



Department of Energy

Washington, DC 20585

July 19, 2018

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Deputy Director
Mail Stop T8-F5
Washington, DC 20555-0001

Subject: U.S. Department of Energy Office of Legacy Management Evaluation of ExxonMobil's License Request to Include the Pit Lake within the Highland, Wyoming, UMTRCA Title II Site Long-Term Surveillance Boundary (Docket No. 40-8102)

To Whom It May Concern:

In a license amendment request submitted to the U.S. Nuclear Regulatory Commission (NRC) on May 12, 2011, ExxonMobil (licensee) proposed to extend the long-term surveillance boundary (LTSB) at the Highland, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II uranium mill site to include an area called the Southeast Drainage and also the flooded open pit mine that remains on the licensee's property. The extension of the LTSB would more than double the amount of land proposed to be transferred to the U.S. Department of Energy (DOE) Office of Legacy Management for long-term care (see enclosed site map Figure 1-2). DOE has reviewed the information submitted in support of this license amendment as well as other historical documentation for the site. Based on our review, we agree with the eastern boundary extension to encompass groundwater concerns in the Southeast Drainage. However, we object to a western extension of the boundary, which includes the former open pit mine. Our rationale for this position is summarized below. DOE's position has both a regulatory and technical basis.

For more than twenty years, both during and after termination of the milling operation, the licensee submitted monitoring and other reports indicating that seepage from the tailings basin was limited in extent, and it would not affect the water quality in the pit lake. Elevated concentrations of certain constituents in the pit lake (primarily uranium and selenium) were attributed by the licensee to surface water interaction with the exposed ore body as lake infilling progressed. The licensee anticipated water quality in the lake would naturally improve over time, which it did marginally. Around 2006, the licensee changed their conceptual model, indicating that milling-related constituents had probably migrated to the lake, justifying the inclusion of the lake in the LTSB for transfer to DOE. The licensee began referring to the "11e.(2) byproduct material" contained in the lake in subsequent reports, presentations, and correspondence. The licensee provided no new data to invalidate the previous conceptual model that attributed pit lake contamination to mining rather than milling activities.

The main reasons that DOE disagrees with inclusion of the pit lake within the LTSB are as follows, with additional explanation to support DOE's position included in the enclosure:

- **The possible presence of milling-related constituents in the pit lake does not by itself compel DOE ownership for long-term care.** Most (if not all) of the contaminants in the pit lake are mine-related (therefore non-11e.(2)). DOE is only required to assume ownership of the "land used for disposal of byproduct material" and must agree to accept



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any non-11e.(2) materials under the general license. DOE is not willing to accept the non-11e.(2) materials in the pit lake. NRC can make the determination that any potential mill-related constituents in the pit lake are not considered "hazardous constituents" under UMTRCA and defer to state regulation of the pit lake under the mining permit.

- **The licensee's calculations and conceptual model for tailings seepage contribution to the pit lake are not definitive, and there are many inconsistencies with site observations.** The licensee proposes a solution that is not unique and is not founded on modeling or monitoring data. The proposed conceptual model is inconsistent with observations and models at other UMTRCA sites. Even the use of assumptions that maximize the estimated contribution of seepage indicate a predominantly (75% or more) mine-related contribution to the pit lake. The State of Wyoming has indicated the provided rationale may be insufficient to justify the proposed long-term boundary revision.
- **The pit lake in its current state is not protective, likely does not meet end-use requirements under the state mine permit, and does not meet NRC closure requirements for a uranium recovery operation.** DOE does not have the authority to accept a site under a general license that requires further remediation or reclamation (10 CFR 40, Appendix A, Criterion 12).

On basis of the above facts, DOE objects to the licensee's proposal to include the pit lake in the LTSB. The original western LTSB, which encompasses the tailings impoundment, is adequate to ensure protection of human health and the environment under the requirements of UMTRCA. DOE agrees with the eastern boundary extension to include mill-related contamination.

Please call me at (970) 248-6041 if you have any questions. Please address any correspondence to:

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Sincerely,



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Office of Legacy Management

Enclosures

cc w/enclosures:

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File: HIG 0030.10 (records)

Sites\HIG\5-23-18 Highland Eval of ExxonMobil License Request (NRC)

**SUPPORTING INFORMATION FOR DOE'S POSITION TO NOT INCLUDE THE
PIT LAKE IN THE HIGHLAND, WYOMING, SITE LONG-TERM
SURVEILLANCE BOUNDARY**

1. The possible presence of milling-related constituents in the pit lake does not by itself compel DOE ownership for long-term care

- Any milling-related contamination in the groundwater and pit lake is not Atomic Energy Act (AEA) Section 11e.(2) byproduct material, but rather “hazardous constituents” derived from 11e.(2) byproduct material (10 CFR 40 Appendix A, criterion 5B(2)). The Atomic Energy Act only requires that the federal government assume ownership of “the land which is used for the disposal of any byproduct material.” The AEA and U.S. Nuclear Regulatory Commission (NRC) regulations do not explicitly state that the federal government must own the land containing hazardous constituents in groundwater or surface water.
- Even if a contaminant in groundwater or surface water at a site meets NRC criteria for a hazardous constituent (10 CFR 40 Appendix A, Criterion 5B(2)), NRC can exclude said contaminant as a hazardous constituent if it finds that the contaminant “is not capable of posing a substantial present or potential hazard to human health or the environment” (Criterion 5B(3)). This would be the case if constituents from a uranium milling operation are present in groundwater (or surface water) that contains high concentrations of naturally occurring uranium.
- ExxonMobil (licensee) has shown that at least 75% (and possibly closer to 96%) of the uranium in the pit lake is mine-related and not mill-related (so it is mostly non-11e.(2) material) (Tetra Tech 2007). The lake is an artifact of mining, as are backfilled mine pits between the disposal area and the pit lake. It is beyond DOE’s responsibilities under the Uranium Mill Tailings Radiation Control Act (UMTRCA) to assume responsibility for what is primarily a mine waste problem.
- Concurrence and commitment from DOE is needed if non-11e.(2) materials are to be disposed of in a tailings impoundment (NUREG 1620, Appendix I, Attachment 1) (NRC 2003). It is assumed that similar DOE concurrence would be needed before extending a long-term surveillance boundary (LTSB) to specifically encompass non-11e.(2) materials that pose a potential threat to human health or the environment.
- NRC’s current Alternate Concentration Limits guidance says that DOE would have to agree to take custody of “excess land” beyond that actually being used for byproduct material disposal when a “distant POE” is being used to encompass hazardous constituents in groundwater (and presumably surface water) (NRC 1996). DOE, therefore, can decline to accept the excess land that includes the pit lake.
- Based on the licensee’s worst-case estimates, the primary contaminant of concern in the lake (uranium) is mainly mine-related. The hazards associated with the mine waste would be present even if the postulated mill-related contribution were removed. Therefore, this is a mine waste issue. Where mine- and mill-related materials were present at the Church Rock, New Mexico, UMTRCA Title II site, cleanup under the NRC license was only required when the mill component exceeded 50% of the material (UNC 1989). Based on this precedent, the pit lake should not be regulated under the existing or general license,

but should be subject to state regulation under the mining permit (avoiding dual regulation).

- The licensee argues that the pit lake should be included in the LTSB in part because of NRC's former position of having exclusive jurisdiction over milling-related groundwater contamination. This is no longer NRC's position. NRC has exclusive jurisdiction under UMTRCA, but other agencies could have jurisdiction under other statutes. The pit lake is regulated under a Wyoming Land Quality Division mining permit. DOE expects that the water in the pit lake must meet State of Wyoming surface water-quality standards, as well. If the water does not meet these standards, DOE cannot assume responsibility for a site that has not achieved compliance with applicable regulations. Because most (if not all) of the associated contamination in the pit lake is mine-related, NRC should defer to the State of Wyoming in this situation.

2. *The licensee's calculations and conceptual model for tailings seepage contribution to the pit lake are not definitive, and there are many inconsistencies with site observations.*

- The State of Wyoming has stated that the evidence provided for including the pit lake in the license boundary is questionable and may not be sufficient (WDEQ 2011). Furthermore, because the pit lake is within the mine permit boundary regulated by the Wyoming Land Quality Division, NRC would need to obtain concurrence from the State of Wyoming to expand the license boundary to include the pit lake (WDEQ 2008).
- The licensee's geochemical argument is conceptual in nature—there are no actual modeling or monitoring data to support conservative transport of uranium under conditions that exist(ed) at the Highland site. The licensee states that the transport of uranium through the Tailings Dam Sandstone (TDSS) (shown on enclosed cross section Figure 1-10) occurred before groundwater monitoring was conducted.
- For the operational history of the mill, the conceptual model for the site was one of very limited seepage beyond the boundary of the tailings impoundment. Monitoring conducted in the 1980s supported this model and indicated limited movement of chloride and other tailings constituents. The licensee points out that some of the early modeling underestimated the degree to which seepage occurred and disregards this early work altogether in favor of a completely different conceptual model where significant transport of mill tailings fluids occurred during the early phase of mill operation. The licensee's monitoring data do not support the current conceptual model.
- Most of the early models overestimated how quickly the lake would fill. This would be an argument for a lesser contribution of early inflow from the TDSS (and from tailings seepage) rather than more.
- The licensee's conceptual model for the geochemical evolution of the pit lake is at odds with what is known about the lake filling and monitoring history. The revised model calls for significant migration of high-concentration seepage from the tailings pond into the TDSS during the early (pre-monitoring) operation of the site. The model calls for the influx of this high-concentration seepage into the pit lake over a 20-year period to produce the currently observed pit lake chemistry. The pit lake did not start filling until 1984. Prior to this, the mine was dewatered and these fluids were either used in the

milling process or discharged to the tailings pond. For significant seepage to enter the pit lake, it would need to first be stored in the TDSS until lake filling began in 1984. Therefore, monitoring of the TDSS during the early filling period should have detected some of these high-concentration fluids. This is not the case. Monitoring data from as early as 1988 show very low concentrations of uranium in the TDSS and elevated concentrations in the pit lake. These observations support the earlier explanation that the pit lake chemistry is mine-related and that the seepage front from the tailings has only migrated to a very limited extent.

- The licensee's geochemical argument is based on nonunique mixing calculations where end member compositions are arbitrarily adjusted to match the concentrations in the pit lake—many other such solutions exist. It is not clear if the assumptions made for the geochemical mixing model are feasible from a hydrologic and water-balance perspective.
- End members for mixing calculations were selected to maximize the potential contribution from seepage. The evaluation makes the assumption that much of the chloride in the lake is from tailings seepage even though concentrations are similar to those in Ore Body Sandstone (OBSS; labeled as 30-, 40-, and 50-Sandstone on enclosed cross section) groundwater based on monitoring data; in other words, all chloride in the pit lake could come from the OBSS based on concentrations observed in monitoring wells.
- Mixing calculations assume that the uranium/chloride ratio in seepage discharging to the lake is the same as that in pure tailings (no attenuation of uranium compared to chloride).
- It is unclear whether the composition of tailings seepage that was used in the mixing calculations is actually representative of liquids that were in the tailings pond. The composition used was from a single sample collected from the discharge pipe that went from the mill to the tailings pond and not from the tailings pond itself. Historical information about site operations indicates that the tailings pond also received fluids from dewatering wells, mine seepage, solution mine waste, and precipitation. These fluids would serve to dilute the processing fluids discharged to the tailings pond. Fluids seeping into the groundwater from the tailings pond may have been considerably more dilute than assumed in the mixing calculations, and potential milling contributions to the pit lake may be highly overestimated.
- At other UMTRCA sites where high concentrations of uranium in groundwater have migrated from a tailings impoundment, there is evidence of persistent secondary uranium sources along the groundwater flow path. At nearly every site, uranium has proven to be less mobile than originally assumed, even in near-surface oxygenated environments. At the Highland site, there is no evidence that fluids with high uranium concentrations migrated any distance away from the disposal cell. Observed concentrations of uranium in groundwater are much lower than those observed in the pit lake. For many years, this observation was used by the licensee to support the argument that pit lake contaminants were derived from the ore body and not seepage from the tailings impoundment.
- The TDSS was only in contact with the tailings pond in the eastern half of the impoundment (EPRC 1982). This means that any tailings pond seepage into the TDSS would need to migrate nearly a mile before discharging to the pit lake (see enclosed site map [Figure 1-2] and cross section [Figures 1-10]). In addition, backfilled former open pit uranium mines lie between the tailings impoundment and the pit lake, so seepage would need to migrate through this backfill material before entering the lake. A review of

the 1982 pit lake hydrology report done on behalf of NRC indicated that the backfill material likely acted as a barrier for migration of groundwater from the TDSS to the pit lake (WRA 1982). Consequently, tailings pond seepage was predicted to move to the northwest and southwest rather than directly west to the pit lake. This would further increase the distance that tailings seepage would need to move before entering the pit lake. Based on DOE's experience at numerous other sites, the licensee's conceptual model of high concentration tailings seepage entering the pit lake appears to be unlikely.

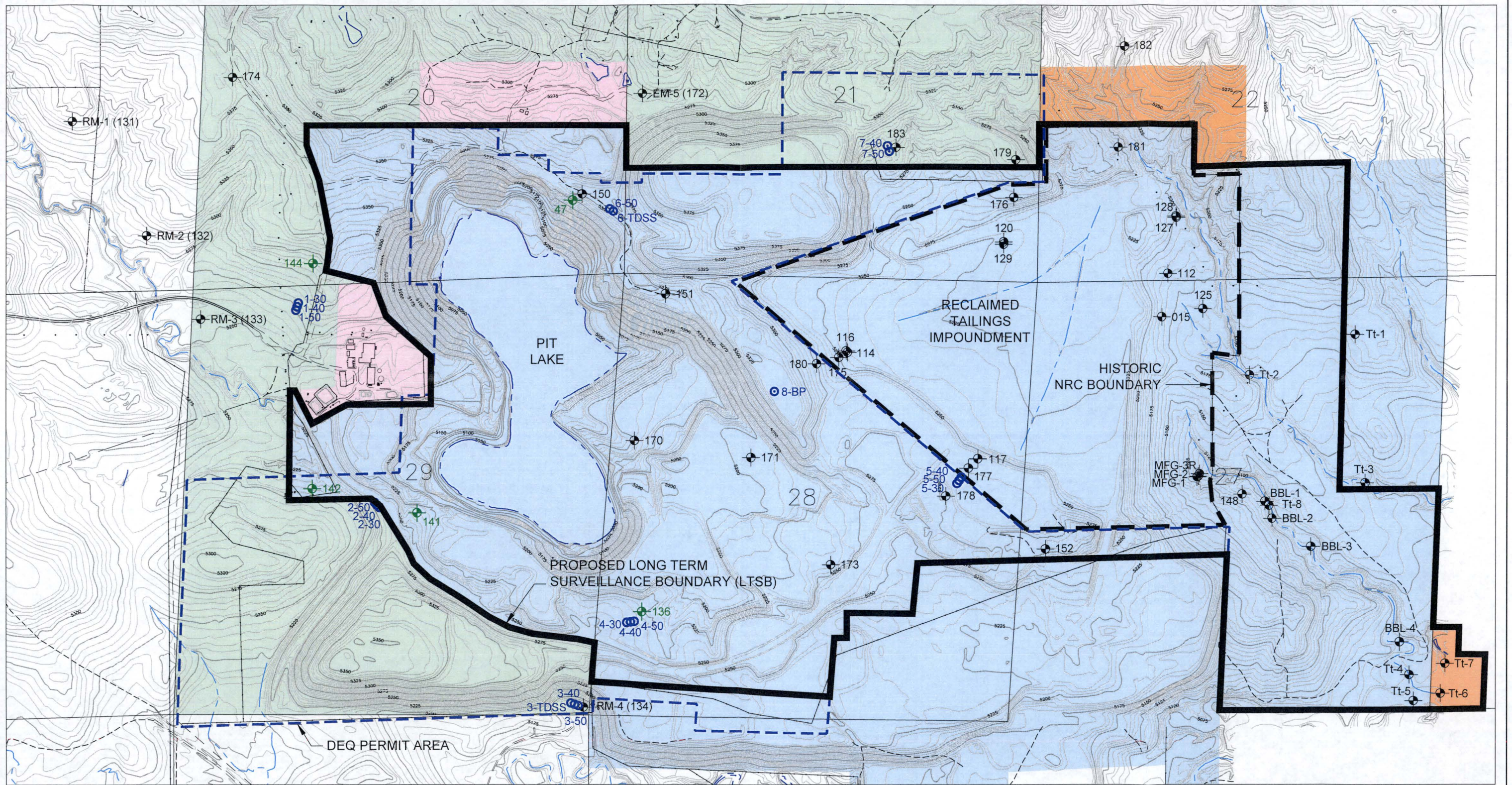
- The only new data that are provided to support the presence of potential mill waste in the pit lake are based on uranium isotopes. The licensee claims that the uranium-234/238 ratio of about 1 is an indication that water in the pit lake is milling-derived based on the work of Zielinski et al. (1997). However, a study of the Schwartzwalder uranium mine in Colorado (where no mill is present) indicated that isotopic ratios and uranium concentrations similar to those observed in the pit lake occur through surface water leaching of exposed uranium ore bodies (Caine et al. 2011). Thus, the uranium chemistry in the pit lake is also consistent with a mining-related origin.

3. The pit lake in its present state is not protective, likely does not meet end-use requirements under the state mine permit, and does not meet NRC closure requirements for a uranium recovery operation.

- The license amendment request does not mention the originally intended end use of the pit lake. It is not clear if alternatives were considered to leaving the pit lake unreclaimed.
- If there are hazardous constituents present in the pit lake that require it to be included in the LTSB for the disposal site, it should first be reclaimed to meet the 10 CFR 40 Appendix A Criterion 1 requirement of "permanent isolation of tailings and associated contaminants." In its current state, contaminants in the lake are not isolated from contact with humans or ecological receptors, nor does the pit lake meet the definition of a disposal area under UMTRCA. The licensee indicates that the lake will continue to act as a sink over time; if so, contaminant concentrations should continue to increase.
- The U.S. Fish and Wildlife Service (USFWS) did not agree with the licensee's conclusion that the pit lake would result in "insignificant effects" to migratory birds (DOI 2004). Several approaches to achieve water-quality improvements were suggested but were not acted upon. Therefore, the pit lake water quality cannot be demonstrated to be as low as reasonably achievable. There is a possibility that USFWS could request improvements to pit lake water quality in the future for the protection of migratory birds. DOE does not have the authority under the general NRC license to accept responsibility for a site that requires additional reclamation or remediation to meet applicable standards for mine and mill sites.
- Although leaving some highwalls along the pit lake may have met state reclamation requirements, DOE believes that they pose a significant safety risk because of potential mass wasting. Therefore, the pit lake in its current condition is not protective.

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OWNERSHIP:

	EXXONMOBIL		FOWLER
	BONER		CAMECO RESOURCES

LEGEND




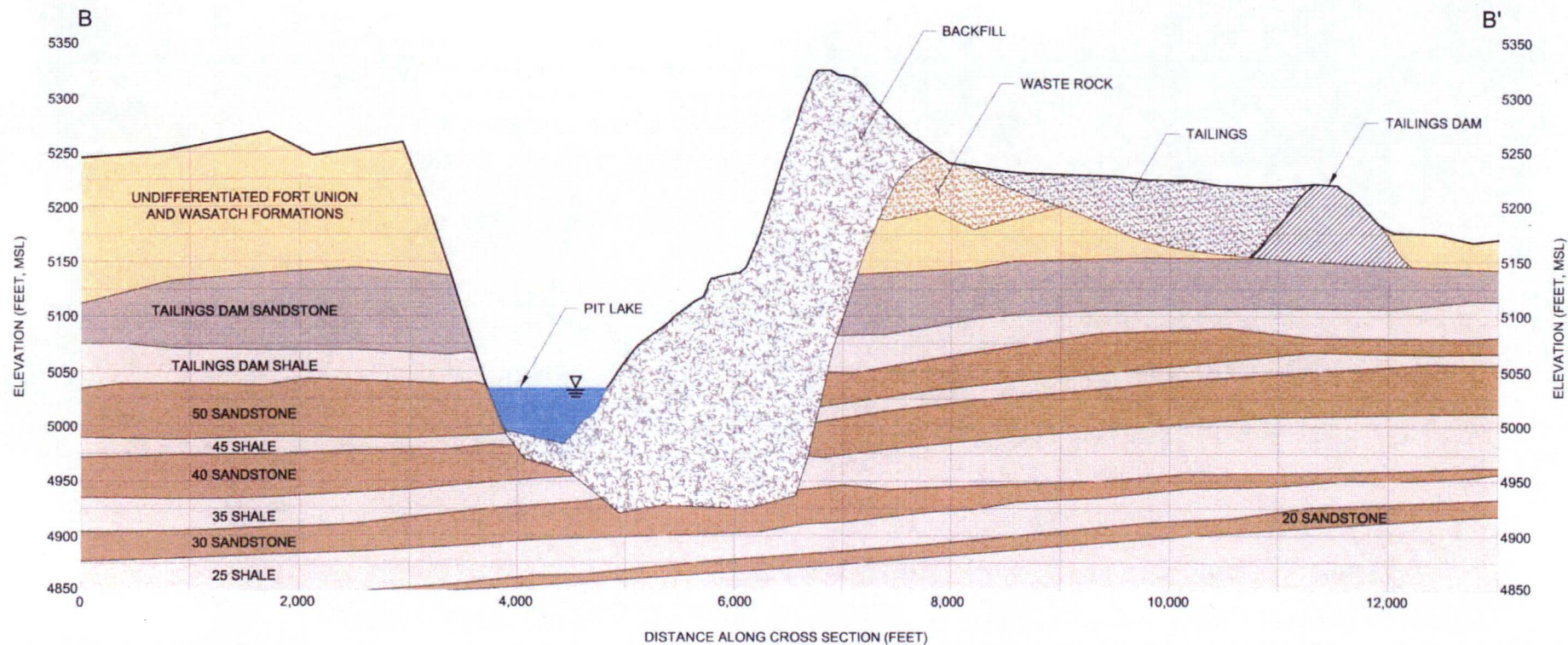
-  EXISTING WELLS
-  LOCATION OF NESTED WELLS IN THE ORE BODY SANDSTONE UNITS
-  FORMER PIT DEWATERING WELLS




FIGURE 1-2
 HIGHLAND SITE PROPOSED LONG TERM
 SURVEILLANCE BOUNDARY

WORTHINGTON
 MILLER
 ENVIRONMENTAL, LLC.

Date: JUNE 2017
 Project: HIGHLAND
 File: FIGURE-1-2-LTSB



CLIENT		ExxonMobil		
PROJECT		HIGHLAND URANIUM PROJECT ACL APPLICATION		
TITLE		CROSS-SECTION B-B' CURRENT CONDITIONS		
 amec EARTH AND ENVIRONMENTAL	DRAWN BY	JKM	CHECKED BY	BW
	FILENAME	877520022	DATE	4/28/11
	FIGURE No. 1-10			

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EARTH AND ENVIRONMENTAL