

APPENDIX H: ALTERNATIVE SITE ANALYSIS

Albemarle considered additional locations prior to selecting the Kings Mountain Mine site proposed to DOE. Five alternative project sites were evaluated by the applicant: the Hallman-Beam Mine, the Kings Mountain Quarry, the Imerys Mine, the Archdale Mine, and the Kings Mountain Lithium Mine Project (Preferred Site Alternative) (Proposed Project). Each site was screened by Albemarle to determine its practicability in implementing the Proposed Project's purpose.

Table 1: Offsite Alternative Site Screening Definitions

Screening Criteria	Description
Criterion A: Location	The alternative would only be considered practicable and achieve the overall Proposed Project's purpose if it is located within the Carolina TSB and if there was a history of previous exploration with positive identification of mineralized spodumene within the alternative identified. The TSB contains over half of the U.S. lithium supply. Spodumene-based lithium mines in the TSB were the world's leading producer of lithium from the 1950s to the 1980s. Historical knowledge of mineralized spodumene locations within the TSB narrows potential mine sites and saves capital exploration costs. Therefore, the Proposed Project should be located on previously explored properties within the TSB.
Criterion B: Mining Technology	The alternative would only be considered practicable and achieve the overall Proposed Project's purpose if it relied on open-pit, hardrock mining techniques. The TSB is a hardrock resource that can only be extracted using hardrock mining techniques. The presence of an existing open pit reduces waste handling and management costs supporting the Proposed Project's financial feasibility. Furthermore, the depth of the resource dictates the mining method. To achieve the Proposed Project's purpose of extracting spodumene-containing lithium, the alternative would only be considered practicable if it relied upon open-pit, hardrock mining techniques.
Criterion C: Historical Active Mine Sites	Historical/active mine sites are those areas with historical operations or existing mining operations. These areas typically have existing infrastructure such as roads, power, and in some cases, processing facilities. In addition, a sense of community (stakeholder) acceptance of the operation already exists. Greenfield sites refer to those areas that involve searching for mineral deposits in unexplored regions where no significant mining activities have taken place. There is typically no infrastructure in place and no previous community (stakeholder) engagement. Moreover, greenfield sites would necessarily have a greater adverse impact on natural resources than areas that have previously been disturbed by historical or existing mining operations. To achieve the Proposed Project's purpose, the alternative site would only be considered if there was historical or ongoing mining activity.
Criterion D: Minimum Mine Size	Few large parcels (≥ 120 acres) remain in the TSB. The alternative would only be considered practicable and achieve the Proposed Project's purpose if an initial core parcel of at least 120 acres was identified to warrant the assembly of other adjacent properties into a larger project area of approximately 800 to 1000 acres. This total mine area would be of sufficient size to extract the minimum amount of mineralized spodumene to produce sufficient lithium hydroxide needed to balance capital investment costs and to operate a mine designed to MSHA standards, while also observing state and local requirements, such as buffers.
Criterion E: Property Availability	The alternative would only be considered practicable and achieve the Proposed Project's purpose if the current landowner(s) would be willing to sell or lease the core parcel alternatives identified.

Criterion F: Environmental Impacts Minimization	The alternative would only be considered practicable and achieve the overall Proposed Project's purpose if minimal environmental impacts would occur. A desktop analysis of environmental impacts will be assessed for each alternative using publicly available NWI and NHD data. Additionally, those NWI and NHD features depicted within 100-year FEMA floodplains will be assumed to be avoided due to the additional permitting associated with impacting floodplains, allowing equal comparison across offsite alternatives of NWI and NHD features outside FEMA floodplains.
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FEMA = Federal Emergency Management Agency; MSHA = Mine Safety and Health Administration; NHD = National Hydrography Dataset; NWI = National Wetland Inventory; TSB = Tin-Spodumene Belt; U.S. = United States

1.0 Offsite Alternatives

Offsite alternatives for the Proposed Project outside of the Carolina TSB were eliminated as these alternatives would be unreasonable based on the Proposed Project's purpose and need and current known reserves within the TSB. The offsite location was evaluated for tailings storage, rock storage, spodumene resource availability, and the processing plant site. A comparison of the screening criteria for the No Action Alternative and the five offsite alternatives is summarized in Table 2: Offsite Alternatives Screening Summary. Based on the screening, the Preferred Alternative (Site 5) is the only viable option for the Proposed Project.

Table 2: Offsite Alternatives Screening Summary

Screening Criteria	A Location	B Mining Technology	C Historic/Active Mine Sites	D Minimum Mine Size	E Property Availability	F Environmental Impacts Minimization
Alternative						
No Action	No	No	No	No	No	No
Site 1. Hallman-Beam Mine	Yes	Yes	Yes	Yes	No	Yes*
Site 2. Kings Mountain Quarry	No	Yes	Yes	Yes	No	Yes*
Site 3. Imerys Mine	No	Yes	Yes	Yes	No	Yes*
Site 4. Archdale Mine	No	Yes	Yes	Yes	No	Yes*
Site 5. Kings Mountain Lithium Mine (preferred)	Yes	Yes	Yes	Yes	Yes	Yes*

*Dependent on minimization of impacts and appropriate mitigation

The Preferred Alternative is to restart mining activities at the KMM and store tailings at the Archdale TSF. The site layout was designed based on data collected during the drilling program.

Offsite Alternative 1: Hallman-Beam Mine

Between the 1950s and 1990s, the former Hallman-Beam Lithium Mine was one of the largest lithium producers where mineralized spodumene was mined from a hardrock open-pit

mine. The lithium mine closed in 1998 and was purchased by Martin Marietta and continues to operate as a hardrock mine for construction aggregates (North Carolina Division of Energy, Mineral, and Land Resources [DEMLR] Mine Permit No.36-01). The parent parcel is approximately 627 acres and under one ownership. Additional parcels adjacent to this operation would need to be acquired for the site to be of sufficient size (approximately 383 acres) to extract the minimum amount of mineralized spodumene to produce sufficient lithium hydroxide to balance capital investment costs and operate a mine designed to Mine Safety and Health Administration (MSHA) standards (Figure 8: Offsite Alternative Locations). Desktop review of National Wetland Inventory (NWI) and National Hydrography Dataset (NHD) data indicates that aquatic resources occur on the parent parcel.

The parent parcels are not for sale, as Martin Marietta intends to continue processing construction aggregates. Impacts to aquatic resources would be variable depending on parcel availability and mine plan, but it is assumed they would be minimized to create the least possible impact. Table 3: Offsite Alternative 1 Summary details the analysis of this alternative against the screening criteria.

Table 3: Offsite Alternative 1 Summary

Screening Criteria	Criteria Satisfied	Explanation
Location (A)	Yes	The alternative satisfies the screening criteria as it is located within the TSB and is known to contain spodumene.
Mining technology (B)	Yes	This alternative satisfies the screening criteria as it was a former open-pit lithium mine and is currently an active open-pit aggregates mine. However, the infrastructure would need to be retrofitted for spodumene processing.
Historical active mine sites (C)	Yes	This alternative satisfies the screening criteria as the site contains previous hardrock mining operations.
Minimum mine size (D)	Yes	This alternative satisfies the screening criteria as the parent parcels are approximately 627 acres, and the identified Proposed Project area parcels are 383 acres for a total mine size of approximately 1100 acres.
Property availability (E)	No	This alternative does not satisfy the screening criteria as the parent parcels are not available for purchase or lease.
Environmental impacts minimization (F)	Yes	Based on review of the NHD and NWI databases, both wetland and stream resources can be found within the parent and adjacent parcels. This alternative may satisfy the screening criteria assuming minimization of impacts and appropriate mitigation were provided. The quantity of impacts would be dependent upon the resource (spodumene) location, mine pit design, waste rock and tailings requirements, and infrastructure support.

NHD = National Hydrography Dataset; NWI = National Wetland Inventory; TSB = Tin-Spodumene Belt

Offsite Alternative 2: Kings Mountain Quarry

The Kings Mountain Quarry, adjoining the King's Mountain Lithium Mine, is adjacent to the Preferred Alternative with a parent parcel of approximately 418 acres under one owner (Figure 8: Offsite Alternative Locations). The Kings Mountain Quarry, operated by Martin Marrietta, is a hardrock aggregate quarry under DEMLR Mine Permit N0. 23-02. Even though the Kings Mountain Quarry is located within the TSB, there is no evidence that the site contains mineralized spodumene. A minimum of an additional 234 acres would need to be acquired from multiple landowners to develop a mine of sufficient size for a lithium mining operation.

The parent parcels are not for sale, as Martin Marietta intends to continue processing construction aggregates. This quarry has a history of impacts to wetlands and streams from activities supporting its current operation. Additional impacts to aquatic resources would be variable depending on parcel availability and mine plan, but it is assumed that there would be impacts based on NWI and NHD datasets. Table 4: Offsite Alternative 2 Summary details the analysis of this alternative against the screening criteria.

Table 4: Offsite Alternative 2 Summary

Screening Criteria	Criteria Satisfied	Explanation
Location (A)	No	The alternative does not satisfy the screening criteria. Although it is located within the TSB, there is no evidence that spodumene exists in the mining parcel.
Mining technology (B)	Yes	This alternative satisfies the screening criteria due to previous mining activities. Although located within the TSB, there is no evidence that there is mineralized spodumene in the area.
Historical active mine sites (C)	Yes	This alternative satisfies the screening criteria as the site contains previous hardrock mining operations.
Minimum mine size (D)	Yes	This alternative satisfies the screening criteria as the parent parcels are approximately 412 acres and identified project area parcels are 234 acres, for a total mine size of 646 acres.
Property availability (E)	No	This alternative does not satisfy the screening criteria as the parent parcels are not available for purchase or lease.
Environmental impacts minimization (F)	Yes	Based on review of the NHD and NWI databases, both wetland and stream resources are within the parent and adjacent parcels. The quarry has a history of wetland and stream impacts and additional impacts to aquatic resources from mining activity are likely. This alternative may satisfy the screening criteria assuming minimization of impacts and appropriate mitigation were provided. The quantity of impacts would be dependent upon the resource (spodumene) location, mine pit design, waste rock and tailings requirements, and infrastructure support.

NHD = National Hydrography Dataset; NWI = National Wetland Inventory; TSB = Tin-Spodumene Belt

Offsite Alternative 3: Imerys Mine

The Imerys Mica Mine has been in operation since the 1960s and continues to operate as an open-pit mine (DEMLR Mine Permit No. 23-03). The parent parcels comprise approximately 423 acres located within the TSB under one owner (Figure 1: Offsite Alternative Locations). Even though the Imerys Mica Mine is located within the TSB, there is no evidence that the site contains mineralized spodumene. Additional parcels adjacent to this operation would need to be acquired to be of sufficient size for operation of an open-pit mine. The core parcel is not for sale, as Imerys intends to continue mining and processing mica at the site. A minimum of an additional 250 acres, for a total mine size of 673 acres, would need to be acquired from multiple landowners to develop a mine of sufficient size. Desktop review of NWI and NHD datasets indicates that aquatic resources occur on the site. Impacts to aquatic resources would be variable depending on parcel availability and mine plan, but it is assumed that there would be impacts based on the NWI and NHD datasets. Table 5: Offsite Alternative 3 Summary details the analysis of this alternative against the screening criteria.

Figure 1: Offsite Alternative Locations

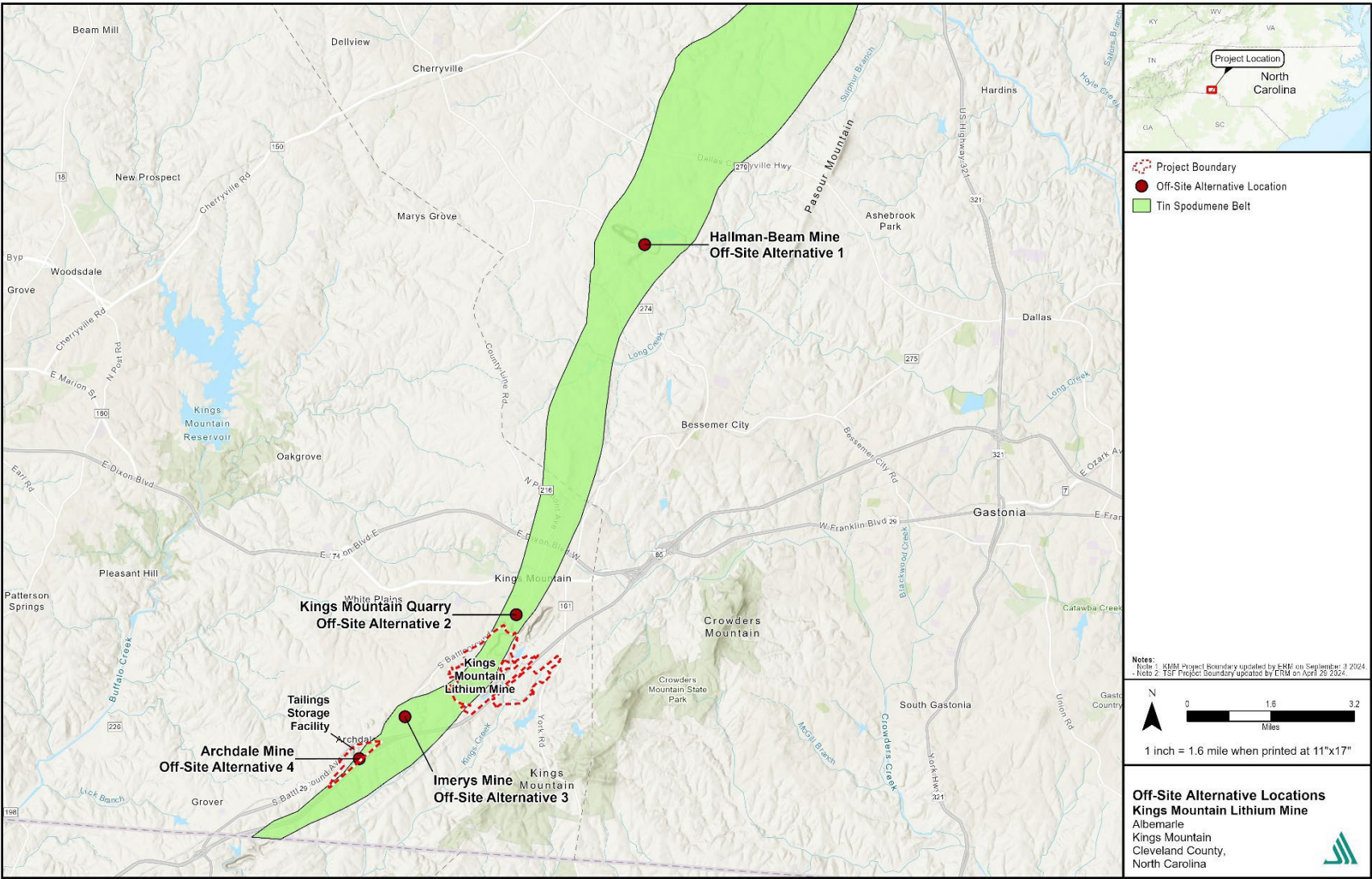


Table 5 Offsite Alternative 3 Summary

Screening Criteria	Criteria Satisfied	Explanation
Location (A)	No	The alternative does not satisfy the screening criteria. Although it is located within the TSB, there is no evidence that spodumene exists in the mining parcel.
Mining technology (B)	Yes	This alternative satisfies the screening criteria as it is currently an active open-pit mine; however, the infrastructure would require retrofitting for processing spodumene.
Historical Active Mine Sites (C)	Yes	This alternative satisfies the screening criteria as the site contains previous hardrock mining operations.
Minimum mine size (D)	Yes	This alternative satisfies the screening criteria as the parent parcels are approximately 423 acres and identified Proposed Project area parcels are approximately 250 acres, for a total mine size of 673 acres.
Property availability (E)	No	This alternative does not satisfy the screening criteria as the parent parcels are not available for purchase or lease.
Environmental impacts minimization (F)	Yes	Based on review of the NHD and NWI databases, both wetland and stream resources are within the parent and adjacent parcels. This alternative may satisfy the screening criteria assuming minimization of impacts and appropriate mitigation were provided. The quantity of impacts would be dependent upon the resource (spodumene) location, mine pit design, waste rock and tailings requirements, and infrastructure support.

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Offsite Alternative 4: Archdale Mine

The Archdale Mine is adjacent to the Imerys Mine and operates under the Imerys Mine permit (DEMLR Mine Permit No. 23-03). The parent parcel is approximately 643 acres within the TSB (Figure 8: Offsite Alternative Locations). Even though it is located within the TSB, there is no evidence that the site contains mineralized spodumene. Additional parcels adjacent to this operation would need to be acquired for the area to be of sufficient size for operation of an open-pit mine. Small portions of the parent parcel are known to be for sale—an additional 298 acres, for a total mine size of 992 acres—and would need to be acquired from multiple landowners. Desktop review of NWI and NHD datasets indicates that aquatic resources occur on the site. Impacts to aquatic resources would be variable depending on parcel availability and mine plan, but impacts are assumed based on the NWI and NHD datasets. Table 6: Offsite Alternative 4 Summary details the analysis of this alternative against the screening criteria.

Table 6: Offsite Alternative 4 Summary

Screening Criteria	Criteria Satisfied	Explanation
Location (A)	No	The alternative does not satisfy the screening criteria. Although it is located within the TSB, there is no evidence that spodumene exists in the mining parcel.
Mining technology (B)	Yes	This alternative satisfies the screening criteria as it is currently an active open-pit mine; however, the infrastructure would require retrofitting for processing spodumene.
Historical Active Mine Sites (C)	Yes	This alternative satisfies the screening criteria as the site contains previous hardrock mining operations.
Minimum mine size (D)	Yes	This alternative satisfies the screening criteria as the parent parcels are approximately 643 acres and identified Proposed Project area parcels are 298 acres, for a total mine size of 992 acres.
Property availability (E)	No	This alternative does not satisfy the screening criteria as the parent parcels are not available for purchase or lease.
Environmental impacts minimization (F)	Yes	Based on review of the NHD and NWI databases, both wetland and stream resources are within the parent and adjacent parcels. This alternative may satisfy the screening criteria assuming minimization of impacts and appropriate mitigation were provided. The quantity of impacts would be dependent upon the resource (spodumene) location, mine pit design, waste rock and tailings requirements, and infrastructure support.

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2.0 Onsite Alternatives

Onsite Alternative 1: Kings Mountain Mine

This alternative would restart the legacy mine, maximizing the use of the property and keeping all operations and materials storage within the KMM. The additional land required to fulfill the purpose and need for the Proposed Project at the KMM location is approximately 240 acres. Attaining the 240 acres would be accomplished by either acquiring more properties and expanding the Proposed Project boundary, impacting more Waters of the United States (WOTUS) within the KMM, or a combination of both. Kings Creek would likely be the only WOTUS north of I-85 that would not be impacted. An additional 73 acres of adjacent land would be required to store the tailings onsite. If that land was not available to purchase, an additional approximately 107 acres offsite would need to be purchased to store the tailings. Since neither of those options were pursued, an updated site layout is not available to calculate the additional potential WOTUS impacts.

Onsite Alternative 2: Kings Mountain Mine and Archdale Tailings Storage Facility Site

Approximately 10,757,620 tons of tailings are anticipated to be generated during the permitted life of the mine. Approximately 10,000,000 tons of tailings are anticipated to be stored at the Archdale TSF site. The Archdale TSF site, as described above, was specifically purchased by

Albemarle to reduce the amount of material that would be discharged into WOTUS under Onsite Alternative 1. No jurisdictional WOTUS occur within the Archdale TSF site and acquiring the Archdale TSF site removes potential WOTUS impacts in the adjacent 73 acres of the Kings Mountain site (onsite Alternative 1) and other neighboring properties that might have WOTUS.

Onsite Alternative 3 (Final Design): Kings Mountain Mine, Archdale Tailings Storage Facility Site, and Partnership with Martin Marietta to Utilize the Aggregate Byproduct

To further reduce the amount of material that would be discharged into WOTUS, Albemarle has entered into an agreement with Martin Marietta to receive and sell aggregate byproducts of the mining operation that meet Martin Marietta's specifications. Approximately 42,000,000 tons of aggregate is anticipated to be delivered to Martin Marietta over the life of the permitted mine.

Without the Martin Marietta agreement, a 300-foot-tall pile of aggregate, covering approximately 110 acres, would need to be built withing the KMM site. By removing the need for aggregate to be stored at the KMM, Albemarle will be able to avoid impacting most of South Creek and associated headwaters and wetlands, as well as the South Creek Reservoir. Avoiding these impacts will largely be accomplished by separating RSF-A and RSF-X in the design, which was made possible by the reduction in onsite tailings.

Archdale Tailings Storage Facility

Archdale is one of the offsite alternatives for the mining site itself, which led to its acquisition for the TSF. Since there are no WOTUS at Archdale and space is limited, no onsite alternatives were developed.

Onsite No Action Alternative

Under the No Action Alternative, a hardrock lithium mine would not be constructed and lithium-grade lithium hydroxide made from lithium-bearing spodumene concentrates produced from hardrock mining would not be brought to the U.S. market from the Kings Mountain domestic source. Most lithium chemicals would continue to be imported from outside the U.S. to meet domestic demand. It can be assumed that there would be environmental impacts associated with mines located outside the U.S., especially in areas where environmental regulations may be less stringent, although the quantity of impacts is unknown.
