3-2, coupled with text for various options, describe a proposed geomembrane cover system that would be used for the repository. The design still is more conceptual, but in general, this is a cover system that should minimize permeability, and at the proper slope, should be stable once vegetation is established. A couple of observations: • The design, as described on Page 3-10, seems to call for a geofabric directly on top of the geomembrane. While this will help cushion and protect the liner, this will not, on its own, provide for adequate drainage. The final design should include an engineered drainage layer on top of the geomembrane. • There will be factors at the design phase that should be evaluated further. For instance, the conceptual design assumes polyvinyl chloride (PVC) liner; however, the performance of PVC in the subarctic conditions in Alaska should be evaluated. Furthermore, consideration should be made on whether to use textured liner, etc. • The proposed cover system for the repository would probably be a better choice for the Monofill than the concrete cloth that has been proposed. • The biggest problem typically encountered with geomembrane liner or cover systems is in quality assurance/quality control (QA/QC) related to installation. In multiple cases where there has been a problem with an installed liner, the failure was due to inadequate QA/QC of the liner installation, rather than poor design. Failures have happened due to bad seams between liners, due to mistakes made during field seaming, and choices made during installation that differed from the engineering design, such as welding an abrasion layer.	This comment addresses important considerations in the design of potential remedies at the site. However, it is engineering design-level detail that has little to no effect on the analysis of alternatives at the FS stage of decision making. No change to the text is proposed.

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37.	HELP & VS2DT Modeling	The HELP model is often used for modeling the water balance over time for landfills. The VS2DT model appears to be comparable to the MULTIMED model, as both use the results of HELP modeling to estimate the concentration of a contaminant at some point of compliance. The information provided shows that the HELP and VS2DT were run with a scenario of the repository with a geomembrane cover, and no bottom liner. The assumed slope used for the HELP is 20%. The proposed side slope of 2.5:1 would be 21.8 degrees, or 40%; however, the landfill design includes a top slope of about 3%, so it is difficult to say how this would best be handled, as precipitation on a flatter slope would be in longer contact with the cover system. It is presumed that 20% represents an approximation that combines the side slopes and top slope; however, it is not clear what the justification is. DEC Solid Waste has generally seen HELP analyses consider side slopes, and top slope, as separate analyses. The assumptions also included scenarios using various amounts of holes in the cover, to estimate how the cover would perform if there were damage that decreased hydrological permeability. In actuality, the more likely failure scenario would probably be a tear in the liner, or poorly constructed seam that tears. This would result in a more localized liner breach, and much greater infiltration, than the model predicts. There is no HELP/VS2DT modeling included for the revised Monofill #2 cover. As mentioned above, there is concern about the ability of the proposed concrete cloth to act as a sufficient hydrological barrier. Please provide the raw data sheets that show the outcome of modeling.	The model considers an overall, long-term effect over a 5 acre area; therefore, separate analyses for top slope and side slopes were not considered necessary. While a shallower slope could increase the water ponding time on the surface, it also would increase the rate of evapotranspiration, lessening the potential infiltration. Cap model input parameters such as permeability and the number of holes would have a greater impact on the infiltration rates. No change to the text is proposed. While a tear may initially allow a greater volume of surface water infiltration at a localized area, a breach would be discovered through regular site inspections and the breach would be repaired in a timely manner. The approach of using 50 holes per acre over the entire footprint of the repository for a period of 50 years is a more conservative approach than modeling a more localized breach. Figures A-3 through A-6 provide a summary of the model outputs. If additional output data is requested, please specify what additional data are requested.