Notice

Weir International, Inc. (WEIR) was retained by Ramaco Resources, Inc. (Ramaco) to prepare this Technical Report Summary (TRS) related to Ramaco's Knox Creek Complex. This report provides a statement of Ramaco's coal reserves and resources at its Knox Creek Complex, and has been prepared in accordance with the United States Securities and Exchange Commission (SEC), Regulation S-K 1300 for Mining Property Disclosure (S-K 1300) and 17 Code of Federal Regulations (CFR) § 229.601(b)(96)(iii)(B) reporting requirements. This report was prepared for the sole use of Ramaco and its affiliates, and is effective as of December 31, 2022.

This report was prepared by full-time WEIR personnel who meet the SEC's definition of Qualified Persons (QPs) with sufficient experience in the relevant type of mineralization and deposit under consideration in this report.

In preparing this report, WEIR relied upon data, written reports and statements provided by Ramaco. WEIR has taken all appropriate steps, in its professional opinion, to ensure information provided by Ramaco is reasonable and reliable for use in this report.

The accuracy of reserve and resource estimates are, in part, a function of the quality and quantity of available data at the time this report was prepared. Estimates presented herein are considered reasonable. However, they should be accepted with the understanding that with additional data and analysis available subsequent to the date of this report, the estimates may necessitate revision which may be material. Certain information set forth in this report contains "forward-looking information", including production, productivity, operating costs, capital costs, sales prices, and other assumptions. These statements are not guarantees of future performance and undue reliance should not be placed on them. The assumptions used to develop the forward-looking information and the risks that could cause the actual results to differ materially are detailed in the body of this report.

WEIR and its personnel are not affiliates of Ramaco or any other entity with ownership, royalty or other interest in the subject property of this report.

Weir International, Inc. hereby consents to the use of Ramaco's Knox Creek Complex coal reserve and resource estimates as of December 31, 2022.

Qualified Person: /s/ Weir International, Inc.

Date: April 4, 2023

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APPENDIX A - EXHIBIT

1.0 EXECUTIVE SUMMARY

WEIR was retained by Ramaco Resources, Inc. (Ramaco) to prepare a Technical Report Summary (TRS) related to Ramaco's Knox Creek Complex coal holdings. This report has been prepared in accordance with the United States Securities and Exchange Commission (SEC), *Regulation S-K 1300 for Mining Property Disclosure* (S-K 1300) and 17 Code of Federal Regulations (CFR) § 229.601(b)(96)(iii)(B) reporting requirements.

1.1 PROPERTY DESCRIPTION

The Knox Creek Complex consists of two general properties or areas as shown below and in Figure 1.1-1, General Location Map:

- Big Creek Property
- Knox Creek Property

The Knox Creek Complex is located approximately 80 miles south of Charleston, West Virginia; 100 miles west of Roanoke, Virginia; 60 miles northeast of Kingsport, Tennessee; and 160 miles east/southeast of Lexington, Kentucky in the vicinity of 37.16 degrees North Latitude and 81.87 degrees West Longitude on the World Geodetic System (WGS 84) reference coordinate system. The complex includes areas in Buchanan, Russell and Tazewell Counties, Virginia and McDowell County, West Virginia. The Knox Creek Complex is within the Southwest Virginia and Southern West Virginia coal fields of the Central Appalachia Coal Producing (CAPP) Region of the United States.

The Knox Creek Complex consists of approximately 74,400 acres of owned and leased coal holdings. Within the Knox Creek Complex controlled coal holdings, 9,250 acres lie in McDowell County, West Virginia. There are no active or planned West Virginia mines currently within the Knox Creek Complex. The remaining 65,150 acres lie in Buchanan, Tazewell, and Russell Counties, Virginia. Currently, there are two active mines and two planned and permitted mines within the complex.

Active Mines:

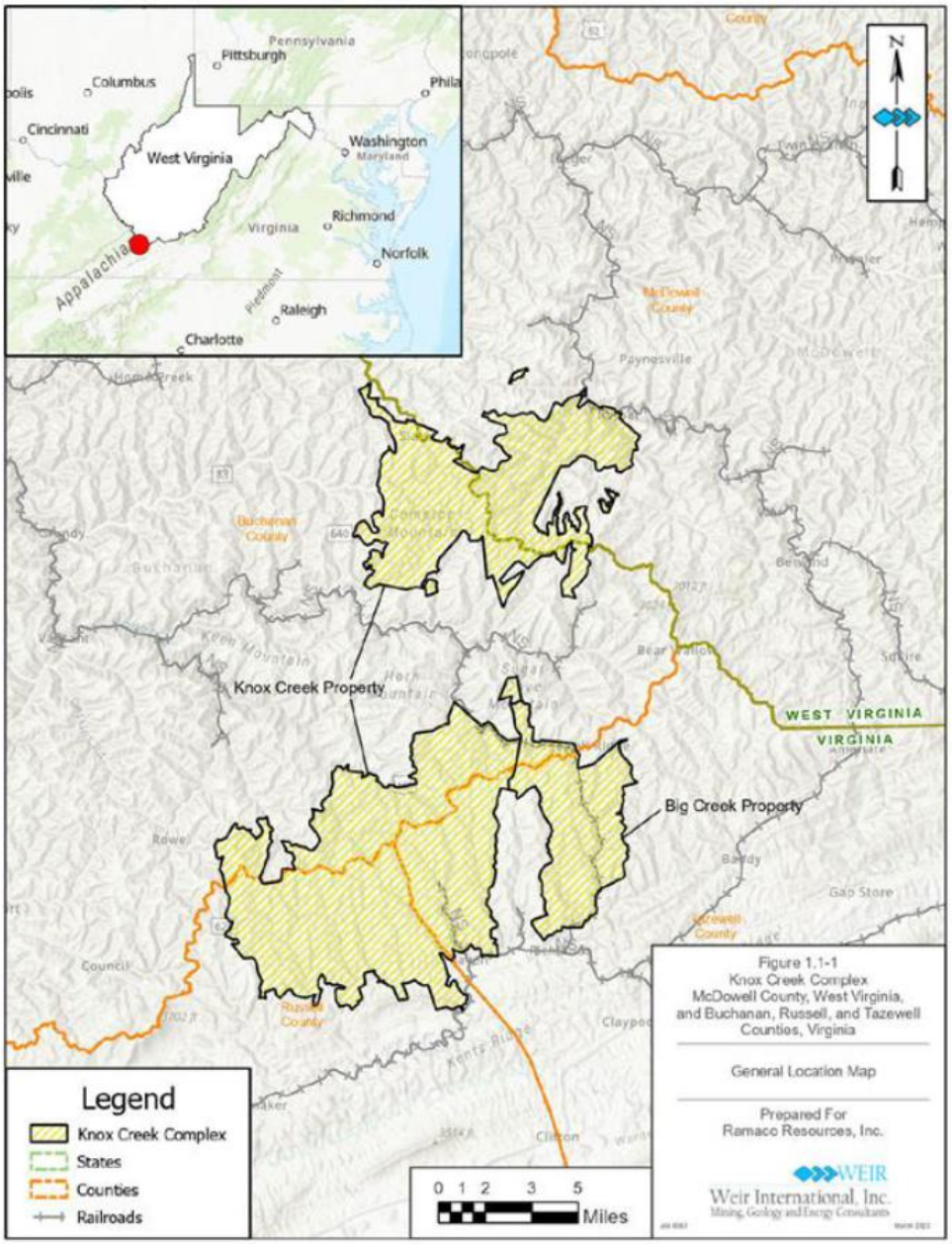
- Big Creek Jawbone No. 1 Deep Mine
- Big Creek Surface and Highwall Mine

Planned and Permitted Mines:

- Knox Creek Tiller Deep Mine
- Kennedy No. 3 Deep Mine

The Knox Creek Tiller Deep Mine has been idle since 2019. The mine was originally planned to re-start in 2023, however, restarting mining operations has been further delayed into 2024. The Knox Creek Kennedy No. 3 Deep Mine was originally in the 2023 budget, but has also been delayed into 2025.

Figure 1.1-1 General Location Map



1.2 GEOLOGICAL SETTING AND MINERALIZATION

The upper coal seams of interest within the Knox Creek Complex belong to the Norton Formation in Virginia of Early Pennsylvanian Age, which is stratigraphically equivalent to the Lower Kanawha and New River formations in southwestern West Virginia. The lower coal seams of interest belong to the Pocahontas Formation of the Pottsville Group (Lower Pennsylvanian). The depositional setting for these seams is complex and thought to be upper delta plain, with subsidence controlling the sedimentation rate. The Lower Pennsylvania (Pottsville) sedimentary strata of the coal-bearing rocks of the Pocahontas Formation rest uncomformably on the Mississippian Bluestone Formation of the Mauch Chunk Group.

1.3 EXPLORATION

Drilling has served as the primary form of exploration within the Knox Creek Complex. In addition to coal-specific exploration drillholes, data from degasification, coal bed methane, and water wells were also implemented to build the geological model. This model was built using a total of 4,188 exploration drillholes and covers the Knox Creek Complex as well as Ramaco's nearby Berwind Complex. Approximately 2,288 of these drillholes can be allocated to the Knox Creek Complex.

In addition to exploration drillholes, coal seam outcrop measurements, in-mine measurements, and survey points taken from mine maps of previous operations were considered. A total of 194 seam outcrop measurements, 356 mine measurements, and 887 survey points were used in the geological model as a supplement to the exploration drillholes.

It is WEIR's opinion that the adequacy of sample preparation, security, and analytical procedures for holes that were drilled by Ramaco after acquiring the property are acceptable and that these procedures meet typical industry standards.

The adequacy of sample preparation, security, and analytical procedures are generally unknown for holes that were drilled prior to Ramaco acquiring the initial leases in 2011. However, the geologist's logs for these holes contain sampling descriptions and lithologic descriptions that are sufficiently detailed to ascertain that an experienced geologist supervised the drilling and sampling. It is unknown if all coal quality analyses were performed to ASTM standards by qualified laboratories, as detailed in Section 8.0, however,

this legacy drillhole information was included as the samples matched the coal seam intervals and reported quality data that was consistent between the different data sources. Model verifications further support WEIR's high level of confidence that a representative, valid, and accurate drillhole database and geological model have been generated for the Knox Creek Complex that can be relied upon to accurately estimate coal resources and reserves.

1.4 DEVELOPMENT AND OPERATIONS

The Knox Creek Complex currently has two active mines, and two planned and permitted mines. The two active mines include one surface mine with a highwall miner, and one underground room and pillar mine, which uses continuous miners (CMs) for coal production. Ramaco began production of metallurgical coal at the complex in 2019. The underground mines will implement retreat mining, which typically results in mining recovery of 50 to 80 percent. At the surface mine, contour mining has an average mining recovery of approximately 90 percent, and highwall mining has an average mining recovery of approximately 40 percent.

The Knox Creek Complex is currently mining two seams. Big Creek Jawbone No. 1 Deep Mine is mining the Jawbone 1 seam. The Big Creek Surface and Highwall Mine is mining the Tiller Seam, with some small tonnage of Jawbone 3 Seam being available as well.

Historical coal production from the Knox Creek Complex, in accordance with the Mine Safety and Health Administration (MSHA) statistics, is summarized in Table 1.4-1 as follows:

Table 1.4-1 Knox Creek Complex Historical Production

Year	Clean Tons Produced (000)
2018	-
2019	1,479
2020	-
2021	45,332
2022	234,710

The current Knox Creek Complex Life-of-Mine (LOM) Plan projects mining through 2037, an expected mine life for the complex of 15 years. It is anticipated that future mines will be planned and scheduled, as necessary, from resource areas within the complex, to meet internal Ramaco production goals aligned with market conditions. This statement is based on the large amount of coal resources that are within the complex.

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All Run-of-Mine (ROM) coal is washed at the Knox Creek Preparation Plant. The Knox Creek Preparation Plant, built in 1981 by Powell Construction Company located in Johnson City, Tennessee, is a well designed and constructed preparation plant, with ROM processing capacity of 750 tons per hour.

The Knox Creek Complex produces high quality, mid and high volatile metallurgical coal. Historically, the market for metallurgical coal from the Knox Creek Complex has included both domestic metallurgical coal consumers and the global seaborne metallurgical coal market. The Knox Creek Complex also sporadically produces a minimal quantity of thermal coal from the surface mine from oxidized zones.

1.5 MINERAL RESERVE AND RESOURCE ESTIMATE

The Knox Creek Complex coal resources, as of December 31, 2022, are reported as in-place resources and are exclusive of reported coal reserve tons. Resources are reported in categories of Measured, Indicated and Inferred tonnage, in accordance with Regulation S-K Item 1302(d), summarized in Table 1.5-1 as follows:

Table 1.5-1 In-Place Coal Resource Tonnage and Quality Estimate, as of December 31, 2022

							Coal Quality (Dry Basis) Raw	
			In-Place Resources (000 Tons)					
Mine Area / Seam	Area (Acres)	Average Coal Thickness (Feet)	Measured	Indicated	Total	Inferred	Ash (%)	Relative Density (Lbs/CF)
Big Creek								
Red Ash 3	1,275	2.04	5,025	—	5,025	—	17.0	88.61
Red Ash 2	1,420	2.75	7,495	—	7,495	—	4.5	87.98
Jawbone 3	1,400	2.27	6,445	—	6,445	—	24.0	92.98
Jawbone 1	2,210	2.99	13,536	—	13,536	—	12.2	94.38
Tiller 1-2	495	2.67	2,520	—	2,520	—	21.7	87.36
	6,800	2.59	35,021		35,021		14.1	91.42
Knox Creek								
Upper Banner 2	450	2.27	2,060	—	2,060	—	17.0	88.61
Kennedy 2	1,765	2.72	8,780	—	8,780	—	13.2	86.28
Red Ash 2	12,485	2.65	59,450	35	59,485	—	4.7	82.41
Jawbone 3	8,420	3.13	50,260	—	50,260	—	15.1	87.43
Jawbone 1	15,025	3.21	93,500	150	93,650	—	13.6	89.46
Upper Seaboard 2	450	2.72	2,340	—	2,340	—	17.0	88.61
Greasy Creek 2	290	4.29	2,640	—	2,640	—	43.0	97.93

Lower Seaboard 2	760	2.75	4,470	—	4,470	—	30.9	98.19
Pocahontas 11	770	4.72	7,010	—	7,010	—	17.0	88.61
Lower Horsepen 1	1,425	2.89	7,965	—	7,965	—	17.0	88.61
Pocahontas 9-2	2,030	2.8	8,240	2,750	10,990	—	17.0	88.61
Pocahontas 4	1,605	2.97	8,300	3,830	12,130	—	26.6	94.90
Pocahontas 3	710	2.77	3,780	—	3,780	—	17.0	88.61
	46,185	2.99	258,795	6,765	265,560		13.5	87.76
Knox Creek Complex - Total	52,985	2.94	293,816	6,765	300,581		13.6	88.23

Notes:

- Mineral Resources reported above are not Mineral Reserves and do not meet the threshold for reserve modifying factors, such as estimated economic viability, that would allow for conversion to mineral reserves. There is no certainty that any part of the Mineral Resources estimated will be converted into Mineral Reserves. Mineral Resources reported here are exclusive of Mineral Reserves.
- Resource economic mineability based on underground minable resources with 2.0 feet minimum seam thickness, surface and highwall mines with 1.0 feet minimum seam thickness, surface and contour mining with a cutoff stripping ratio of 20:1, producing primarily metallurgical mid and high volatile coal product realizing an average sales price of $183.50 per ton at a cash cost of $98.68 per clean ton (FOB Mine)
- Numbers in the table have been rounded to reflect the accuracy of the estimate and may not sum due to rounding

The conversion of resources to reserves at the Knox Creek Complex considers the design of a mine plan accommodating the planned mining equipment and executed in accordance with the MSHA rules and regulations, projected dilution and loss of product coal quality, projected coal sales prices, operating costs, and mineral control to determine if the saleable coal product will be economically mineable.

The coal reserves representing the economically viable tonnage controlled by Ramaco, and estimated in accordance with Regulation S-K Item 1302(e), is summarized in Table 1.5-2 as follows:

Table 1.5-2 Recoverable Coal Reserve Tonnage and Quality Estimate, as of December 31, 2022

							Coal Quality (Dry Basis) Raw	
				Clean Recoverable Tons (000) Reserves				
Area / Mine / Seam	Product Quality	Area (Acres)	Average Coal Thickness (Feet)	Proven	Probable	Total	Ash (%)	Relative Density (Lbs/CF)
Knox Creek								
Kennedy No. 3 Deep Mine								
Kennedy 2	Hi Vol	336	3.23	720	—	720	13.60	86.48
Knox Creek Tiller Deep Mine								
Jawbone 3	Hi Vol	1,546	3.44	6,362	—	6,362	16.10	88.05
		1,882	3.40	7,082		7,082	15.85	87.89
Big Creek								
Surface and Highwall Mine								
Jawbone 1	Mid Vol	20	1.27	30	—	30	18.4	89.50
Tiller 2-2 and 1-2	Mid Vol	175	2.61	318	—	318	19.1	89.75
Jawbone Deep Mine								
Jawbone 1	Mid Vol	383	3.40	586	—	586	30.6	97.38
		578	3.09	934		934	26.3	94.53
Knox Creek Complex Grand Total		2,460	3.33	8,016		8,016	17.06	88.66

Notes:

- Clean recoverable reserve tonnage based on underground mining recovery of 50 to 80 percent (contingent upon retreat mining capability), 90 percent for surface mining, 40 percent for highwall mining, theoretical preparation plant yield, and a 95 percent preparation plant efficiency
- Mineral Reserves estimated based on predominately mid and high volatile metallurgical coal product at an average sales price of $183.50 per ton and cash cost of $98.68 per clean ton (FOB Mine)
- Numbers in the table have been rounded to reflect the accuracy of the estimate and may not sum due to rounding
- Mineral Reserves are reported exclusive of Mineral Resources

1.6 ECONOMIC EVALUATION

WEIR prepared a Preliminary Feasibility Study financial model in order to assess the economic viability of the Knox Creek Complex LOM Plan. Specifically, plans were evaluated using discounted cash flow analysis, incorporating annual revenue projections for the Knox Creek LOM Plan. Cash outflows such as capital, including preproduction costs, sustaining capital, operating costs, transportation costs, royalties, and taxes are subtracted from cash inflows, resulting in annual cash flow projections. No adjustments are made for inflation and all cash flows are in 2022 United States dollars. WEIR's study was conducted on an un-levered basis, excluding costs associated with any debt servicing requirements. In its assessment of the Discounted Cash Flow Net Present Value (DCF-NPV), WEIR utilized a discount rate of 10 percent.

The Preliminary Feasibility Study financial model developed for use in this TRS was meant to evaluate the prospects of economic extraction of coal within the Knox Creek Complex resource area. This economic evaluation is not meant to represent a project valuation. Furthermore, optimization of the LOM Plan was outside of the scope of this engagement.

The results of WEIR's Preliminary Feasibility Study demonstrated an after-tax DCF-NPV of $249.0 million for the Knox Creek Complex LOM Plan. Key operational statistics for the LOM Plan, on an after-tax basis, are summarized in Table 1.6-1 as follows:

Table 1.6-1 Key Operating Statistics

	LOM Plan
ROM Tons Produced (000s)	17,451
Clean Tons Produced (000s)	8,016
Preparation Plant Yield (%)	45.9
Tons Sold (000s)	8,016
	($ Per Ton)
Coal Sales Realization	183.50
Direct Cash Costs	98.68
Non-cash Costs	8.08
Total Cost of Sales	106.76
Profit / (Loss)	76.74
EBITDA	84.82
CAPEX	12.20

A sensitivity analysis was undertaken to examine the influence of changes to coal sales prices, production, operating cost, capital expenditures, and the discount rate on the base case after-tax NPV. The sensitivity analysis range (+/- 25 percent) was designed to capture the bounds of reasonable variability for each element analyzed.

The Knox Creek Complex NPV is most sensitive to changes in coal sales prices and operating costs. It is less sensitive to changes in production and least sensitive to changes in discount rate and capital expenditures.

1.7 ENVIRONMENTAL STUDIES AND PERMITTING REQUIREMENTS

As part of the permitting process required by the Virginia Department of Energy (VDE) and West Virginia Department of Environmental Protection (WVDEP), numerous baseline studies or impact assessments were undertaken by Ramaco. These baseline studies or impact assessments included in the permit are summarized as follows, with pertinent text from the permit replicated below:

- Groundwater Inventory and Baseline Quality
- Surface Water Baseline Quality and Quantity
- Surface Water Runoff Analysis
- Probable Hydrologic Consequences

Based on water samples from adjacent mining and the baseline surface water sampling, acid or toxic mine drainage is not expected or anticipated. All of the Ramaco existing and proposed mines are well above any significantly producing aquifers. Probable Hydrologic Consequence (PHC) studies showed no significant ground or surface water resource is likely to be contaminated, diminished, or interrupted, providing that the approved drainage control and revegetation plans are adhered to throughout existing and planned mining activities.

Coal mines in West Virginia are required to file applications for and receive approval of mining permits issued by the WVDEP to conduct surface disturbance and mining activities. Similar filings are required in Virginia through the VDE. The Knox Creek Complex has been issued mining permits and associated NPDES permits by the WVDEP and the VDE as shown in Table 1.7.-1 as follows:

Table 1.7-1 Knox Creek Complex Mining and NPDES Permits

Property Description	State Permit Number	State	Permitted Surface Area (Acres)	Issue Date	Current Status	NPDES Permit No.
Big Creek Surface Mine	1102335	VA	447.63	1/22/2020	Active	0082335
Big Creek Jawbone 1 Deep Mine	1402231	VA	42.61	5/22/2017	Active	0082231

Knox Creek Tiller No. 1 Deep Mine	1202204	VA	20.57	2/15/2017	TmpIdle	0082204
Kennedy No. 3 Surface Mine	1402215	VA	106.18	4/3/2017	NonProdActive	0082215
Kennedy No. 3 Deep Mine	1702202	VA	75.95	2/14/2017	Idle	0082202
Knox Creek Preparation Plant	1302184	VA	41.94	12/2/2017	Active	0082184
Knox Creek Refuse Disposal Area	1302232	VA	322.71	11/23/2018	Active	0082232
Mudlick Surface Mine	1102334	VA	26.25	7/7/2020	Idle	0082234
Total			1,083.84			

As of December 31, 2022, Ramaco estimated a reclamation liability of $9.2 million for its disturbed permit acreage, which is covered with a total bond amount of $12.2 million.

Ramaco currently employs approximately 107 personnel at the Knox Creek Complex and is projected to have maximum employment of 275 personnel through its Knox Creek Complex LOM Plan. The Knox Creek Complex also creates substantial economic value with its third-party service and supply providers, utilities, and through payment of taxes and fees to local, state and federal governments.

Ramaco's environmental citations issued by the WVDEP and VDE are typical of similar citations issued to other operators in southern West Virginia and Southwestern Virginia. Most of these violations or citations were quickly abated and none were significant in nature.

Based on WEIR's review of Ramaco's plans for environmental compliance, permit compliance and conditions, and dealings with local individuals and groups, Ramaco's efforts are adequate and reasonable in order to obtain necessary approvals relative to its mine plans.

1.8 CONCLUSIONS AND RECOMMENDATIONS

Ramaco has a long operating history of resource exploration, mine development, and mining operations at the Knox Creek Complex, with extensive exploration data including drillholes, in-mine seam thickness and elevation measurements, and in-mine channel samples supporting the determination of mineral resource and reserve estimates, and economic viability. The data has been reviewed and analyzed by WEIR and determined to be adequate in quantity and reliability to support the coal resource and coal reserve estimates in this TRS.

Ramaco has successfully obtained mineral control for approximately 98 percent of all existing and planned mines included in the Knox Creek Complex LOM plan. There are no uncontrolled areas that materially affect any of the LOM plans.

The coal resource and coal reserve estimates and supporting Preliminary Feasibility Study were prepared in accordance with Regulation S-K 1300 requirements. There are 300.6 million in-place tons of measured and indicated coal resources, exclusive of reserves, and 8.0 million clean recoverable tons of underground mineable reserves within the Knox Creek Complex, as of December 31, 2022. Reasonable prospects for economic extraction were established through the development of a Preliminary Feasibility Study relative to the Knox Creek Complex LOM Plan, considering historical mining performance, historical and projected metallurgical coal sales prices, historical and projected mine operating costs, and recognizing reasonable and sufficient capital expenditures.

The ability of Ramaco, or any coal company, to achieve production and financial projections is dependent on numerous factors. These factors primarily include site-specific geological conditions, the capabilities of management and mine personnel, level of success in acquiring reserves and surface properties, coal sales prices and market conditions, environmental issues, securing permits and bonds, and developing and operating mines in a safe and efficient manner. Unforeseen changes in legislation and new industry developments could substantially alter the performance of any mining company.

Coal mining is carried out in an environment where not all events are predictable. While an effective management team can identify known risks and take measures to manage and/or mitigate these risks, there is still the possibility of unexpected and unpredictable events occurring. It is not possible therefore to totally remove all risks or state with certainty that an event that may have a material impact on the operation of a coal mine will not occur.

WEIR assessed that the risks associated with the economic mineability of the Knox Creek Complex were low to moderate and adds that the majority of the risks can be kept low and/or mitigated with efficient and effective mine planning and mine engineering and monitoring of the mining operations.

WEIR recommends that any future exploration work and mineral property acquisition should include what has been historically implemented related to the following:

- Have an experienced geologist log core holes, measure core recovery, and complete sampling. Geophysically log core holes to verify seam and coal thickness and core recovery.
- Geophysically log rotary holes to verify strata and coal thickness.
- Continue to prepare laboratory sample analysis at 1.40 and 1.50 specific gravities to better match the preparation plant specific gravity.
- Continue collecting in mine channel samples.

2.0 INTRODUCTION

2.1 REGISTRANT

WEIR was retained by Ramaco (Nasdaq: METC) to prepare a TRS related to Ramaco's Knox Creek Complex coal holdings.

The Knox Creek Complex is located north of the town of Richlands, Virginia 80 miles south of Charleston, West Virginia; 100 miles west of Roanoke, Virginia; 60 miles northeast of Kingsport, Tennessee; and 160 miles east/southeast of Lexington, Kentucky. The Knox Creek Complex is located in McDowell County, West Virginia, and Buchanan, Russell, and Tazewell Counties, Virginia (see Figure 1.1-1).

2.2 TERMS OF REFERENCE AND PURPOSE

This TRS was prepared specifically for Ramaco's Knox Creek Complex. The reserves and resources at the Knox Creek Complex have been classified in accordance with SEC mining property disclosure rules under Subpart 1300 and Item 601 (96)(B)(iii) of Regulation S-K. Unless otherwise stated, all volumes, qualities, distances, and currencies are expressed in United States customary units.

The accuracy of reserve and resource estimates are, in part, a function of the quality and quantity of available data at the time this report was prepared. Estimates presented herein are considered reasonable, however, estimates should be accepted with the understanding that with additional data and analysis subsequent to the date of this report, the estimates may necessitate revision which may be material. Certain information set forth in this report contains "forward-looking information", including production, productivity, operating costs, capital expenditures, coal sales prices, and other assumptions. These statements are not guarantees of future performance and undue reliance should not be placed on these statements. The assumptions used to develop the forward-looking information and the risks that could cause the actual results to differ materially are detailed in the body of this report.

For the Knox Creek Complex, this TRS reports both mineral reserves and resources (exclusive of reserves). Supporting the assessment of the economic mineability of reported reserves and prospects of economically feasible extraction of reported resources, this report includes summary detail of a Preliminary Feasibility Study conducted relative to the Knox Creek Complex.

WEIR's evaluation of coal reserves and resources was conducted in accordance with Regulation S-K 1300 definitions for Mineral Resource, Mineral Reserve and Preliminary Feasibility Study as follows:

- *Mineral Resource* is a concentration or occurrence of material of economic interest in or on the earth's crust in such form, grade or quality, and quantity that there are reasonable prospects for economic extraction. A mineral resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed and justifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralization drilled or sampled.
- *Mineral Reserve* is an estimate of tonnage and grade or quality of indicated and measured mineral resources that, in the opinion of the Qualified Person, can be the basis of an economically viable project. More specifically, it is the economically mineable part of a measured or indicated mineral resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted.
- *Preliminary Feasibility Study* is a comprehensive study of a range of options for the technical and economic viability of a mineral project that has advanced to a stage where a Qualified Person has determined (in the case of underground mining) a preferred mining method, or (in the case of surface mining) a pit configuration, and in all cases has determined an effective method of mineral processing and an effective plan to sell the product.

2.3 SOURCES OF INFORMATION AND DATA

The primary information used in this study was obtained from the following sources:

- Geological data that was exclusively provided by Ramaco geology and engineering personnel. The geological data includes drillhole information such as driller's logs, geologist's logs, both full and partial scans of geophysical logs, survey data, coal quality laboratory certificates, and MS Excel™ (Excel) versions of drillhole survey, lithology and quality data. Additionally, WEIR was provided with in-mine seam measurement thicknesses, mine channel samples, and other base geological data.

- Mineral and surface ownership maps, and supplemental files were provided exclusively by Ramaco.
- Site visits by WEIR Qualified Persons (QPs) on November 30, 2021.
- Interviews between WEIR personnel and Ramaco personnel including:
  - Senior V.P., General Counsel and Secretary
  - Director of Financial Reporting and Accounting
  - Chief Operating Officer
  - Contract Geologist

- V.P. of Safety
- V.P. of Surface Mining Operations
- V.P. of Underground Mining Operations
- Mine Managers

- Historical production, productivity, staffing levels, operating costs, capital expenditures, and coal sales revenue provided by Ramaco.
- LOM projections and cost models provided by Ramaco.
- Coal processing and handling facilities plot plans and flow sheets provided by Ramaco.
- Health, safety, and environmental issues discussed during interviews between WEIR personnel and Ramaco personnel.
- Current mine permit information, in addition to recent permit revisions and renewals, from documents provided by Ramaco and data that is publicly available from the WVDEP and VDE.
- Current and projected mine plans, including production, productivity, operating costs, and capital expenditures required to sustain projected levels of production for the Knox Creek Complex provided by Ramaco, and all data was reviewed for reasonableness by WEIR.
- Market outlook and coal sales price projections provided by Ramaco.
- Projected reclamation costs for mine closure activities provided by Ramaco.

A detailed list of all data received and reviewed for this study is provided in Sections 24.0 and 25.0 of this TRS.

2.4 DETAILS OF THE PERSONAL INSPECTION OF THE PROPERTY

WEIR personnel visited the Knox Creek Complex on November 30, 2021 and conducted a secondary meeting with management at the Berwind No. 1 Deep Mine Office on January 27, 2023. While on-site, WEIR personnel conducted interviews with company and mine management relative to the following key topics:

- Geology
- Property
- Infrastructure
- Mine Plan, Production and Productivity
- Preparation Plant and Coal Handling Facilities
- Operating Costs and Capital Expenditures
- Marketing
- Environmental and Compliance
- Risks and Uncertainties

Key areas inspected by WEIR personnel at the Knox Creek Complex included the following:

- Mine surface operations including office, maintenance, and warehouse facilities
- Knox Creek Preparation Plant, stockpiles, and rail loadout facilities
- Mine operations
  - Big Creek Surface and Highwall Mine
- Knox Creek Refuse Disposal Facilities

Based on WEIR's inspection of the Knox Creek Complex, the mines, preparation plant, and associated infrastructure facilities and equipment are well maintained and operated with regard for all state and federal rules and regulations related to mine safety and health standards.

2.5 PREVIOUS TRS

This TRS is the initial TRS to be filed related to the Knox Creek Complex. The Knox Creek mines and facilities were previously included in the Berwind Complex TRS which reported mineral reserves and resources as of December 31, 2021. Ramaco has decided to separate the Knox Creek Complex from the Berwind Complex as the operations within the Berwind Complex no longer use the Knox Creek Preparation Plant facilities as a result of Ramaco's late 2021 acquisition of the Amonate property which includes its own preparation plant which now services the Berwind Complex. Ramaco decided that the large tonnage of resources available at the Knox Creek Complex, along with the Knox Creek Preparation Plant and refuse disposal establish this complex as an independent material property.

3.0 PROPERTY DESCRIPTION

3.1 PROPERTY LOCATION

The Knox Creek Complex consists of two separate properties as follows:

- Knox Creek Property
- Big Creek Property

The town of Richlands, Virginia is located approximately just south of the Knox Creek Complex. The Knox Creek Complex is generally located approximately 80 miles south of Charleston, West Virginia; 100 miles west of Roanoke, Virginia; 60 miles northeast of Kingsport, Tennessee; and 160 miles east/southeast of Lexington, Kentucky at 337.16 degrees North Latitude and 81.87 degrees West Longitude on the WGS 84 reference coordinate system. The comprised properties are fairly remote containing scattered rural residences and some small towns.

The Knox Creek Complex is within the Southern West Virginia and Southwest Virginia Coal Fields of the CAPP Region of the United States (see Figure 1.1-1). The USGS 7.5-minute quadrangle map sheets are Patterson, Keen Mountain, Honaker, Bradshaw, Jewell Ridge, Richlands, and Amonate.

3.2 PROPERTY AREA

Details of each Knox Creek Complex property are as follows:

Knox Creek Property

The Knox Creek Property covers approximately 56,600 acres of owned and leased coal holdings in McDowell County, West Virginia, and Buchanan, Tazewell, and Russell Counties, Virginia. The areas are shown in Figure 1.1-1. The original Knox Creek Property was obtained by Ramaco in 2016. Ramaco started mining coal on the property in 2019. The Knox Creek Jewell Property was acquired subsequently. The Knox Creek Jewell Property does not currently contain active or planned mines. However, it does have material coal resources.

The Knox Creek Property includes the Knox Creek Preparation Plant, which currently processes coal from both the Knox Creek and Big Creek Properties. The Jamison Creek Refuse Disposal Area, which services the Knox Creek Preparation Plant, is located on the property adjacent to and just northeast of the plant. The property also includes the currently idle Knox Creek Tiller Deep Mine which is currently in the Jawbone 3 Seam. The Knox Creek Tiller Deep Mine is planned to restart at a yet to be determined date.

Ramaco owns approximately 976 acres (1.7 percent) of mineral rights on the overall Knox Creek Property. All other mineral rights are leased. Ramaco also owns surface rights to 1,026 acres on the property, which includes the Knox Creek Preparation Plant. Ramaco holds surface leases to approximately 21,994 acres (39 percent of total at the Knox Creek Property), which includes the Jamison Creek Refuse Disposal Area that is adjacent to, and northeast of, the Knox Creek Preparation Plant.

Ramaco's Knox Creek Property coal holdings covers a very large area that has large amounts resources in many different seams (see Section 11). However, current mine plans and permits on the property are currently limited to the Knox Creek Tiller Deep Mine and the Kennedy No. 3 Deep Mine.

Big Creek Property

The Big Creek Property covers an area of approximately 17,800 acres of leased coal holdings in Buchanan and Tazewell counties, Virginia. Ramaco obtained leases for the Big Creek Property in late 2019 and commenced surface mining activities in 2021.

The Big Creek Property includes Ramaco's Big Creek Surface and Highwall Mine which is a currently active multi-seam surface mine with associated highwall mining operations. The northern portion of the permit is a contour mining operation in the Tiller Seam with subsequent highwall mining. The southern portion of the permit involves surface area mining with the Tiller Seam as a base. Over the permit area, small amounts of the above Jawbone Seam that are mineable are also recovered. In the future, the Red Ash Seam may be contour and highwall mined on the far north side of the permitted area. The Red Ash Seam mining prospects are still being evaluated.

The Big Creek Property also includes the active Big Creek Jawbone 1 Deep Mine in the Jawbone No. 1 Seam just to the north of the current Big Creek Surface and Highwall Mine. The Big Creek Jawbone 1 Deep Mine started producing coal mid-2022.

3.3 PROPERTY CONTROL

The Big Creek Property consists of leases from White Wolf Energy and Omega Highwall Mining LLC that were secured in late 2019. The Knox Creek Property is primarily comprised of numerous deeds and leases from both private individuals and other business entities.

Over the Knox Creek Complex extents, leases typically apply to specific seams, or a vertical range of seams. Therefore, the seams involved often vary from lease to lease for specific areas across the complex. Table 3.3-1 below shows the various property control contracts.

Table 3.3-1 Knox Creek Complex Property Control

Area	Document Type	Quantity
Big Creek	Coal Leases	2
Knox Creek	Agreements	2
	Assignments	37
	Coal Leases/Coal Subleases	72
	Deeds	113
	Easements	11

Guarantees	1
License	1
Options	1

3.4 MINERAL CONTROL

The Knox Creek Complex mineral control is detailed in Table 3.4-1 below:

Table 3.4-1 Knox Creek Complex Mineral Control

Area	File Number	Document Type	Seams	Expiration Date [1]
Big Creek	25	Coal Lease		9/19/2026 Extensions of 5 years until all coal exhausted
	26	Coal Lease		02/28/2026 Extensions of 5 year until all coal exhausted
Knox Creek	1A	Coal Deed	Unknown	NA
	2	Deed of Lease	Jawbone	20 year term, extensions of 20 years until all coal exhausted
	3	Coal Lease		30 year term, extensions of 20 years until all coal exhausted
	4	Coal Lease	Raven, Tiller and Lower Seaboard	2 year term, extensions of 50 years until all coal exhausted
	5 through 64	Coal Deeds	Unknown	NA
	65	Coal Lease	Tiller and Above	1 year terms until all coal exhausted
	66	Coal Lease	Tiller and Above	1 year terms until all coal exhausted
	67	Coal Lease	Tiller and Above	1 year terms until all coal exhausted
	68	Coal Lease	Tiller and Above	1 year terms until all coal exhausted
	69	Coal Lease	Tiller and Above	10 year terms until all coal exhausted
	70	Coal Lease	Tiller and Above	10 year terms until all coal exhausted
	72	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	73	Coal Lease	Red Ash	1 year terms until all coal exhausted
	74	Coal Lease	Jawbone, Red Ash and Kennedy	4 year terms until all coal exhausted
	75	Coal Lease	Tiller and Above	1 year terms until all coal exhausted
	76	Coal Lease	Kennedy and Above	1 year terms until all coal exhausted
	79	Coal Lease	Tiller and Above	10 year terms until all coal exhausted
	80	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	81	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	82	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	83	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	84	Coal Lease	Tiller and Above	5 year terms shall not exceed 20 years
	85	Coal Lease	Tiller and Above	5 year terms shall not exceed 20 years
	86	Coal Lease	Tiller and Above	5 year terms shall not exceed 20 years
	87	Coal Lease	Tiller and Above	5 year terms shall not exceed 20 years
	88	Coal Lease	Tiller and Above	5 year terms shall not exceed 20 years
	89	Coal Lease	Tiller and Above	5 year terms shall not exceed 20 years
	90	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	91	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	92	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	93	Coal Deed	Unknown	NA
	94	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	95	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	96	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	97	Coal Lease	Tiller and Above	5 year terms until all coal exhausted
	99	Coal Lease	Jawbone and Tiller	5 year terms until all coal exhausted
	100	Coal Lease	Jawbone and Tiller	5 year terms until all coal exhausted
	101	Coal Lease	Jawbone and Tiller	5 year terms until all coal exhausted
	102	Coal Lease	Jawbone and Tiller	5 year terms until all coal exhausted
	103	Coal Lease	Jawbone and Tiller	5 year terms until all coal exhausted
	104	Coal Lease	Jawbone and Tiller	5 year terms until all coal exhausted
	105	Coal Lease	Jawbone and Tiller	1 year terms until all coal exhausted
	106	Coal Sublease	Jawbone and Tiller	20 year term
	109 through 117	Coal Lease	Right to surface mine	Until all surface mineable coal has been removed
	122	Coal Lease	All coal above drainage	5 year terms, up to 20 times
	124	Coal Lease	Tiller	5 year terms, up to 20 times
	127	Coal Sublease	Lower Spit of Banner	1 year terms until all coal exhausted
	128	Coal Sublease	Unknown	Terminates with 30 day notice from either party
	130	Coal Deed	Unknown	NA
	138	Coal Sublease	Kennedy	Until all mineable coal has been removed
	139	Coal Sublease	Banner	Until all mineable coal has been removed
	140	Coal Sublease	Kennedy	Until all mineable coal has been removed
	141	Coal Sublease	Upper and Lower Banner	Until all mineable coal has been removed
	143	Coal Deed	Unknown	NA
	164	Coal Sublease	Banner	Until all mineable coal has been removed
	178 through 225	Coal Deeds	Unknown	NA

3.5 SIGNIFICANT PROPERTY ENCUMBRANCES AND PERMIT STATUS

WEIR is not aware of any significant encumbrances for any of the tracts within the Knox Creek Complex.

A list of Ramaco's permits for the Knox Creek Complex and permit status is shown in Table 3.5-1, with a more detailed description of the permits discussed in Section 17.3.

Table 3.5-1 Permit Status

Property Description	State Permit Number	State	Permitted Surface Area (Acres)	Issue Date	Current Status	NPDES Permit No.
Big Creek Surface Mine	1102335	VA	447.63	1/22/2020	Active	0082335
Big Creek Jawbone 1 Deep Mine	1402231	VA	42.61	5/22/2017	Active	0082231
Knox Creek Tiller No. 1 Deep Mine	1202204	VA	20.57	2/15/2017	TmpIdle	0082204
Kennedy No. 3 Surface Mine	1402215	VA	106.18	4/3/2017	NonProdActive	0082215
Kennedy No. 3 Deep Mine	1702202	VA	75.95	2/14/2017	Idle	0082202
Knox Creek Preparation Plant	1302184	VA	41.94	12/2/2017	Active	0082184
Knox Creek Refuse Disposal Area	1302232	VA	322.71	11/23/2018	Active	0082232
Mudlick Surface Mine	1102334	VA	26.25	7/7/2020	Idle	0082234
Total			1,083.84			

3.6 SIGNIFICANT PROPERTY FACTORS AND RISKS

Given Ramaco's controlled interests at the Knox Creek Complex, which relate to property that is mostly held by others and leased to Ramaco, WEIR assesses that there are no significant issues affecting access to the coal interests or Ramaco's ability to execute its mine plans.

WEIR did not conduct an independent verification of property control, nor has it independently surveyed the mining locations. Rather, WEIR has relied on information compiled from maps and summaries of the leased properties prepared by Ramaco. WEIR did not conduct a legal title investigation relative to Ramaco's mineral and surface rights.

3.7 ROYALTY INTEREST

Ramaco, within the Knox Creek Complex, holds no material royalty or similar interest in property which is owned or operated by another party.

4.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

4.1 TOPOGRAPHY, ELEVATION, AND VEGETATION

The Knox Creek Complex is in the southwestern part of the Appalachian Plateau Province directly north and adjacent to the Valley and Ridge Province. It is in the Cumberland Mountain zone of the Appalachian Plateau. The terrain is mountainous, steep, and rugged with elevations ranging from approximately 1,120 feet above Mean Sea Level (MSL) along the valley bottoms to over 4,040 feet above MSL along the ridges, averaging 2,230 feet. The landscapes are well-dissected with dendritic drainage systems. There are no major rivers in the area, however, there are numerous small creeks throughout the complex. The Dry Fork, Jacobs Fork, Indian Creek, and War Creek rivers, all tributaries of the Tug Fork River of the Ohio River watershed, traverse the complex. Topography and other features of the area are shown on Figure 7.5-1.

The Knox Creek Complex consists mostly of unmanaged forestland and scattered pastureland. The forestland consists of typical trees for this area of the Appalachians, with Oak/Hickory as the dominant forest-type group and a lesser percentage of the Maple/Beech/Birch forest-type group.

The wildlife indigenous to the area is typical of the species and diversities associated with the geographical and climatic areas within which the proposed surface mine site is located. Reconnaissance of the area affected by the proposed mining determined that the following species are or have been present: Whitetail Deer, Fox Squirrels, Gray Squirrels, Ground Squirrels, Eastern Opossums, Raccoon, Rabbits, Eastern Black Bear, Wild Turkey, and numerous species of birds. On the basis of numerous reconnaissance surveys, no endangered or threatened species of plants or animals, or habitats of such species were found to exist within or adjacent to the mine permit areas.

4.2 PROPERTY ACCESS

The primary access road to the properties is US Route 460, a four-lane highway, located south of the Knox Creek and Big Creek properties. From US Route 460, Virginia Route 637 and connecting West Virginia Routes 9 and 11 can be used to access the Knox Creek Property to the north.

The NS Railroad provides rail service in the area extending north from Raven, Virginia northward to the Knox Creek Preparation Plant (see Figure 1.1-1).

The nearest airport is the Tri-Cities Airport (TRI), which is located in Bristol, Tennessee. The Tri-Cities Airport is approximately 90 miles from Berwind, West Virginia and the Yeager International Airport (CRW) in Charleston, West Virginia, 120 miles from Berwind, West Virginia.

The surrounding waterways are not navigable for commercial traffic. The closest barge docking area is approximately 70 miles to the north on the Kanawha River, south of Charleston, West Virginia.

4.3 CLIMATE AND OPERATING SEASON

The climate associated with the Knox Creek Complex is classified as humid continental, characterized by hot, humid summers and moderately cold winters. Climate conditions vary greatly in the state of West Virginia due to influence of the rugged topography. Average high temperatures range from 82 to 87 degrees Fahrenheit in the summer, with average low temperatures ranging from 20 to 25 degrees Fahrenheit in winter. Average yearly rainfall measured in nearby Logan, West Virginia is approximately 47 inches per year, with approximately 1.6 inches occurring as snowfall. The mines on the Knox Creek Complex currently operate year-round, regardless of weather conditions.

4.4 INFRASTRUCTURE

Power

Electrical power for the Knox Creek Preparation Plant and mines on the Knox Creek Complex is provided by American Electric Power (AEP). AEP's average industrial price is approximately 10 cents per kWh, which is slightly higher than the U.S. national average industrial price of 8.63 cents per kWh (EIA.gov statistics, December 2022).

Water

Water for mining and coal processing operations is provided by a combination of extraction from abandoned underground mine pools and from settling ponds located on the surface.

Individual mine sites use purchased potable water. Potable water at the preparation plant is supplied by a local municipality water connection.

Personnel

The area surrounding the Knox Creek Complex has a long history of coal mining and attracting mining personnel with qualified skills has not been an issue for Ramaco thus far. The Knox Creek Complex is projected to employ a maximum of 275 personnel over the LOM Plan. The Knox Creek Complex operations employed approximately 107 personnel, at the end of December 2022. The hourly labor force remains non-union and no change in this labor arrangement is anticipated in the near term.

Supplies

Supplies for the mining operations are available from multiple nearby vendors that service the coal industry in the CAPP Region. There are 10 Caterpillar mining equipment dealerships located within 50 miles of the Knox Creek Complex. There are three Komatsu/Joy Manufacturing mining equipment dealerships within 50 miles of the Knox Creek Complex.

5.0 HISTORY

5.1 PREVIOUS OPERATIONS

The Knox Creek Complex and surrounding area has an extensive history of coal mining, primarily by underground mining methods. Detailed underground mine maps showing previous mine workings were provided by Ramaco. Other sources of maps showing previous mine workings that WEIR referenced were from the West Virginia Geological and Economic Survey, the Virginia Department of Mines Minerals and Energy, the USGS, and the MSHA. Mining within the Knox Creek Complex likely began in the early 1900s. There have been many different mine operators both large and small in the region since then.

Areas of the Big Creek Property have been previously surface and underground mined. Ramaco is currently surface mining the Tiller Seam at the Big Creek Surface and Highwall Mine. Previous mining on this property mostly involved the Jawbone, Tiller, and Red Ash seams. Previously mined out areas on the property were provided to WEIR by Ramaco, however, WEIR has not verified, nor field checked these previously mined out areas.

Areas of the Knox Creek Property have also been previously surface and underground mined. There is currently no mining activity within the Knox Creek Property. However, the Red Ash 2, Jawbone 3 and Jawbone 1 seams have been extensively mined on the property, as a result of desirable metallurgical coal properties, seam continuity, and ease of seam access. Previously mined out areas on the property were provided by Ramaco, however, WEIR has not verified, nor field checked these previously mined out areas.

5.2 PREVIOUS EXPLORATION AND DEVELOPMENT

Prior to Ramaco's control of the property in 2011, previous exploration included 4,821 holes drilled within or in proximity to both Ramaco's Knox Creek and Berwind Complexes. Previous exploration activity dates back prior to 1910. A list of companies conducting exploration, number of holes drilled, total footage drilled, and approximate dates are shown in Table 5.2-1. Since property ownership has changed several times over the years, prior exploration drilling records are not fully available in original form.

Table 5.2-1 Previous Exploration

Company	Drill Holes	Drilled Footage	Year Drilled
Anker Coal Group, Inc.	57	25,087	Unknown
Consol Energy, Inc.	3,474	4,497,009	1970's-1980's
Georgia-Pacific	31	39,355	Unknown
Harmon Coal Company	1	750	Unknown
Island Creek Coal Coampany	70	114,561	Unknown
Jewell Ridge Coal Company	241	125,314	1960's-1990's
Jewell Smokeless Coal Corporation	473	221,931	1940's-2013
New River & Pocahontas Consolidated	73	50,287	1910's-Unknown
Olga Mining Company	22	17,434	Unknown
Paramont Coal Company Virginia, LLC	9	3,828	Unknown
Permac, Inc.	19	7,029	Unknown
Pocahontas Fuel Company, Inc.	25	18,649	Unknown
Republic Steel Corporation	98	47,738	Unknown
United Coal Company	126	53,973	Unknown
US Steel Corporation	1	617	Unknown
West Virginia Geological & Economic Survey	2	9	Unknown
Unknown	99	5,688	Unknown
Total	4,821	5,229,258	

As can be seen in Table 5.2-1, Ramaco's Knox Creek and Berwind Complexes have a rich history of coal exploration. It should be noted that Consol Energy, Inc. has an exceptionally large number of drillholes because of their substantial participation in the natural gas industry in the area.

Organizing such a significantly large amount of data requires performing tasks such as; 1) removing drillhole duplicates (especially where companies change drillhole names to match their own naming conventions), 2) resolving multiple copies of drillholes "shared" between companies (i.e. different companies own different seams over the same area and agree to "share" drillhole data, but delete the data for their seams before sharing), 3) resolving localized seam naming differences, and 4) resolving different coordinate systems. These are significant (and on-going) tasks for Ramaco. WEIR's review of Ramaco's current drillhole database is highly complementary based on the results of its work to date on these matters. Based upon thorough review of Ramaco's compilation of this historical drilling data, it is WEIR's opinion that this historical data is reliable for use in generating an accurate geological and quality model for the Knox Creek Complex.

6.0 GEOLOGICAL SETTING, MINERALIZATION, AND DEPOSIT

6.1 REGIONAL, LOCAL, AND PROPERTY GEOLOGY

6.1.1 Regional Geology

The upper coal seams of interest within the Knox Creek Complex belong to the Norton Formation in Virginia of Early Pennsylvanian Age, which is stratigraphically equivalent to the Lower Kanawha and New River formations in southwestern West Virginia. The lower coal seams of interest belong to the Pocahontas Formation of the Pottsville Group (Lower Pennsylvanian). The depositional setting for these seams is complex and thought to be upper delta plain, with subsidence controlling the sedimentation rate. The Lower Pennsylvania (Pottsville) sedimentary strata of the coal-bearing rocks of the Pocahontas Formation rest uncomformably on the Mississippian Bluestone Formation of the Mauch Chunk Group.

The Norton and Lee Formations (Virginia nomenclature) encompasses the Knox Creek Complex which additionally is within the western margin of the folded and faulted Central Appalachian Basin, with deformation occurring during the Alleghany (post-Permian) Orogeny. The Dry Fork Anticline is a regionally persistent fold, which extends from Buchanan County, Virginia to Mercer County, West Virginia. The anticline passes through the center of the complex and plunges to the southwest. North of the Dry Fork Anticline, coal beds dip at approximately one degree to the northwest, while to the south, seams dip one to two degrees toward the Boissevain Fault to the south/southwest.

The coalbeds of the Norton Formation are interbedded with sandstones, shales, siltstones, and underclays. The sandstones are light gray, very fine to coarse grained, thin bedded to massive, and crossbedded, and consist of 50 to 65 percent quartz, with large proportions of white-weathering feldspar, mica flakes and dark mineral grains. The shales are

medium to dark, thinly laminated, and carbonaceous. Horizontally laminated or crossbedded medium light gray siltstones and medium gray clayey to silty underclays occur in thin beds throughout the formation.

6.1.2 Local Geology

The coal seams of interest within the Knox Creek Complex are in the Southwest Virginia Coal Field and the Southern Coal Field in West Virginia. These coal seams are known for very high calorific content (Btu/lb) and high through low-volatile metallurgical coal characteristics, with high fluidity, low ash content, and low sulfur content.

The Boissevain and Middle Creek faults are major northeast/southwest trending thrust faults, which pass through the southern boundary of the Knox Creek Property. The strata on the southeast side of the fault has been thrust upward, relative to the strata on the northern side, along a plane which is, in most places, inclined at approximately 45 degrees. Along much of the length of the fault, the strata have been overturned, and the fault offset is over 200 feet. The Boissevain and Middle Creek faults parallel the Richlands Fault, another large thrust fault to the south of the property, where Mississippian Age strata have been thrust above the Pennsylvanian coal-bearing formations. No mining has occurred south of the Boissevain and Middle Creek faults, within or near the complex.

The Keen Mountain and Pistol Gap faults are northwest/southeast trending right-lateral strike slip faults. The southern side of both faults is downthrown, up to 18 feet vertically. The Spur Fault is a small fault which occurs perpendicular to, and terminates in, the Keen Mountain Fault in the northern area of the property. Mining has occurred on both sides of these faults throughout the area, and fault crossings were common. These minor faults appear in the northwestern part of the Knox Creek Property.

The Canebrake Fault is a northwest/southeast trending fault, with an offset of approximately 200 feet based on evaluation of drillhole information. The upthrown side is to the north of the fault. Underground mining in the Red Ash Seam has occurred on both sides of the fault. This fault passes through the northern part of the Knox Creek Jewell Property

6.1.3 Property Geology

Big Creek Property

The primary coal seams of interest on the Big Creek Property, in descending order, are the Red Ash, Jawbone 1, and Tiller. No significant faults have been mapped on the property.

Knox Creek Property

The primary coal seams of interest on the Knox Creek Property, in descending stratigraphic order, are the Kennedy, Red Ash, Jawbone 3, and Jawbone 1 (see Figure 6.3-1, Generalized Stratigraphic Section). However, there are several other mineable seams that occur throughout the property.

6.2 MINERAL DEPOSIT TYPE AND GEOLOGICAL MODEL

The Knox Creek Complex resource area is a relatively flat lying, sedimentary deposit of Pennsylvanian Age. The 34 coal seams in the Pocahontas Formation and the overlying Norton Formation account for approximately 3,000 feet of geologic section. For internal planning, Ramaco models these seams from exploration results using the SurvCad® mine planning software package, completing model updates after each phase of exploration drilling. WEIR modeled the reserves and resources using Datamine MineScape® Stratmodel geological modeling software. Exploration consists of core drilling for all the mineable seams, which is performed each year in advance of mining, to refine the resource boundary and to define limits of the mine plans. The WEIR geological model is discussed in more detail in Section 9.1.

6.3 STRATIGRAPHIC COLUMN AND CROSS SECTION

Figure 6.3-1 shows the stratigraphic column for the Knox Creek Complex. Cross sections related to the Knox Creek Complex can be found on Figure 6.3-2. For more detail on these sections, please see Exhibit 6.3-2.

Figure 6.3-1 Knox Creek Stratigraphic Column

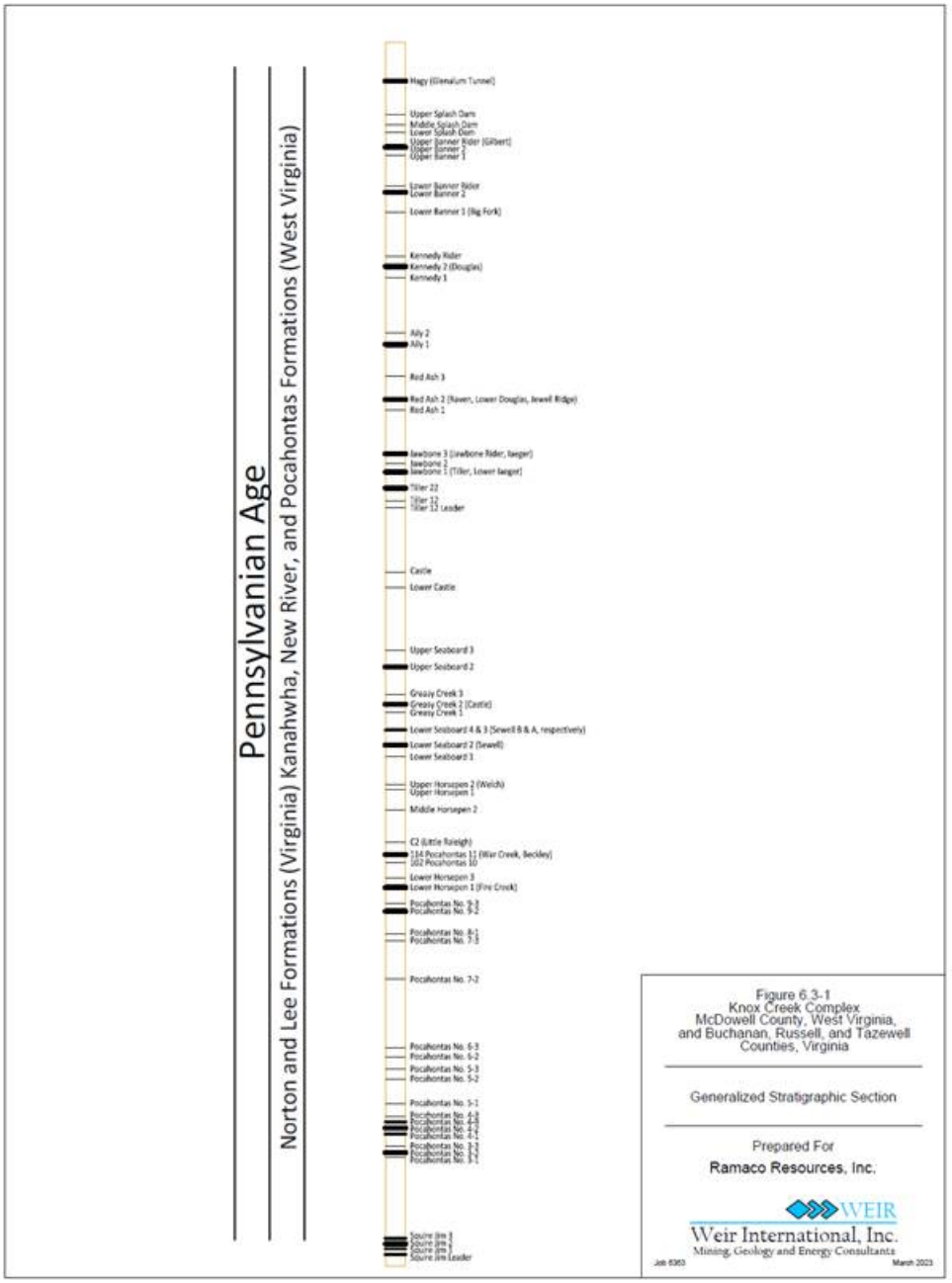
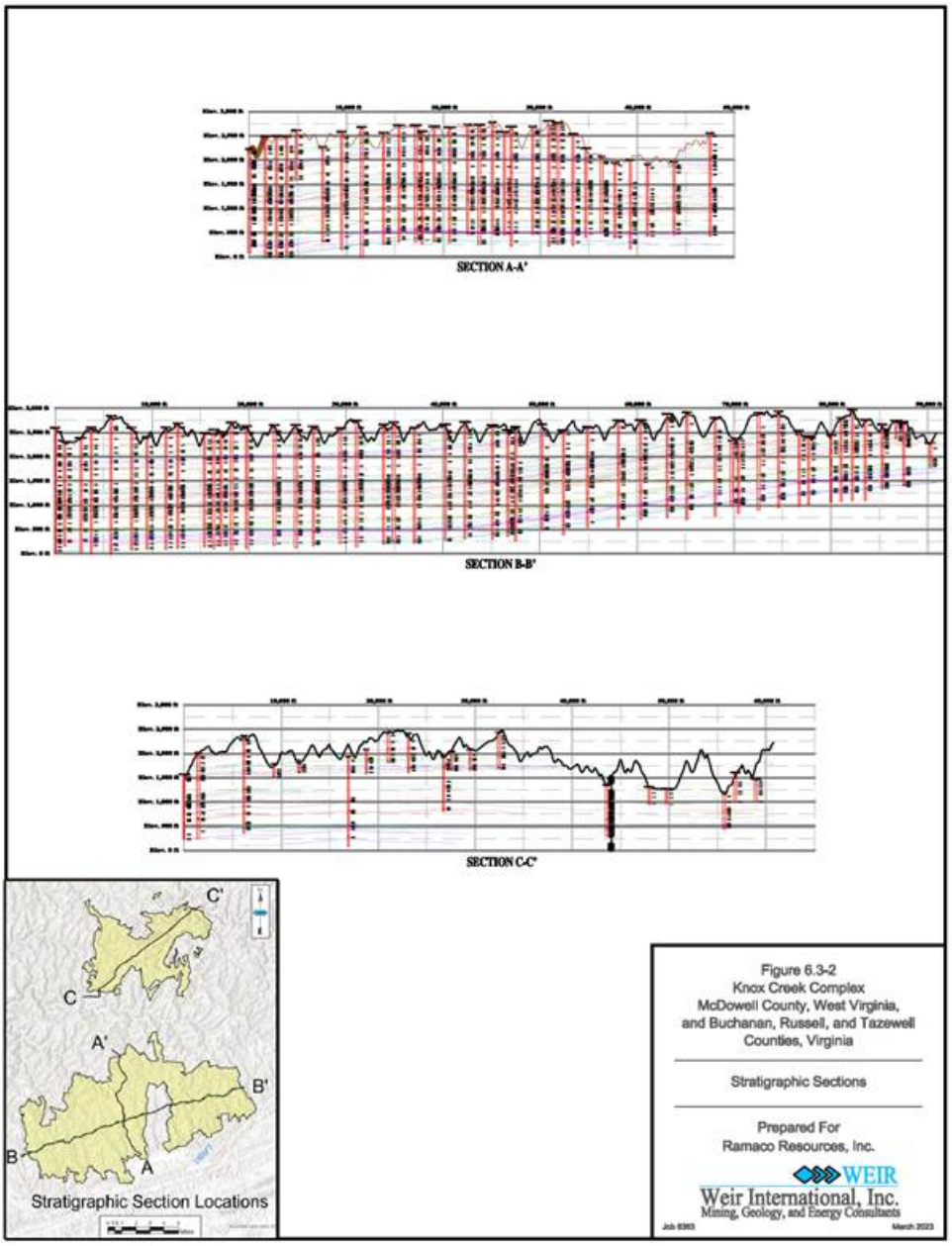


Figure 6.3-2 Knox Creek Stratigraphic Cross Sections



7.0 EXPLORATION

7.1 NON-DRILLING EXPLORATION

Drilling has served as the primary form of exploration within the Knox Creek Complex. In addition to exploration drillholes, seam outcrop measurements, in-mine measurements, and survey points taken from mine maps of previous operations were considered. A total of 194 seam outcrop measurements, 356 mine measurements, and 887 survey points were implemented in modeling the deposit. Data from degasification, coal bed methane, and water wells were also incorporated in the geological model, including a total of 4,188 drillholes.

7.2 DRILLING

Ramaco's exploration activities involve rotary and continuous core drilling performed by competent contract drilling companies. In addition to providing information about the coal seams present, the exploration drilling also provides core samples of roof strata and floor strata for geotechnical evaluation which is stored and evaluated as needed. The geologist's drilling logs are checked against the geophysical logs for thickness accuracy and to confirm core recovery. Drillholes with core recovery of less than 90 percent are noted and subsequently reviewed in consideration for re-drilling. The successful acquisition of accurate geophysical logs for holes with poor core recovery play an important role in the decision to re-drill, since improvements in lithology recognition in geophysical logging has significantly improved over the years.

Once recovered, all core samples are boxed, photographed, and stored. Coal seam core samples are sent to laboratories for quality analyses. Caliper, density, gamma, and resistivity downhole geophysical logs are completed as drill site and hole conditions allow. Each drillhole collar location is surveyed using RTK GPS equipment to obtain accurate coordinates for subsequent modeling efforts.

Table 7.2-1 summarizes data for Ramaco's drilling programs.

Table 7.2-1 Drilling Programs

Drilling Series	Program Dates	Total Number of Drill Holes	Drilled Footage	Hole Type		Number of Holes with Base Data					
				Rotary	Core	Drill Hole Header	Geophysical Logs	Downhole Deviation Log	Geologist's Log	Driller's Log	Lab Analyis Certificates
BC Series	2022	3	770	0	3	3	3	—	3	3	—
KC Series	1998-2018	37	14,725	5	32	37	31	—	8	32	11
		40	15,495	5	35	40	34		11	35	11

Referring to the drilling programs outlined in Table 7.2-1, the BC (Big Creek) and KC (Knox Creek) series of drillholes are mainly intended as in-fill drilling on the complex. Quality control procedures followed by Ramaco geologists are clearly defined. Ramaco's field geologists take specified steps to protect sample integrity and to ensure core samples are always under Ramaco geologist's control. These steps include the following:

- Field geologist to be on site whenever drilling is occurring
- Geologist's log to be created for each drillhole
- Each drillhole to be logged using geophysical methods if physically possible
- Geologist to compare field geologist's logs to the e-log data
- Geologist to compare the core samples against both field geologist's logs and e-logs to confirm coal thickness
- All immediate roof, coal and immediate floor core are to be boxed and photographed
- Quality sample sheets to be filled out, provided to a supervisor for approval and shipped to the laboratory
- Once core samples have been analyzed, field geologists to scrutinize the resulting quality data for accuracy

WEIR did not have direct involvement with the planning, implementation, or supervision of Ramaco's drilling programs. However, having reviewed the details of Ramaco's drilling programs, WEIR finds the results to be consistent with industry standards and appropriate for use in the estimation of reserves and resources.

WEIR did not observe core samples in person, however, Ramaco provided photos of core logs for 19 drillholes. In review of these photos, WEIR found the cores to be representative of the data reported for each drillhole.

7.3 HYDROGEOLOGICAL DATA

Hydrological data for the complex is generally obtained from existing wells and surface water monitoring locations in proximity to Ramaco's existing and planned operations. No additional exploration is performed specifically for the purposes of hydrological study. See Section 13.1.2, Hydrogeological Model, for more detail.

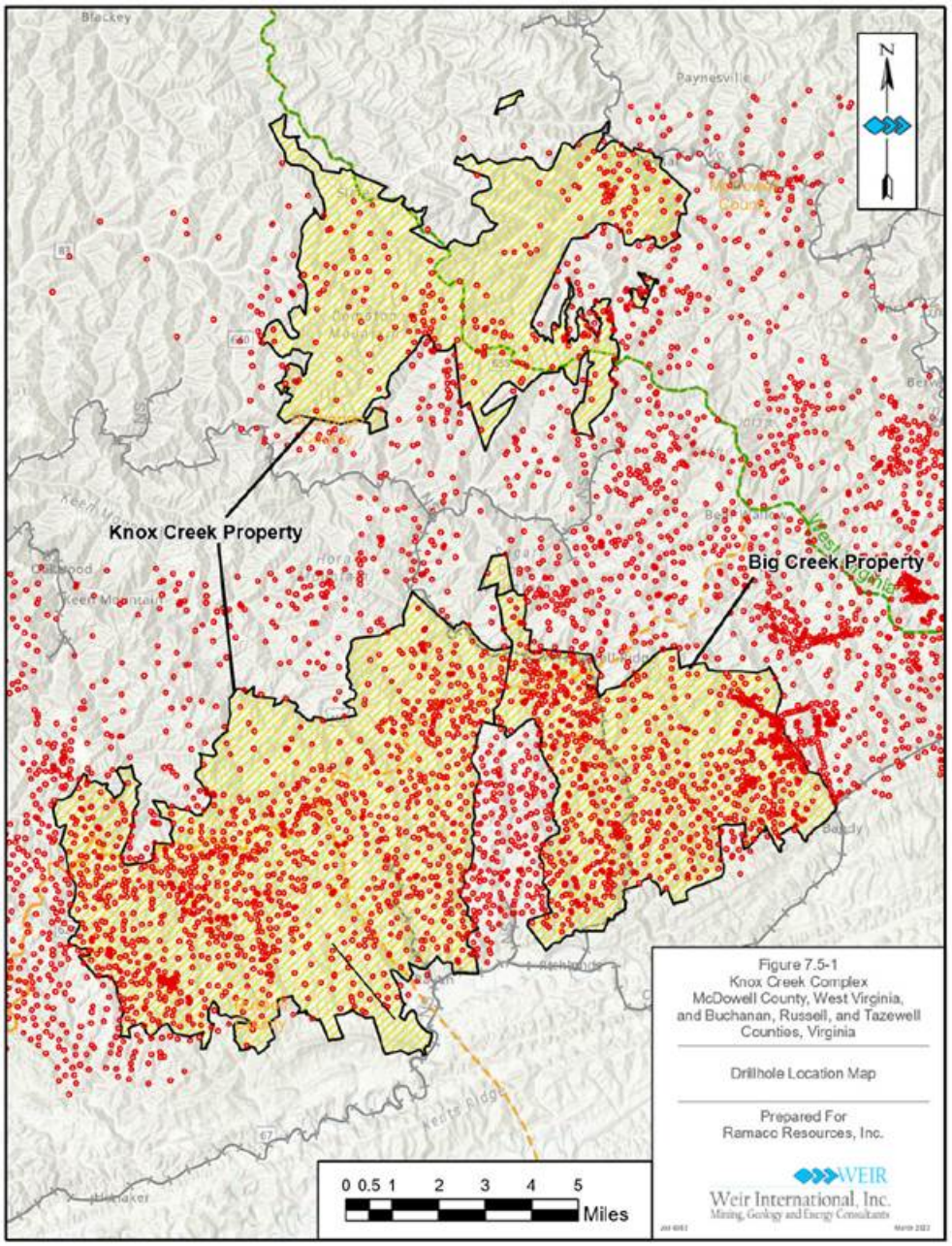
7.4 GEOTECHNICAL DATA

Ramaco does not specifically gather geotechnical data at its existing or planned operations at the Knox Creek Complex. See Section 13.1.1, Geotechnical Model, for more detail.

7.5 SITE MAP AND DRILLHOLE LOCATIONS

A map showing the location of all drillholes on the Knox Creek Complex is provided on Figure 7.5-1. Mine measurements are excluded from this figure to assist with legibility.

Figure 7.5-1 Drillhole Locations



7.6 OTHER RELEVANT DRILLING DATA

Ramaco generally uses one of several local drilling companies based on availability and pricing. Downhole geophysical logging is usually performed by Marshall Miller & Associates of Bluefield, Virginia. Coal quality analyses are typically performed by Precision Testing Laboratory, Inc. (Precision) of Beckley, West Virginia.

8.0 SAMPLE PREPARATION, ANALYSES, AND SECURITY

8.1 SAMPLE PREPARATION METHODS AND QUALITY CONTROL

Relative to the drilling overseen by Ramaco, once the target coal seam has been drilled the coal core is stored in plastic lined wooden core boxes. The core is photographed, and

the coal seam is measured and described by the geologist. The geologist's seam thickness measurements are cross checked against geophysical logs for thickness accuracy and to confirm core recovery.

8.2 LABORATORY SAMPLE PREPARATION, ASSAYING, AND ANALYTICAL PROCEDURES

8.2.1 SGS North America Inc.

Ramaco used SGS North America Inc. (SGS) located in Sophia, West Virginia as its primary laboratory for coal analyses, prior to 2016. Typically, once quality samples were bagged and labeled at the mine, the samples were delivered to SGS for quality analyses. The samples were first prepared by crushing, splitting, and sizing. The analyses performed included Proximate, Washability, Ash Fusion, Ultimate, Ash Mineral, Dilatometer, Plastometer, Trace Elements, and Petrographics. SGS is certified by the ANSI National Accreditation Board. SGS performs all of the coal analyses to ASTM standards.

8.2.2 Precision Testing Laboratory, Inc

Ramaco has utilized Precision Testing Laboratory, Inc. (Precision) located in Beckley, West Virginia beginning in 2016. Also certified by the ANSI National Accreditation Board, Precision performs all the coal analyses to ASTM standards. Once quality samples are bagged and labeled at the mine, the samples are delivered to Precision for quality analyses. The samples are first prepared by crushing, splitting, and sizing. The analyses performed included Proximate, Washability, Ash Fusion, Ultimate, Ash Mineral, Dilatometer, Plastometer, Trace Elements, and Petrographics.

8.2.3 Other Laboratories

As outlined in Section 5.2, WEIR relied upon drillhole data from prior property owners. The quality data from other laboratories appears to be valid and appropriate to include in this study based upon available documentation and consistency of the data between the different sources.

8.3 QUALITY CONTROL PROCEDURES AND QUALITY ASSURANCE

As ANSI certified laboratories, both SGS and Precision have in-house quality control and assurance procedures. Both are well-known and respected providers of coal quality analysis services.

8.4 SAMPLE PREPARATION, SECURITY, AND ANALYTICAL PROCEDURES ADEQUACY

Once in possession of the samples, Precision's standard sample preparation and security procedures are followed. After the sample has been tested, reviewed, and accepted, the disposal of the sample is done in accordance with local, state and EPA approved methods.

WEIR has determined the sample preparation, security and analysis procedures used for the Knox Creek Complex's drillhole samples meet current coal industry standards and practices for quality testing, with laboratory results suitable to use for geological modeling, mineral resource estimation and economic evaluation.

9.0 DATA VERIFICATION

9.1 DATA VERIFICATION PROCEDURES

Ramaco provided WEIR copies of all available drilling records for the Knox Creek Complex, which included Excel spreadsheets, driller's log, field geologist's logs, core photographs, quality results sheets from the coal quality laboratories, mine measurement tables, as well as drawing files or PDFs of the e-logs. Each hole in the database was individually checked by WEIR against a copy of the driller's and/or geologist's log to confirm data accuracy.

Geological reviews performed by WEIR included:

- Drillhole lithology database comparison to geophysical logs
- Drillhole coal quality database comparison to quality certificates

After completing the precursory verifications and validations described above, the drillhole data was loaded into Datamine's MineScape® Stratmodel, a geological modeling software. MineScape provides robust error checking features during the initial data load, which include confirmations of seam continuity, total depth versus hole header file data, interval overlap, and quality sample continuity with coal seams. Once the drillhole data was loaded, a stratigraphic model was created.

Several further verifications were then possible, which included:

- Creating cross sections through the model to visually inspect if anomalies occur due to miscorrelation of seams
- Creating structural and quality contour plots to visually check for other anomalies due to faulty seam elevations or quality data entry mistakes in the drillhole database

Typical errors which may impact reserve and resource estimates relate to discrepancies in original data entry. These errors may include:

- Incorrect drillhole coordinates (including elevation)
- Mislabeled drillhole lithology
- Unnoticed erroneous quality analyses where duplicate analyses were not requested
- Excessive drillhole core loss

WEIR conducted a detailed independent geological evaluation of data provided by Ramaco to identify and correct errors of the nature listed above. Where errors are identified and cannot be successfully resolved, it is WEIR's policy to exclude that data from the geological model. Based on WEIR's geological evaluation of data provided, 81 drillholes were excluded from the drillhole database due to various reasons.

9.2 DATA VERIFICATION LIMITATIONS

Limitations of data verification included incomplete or missing records for some drillholes. The primary reason for this situation is incomplete data transfers upon change in property ownership. Based on its modeling results, WEIR found some of the drillholes with incomplete data to be consistent with the deposit and appropriate to include in WEIR's geological model.

9.3 ADEQUACY OF DATA

It is WEIR's opinion that the adequacy of sample preparation, security, and analytical procedures for holes and procedures that were drilled by Ramaco after acquiring the property is acceptable and that these methods meet typical industry standards. Ramaco employs detailed process and procedures, described in Section 8.4, that are followed each time a core hole is to be sampled. The Ramaco geologist's logs for these holes contain sampling descriptions and lithologic descriptions that are sufficiently detailed to ascertain that an experienced geologist supervised the drilling and sampling. Ramaco coal quality analyses performed by both SGS and Precision have been to ASTM standards, as detailed in Section 8.0.

The adequacy of sample preparation, security, and analytical procedures are generally unknown for drillholes that were drilled prior to Ramaco acquiring the initial leases in 2016. However, the geologist's logs for these holes contain sampling descriptions and lithologic descriptions that are sufficiently detailed to ascertain that an experienced geologist supervised the drilling and sampling. It is unknown if all coal quality analyses were performed to ASTM standards by qualified laboratories, as detailed in Section 8.0, however, this legacy drillhole information was included as the samples matched the coal seam intervals and reported quality data that was consistent between the different data sources. Model verifications further support WEIR's high level of confidence that a representative, valid, and accurate drillhole database and geological model have been generated for the Knox Creek Complex that can be relied upon to estimate coal resources and reserves to an accuracy that is acceptable for this report's specified standards.

10.0 MINERAL PROCESSING AND METALLURGICAL TESTING

10.1 MINERAL PROCESSING TESTING AND ANALYTICAL PROCEDURES

Daily sampling is performed by SGS on samples obtained from various conveyor and stockpile locations prior to shipping clean coal products. Proximate and oxidation analyses are performed on the samples. Train and sublot samples include all petrographic and rheology analyses for each individual customer specification.

These results help ensure both proper preparation plant operation and coal product classification. Coal tonnages for raw and post-processed products are estimated using standard belt scales, which are calibrated monthly against the end of month survey data summary reports.

Efficiency testing is performed on all critical preparation plant circuitry on an on-going basis to help ensure proper coal and non-coal separations are occurring throughout the preparation plant processing operation. This performance testing is extensive and involves measuring flow rates, pressures, moistures, reagent application rates, size fractions, specific gravity, and coal quality at specific locations from raw feed through clean coal products and tailings.

10.2 MINERALIZATION SAMPLE REPRESENTATION

Coal deposits originate in flat, low-lying ground within deltas, alluvial plains, and coastal systems, and as such are a relatively homogeneous, sedimentary mineral occurrence. The deposit within the Knox Creek Complex area exhibits homogeneous characteristics and does not show any substantial variations in mineralization types or styles that would adversely affect processing of the coal. Sample data are well representative of the deposit as a whole.

10.3 ANALYTICAL LABORATORIES

Coal sample analyses performed by Precision are described in Section 8.2.1. Preparation plant circuitry performance is maintained by plant staff through the plant monitoring systems. SGS performs daily analysis on the collected clean coal samples from automated samplers and any raw coal samples collected. Typical analysis on daily runs is proximate analysis only plus oxidation. Train and sublot samples with petrographics and rheology are performed per individual customer specifications.

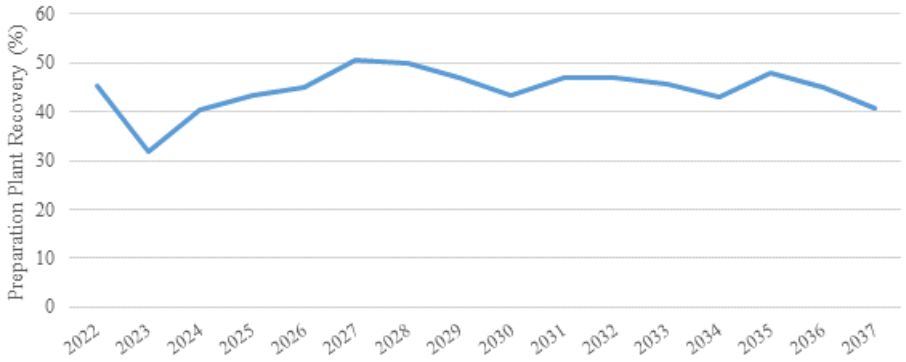
10.4 RELEVANT RESULTS AND PROCESSING FACTORS

Coal recovery and resulting product qualities are primary concerns for any coal preparation plant. A coal preparation plant's recovery and resulting quality of its saleable products are dependent on ROM coal quality and the efficiency at which non coal impurities are removed by the preparation plant process. Tracking and adjusting throughput rates for different plant circuitry, based on ROM coal feed quality, are critical to plant efficiency and product quality. The Knox Creek Preparation Plant processes ROM coal at specific

gravities ranging from 1.50 to 1.65, depending on customer specifications, in order to produce saleable metallurgical coal products.

Historical (2022) and projected LOM Plan preparation plant recovery are shown on Figure 10.4-1.

Figure 10.4-1 Preparation Plant Recovery



The preparation plant yield decreases in 2023 associated with increasing tons from the Big Creek Jawbone 1 Deep Mine and the exhaustion of the Big Creek HWM reserves.

Preparation plant recovery and saleable product quality are expected to track closely with the modeled recovery from raw coal analysis, once adjusted for out of seam dilution (OSD) mined by the surface and underground mines.

Historical preparation plant recovery from 2022, based on plant belt scale records, is summarized in Table 10.4-1 as follows:

Table 10.4-1 Historical Preparation Plant Recovery

	2022
Raw tons processed	600,608
Clean tons processed	234,710
Plant Recovery (%)	39.1

The testing procedures described above provide validation for modeled data and help to ensure coal sales specifications are met for resulting saleable coal products. The testing also helps to maintain preparation plant efficiency at a high level so that processing costs are minimized.

10.5 DATA ADEQUACY

Ramaco employs testing and analytical procedures in accordance with industry standards, which result in efficient preparation plant operations and provides the necessary quality control to meet product quality and quantity projections. The testing performed is sufficient to support the projected preparation plant yield and saleable product quality for the LOM Plan.

11.0 MINERAL RESOURCE ESTIMATES

The coal resources, as of December 31, 2022, are reported as in-place resources and are exclusive of reported coal reserve tons (see Section 12.0 for reserve tonnage estimates). Resources are reported in categories of Measured, Indicated, and Inferred tonnage in accordance with Regulation S-K Item 1302(d).

In addition to the currently active and planned mines, there are numerous other resource areas within the Knox Creek Complex which Ramaco may plan and/or permit at a future date.

11.1 KEY ASSUMPTIONS, PARAMETERS, AND METHODS

Data Sources

Planimetric data was provided by Ramaco in AutoCAD format and primarily included base map information such as rivers, drainages, roads, mine features, and property boundaries.

Ramaco provided WEIR drillhole data, which included survey, lithology, and coal quality information. This data was provided in different formats including Excel, ASCII files and PDFs. Geophysical logs, coal quality certificates, driller's logs, geologist's logs, downhole deviation data, and drillhole survey records were provided as scanned PDF files and AutoCAD drawing files. Data was provided for 4,290 drillholes, 4,188 holes of which are included in the geological model.

In-mine seam thickness and floor measurement from previous operations' mine maps were provided in tabular file format. These mine measurements included 356 data points. Mine measurement data points were used to model coal seam thickness and structure but were not used as points of observations in estimating resource confidence.

Coal quality data for 625 drillholes was provided for the Knox Creek Complex. Of the 625 drillholes, 558 holes were used in the quality model. Data was provided in Excel format along with quality certificates in PDF format.

Reasons for excluding drillhole quality samples in the modeling process included:

- Poor core recovery noted in the driller's logs.
- Quality logs that could not be matched to a drillhole.

- The qualities listed for the hole were not relevant to the model (for example raw Btu/lb. or sulfur were supplied, but not final product Btu/lb. or sulfur). The only relevant raw values used are specific gravity and raw ash. Both are derivable from one another and have bearing on estimated in-place tons.
- Analyses were not performed at the appropriate wash specific gravity.

Geological Model

The Knox Creek Complex geological model was developed by using seam surface grids that were created in Datamine's MineScape® Stratmodel (MineScape) geological modeling software.

Topography data was gridded using MineScape software and a grid cell size of 100 feet by 100 feet from the USGS on-line 3-D Elevation Project data source. The resolution of the topography data is 1/3 arc-second, which results in approximately a 30 by 30 feet data point spacing. The gridded USGS topography contours were compared to drillhole collars. WEIR investigated significant collar elevation discrepancies. Most differences are due to original drillhole locations being covered with burden or being subsequently mined. Drillholes for which such discrepancies could not be resolved were not used in the model.

The seam surfaces and thicknesses were created by loading the drilling and mine measurement data into MineScape and gridding the seam intercepts using a grid cell size of 100 feet by 100 feet. The parameters used to create the model are defined in the MineScape modeling schema which is a specification of modeling rules that is created for the site. The MineScape interpolators that were used in this study are common in most mine planning software packages. The Planar interpolator is a triangulation method with extrapolation enabled. Finite Element Analysis (FEM) is a widely used method for numerically solving differential equations arising in engineering and mathematical modeling. A trend surface is used in MineScape to promote conformability for the modeled seams to regional structures such as synclines, anticlines, or simply seam dip. MineScape caters to using different interpolators for thickness, roofs and floors (surfaces), and the selected trend surface as they are all modeled separately. The interpolator used for each of these items is selected on the basis of appropriateness to the data sets involved, as well as modeling experience. Stratigraphic Model Interpolators are shown in Table 11.1-1, as follows:

Table 11.1-1 Stratigraphic Model Interpolators

Interpolator	Parameter	Power/Order
PLANAR	Thickness	0
FEM	Surface	1
PLANAR	Trend	0

Ninety-eight (98) coal seams (including seam splits) were modeled for the Knox Creek Complex. A summary of drillhole statistics for the 16 seams that WEIR considered to have economic potential for the Knox Creek Complex are shown in Table 11.1-2. These statistics involve the 2,288 drillholes out of the total 4,188 that can be allocated to the Knox Creek Complex versus the Berwind Complex.

Table 11.1-2 Drillhole Statistics

CODE	Seam	In Mine Plan	Number of Intercepts	Average Thickness (Feet)	Minimum Hole Name	Minimum Thickness (Feet)	Maximum Hole Name	Maximum Thickness (Feet)	Standard Deviation (Feet)
UPB2	Upper Banner 2	No	150	1.28	J-328	0.08	J-542	4.32	0.86
KDY2	Kennedy 2	Yes	877	2.03	20	0.04	04BI113	9.50	1.25
RED3	Red Ash 3	No	730	0.90	VA-160	0.02	CBMW49A	4.30	0.77
RED2	Red Ash 2	No	1662	2.47	25	0.08	80RU-8	8.00	0.94
JWB3	Jawbone 3	Yes	1936	2.07	KC00-03	0.05	06AW114A	8.00	0.98
JWB1	Jawbone 1	Yes	1930	2.57	L053	0.05	85RU-53	11.74	1.18
TL22	Tiller 2-2	Yes	1137	1.22	96VA283	0.08	00-VA-301	7.70	0.87
TL12	Tiller 1-2	Yes	851	1.39	VA-157	0.03	07BB48A	7.20	1.10

USB2	Upper Seaboard 2	No	626	1.46	O-M	0.04	VA-48	6.69	0.91
GCK2	Greasy Creek 2	No	1329	1.27	L038	0.08	BC30-97	6.35	0.64
LSB2	Lower Seaboard 2	No	1289	1.38	OLGA-13	0.08	VA-235	5.23	0.91
P114	Pocahontas 11	No	1461	2.48	L038	0.04	110107033	9.00	0.88
LHP1	Lower Horsepen 1	No	731	1.35	VA-145	0.05	PCP-136	4.65	0.72
PO92	Pocahontas 9-2	No	331	1.31	05BE121	0.10	VA-91	8.90	0.91
PO42	Pocahontas 4	No	602	1.23	PCP-108	0.08	02DGDD29	7.66	1.23
PO32	Pocahontas 3	No	806	2.41	05AY140	0.03	VA-206	9.25	2.07

The gridded coal seam structure and coal seam thicknesses were validated against drillhole information to ensure that the data was properly modeled. Inconsistencies between modeled seam surfaces and surrounding drillholes were investigated and any confirmed errors in the drillhole data or model parameters were corrected. This process was repeated until a final version of the model was developed.

Coal Quality Model

The drillhole data described previously in this report were used to create a washed coal quality model that included raw ash and raw relative density. The washed quality model values were based on a specific gravity of 1.50.

The drillholes were verified to ensure that the seam depths used in the lithology file matched the sample depths in the quality file. Coal quality samples were loaded into MineScape and composited against the drillhole thicknesses. The composited values were then gridded using a grid cell size of 200 feet by 200 feet and the inverse distance weighted (squared) interpolator. The following quality data was modeled for all seams:

- Raw
  - Ash, Dry weight percent
  - Relative Density
- Float @ 1.50 Specific Gravity
  - Ash, Dry weight percent
  - Calorific Value, Dry Btu/lb
  - Total Sulfur, Dry weight percent
  - Volatile Matter, Dry weight percent
  - Audibert-Arnu Maximum Dilation (ARNU), Dry percent
  - Coal Oxidation by Light Transmittance, Dry percent
  - Total Inerts, Dry weight percent
  - Rank Index
  - Composition Balance Index
  - Gieseler Maximum Fluidity, Dry DDPM
  - Hargrove Grindability Index
  - Reflectance (ROMAX), Dry percent
  - Calculated Stability Index
  - Free Swell Index
  - Yield, weight percent

Quality contours were generated from the grids to check outlier values.

Additional Resource Criteria and Parameters

Based on WEIR's review and evaluation of the data and plans relative to the Knox Creek Complex, resource estimation criteria were applied to ensure reported mineral resource tonnage has a reasonable prospect for economic extraction. Resource criteria and parameters for the Knox Creek Complex are as follows:

- Resources were estimated as of December 31, 2022.
- Underground areas where coal thickness did not meet a minimum thickness of 2.0 feet were excluded from the resource estimate.

- Underground areas within 200 feet of old mine workings were excluded from resource estimates.
- Underground areas with less than 100 feet of cover were excluded from resource estimates.
- Surface and highwall mining areas where coal thickness did not meet a minimum thickness of 1.0 feet were excluded from the resource estimate.
- Surface areas, where there was no subsequent highwall mining, and where stripping ratio exceeds 20:1, were excluded from the resource estimate.
- Tonnage outside of current LOM plans, but within existing property control, and meeting the criteria listed here, is classified as Resource tonnage and is reported exclusive of Reserve tonnage.
- Coal density (pounds per cubic foot) is based on apparent specific gravity data from dill holes and channel samples, where available. Otherwise, it is based on raw coal ash (dry basis) using the formula [1.25+(Ash/100)] x 62.4 pounds per cubic foot

11.2 ESTIMATES OF MINERAL RESOURCES

The coal resources, as of December 31, 2022, are reported as in-place resources and are exclusive of reported coal reserve tons (see Section 12.0). Resources are reported based on the coal resource estimate methodology described and are summarized in Table 11.2-1 as follows:

Table 11.2-1 In-Place Coal Resource Tonnage and Quality Estimate as of December 31, 2022

							Coal Quality (Dry Basis) Raw	
	Area	Average Coal Thickness	In-Place Resources (000 Tons)				Ash	Relative Density
Mine Area / Seam	(Acres)	(Feet)	Measured	Indicated	Total	Inferred	(%)	(Lbs/CF)
Big Creek								
Red Ash 3	1,275	2.04	5,025	—	5,025	—	17.0	88.61
Red Ash 2	1,420	2.75	7,495	—	7,495	—	4.5	87.98
Jawbone 3	1,400	2.27	6,445	—	6,445	—	24.0	92.98
Jawbone 1	2,210	2.99	13,536	—	13,536	—	12.2	94.38
Tiller 1-2	495	2.67	2,520	—	2,520	—	21.7	87.36
	6,800	2.59	35,021		35,021		14.1	91.42
Knox Creek								
Upper Banner 2	450	2.27	2,060	—	2,060	—	17.0	88.61
Kennedy 2	1,765	2.72	8,780	—	8,780	—	13.2	86.28
Red Ash 2	12,485	2.65	59,450	35	59,485	—	4.7	82.41
Jawbone 3	8,420	3.13	50,260	—	50,260	—	15.1	87.43
Jawbone 1	15,025	3.21	93,500	150	93,650	—	13.6	89.46
Upper Seaboard 2	450	2.72	2,340	—	2,340	—	17.0	88.61
Greasy Creek 2	290	4.29	2,640	—	2,640	—	43.0	97.93
Lower Seaboard 2	760	2.75	4,470	—	4,470	—	30.9	98.19
Pocahontas 11	770	4.72	7,010	—	7,010	—	17.0	88.61
Lower Horsepen 1	1,425	2.89	7,965	—	7,965	—	17.0	88.61

							Coal Quality (Dry Basis) Raw	
	Area	Average Coal Thickness	In-Place Resources (000 Tons)				Ash	Relative Density
Mine Area / Seam	(Acres)	(Feet)	Measured	Indicated	Total	Inferred	(%)	(Lbs/CF)
Knox Creek								
Pocahontas 9-2	2,030	2.8	8,240	2,750	10,990	—	17.0	88.61
Pocahontas 4	1,605	2.97	8,300	3,830	12,130	—	26.6	94.90
Pocahontas 3	710	2.77	3,780	—	3,780	—	17.0	88.61
	46,185	2.99	258,795	6,765	265,560		13.5	87.76
Knox Creek Complex - Total	52,985	2.94	293,816	6,765	300,581		13.6	88.23

Notes:

- Mineral Resources reported above are not Mineral Reserves and do not meet the threshold for reserve modifying factors, such as estimated economic viability, that would allow for conversion to mineral reserves. There is no certainty that any part of the Mineral Resources estimated will be converted into Mineral Reserves. Mineral Resources reported here are exclusive of Mineral Reserves.
- Resource probable economic mineability based on underground minable resources with 2.0 feet minimum seam thickness, surface and highwall mines with 1.0 feet minimum seam thickness, area mining with a cutoff stripping ratio of 20:1, and primarily metallurgical mid and high volatile coal product realizing a sales price of $183.50 per ton at a cash cost of $98.68 per clean ton (FOB Mine)
- Numbers in the table have been rounded to reflect the accuracy of the estimate and may not sum due to rounding

11.3 TECHNICAL AND ECONOMIC FACTORS FOR DETERMINING PROSPECTS OF ECONOMIC EXTRACTION

A Preliminary Feasibility Study was conducted to assess the prospects for economic extraction of coal within the Knox Creek Complex.

Ramaco's forecasted Knox Creek Complex FOB mine coal sales prices are $164.36 per ton in 2023, $172.10 in 2024, $179.69 in 2025 and $186.00 thereafter through 2037. Ramaco's sales price projections conform to published forward price curves for coal of similar quality to that of the Knox Creek Complex. The sales price is further supported in Section 16.0 of this report.

Capital expenditures are discussed in further detail in Section 18.1 and are projected to average $12.20 per ton over the Knox Creek Complex LOM Plan, compared to actual capital expenditures of $25.35 per ton in 2022.

Operating cash costs are discussed in further detail in Section 18.2 and are projected to average $98.68 per ton over the Knox Creek Complex LOM Plan, compared to actual Knox Creek Complex operating cost of $117.25 per ton in 2022.

Total projected capital expenditures and operating cost of $110.88 per ton and a coal sales price per ton as indicated above, provide a reasonable basis for WEIR to determine that all underground mineable coal of thickness greater than 2.0 feet, surface and highwall mineable coal with seam thickness greater than 1.0 feet, and surface and contour mineable

coal with stripping ratio of approximately 20:1 or lower, has prospects of economic extraction within the Knox Creek Complex.

11.4 MINERAL RESOURCE CLASSIFICATION

Mineral Resource estimates prepared for the Knox Creek Complex are based on the Regulation S-K Item 1302(d), which established definitions and guidance for mineral resources, mineral reserves, and mining studies used in the United States. The definition standards relative to resources are as follows:

Mineral Resource:

Mineral resource is a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, grade or quality, and quantity that there are reasonable prospects for economic extraction. A mineral resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed and justifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralization drilled or sampled.

- *Inferred mineral resource* is that part of a mineral resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. The level of geological uncertainty associated with an inferred mineral resource is too high to apply relevant technical and economic factors likely to influence the prospects of economic extraction in a manner useful for evaluation of economic viability. Because an inferred mineral resource has the lowest level of geological confidence of all mineral resources, which prevents the application of the modifying factors in a manner useful for evaluation of economic viability, an inferred mineral resource may not be considered when assessing the economic viability of a mining project, and may not be converted to a mineral reserve.
- *Indicated mineral resource* is that part of a mineral resource for which quantity and grade or quality are estimated on the basis of adequate geological evidence and sampling. The level of geological certainty associated with an indicated mineral resource is sufficient to allow a qualified person to apply modifying factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Because an indicated mineral resource has a lower level of confidence than the level of confidence of a measured mineral resource, an indicated mineral resource may only be converted to a probable mineral reserve.

- *Measured mineral resource* is that part of a mineral resource for which quantity and grade or quality are estimated on the basis of conclusive geological evidence and sampling. The level of geological certainty associated with a measured mineral resource is sufficient to allow a Qualified Person to apply modifying factors, as defined in this section, in sufficient detail to support detailed mine planning and final evaluation of the economic viability of the deposit. Because a measured mineral resource has a higher level of confidence than the level of confidence of either an indicated mineral resource or an inferred mineral resource, a measured mineral resource may be converted to a proven mineral reserve or to a probable mineral reserve.

Geostatistical methods were applied to drillhole and mine measurement coal thickness data for four primary seams at the Knox Creek Complex to develop variogram ranges (radii) used for resource classification. Figure 11.4-1 illustrates the variogram for the Tiller No. 1 Seam, containing 649 seam thickness measurements. Table 11.4-1 shows the sample count, Measured and Indicated resource ranges determined by the variogram model, and average sample spacing in feet for the Jawbone No. 1, Pocahontas No. 4, and Tiller No.1 and No. 2 seams. Variographic ranges were similar in each seam, demonstrating seam thickness continuity over 9,000 feet in each case. Theoretical ranges estimated for Measured (to 3,000 feet) and Indicated (to 9,200 feet) resources in the analysis demonstrates the spatial continuity of mineable coal seam thickness at the Knox Creek Complex.

Figure 11.4-1 Variogram Model Tiller No. 1 Seam Thickness

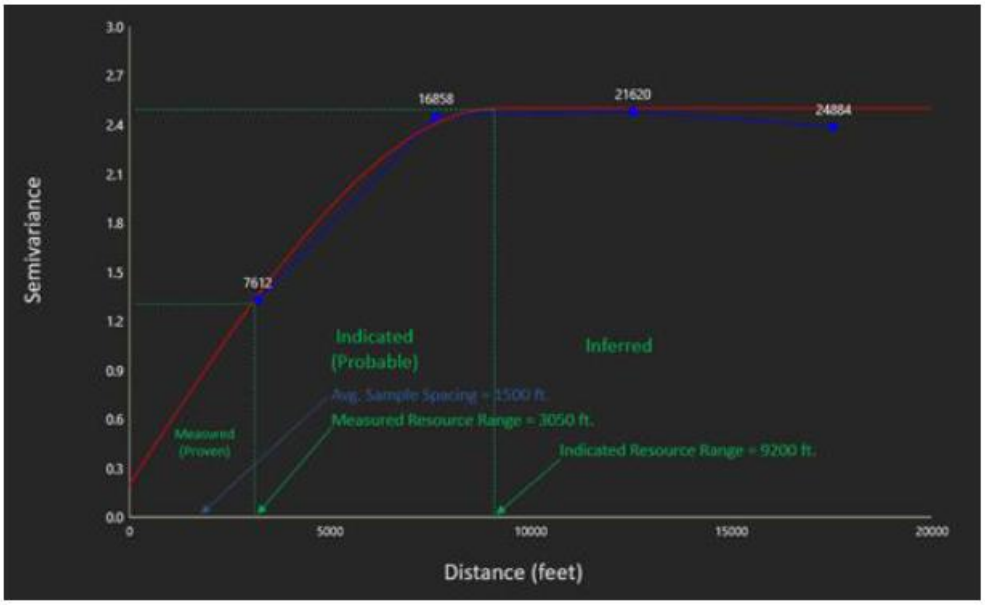


Table 11.4-1 Theoretical Variogram Ranges

Variogram	Figure	Sample Count	Measured Range (Ft.)	Indicated Range (Ft.)
Jawbone No. 1 Seam	1	1,290	2,250	6,800
Pocahontas No. 4 Seam	2	865	7,300	22,000
Tiller No. 1 Seam	3	649	3,050	9,200
Tiller No. 2 Seam	4	702	4,800	14,500

As depicted above, variability in drillhole thickness measurements is highly correlated with the distance between individual drillholes, in particular within the theoretical ranges for Measured and Indicated tonnage. Additionally, WEIR's generation and review of the applicable quality contours further supports the continuity of coal quality throughout the deposit. Table 11.4-2 shows overall quality parameters for the coal seams at the Knox Creek Complex.

Table 11.4-2 Statistics for Composited Drillhole Samples

Quality Parameter	Number of Samples	Total Sample Length (ft)	Minimum Value	Maximum Value	Average Value
Audibert-Arnu Maximum Dialation (%)	116	314	0	300	188
Composition Balance Index	48	135	0.51	7.63	5.38
Free Swell Index	374	1,020	3.1	9	8.6
Gieseler Maximum Fluidity (DDPM)	219	586	1	30,000	9,457
HGI	17	60	94	105	99
Inerts (%)	61	169	8.2	36.3	25.8
Raw Ash (%)	357	984	2.7	62.1	20.4
In-Place Relative Density	925	2,585	1.27	1.96	1.44
Reflectance (ROMAX, %)	112	323	1.2	1.71	1.45
Rank	48	135	0.6	7.0	4.7
Stability Index	99	289	42.0	65.0	55.7
Coal Oxidation by Light Transmittance (%)	17	60	97.0	99.0	97.7
Ash (%)	809	2,223	2.0	19.1	5.9
BTU/lb	507	1,361	12,509	15,505	14,627
Sulfur (%)	803	2,206	0.37	3.50	0.85
Volatiles (%)	721	1,983	15.5	37.4	26.2
Yield (%)	923	2,582	10.4	100.0	74.8

Note: Unless otherwise specified, analyses are on a Dry Basis for coal washed at 1.50 specific gravity

Within the Measured and Indicated ranges, WEIR has demonstrated a level of geological confidence sufficient to allow for the application of modifying factors to support detailed mine planning and evaluation of the economic viability of the deposit. Beyond the four coal seams mentioned above, there are no outlier seams being considered for resources that display anomalous behavior in comparison. As such, classification radii utilized by WEIR in this study are as follows:

- Measured: 0 - 3,000 feet (based on 905 observations informing estimate of coal thickness within this range)
- Indicated: 3,000 – 9,200 feet (based on 905 observations informing estimate of coal thickness within this range)
- Inferred: greater than 9,200 feet (based on 905 observations informing estimate of coal thickness within this range)

11.5 UNCERTAINTY IN ESTIMATES OF MINERAL RESOURCES

Mining is a high risk, capital-intensive venture and each mineral deposit is unique in its geographic, social, economic, political, environmental, and geologic aspects. At the base of any mining project is the mineral resource itself. Potential risk factors and uncertainties in the geologic data serving as the basis for deposit volume and quality estimations are significant considerations when assessing the potential success of a mining project.

Geological confidence may be considered in the framework of both the natural variability of the mineral occurrence and the uncertainty in the estimation process and data behind it. The mode of mineralization, mineral assemblage, geologic structure, and homogeneity naturally vary for each deposit. Structured variability like cyclic depositional patterns in sedimentary rock can be delineated mathematically with solutions like trend surface analysis or variography. Unstructured variability, in the distribution of igneous rock composition, for example, is more random and less predictable.

The reliability of mineral resource estimation is related to uncertainties introduced at different phases of exploration. Resources meeting criteria for Measured, Indicated, and Inferred categories are determined by the quality of modeled input data, both raw and interpreted. An exploration program comprises several stages of progressive data collection, analysis, and estimation, including:

- Geological data collection

- Geotechnical data collection
- Sampling and assaying procedures
- Bulk density determination
- Geological interpretation and modeling
- Volume and quality estimation
- Validation
- Resource classification and estimation

Error may be introduced at any phase. Data acquisition and methodologies should be properly documented and subject to regular quality control and assurance protocols at all stages, from field acquisition through resource estimation. Managing uncertainty requires frequent review of process standards, conformance, correctional action, and continuous improvement planning. Risk can be minimized with consistent exploration practices that provide transparent, backwards traceable results that ultimately deliver admissible resource estimates for tonnage and quality.

As discussed in Sections 8.0, 9.0, and 10.0, it is WEIR's opinion that Ramaco's methodology of data acquisition, record-keeping, and QA/QC protocols are adequate and reasonable for resource estimation at the Knox Creek Complex.

In summary, WEIR has reviewed all geologic and geotechnical data inputs, collection protocols, sampling, assaying, and laboratory procedures serving as the basis for the deposit model, its interpretation, and the estimation and validation of the volume and quality of coal resources at the Knox Creek Complex. The spatial continuity of all seams with resource attributes at the Knox Creek Complex is well demonstrated by professionally developed, well maintained, quantitative and qualitative data. WEIR finds no material reason, regarding geologic uncertainty, that would prohibit acceptably accurate estimation of mineral resources.

11.6 ADDITIONAL COMMODITIES OR MINERAL EQUIVALENT

There are no other commodities or minerals of interest within the Knox Creek Complex resource area other than the coal deposit discussed in this TRS.

11.7 RISK AND MODIFYING FACTORS

The existing and planned underground mines in the complex are above drainage and relatively dry, which decreases risk for bad floor conditions from the presence of underclays.

The consistency of the seams within the complex and good exploration drilling coverage combine to reduce geological risks at the complex. This also relates to product quality risks, which WEIR sees as low for the same reasons. The appearance and disappearance of partings within mined benches is expected and is difficult to accurately map without extensive drilling.

However, these partings are of little consequence to the final product, apart from the marginal additional processing costs involved at the preparation plant for non-coal partings removal.

A large percentage (approximately 98 percent) of currently planned coal deeds and leases have been secured by Ramaco at the Knox Creek Complex and WEIR finds no high risks associated with these coal deeds and leases. Resources that exist in currently unplanned areas are well situated for potential mining as the total size of the uncontrolled areas are not significant in comparison to the total potential mining areas.

Risk is also associated with volatility of coal market prices. Significant variations in operating costs, capital expenditures, productivity, and coal sales prices could impact the economic mineability of the Knox Creek Complex.

Unforeseen changes in legislation and new industry developments could alter the performance of Ramaco by impacting coal consumer demand, regulation and taxes, including those aimed at reducing emissions of elements such as mercury, sulfur dioxides, nitrogen oxides, particulate matter or greenhouse gases. The emphasis on reducing emissions, however, is more of a concern for mines producing a thermal coal product, as opposed to the metallurgical coal produced from the Knox Creek Complex.

12.0 MINERAL RESERVE ESTIMATES

12.1 KEY ASSUMPTIONS, PARAMETERS, AND METHODS

The conversion of resources to reserves at the Knox Creek Complex considers the effects of projected dilution and associated loss of product coal quality, projected coal sales prices, operating costs, regulatory compliance requirements, and mineral control. These factors all determine if the saleable coal product will be economically mineable. The design of executable mine plans that accommodate the planned mining equipment and facilities and provide a safe work environment is also considered.

For Ramaco's underground room and pillar operations, retreat mining will be implemented in most of the existing and planned underground operations within the complex, as permitted. This will result in 50 to 80 percent mining recovery of coal.

The Knox Creek Complex mine layouts have several key variables that will largely impact coal recovery. Pillar and panel dimensions are based on minimum, maximum, and optimal equipment operating parameters, as well as geotechnical considerations relative to the safety of the mining operations and mine subsidence predictions.

Based on a mine's historical performance and projected mineral continuity, the mine design is the primary consideration, apart from mineral resource classification, whereupon resources are converted to reserves at the Knox Creek Complex.

Based on WEIR's review and evaluation of the Knox Creek Complex LOM plans, the justification for conversion of resources to reserves was based on specific criteria. In addition to the criteria stated in Section 11.0 for resources, the following criteria were used to estimate reserves for the Knox Creek Complex:

- Reserves were estimated as of December 31, 2022.
- Underground mining recovery of 50 to 80 percent (dependent on whether retreat mining can be performed), surface mining recovery of 90 percent, and highwall mining recovery of 40 percent were assumed.
- A minimum of two inches of out of seam dilution is included in the ROM underground tonnage estimates, except in areas where the total seam thickness is greater than the maximum mining height.

- A highwall mining maximum penetration depth of 800 feet. Areas with less than 400 feet penetration depth potential, as a result of any site-specific boundary limitations, were excluded from reserve classification.
- The point of reference for reserve estimates is post preparation plant processing and recoverable tons were adjusted for a theoretical preparation plant yield based on drillhole and channel sample analyses washed at a 1.50 specific gravity.
- A conservative preparation plant efficiency factor of 95.0 percent was applied to reflect actual performance of the preparation plant, compared to theoretical laboratory results at a 1.50 specific gravity.
- The estimate of reserve tons includes areas that are exclusively within the current Knox Creek Complex LOM plans.

12.2 ESTIMATES OF MINERAL RESERVES

The coal reserves that represent the economically viable tonnage controlled by Ramaco at the Knox Creek Complex, based on the coal reserve estimate methodology described, are shown in Table 12.1-3 as follows:

Table 12.1-3 Recoverable Coal Reserve Tonnage and Quality Estimate as of December 31, 2022

							Coal Quality (Dry Basis)	
							Raw	
	Product	Area	Average Coal Thickness	Clean Recoverable Tons (000) Reserves			Ash	Relative Density
Area / Mine / Seam	Quality	(Acres)	(Feet)	Proven	Probable	Total	(%)	(Lbs/CF)
Knox Creek								
Kennedy No. 3 Deep Mine								
Kennedy 2	Hi Vol	336	3.23	720	—	720	13.60	86.48
Knox Creek Tiller Deep Mine								
Jawbone 3	Hi Vol	1,546	3.44	6,362	—	6,362	16.10	88.05
		1,882	3.40	7,082		7,082	15.85	87.89
Big Creek								
Surface and Highwall Mine								
Jawbone 1	Mid Vol	20	1.27	30	—	30	18.4	89.50
Tiller 2-2 and 1-2	Mid Vol	175	2.61	318	—	318	19.1	89.75
Jawbone Deep Mine								
Jawbone 1	Mid Vol	383	3.40	586	—	586	30.6	97.38
		578	3.09	934		934	26.3	94.53
Knox Creek Complex Grand Total		2,460	3.33	8,016		8,016	17.06	88.66

Notes:

- Clean recoverable reserve tonnage based on underground mining recovery of 50 to 80 percent (contingent upon retreat mining capability), 90 percent for surface mining, 40 percent for highwall mining, theoretical preparation plant yield, and a 95 percent preparation plant efficiency
- Mineral Reserves estimated based on predominately mid and high volatile metallurgical coal product at a sales price of $183.50 per ton and cash cost of $98.68 per clean ton (FOB Mine)
- Numbers in the table have been rounded to reflect the accuracy of the estimate and may not sum due to rounding
- Mineral Reserves are reported exclusive of Mineral Resources

12.3 ESTIMATES OF RESERVE CUT-OFF GRADE

The seams within the Knox Creek Complex display consistent quality attributes representative of high-quality metallurgical coal. Current mine plans involve mid to high volatile products. One significant variable regarding cost considerations is OSD which results in additional preparation plant costs to obtain a saleable coal product. Preparation plant throughput is also a consideration. However, preparation plant ROM throughput is not a limitation at the Knox Creek Complex, and the incremental cost of "washing out" the additional OSD as a result of minimum mining heights for equipment clearance does not forgo mining coal seams with thicknesses of 2.0 feet. Mining heights below 2.0 feet result in increased operational difficulty given equipment limitations and capabilities. WEIR did not discover any areas within the complex where washed coal quality parameters for planned mining tonnage was deficient relative to maintaining a high-quality metallurgical grade coal status. The coal on the property is consistently of high-quality.

In summary, based on Ramaco's Knox Creek Complex historical and consistent saleable coal product quality, current coal sales contract specifications, and the projected coal quality that has been modeled, WEIR does not foresee any deviations that would adversely affect future saleable coal product.

12.4 MINERAL RESERVE CLASSIFICATION

WEIR prepared the Knox Creek Complex reserve estimates in accordance with Regulation S-K Item 1302(e), which establishes guidance and definitions for mineral reserves to be used in the United States. The SEC Regulation S-K 1300 Definition Standards relative to reserves are as follows:

> *Modifying factors* are the factors that a qualified person must apply to indicated and measured mineral resources and then evaluate to establish the economic viability of mineral reserves. A qualified person must apply and evaluate modifying factors to convert measured and indicated mineral resources to proven and probable mineral reserves. These factors include but are not restricted to: Mining; processing; metallurgical; infrastructure; economic; marketing; legal; environmental compliance; plans, negotiations, or agreements with local individuals or groups; and governmental factors. The number, type and specific characteristics of the modifying factors applied will necessarily be a function of and depend upon the mineral, mine, property, or project.

> A *mineral reserve* is an estimate of tonnage and grade or quality of indicated and measured mineral resources that, in the opinion of the qualified person, can be the basis of an economically viable project. More specifically, it is the economically mineable part of a measured or indicated mineral resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted.
>
> - *Probable mineral* reserve is the economically mineable part of an indicated and, in some cases, a measured mineral resource.
> - *Proven mineral reserve* is the economically mineable part of a measured mineral resource and can only result from conversion of a measured mineral resource.

Within the extent of the LOM Plan for the Knox Creek Complex, Measured Resources were converted to Proven Reserves and Indicated Resources were converted to Probable Reserves.

12.5 COAL RESERVE QUALITY AND SALES PRICE

Knox Creek Complex coal quality was determined by modeling the drillhole coal quality for the reserve areas. The average dry basis coal quality by seam, for raw coal and washed coal at a 1.50 specific gravity, for the reserves are shown in Table 12.5-1 as follows:

Table 12.5-1 Average Reserve Coal Quality

	Coal Quality (Dry Basis)											
	Raw		Washed @ 1.50 Specific Gravity									
Seam	Ash (%)	Relative Density (Lbs/CF)	Ash (%)	Sulfur (%)	Volatile Matter	Calorific Value (Btu/lb.)	Theoretical Plant Yield (%)	Audibert-Arnu MaximumDilation (%)	Calculated Stability Index	Fluidity DDPM	Free Swell Index	Reflectance ROMAX (%)
Knox Creek												
Kennedy 2	13.6	86.9	5.2	0.83	35.3	14,803	86.9	220	ND	30,024	9.0	ND
Jawbone 3	16.1	88.1	5.0	0.85	32.2	14,732	79.5	246	ND	30,017	8.7	ND
Average	15.8	87.9	5.0	0.85	32.5	14,739	80.3	243	—	30,018	8.7	—
Big Creek												
Jawbone 1	30.6	97.2	7.2	0.62	25.9	14,465	50.8	208	56.2	17,595	8.3	1.46
Tiller 1-2	19.1	89.8	5.3	0.66	28.9	14,780	75.5	198	49.6	26,498	8.0	0.94
Average	26.7	94.7	6.5	0.63	26.9	14,572	59.2	205	53.9	20,626	8.2	1.28
Overall Average	17.1	88.7	5.2	0.82	31.9	14,720	77.8	239	—	28,923	8.7	—

ND = No Data

The average quality for the reserve tons shows that the Knox Creek Complex ranges from a high quality mid volatile to a high quality high volatile metallurgical coal product, all possessing good coking properties. The range of dry washed volatile matter is between approximately 25.9 and 35.3 percent, with an average of 31.9 percent. The average proximate analyses reflect an overall coal product that is relatively low in ash and sulfur, and high in calorific value. Other quality parameters such as ROMAX, Free Swelling Index, Audibert-Arnu Maximum Dilation, and Gieseler Fluidity indicate high quality metallurgical grade coal products.

Ramaco's forecasted Knox Creek Complex FOB mine coal sales prices are $164.36 per ton in 2023, $172.10 in 2024, $179.69 in 2025 and $186.00 thereafter through 2037. Ramaco's sales price projections conform to published forward price curves for coal of similar quality to that of the Knox Creek Complex. The sales price is further supported in Section 16.0 of this report.

12.6 RISK AND MODIFYING FACTORS

Due to the relatively high continuity of the coal seams within the Knox Creek Complex LOM plans (both in terms of structure and quality), geologic uncertainties do not appear to pose a significant mining risk.

The operating mines at Knox Creek Complex have good safety records and maintain diligent regulatory compliance. Workforce census has been and is expected to remain stable. The primary mining equipment is well-maintained, as observed from WEIR's site visit, and has sufficient capacity to attain projected levels of productivity and production. This further contributes to the Knox Creek Complex being a relatively low risk operation. As previously noted, mineral rights are acceptably secure for all operating and planned mines.

Mining recovery is an important aspect in assessing the economic viability of a mine. Based on Ramaco's historical extraction rates, WEIR does not anticipate significant deviation of product recovery in the future. For deep mines, aerial recovery is based on the pillar size that has been designed for the operation, which is dependent on depth of cover and overlying rock strength and quality. The pillar design is most importantly intended to provide safe operation of the primary coal extraction efforts. Where planned advance and retreat recoveries were not provided by Ramaco, WEIR utilized an average mining recovery of 50 percent for the Knox Creek Complex CMs for first mining and an additional 30 percent mining recovery for areas of retreat mining. This is consistent with industry standards and with actual mining recovery reported and planned by Ramaco.

Risk is also associated with the volatility of coal market prices. Significant variations in operating costs, capital expenditures, productivity, and coal sales prices could impact the economic mineability of the Knox Creek Complex. Economic analyses and associated sensitivities are further detailed in Section 19.0.

13.0 MINING METHODS

The underground mining method at the Knox Creek Complex is room and pillar mining utilizing CMs. Mains and submains are generally developed on 120 feet by 90 feet centers. Panels are generally developed on 70 feet by 70 feet centers, depending on depth of cover and exposed surface structure concerns with potential subsidence. Mine entry widths are approximately 20 feet for all entries. Retreat mining in the panels, where it is permitted, will typically increase overall mining recovery to approximately 80 percent. Due to lack of surface structures within the complex, retreat mining is planned for the majority of the underground mining areas. Although Ramaco has subsidence rights, Ramaco acknowledges the rules and regulations in regard to measures to be taken to mitigate or remedy any material damage or diminution in value that may occur to surface lands, structures, or facilities due to subsidence. No deep mining is proposed within 50 feet of gas wells.

The Big Creek Surface and Highwall Mine operations involve a mix of contour mining and area removal methods. To accommodate the subsequent highwall mining, a minimum contour mining bench width of 125 feet projected by WEIR. Concern regarding stripping ratio for Ramaco's contour operations in this area is secondary in comparison to the access gained to coal seams to be mined by lower cost highwall mining. The area removal method is planned in the southern portion of the mine plan where the economically feasible in-place stripping ratio of approximately 20:1 (BCY per ton) or less occurs.

13.1 GEOTECHNICAL AND HYDROLOGICAL MODELS

13.1.1 Geotechnical Model

Ramaco bases its underground mine pillar design on; 1) the general characteristics of the roof, coal, and floor strata in concert with Analysis of Coal Pillar Stability (ACPS) and Analysis of Retreat Mining Pillar Stability (ARMPS) software which are both accepted industry standards, 2) experience in the mining industry, and 3) results from similar or adjacent mines. Underground mining conditions at the Knox Creek Complex are consistent with roof and floor being primarily shales and sandstones, with competent coals seams (See Figure 6.3-1). Pillars for first mining are designed according to minimum unconfined compressive strengths (UCS) of materials such that pillar stability is greater than 2.0. In the currently active and planned underground mines on the Knox Creek Complex, the first mining protection zones are limited to small areas where there are intermittent streams with less than 200 feet of cover.

Generally speaking, the UCS of shale ranges from 2,000 to 20,000 pounds per square inch (psi) while sandstone ranges from 7,000 to 35,000 psi. The compressive strength of the coal used in the coal pillar stability analysis is 900 psi. This means that there is a safety factor of at least 2.0 above the safety factor in the coal pillar analysis, when using the lowest value for the compressive strength of shale. Due to this large safety factor when using the minimum commonly accepted UCS value for shale, and since the only protection zones are for intermittent streams in areas of less than 200 feet of cover, Ramaco has waivers in its WVDEP and VDE permits for analysis of the engineering properties of soft rock.

The subsidence surveys have identified some gas wells and associated gas lines in proposed underground mining areas. The owners of the gas wells have been identified on the Subsidence Survey Map in the associated WVDEP and VDE permits. No mining is proposed within 50 feet of the gas wells. No protection is proposed for the gas lines that lie within the proposed mining areas.

Ramaco has roof control plans for all of its permitted underground mines. The plans must be approved by the MSHA before mining can commence. The MSHA routinely performs

inspections to ensure that the roof control plans are being properly implemented.

For Ramaco's surface mining operations, standing highwall configurations are not substantial enough to warrant specific geotechnical studies. Maximum cut slopes and safety benches are maintained according to Ramaco's MSHA-approved Ground Control Plans.

For highwall mining operations, hole spacing is based on ACPS analysis and previous results in combination with accepted industry standards. The maximum anticipated recovery within highwall mining areas is less than 50 percent, which should not result in subsidence. No other measures are required to prevent or minimize subsidence or subsidence related damage. Because no subsidence is anticipated from the proposed highwall mining, no plan for monitoring the extent of subsidence is proposed at this time. No water supplies are located above the proposed highwall mining areas. The subsidence surveys have identified some gas wells and associated gas lines in proposed highwall mining areas. The owners of the gas wells have been identified on the Subsidence Survey Map in the WVDEP and VDE permits. No mining is proposed within 50 feet of the gas wells. One gas well will be replaced on the property at the well owner's expense. No protection is proposed for the gas lines that lie within the proposed highwall mining areas.

In summary, no specific detailed geotechnical models or data sets have thus far been created for Ramaco's existing or planned mining operations at the Knox Creek Complex. WEIR notes that to date, Ramaco has not experienced any significant stability problems at its Knox Creek Complex mines. Based on WEIR's experience in the coal industry, and Ramaco's successful operating history, both in regard to geotechnical considerations, Ramaco is operating its mines in accordance with industry acceptable geotechnical evaluation and standards.

13.1.2 Hydrogeological Model

The Knox Creek Complex is regionally within the Virginia Big Sandy River Basin and Upper Guyandotte River watershed of West Virginia. The Clinch River, to the south of the complex, is the primary hydrological feature in the local area and is a tributary of the Tennessee River. The major hydrogeological unit in the area is the Lower Pennsylvanian.

Recharge rates for aquifers in this area are relatively low at approximately 12 inches per year. Transmissivity data for the Norton Formation in the region shows relatively high rates of 100 to 2000 square feet per day (Aquifer-Characteristics Data for West Virginia, Water-Resources Investigations Report 01-4036, USGS/West Virginia Bureau for Public Health, 2001). These data both suggest unconfined aquifers, and this generally supports the hydrology sections of permits for the Ramaco mines on the complex.

A 1993 study conducted by the USGS in cooperation with the VDE in the immediate vicinity further supports this and suggests that the primary aquifers with significant horizontal flow in the area are due to relatively shallow fracture flow systems. Coal seams also act in horizontal flow systems typically resulting in discharge as springs or seeps on hill slopes, or recharge of coal seams at depth. The study found that as depth increases beyond 100 feet, hydraulic conductivity significantly decreases for strata other than coal. This results in little deep regional ground-water flow.

Due to the rural nature of the area, there are several cooperative and private water wells on and adjacent to the Knox Creek Complex. There are also structures that utilize the Public Service District water services, and those that utilize both. This ground water inventory information has been summarized by Ramaco in its permit applications.

The operating and planned Ramaco mines will be constructed above drainage and above all domestic surface and groundwater sources. Due to above-drainage construction and low aquifer recharge rates in the area, the Ramaco mines are relatively dry with little concern for water infiltration. Fracturing and weathering are invariably present in varying degrees in shallow rocks throughout the property. Fracturing affects the hydrologic regime by controlling subsurface water flow (and thus weathering) due to the very low permeability of un-fractured strata. Infiltration due to this fracturing is sometimes encountered but is insignificant to mine operations.

Surface Water Runoff Analyses are included in permit submittals and indicate that stream flows will not increase during or after mining, therefore there will be no increased potential for flooding or channel scouring. In general, diminution, or interruption of any water supply, as a result of the Ramaco mines, is not anticipated.

Groundwater inventories, water quality data, water balance, recharge and seepage rates have been reviewed in the approved permits and current permit revisions, including hydrologic impact assessments outlining risks, monitoring program detail, and mitigation obligations. Ramaco's approach to obtaining and managing its surface and groundwater data for the Knox Creek Complex has been demonstrated to be adequate and aligned with regulatory requirements and standard industry practices. WEIR finds no material barriers to the continued success of the Knox Creek Complex regarding hydrologic impact or compliance.

13.1.3 Other Mine Design and Planning Parameters

Mine ventilation is a primary design concern for underground mines. WEIR has reviewed Ramaco's designs and planning for this aspect of its mining operations and has found no significant problems concerning adequacy of ventilation fans or fan locations.

Proximity to previously underground mined areas above or below the operating or planned underground mine is an important consideration at the Knox Creek Complex, since there are many areas that have been previously mined in many coal seams. WEIR reviewed Ramaco's mines in proximity to previous mine workings and associated fracture depths and cones used by Ramaco and found no concerns for its existing or planned operations.

Underground mine surface facilities and surface mining sites require drainage designs to control surface water runoff. WEIR has reviewed Ramaco's designs, which have been approved in its WVDEP, VDEP, and NPDES permits, and found the designs to be adequate and consistent with industry standards.

13.2 PRODUCTION, MINE LIFE, DIMENSIONS, DILUTION, AND RECOVERY

13.2.1 Production Rates

Big Creek Surface and Highwall Mine

The mine employs both contour mining and area removal mining methods. Highwall mining follows behind contour mining. The stripping ratio averages approximately 20:1 BCY/ton, excluding highwall miner contour mining areas. The highwall miner has the ability to penetrate approximately 800 feet into targeted coal seams that are, on average, at least two feet in thickness. Highwall mining in an area is avoided if the holes cannot average more than 400 feet in penetration, as a result of boundary restrictions or seam thickness shortcomings.

This relatively new Ramaco mine is a multiple seam operation involving the Jawbone and Tiller seams. The Tiller Seam is the only seam that is highwall mined. Ramaco started operations here in early 2021 and currently employs a total of 32 people as of year-end 2022.

Big Creek Jawbone 1 Deep Mine

The mine utilizes one CM unit (single section) which is in the Jawbone 1 Seam. Coal production started in mid-2022. Seam thickness is consistent at approximately 3.4 feet. The Tiller Seam has been previously undermined in this area and Ramaco has adjusted the mine plan accordingly considering total planned extraction and panel design extents. Retreat mining is planned for all panels at approximately an 80 percent total extraction rate. Approximately 54 people will be involved in the mine's normal operations. The CM unit's productivity is projected to be 180 feet per shift.

Knox Creek Property Planned Mines

Knox Creek planned mines that will start/re-start production in the future include:

- Knox Creek Tiller Deep Mine (Jawbone 3 Seam, currently inactive, currently targeted for 2024 startup). This is a dual section CM mine with projected productivity at 160 feet per unit shift and employing approximately 98 people for normal operations.
- Kennedy No. 3 Deep Mine (Kennedy 2 Seam, currently targeted for 2024 startup). This is a single section CM mine with projected productivity at 150 feet per shift and employing 54 people for normal mine operations.

Actual clean coal production attained by the Knox Creek Complex for 2018 through 2022 is shown in Table 13.3.1-1 as follows:

Table 13.2.1-1 Knox Creek Complex Historical Clean Production

	Clean Tons Produced (000)				
Mine	2018	2019	2020	2021	2022 (1)
Big Creek Jawbone 1 Deep Mine	—	—	—	—	63,852
Big Creek Surface and Highwall Mine	—	—	—	45,332	170,858
Knox Creek Tiller Deep Mine	—	1,479	—	—	—
Knox Creek Complex Total	—	1,479	—	45,332	234,710

(1) 2022 - Eleven Months Actual, One Month Forecast

Actual and projected ROM and clean coal production, and preparation plant yield for the Big Creek Surface and Highwall Mine, and each of the underground mines for the Knox Creek Complex LOM Plan are shown in Table 13.2.1-2 as follows:

Table 13.2.1-2 Knox Creek Complex LOM Plan Projected ROM and Clean Production, and Preparation Plant Yield

	2022(1)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	Total
ROM Tons (000)																	
Big Creek Jawbone 1 Deep Mine	173	492	392	397	359	-	-	-	-	-	-	-	-	-	-	-	1,639
Kennedy No. 3 Deep Mine	-	-	-	268	342	393	304	199	-	-	-	-	-	-	-	-	1,506
Knox Creek Tiller Deep Mine	-	-	672	1,195	1,200	1,158	1,175	1,243	1,180	1,194	1,195	1,204	788	580	635	328	13,748
Big Creek Surface and Highwall Mine	428	251	210	98	-	-	-	-	-	-	-	-	-	-	-	-	559
Total	601	743	1,273	1,957	1,901	1,551	1,479	1,442	1,180	1,194	1,195	1,204	788	580	635	328	17,451
Clean Tons (000)																	
Big Creek Jawbone 1 Deep Mine	64	151	159	142	135	-	-	-	-	-	-	-	-	-	-	-	586
Kennedy No. 3 Deep Mine	-	-	-	120	175	189	140	97	-	-	-	-	-	-	-	-	720
Knox Creek Tiller Deep Mine	-	-	269	547	544	599	597	583	513	560	563	550	339	279	286	134	6,362
Big Creek Surface and Highwall Mine	171	148	137	63	-	-	-	-	-	-	-	-	-	-	-	-	348
Total	235	298	565	872	853	787	737	679	513	560	563	550	339	279	286	134	8,016
Preparation Plant Yield (%)																	
Big Creek Jawbone 1 Deep Mine	37.0	30.6	40.6	35.7	37.6	-	-	-	-	-	-	-	-	-	-	-	35.7
Kennedy No. 3 Deep Mine	-	-	-	44.9	51.1	47.9	46.0	48.6	-	-	-	-	-	-	-	-	47.8

Knox Creek Tiller Deep Mine	-	-	40.1	45.8	45.3	51.7	50.8	46.9	43.5	46.9	47.1	45.6	43.0	48.0	45.1	40.8	46.3
Big Creek Surface and Highwall Mine	39.9	58.8	65.2	65.0	-	-	-	-	-	-	-	-	-	-	-	-	62.3
Average	39.1	40.2	44.4	44.6	44.9	50.7	49.8	47.1	43.5	46.9	47.1	45.6	43.0	48.0	45.1	40.8	45.9
Tons Sold (000)																	
Big Creek Jawbone 1 Deep Mine	51	151	159	142	135	-	-	-	-	-	-	-	-	-	-	-	586
Kennedy No. 3 Deep Mine	-	-	-	120	175	189	140	97	-	-	-	-	-	-	-	-	720
Knox Creek Tiller Deep Mine	-	-	269	547	544	599	597	583	513	560	563	550	339	279	286	134	6,362
Big Creek Surface and Highwall Mine	168	178	104	67	-	-	-	-	-	-	-	-	-	-	-	-	348
Total	219	328	532	875	853	787	737	679	513	560	563	550	339	279	286	134	8,016

(1) 2022 - Eleven Months Actual, One Month Forecast

13.2.2 Expected Mine Life

Individual mines at the Knox Creek Complex have expected mine lives varying from about four years to 15 years. Because the mines are being staged in development, estimation of an expected life of mine for the complex is not appropriate, since there are fairly vast resources available to be mined as reported in Section 11.0. As mining at the complex progresses, future mines will be planned and scheduled as necessary to meet internal Ramaco goals as they align with market conditions. WEIR and Ramaco both acknowledge that this reporting methodology may result in the need for future updates to this TRS.

13.2.3 Mine Design Dimensions

The projected mining through 2037 for the various mine plans are shown on Figures 13.5-1 through 13.5-4.

Mine design criteria utilized for these mine plans are as follows:

- Gas Wells
  - State Permit required to mine within 500 feet of a well
  - MSHA Permit required to mine within 150 feet of a well
  - Active Well barrier - tangent of 15 degrees x depth of cover or 50 feet, whichever is greater
  - Inactive Well barrier - tangent of 5 degrees x depth of cover or 50 feet, whichever is greater
  - Plugged Wells - mine-through is allowed with acquisition of proper State and MSHA Permits
- Pillar Size
  - ARPMS stability factor of 2.0 or greater for mining under protected areas, which is primarily intermittent streams with less than 200 feet of cover. This is true throughout the complex.
  - ARMPS stability factor of 1.5 or greater for all other room and pillar development.
- Depth of Cover
  - Ramaco implements a 100 feet minimum depth of cover for all of their underground mines
- Areas without Subsidence Rights
  - ARMPS stability factor of 2.0 or greater will be maintained during first mining.
  - Retreat mining will come no closer than a tangent of 30 degrees times depth of cover to the property boundary.
- Coal Thickness
  - Mining is not planned in areas of coal seams less than 2.0 feet in thickness.
  - CM units are assumed to mine the entire seam thickness (averaging approximately 3.0 feet, and ranging from 2.0 to 10.0 feet).

13.2.4 Mining Dilution

OSD on CM units for Ramaco's Knox Creek Complex typically consists of a total of two to three inches of waste from the roof and/or floor. Some areas may require mining more OSD to accommodate mine facilities such as ventilation or conveyors. OSD is not included in the reserve or resource estimates since all underground ROM coal is processed at the preparation plant, which effectively eliminates OSD from the saleable coal product.

13.2.5 Mining Recovery

Mining recovery when utilizing CM mining is based on the pillar design, which is in turn based on depth of cover. Mining recovery varies based on whether the panel is a main or sub-main entries, or a production panel due to the longevity requirements for the mine entries. Mining recovery for first mining at the complex is usually approximately 50 percent, based on pillar design. In the areas where retreat mining is conducted, an additional 30 percent mining recovery is usually attainable. The CMs have the cutting height capacity to recover the entire seam thickness in the planned mining areas.

For surface mining, a recovery of 90 percent was projected. The hole spacing for highwall mining results in a mining recovery of approximately 40 percent.

13.3 DEVELOPMENT AND RECLAMATION REQUIREMENTS

13.3.1 Underground Development Requirements

The Knox Creek Complex currently has one active underground mine and an active surface mine. As underground mines progress, and as with similar mining operations, continuous development is required for extensions of belt conveyors, mine power, pipelines, track, and ventilation facilities.

Future ventilation punchouts, or bleeder holes, are anticipated for areas where retreat mining is executed, applicable at most deep mines within the complex. Each bleeder hole installation will be completed just prior to starting panel development.

Minor development such as drilling holes for rock dust and electrical distribution from the surface may be required at some of the mines, where existing underground mine development is extensive.

13.3.2 Reclamation (Backfilling) Requirements

The construction of underground mines requires the removal of material to create an adequate working surface for the underground mine face-up, haul roads, mine surface facilities, and access roads. Upon mine closure, selected areas will be reclaimed to near Approximate Original Contour (AOC). Other areas will be left in-place as per the approved alternate post-mining land use requirements. Regrading and backfilling activities will commence within 180 days after the mining operations are complete.

As part of Ramaco's surface mine plans, the contour mining method will require backfilling as mining progresses. Material from the current contour cuts will be used to re-slope previously contour-mined areas to AOC. To the extent possible, Ramaco avoids the use of valley fills during surface mining operations in preference to backfilling of previously contour mined working areas.

WEIR has reviewed Ramaco's 1/11/23 Asset Retirement Obligations (ARO) summary for the period ending 12/31/22. Backfilling obligations appear to be properly accounted for at Ramaco's mines. Based on Ramaco's permit filings with the WVDEP and VDE, bonding requirements are also current and at satisfactory levels at the Knox Creek Complex (see Section 17.3 and 17.5 for additional details on bonding and mine closure planning).

13.4 MINING EQUIPMENT AND PERSONNEL

13.4.1 Mining Equipment

The Knox Creek Complex is currently utilizing the following industry standard mining equipment on the CM sections, as shown in Table 13.4-1.

Table 13.4.1-1 Standard/Typical Continuous Miner Section Equipment

Units	Continuous Miner Supersection Equipment
2	- Joy 1415 Continuous Miners
3	- Narco 10SC32 Shuttle Cars
2	- Fletcher CHDDR15 Roof Bolters
2	- Fairchild 35C Battery Scoops
1	- Feeder Breaker
2	- Mantrips

Table 13.4.1-2 shows the total underground equipment fleet expected at the Knox Creek Complex over the next 10 years. In some cases, mines that commence later in the LOM Plan will utilize equipment currently being used at other mines at the Knox Creek Complex to avoid additional capital expenditures.

Table 13.4.1-2 Knox Creek Complex Primary Underground Equipment Fleet

Mine	Supersections	Continuous Miners	Shuttle Cars	Roof Bolters	Battery Scoops	Feeder Breakers	Mantrips	Service Locomotive
Big Creek Jawbone Deep Mine	1	2	3	2	2	1	2	1
Kennedy No. 3 Deep Mine	1	2	3	2	2	1	2	1
Knox Creek Tiller Deep Mine	2	4	6	4	4	2	4	2
Total	4	8	12	8	8	4	8	4

Current equipment at the Big Creek Surface and Highwall Mine is shown in Table 13.4.1-3. There will be one highwall miner at the Big Creek Surface and Highwall Mine. The equipment for the highwall mining operations will be owned, operated, and maintained by Ramaco.

Table 13.4.1-3 Surface Mining Equipment

Units	Surface Mining Equipment
1	Caterpillar 992G Front End Loader (15 Cu. Yard)
1	Caterpillar 988H Front End Loader (10 Cu. Yard)
1	Caterpillar 980H Front End Loader (8 Cu. Yard)
1	John Deere 724K Front End Loader (4.5 Cu. Yard)
3	Caterpillar 777 Overburden End Dump Haul Trucks (100-Ton)
1	Caterpillar D10T Track Dozer
1	Caterpillar D9T Track Dozer
1	Superior Highwall Miner #55
1	Caterpillar 16H Road Grader
1	Atlas-Copco DM 50 Overburden Drill
1	Caterpillar 773B 20,000 Gallon Water Truck
1	Komatsu PC360LC Excavator (Utility 2.5 Cu. Yard)
1	John Deere 250G Excavator (Utility 1.5 Cu. Yard)
4	Service Trucks (International 4300-4400 series)
5	Ford F250 Pickup Trucks

No changes are planned in the type of mining equipment used throughout the Knox Creek Complex LOM Plan. Based on WEIR's experience in the industry and on Ramaco's historical performance, WEIR believes that Ramaco can meet planned production requirements with the mining equipment described in this section using prudent operating methods and operating schedules.

13.4.2 Staffing

The current Knox Creek Complex staffing is summarized in Table 13.4.2-1 as follows:

Table 13.4.2-1 Current Staffing

	Total
Big Creek Surface and Highwall Mine	36
Big Creek Jawbone Deep Mine	40
Knox Creek Tiller No. 1 Deep Mine	—
Kennedy No. 3 Deep Mine	—
Knox Creek Preparation Plant	19
Environmental	6
Administration	6
	107

Note: Staffing as of December 2022

Each operating mine at the Knox Creek Complex is scheduled to produce coal on two production shifts each day, the A Shift and the B Shift. Underground mine crews on the night idle shift provide support services including production unit moves, off-shift maintenance and other support functions as required. In addition, general underground support crews work each shift performing routine supply, belt maintenance and outby support functions. Hourly personnel are not affiliated by any union, with no anticipated changes to this in the near term.

The preparation plant is staffed with two crews to process ROM coal 20 hours per day over two, 10-hour shifts, five days per week with no holidays.

The actual and projected staffing for the LOM Plan is shown in Table 13.4.2-2 as follows:

Table 13.4.2-2 LOM Plan Staffing

	Big Creek Surface Mine	Big Creek Jawbone 1 Deep Mine	Knox Creek Tiller Deep Mine	Kennedy No. 3 Deep Mine	Knox Creek Preparation Plant	Environmental	Admin	Total
Current[(1)]	36	40	—	—	19	6	6	107
2023	32	54	—	—	19	6	6	117
2024	32	54	98	54	23	6	8	275
2025	32	54	98	54	23	6	8	275
2026	29	54	98	54	23	6	8	272
2027 - 2037	—	—	98	54	23	6	8	189

(1) As of December 31, 2022.

After 2023, staffing levels are expected to increase in 2024 with the startup of the Kennedy No. 3 and Knox Creek Tiller Mines.

Most of Ramaco's employees live nearby in McDowell County, West Virginia, and Buchanan, Tazewell, and Russell Counties, Virginia. Ramaco has had no major issues hiring qualified candidates for open positions and relies considerably on employee referrals.

Based on industry experience and Ramaco's historical performance, WEIR believes that the staffing levels are adequate to meet Ramaco's planned production.

Mine Safety

An industry standard for safety performance is the Non-Fatal Days Lost (NFDL) Incidence Rate, which is determined by the number of lost time injuries multiplied by 200,000 divided by the manhours worked.

The Knox Creek Complex mines (excluding the preparation plant) manhours worked, NFDL injuries, and NFDL Incidence Rate reported to the MSHA for 2018 through 2022, compared to the national average NFDL Incidence Rate for United States surface and underground coal mines are shown in Table 13.4.2-3 for each of the active mines.

Table 13.4.2-3 Knox Creek Complex Manhours Worked, NFDL Injuries and NFDL Incidence Rate

	Manhours Worked	NFDL Injuries		Incidence Rate	
		Employee	Contractor	Mine Total	National Average
	Big Creek Jawbone Deep Mine (Mine No. 1)				
2022	51,283	1	—	3.90	3.46
2021	—	—	—	—	3.60
2020	—	—	—	—	3.21
2019	—	—	—	—	3.06
2018	—	—	—	—	3.18
	Knox Creek Tiller No. 1 Deep Mine				
2022	—	—	—	—	3.46
2021	1,400	—	—	—	3.60
2020	5,493	—	—	—	3.21
2019	14,583	—	—	—	3.06
2018	—	—	—	—	3.18
	Big Creek Surface Mine				
2022	87,321	—	—	—	0.65
2021	34,656	—	—	—	0.64
2020	—	—	—	—	0.79
2019	—	—	—	—	0.81
2018	39,778	—	—	—	0.80

The Knox Creek Complex NFDL Incidence Rates are perfect and are significantly lower than the national average, except for the Big Creek Jawbone Deep Mine that incurred one lost time injury in 2022 with low manhours during the initial mine startup.

The Knox Creek Preparation Plant manhours worked, NFDL injuries, and NFDL Incidence Rate reported to the MSHA for 2018 through 2022, compared to the national average NFDL Incidence Rate for United States preparation plants are shown in Table 13.4.2-4 as follows:

Table 13.4.2-4 Plant Manhours Worked, NFDL Injuries and NFDL Incidence Rate

	Manhours Worked	NFDL Injuries		NFDL Incidence Rate	
		Knox Creek	Contractor	Knox Creek Plant	National Average
2022	56,158	—	—	—	0.85
2021	39,933	—	—	—	1.00
2020	32,996	—	—	—	1.83
2019	19,480	—	—	—	2.08
2018	20,345	—	—	—	1.84

The Knox Creek Preparation Plant historical NFDL Incidence Rates are perfect and are significantly lower than the national average.

13.5 LIFE OF MINE PLAN MAP

The projected mining areas for the Knox Creek Complex LOM Plans are shown on Figures 13.5-1 through 13.5-4.

Figure 13.5-1 Life of Mine Plan, Big Creek Surface and Highwall Mine

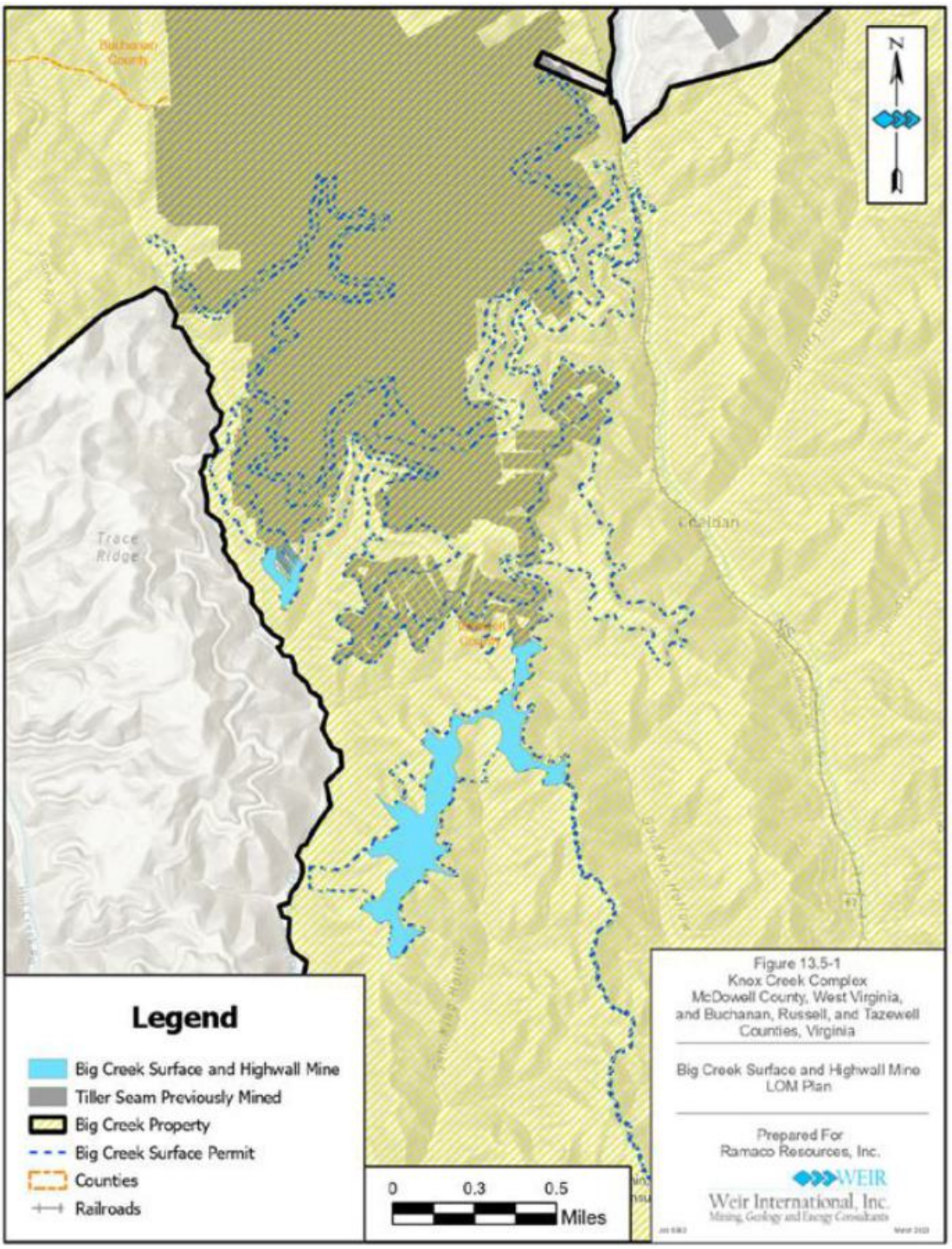


Figure 13.5-2 Life of Mine Plan, Big Creek Jawbone 1 Deep Mine

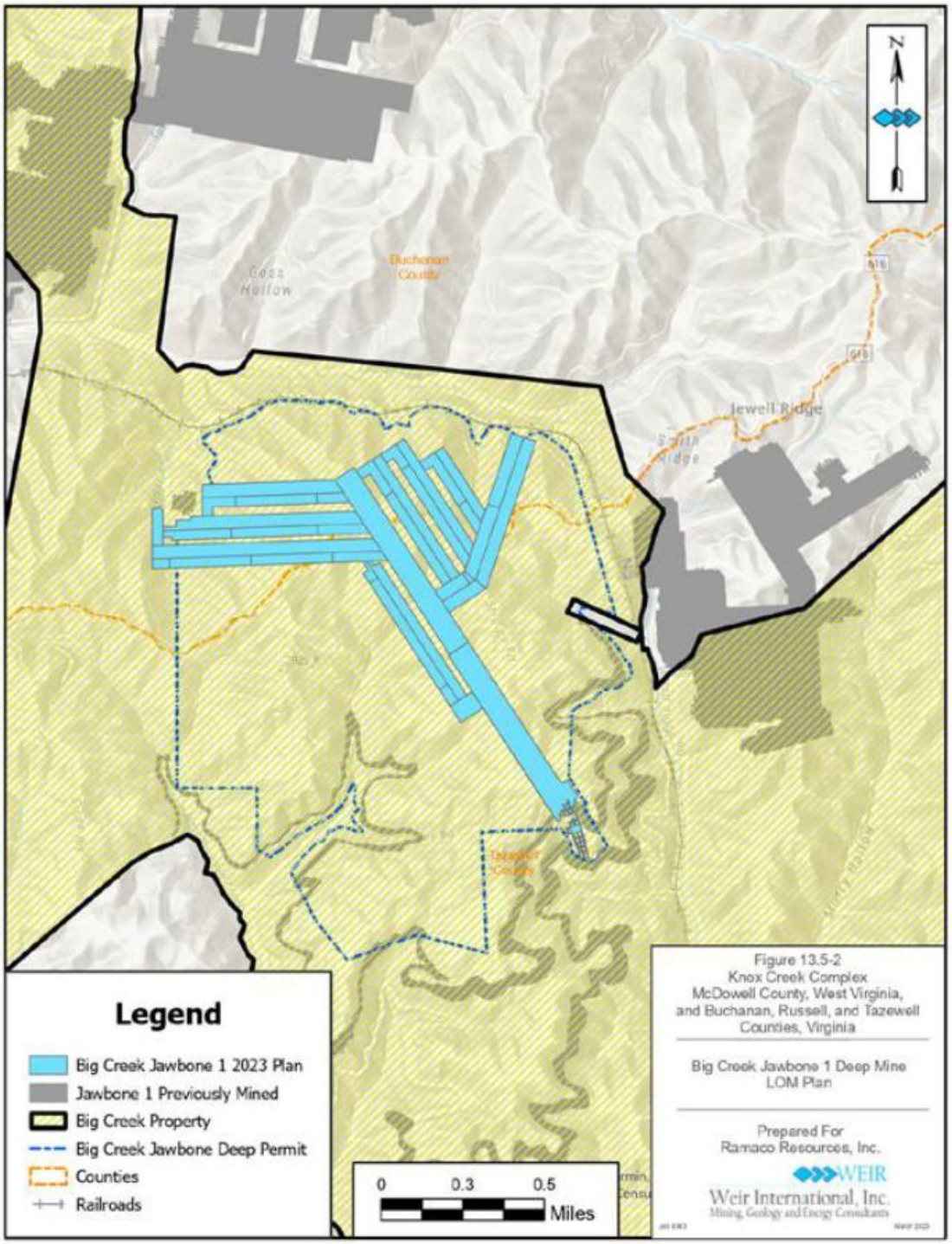


Figure 13.5-3 Life of Mine Plan, Knox Creek Tiller Deep Mine

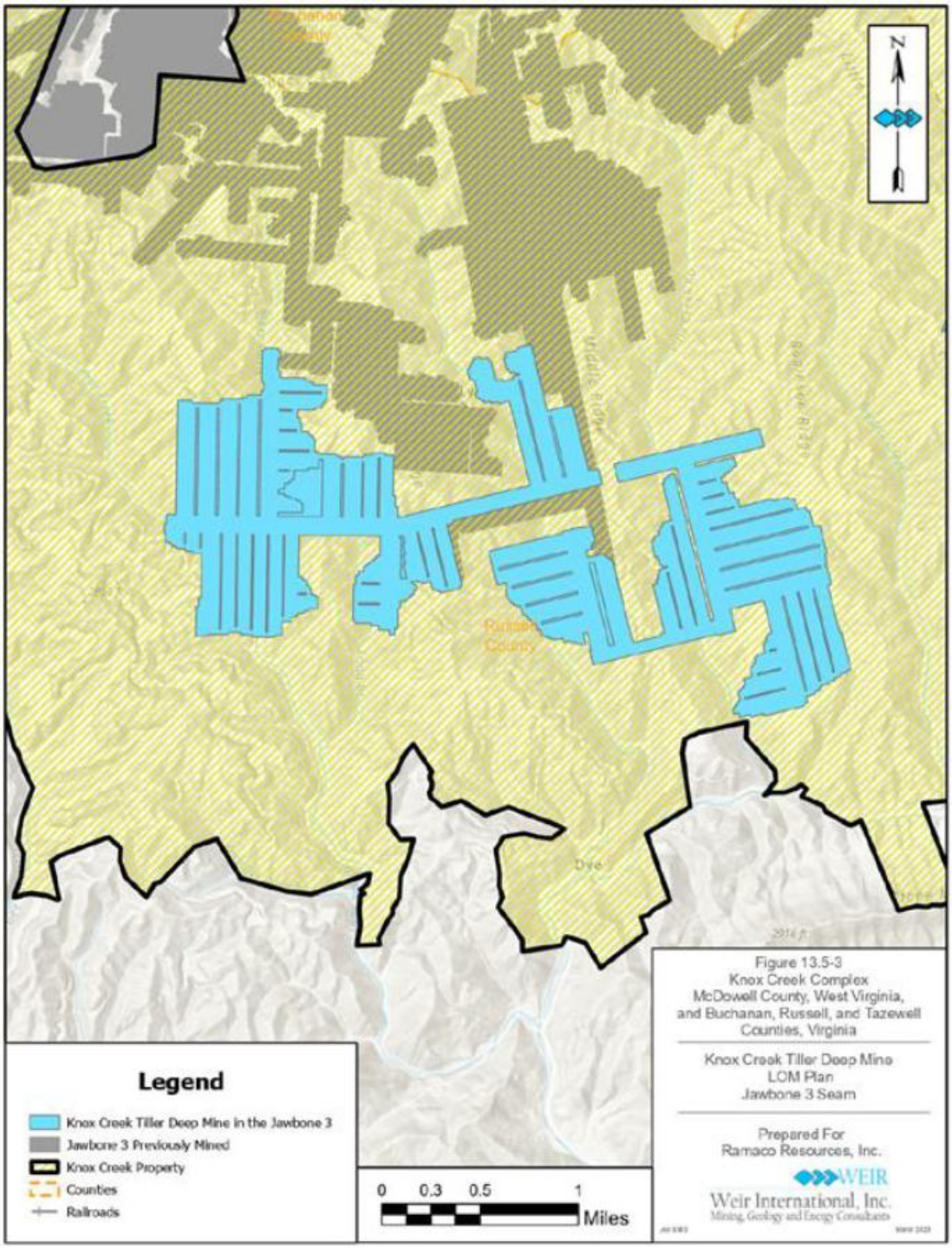
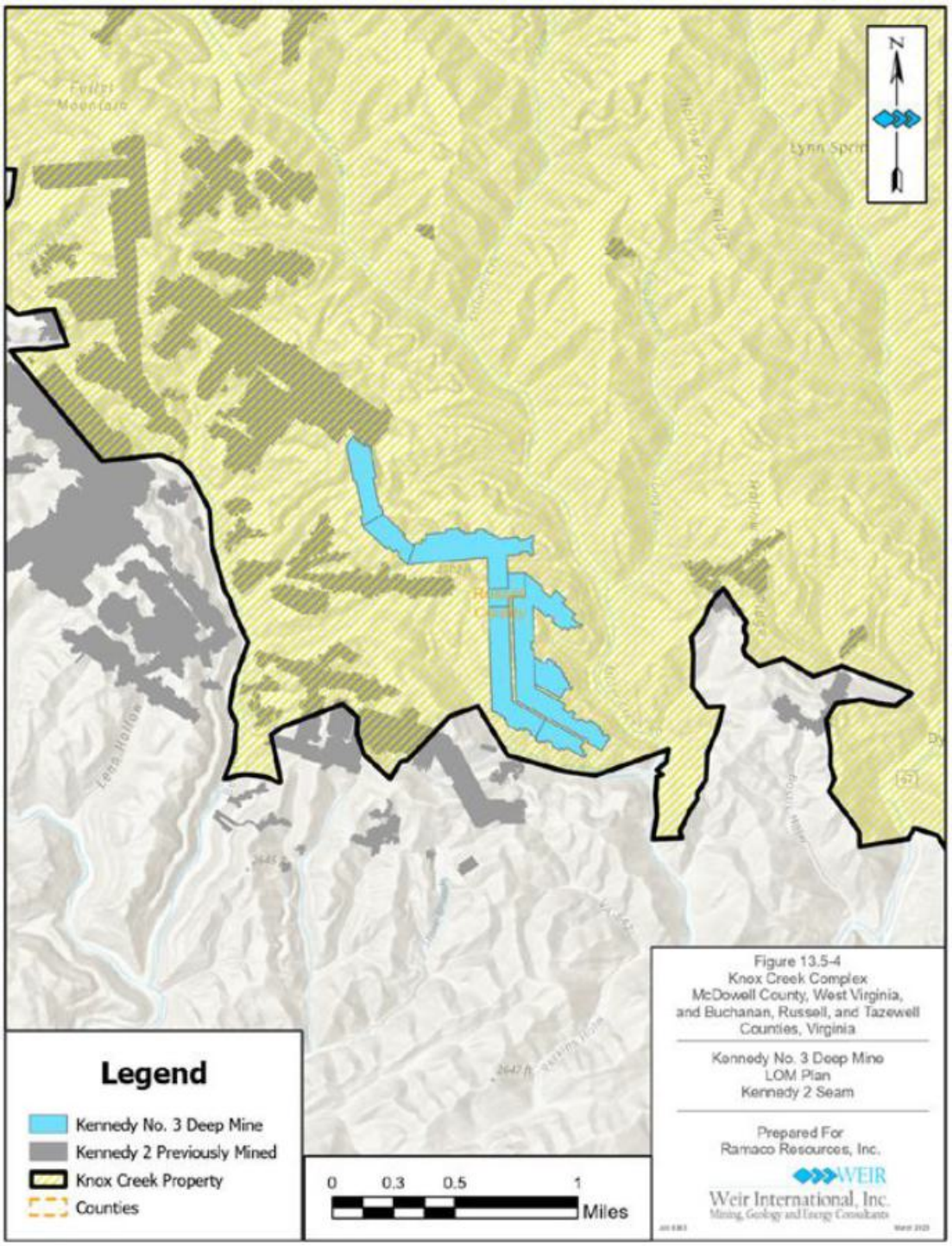


Figure 13.5-4 Life of Mine Plan, Knox Creek Kennedy No. 3 Deep Mine

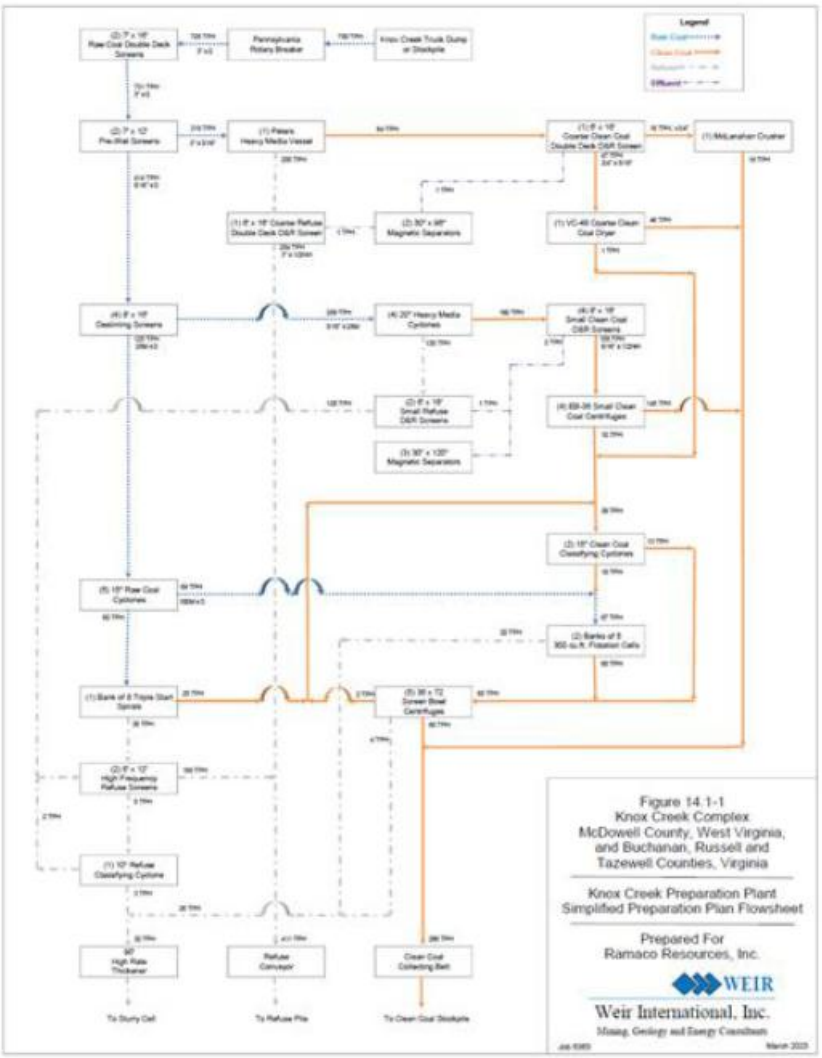


14.0 PROCESSING AND RECOVERY METHODS

14.1 PLANT PROCESS AND FLOWSHEET

Presently coal requiring processing within the Knox Creek Complex is processed at the Knox Creek Preparation Plant. The processing circuits include a heavy media cyclone, classifying cyclones, spirals, and conventional self-aspirating flotation cells. A simplified flowsheet for the Knox Creek Preparation Plant is shown on Figure 14.1-1.

Figure 14.1-1 Simplified Preparation Plant Flowsheet



14.2 PLANT PROCESSING DESIGN, EQUIPMENT CHARACTERISTICS AND SPECIFICATIONS

The Knox Creek Preparation Plant, built in 1981 by Powell Construction Company located in Johnson City, Tennessee, is a well designed and constructed preparation plant. The preparation plant has a design capacity of 750 ROM tons per hour. Based on the Knox Creek Complex LOM Plan average projected preparation plant yield of 45 percent, a 20 hour per day, 260 days per year processing schedule, and 96 percent plant mechanical availability, the preparation plant has a capacity of approximately 1.8 million clean tons per year, with its existing circuitry. The plant is currently being significantly upgraded to increase capacity and efficiency. These upgrades are scheduled to be completed in 2023.

ROM coal from the mines within the Knox Creek Complex is transported by over the highway end-dump trucks to the Knox Creek Preparation Plant and dumped into either a 100,000 ton ROM ground storage stockpile or into one of seven ROM hoppers. The ROM coal is reclaimed with feeders from either the stockpile or the truck dump bins and enters a nine-feet x 16-feet Pennsylvania rotary breaker at 750 ROM tons per hour. From the rotary breaker, a 36-inch-wide conveyor feeds ROM coal to the preparation plant.

The plant feed ROM coal material is screened at +3 inch, 3/4 inch x 5/16 inch and 5/16 inch x 0. The 3 inch x 5/16 inch ROM coal is processed in a heavy media vessel. The 5/16 inch x 0 material is screened at ½ mm with 5/16 inch x 28 mesh material processed in heavy media cyclones and the 28 mesh x 0 material reporting to raw coal cyclones. From the raw coal cyclones, 28 mesh x 100 mesh material is processed in triple-start spirals. The ultrafine 100 mesh x 0 material is cleaned by way of two banks of 5-300 cubic feet conventional flotation cells.

Clean coal can be stored in either of two clean coal stockpiles, each with a capacity of 40,000 tons. Clean coal is reclaimed from these piles and belted to the rail loadout at a rate of approximately 2,500 tons per hour and it can load 46-car trains. The load-out facility is served by the NS Railroad. The loadout belt is equipped with a J.B. Long two stage sweep sampler. The rail loadout facility has a capacity of 2,500 tons per hour.

Knox Creek disposes of refuse in the adjacent Jamison Creek Refuse Disposal Area, which is an impoundment and coarse refuse disposal area. Coarse refuse is transported to the disposal area by conveyor belt with fine refuse pumped as slurry to the impoundment. Current permitted life for this facility is approximately six years at an annual refuse production rate of 1.48 million tons/year (combined fine and course refuse). A permit package is currently being prepared, which will add an additional 11.8 years of capacity at the same production rate.

The preparation plant is scheduled to operate two, 10-hour shifts per day, five days per week, depending on the quantity of ROM coal to process. According to Ramaco records, the Knox Creek Preparation Plant averaged 96 percent mechanical availability in 2021.

The Knox Creek Preparation Plant and coal handling facilities consist of the following equipment shown in Table 14.2-1:

Table 14.2-1 Major Preparation Plant and Material Handling Equipment

		ROM Coal Handling System
2	-	Truck Scales
7	-	Truck Dumps, 3 - 500 Ton and 4 - 250 Ton Capacity
1	-	Truck Dump Reclaim Conveyor, 48-Inch x 665-Feet
2	-	Stacking Tubes, 70-Feet
2	-	ROM Coal Stockpiles, 110,000 Ton Total Capacity
1	-	Reclaim Tunnel, 331-Feet
11	-	ROM Coal Reclaim Feeders (Truck Dumps and Stockpile)
1	-	ROM Coal Stockpile Reclaim Conveyor, 48-Inch x 590-Feet
1	-	Tramp Iron Magnet
1	-	ROM Breaker Feed Conveyor, 48-Inch x 400-Feet
1	-	Pennsylvania Rotary Breaker, 9-Feet x 16-Feet
3	-	Belt Scales
1	-	Plant Feed Conveyor, 36-Inch x 648-Feet
		Preparation Plant - 750 ROM TPH
2	-	ROM Coal Double Deck Screens, 7-Feet x 16-Feet
2	-	Pre-wet Screens, 7-Feet x 12-Feet
1	-	Peters Heavy Media Vessel, 56-Inch x 9-Feet
1	-	Coarse Clean Coal Double Deck Screen, 6-Feet x 16-Feet
1	-	Refuse Double Deck Drain and Rinse Screen, 6-Feet x 16-Feet
1	-	McLanahan Crusher
1	-	Coarse Clean Coal Centrifuge, VC-48
4	-	Desliming Screens, 8-Feet x 16-Feet
4	-	Heavy Media Cyclones, 20-Inch Diameter

		Preparation Plant - 750 ROM TPH
4	-	Small Clean Coal Single Deck Screens, 8-Feet x 16-Feet
4	-	Small Clean Coal Centrifuge, EB-36
2	-	Small Refuse Single Deck Screens, 6-Feet x 16-Feet
8	-	Triple Start Spirals
2	-	Clean Coal Classifying Cyclones, 15-Inch Diameter
5	-	Raw Coal Classifying Cyclones, 15-Inch Diameter
1	-	Refuse Classifying Cyclone
2	-	Refuse High Frequency Screens, 6-Feet x 12-Feet
10	-	Flotation Cells, 300 Cubic Feet
5	-	Screen Bowl Centrifuges, 36-Inch x 72-Inch
1	-	High Rate Thickener, 90-Feet Diameter
		Clean Coal Handling System
1	-	No. 1 Clean Coal Stacker Conveyor, 42-Inch x 642-Feet
1	-	No. 2 Clean Coal Stacker Conveyor, 42-Inch x 642-Feet
2	-	Stacking Tubes, 91-Feet
2	-	Clean Coal Stockpiles, 70,000 Ton Total Capacity
1	-	Belt Sweep Clean Coal Sampler
1	-	Reclaim Tunnel, 50-Feet
1	-	Loadout Conveyor, 54-Inch x 1,254-Feet
1	-	Belt Scale
1	-	100-Ton Railroad Car Loadout
		Refuse Handling System
1	-	Belt Sweep Refuse Sampler
1	-	Refuse Conveyor, 36-Inch x 615-Feet
1	-	Belt Scale
1	-	Refuse Bin, 100-Ton
7	-	Refuse Conveyors, 42-Inch x 10,269-Feet (Total)

14.3 ENERGY, WATER, PROCESS MATERIALS, AND PERSONNEL REQUIREMENTS

Power is supplied to the plant by AEP. Power is received at a primary voltage of 69,000 volts and fed through a 10,000 KVA substation where voltage is reduced to 12,470 volts. Voltage is further reduced inside the preparation plant, to 480 volts by a 1,000 KVA transformer bank.

Make up water is supplied to the plant from a 100,000 gallon storage tank located above the plant. Water is pumped into the storage tank from an idled underground mine. This underground area has a storage capacity of approximately 8.5 million gallons. Water can also be supplied to the storage tank from ponds located at the toe of the refuse area. Water is supplied to these ponds by the refuse underdrain, clear water diversion ditches and runoff from the refuse area itself. Make up water requirements are approximately 500 gallons per minute.

Magnetite consumption is approximately 0.9 pounds per ROM ton processed. The preparation plant chemicals utilized cost approximately $0.20 per ROM ton processed (excluding magnetite).

Personnel requirements to operate the processing shifts at the preparation plant currently are 15 employees per shift on day shift and eight employees on night shift. The LOM Plan projects a total of 23 employees.

15.0 INFRASTRUCTURE

15.1 ROADS

The primary access road to the properties is US Route 460, a four-lane highway, located to the south of the Knox Creek and Big Creek Properties. From US Route 460, Virginia Route 637 and connecting West Virginia Routes 9 and 11 can be used to access the Knox Creek Property to the North. Similarly, the Big Creek Property can be accessed from US Route 460 to the north using Virginia Route 67. Other highways and county roads traverse these two properties. US Route 460 turns to the north after running south of Big Creek and continues through the middle of the original Knox Creek Property and passes just to the east of the Knox Creek Preparation Plant and its associated Jamison Creek Refuse Disposal Area.

15.2 RAIL

The NS Railroad passes through and has a rail spur to the Knox Creek Preparation Plant. The NS Railroad provides rail service in the area extending from Amonate, Virginia northward through Berwind, West Virginia and from Swords Creek, Virginia eastward through Richlands, Virginia, south of the Knox Creek Property (see Figure 1.1-1).

15.3 POWER

Electrical power is supplied to the Knox Creek Complex by AEP. Electrical power is received at the preparation plant at a primary voltage of 69,000 volts and fed through a 10,000 KVA substation where voltage is reduced to 12,470 volts. Voltage is further reduced inside the preparation plant to 480 volts, by a 1,000 KVA transformer bank. Electrical power is also supplied to mines from the substation.

15.4 WATER

Water for mining and coal processing operations is provided by a combination of extraction from abandoned underground mine pools and from settling ponds located on the surface. Mine pool recharge rates are higher than Ramaco water usages.

Individual mine sites use purchased potable water. Potable water at the preparation plant is supplied by a local municipality water connection.

15.5 PIPELINES

There are some oil and gas collection lines that service gas wells within the Knox Creek Complex. Any construction and earth moving activities in proximity to these lines will require coordination with the oil or gas line owner.

15.6 PORT FACILITIES, DAMS, AND REFUSE DISPOSAL

Port Facilities

The surrounding waterways are not navigable for commercial traffic. The closest barge docking area is approximately 70 miles to the north on the Kanawha River, south of Charleston, West Virginia.

Export coal from the Knox Creek Complex is railed, via the NS Railroad, to the Pier 6 Terminal, owned and operated by Norfolk Southern Corporation, located at Lamberts Point in Norfolk, Virginia.

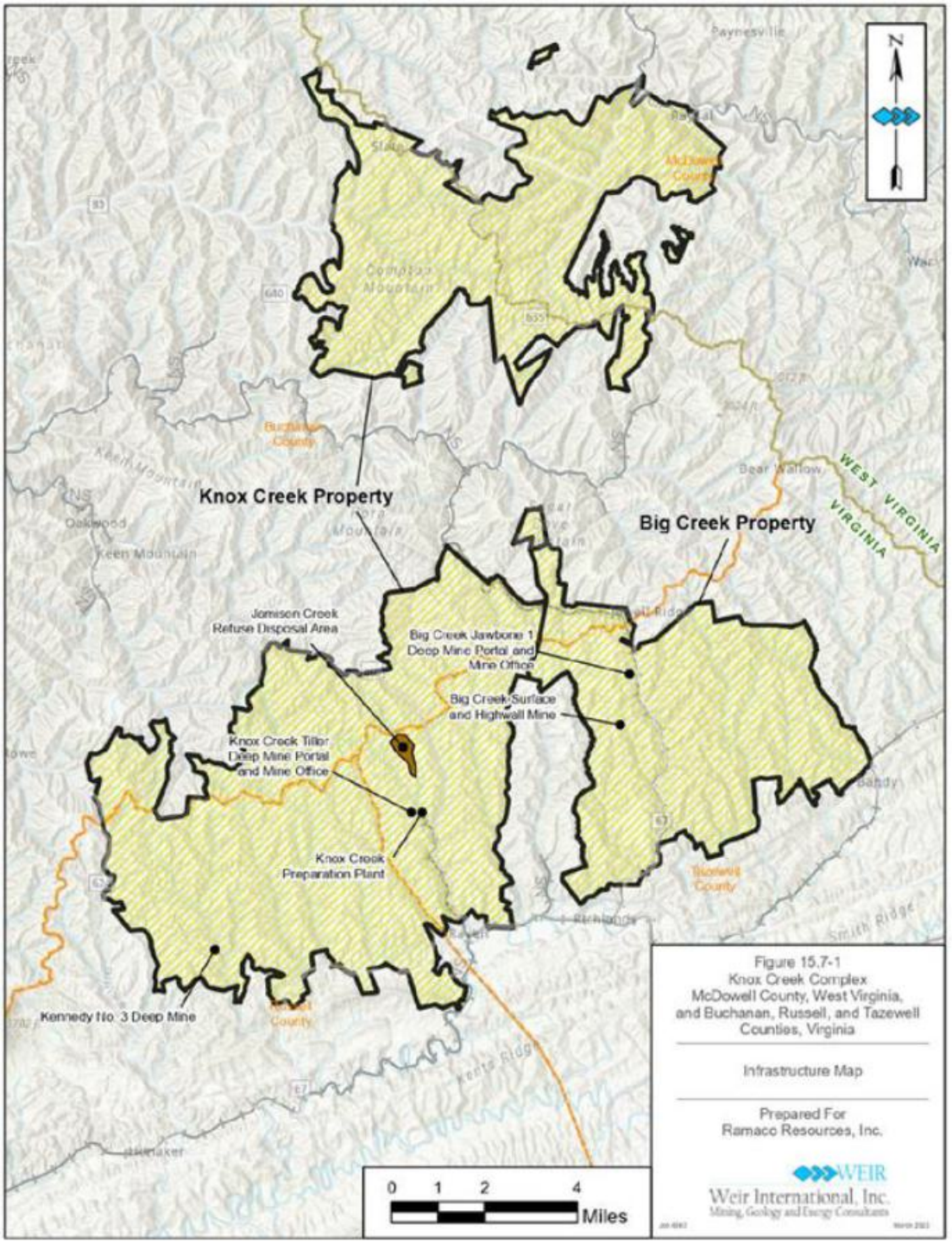
Dams and Refuse Disposal

There are no structures that are existing or planned to be constructed in such a size or manner that will be subject to the West Virginia Dam Control Act, the Virginia Dam Safety Act, and/or MSHA regulations. Refer to Section 17.2 for details on coal refuse disposal for the complex.

15.7 MAP OF INFRASTRUCTURE

Mine facilities are generally kept to a minimum. At the mine portal locations, there is typically a small bath house and office with a parking lot, and a parts trailer. There are no significant facilities at the Big Creek Surface and Highwall Mine. The Knox Creek Complex infrastructure is shown on Figure 15.7-1.

Figure 15.7-1 Infrastructure Map

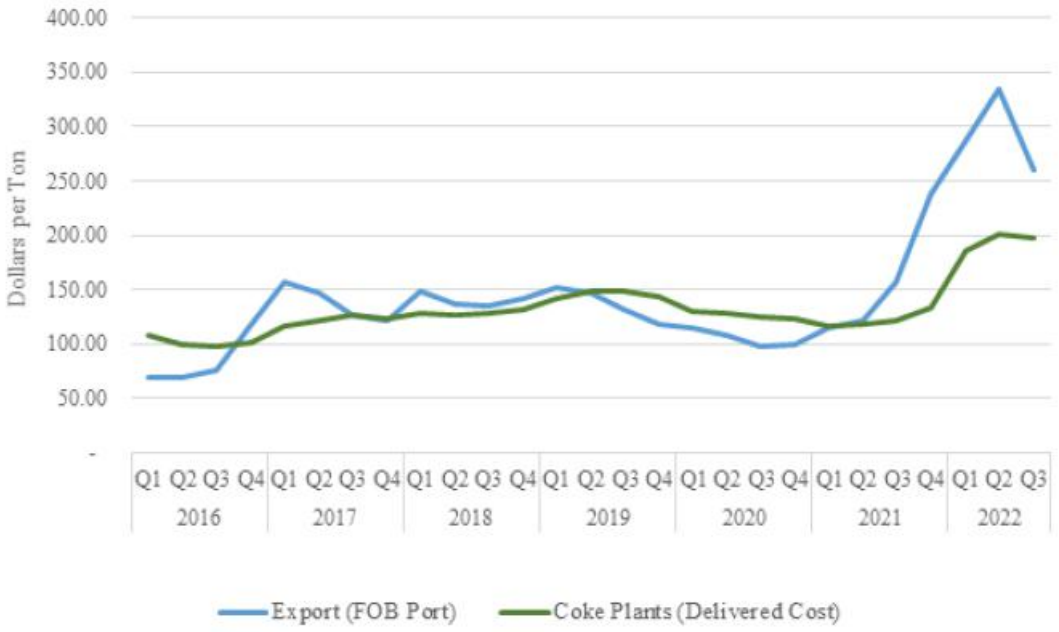


16.0 MARKET STUDIES

16.1 MARKETS

The Knox Creek Complex produces saleable mid volatile and high volatile metallurgical coal. The market for metallurgical coal from the Knox Creek Complex consists of both domestic metallurgical coal consumers and exports into the global seaborne metallurgical coal market. The US Energy Information Administration (EIA) compiles average historical price data for metallurgical coal delivered to domestic coke plants and metallurgical coal delivered to tidewater terminals for export. Note that the EIA data includes all classifications of metallurgical coal (high, mid and low volatile) as well as both spot and contract sales prices. Historical prices for metallurgical coal, as reported by the EIA, are shown on Figure 16.1-1 as follows:

Figure 16.1-1 Metallurgical Coal Sales Prices



Source: EIA Quarterly Coal Report

Between 2016 and third quarter 2022, export prices (FOB port) and domestic coke plant prices (delivered cost) have averaged $145.35 and $132.40 per ton, respectively.

A small amount of thermal coal product is sold from the Knox Creek Complex which is produced from oxidized coal recovered from Ramaco's surface mining operations. Most of this oxidized coal is sold raw while on occasion it is processed at the Knox Creek Preparation Plant. This coal is sold on thermal spot markets, based on product availability. All thermal coal sales from the Knox Creek Complex are projected to end in 2024.

16.2 MATERIAL CONTRACTS

On October 28, 2021, Ramaco announced completion of 2022 sales negotiations with its North American steel customers. Ramaco (across all of its mining operations) is contracted to sell 1.67 million tons of both low-volatile and high-volatile metallurgical coal at an overall average price of roughly $196.00 per ton FOB mine.

Coal sales from the Knox Creek Complex represent approximately 10 percent of Ramaco's 2023 projected coal sales tonnage, with metallurgical coal exports representing nearly 90 percent of Ramaco's 2023 projected coal sales.

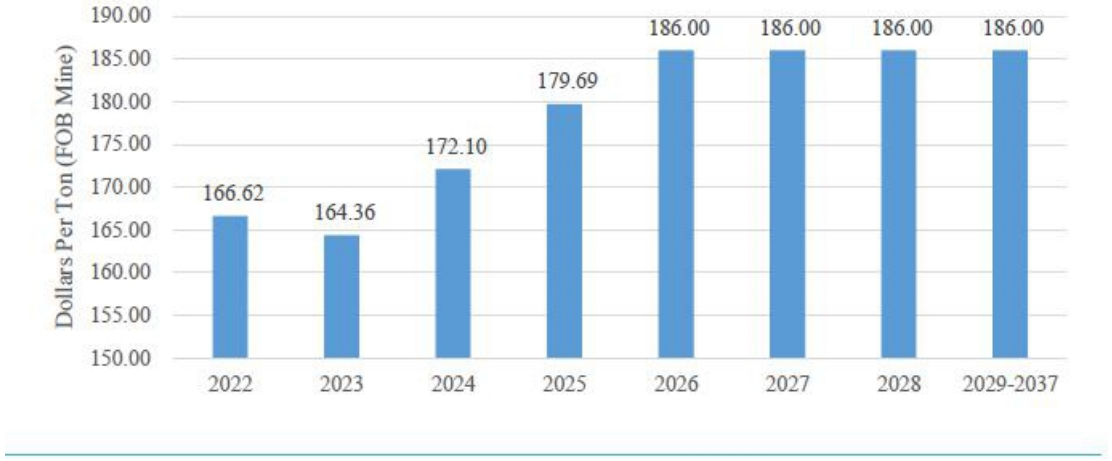
Ramaco has a contract with NS for rail coal haulage from the Knox Creek Complex that is renewed annually.

16.3 PRICE FORECAST

For purposes of this report, WEIR utilized price forecasts which Ramaco prepared for its Knox Creek Complex coal sales. Ramaco based its Knox Creek Complex FOB mine pricing on available FOB Port index forward pricing and Ramaco's estimated adjustments for Knox Creek coal quality, freight expense, and loading expense. Ramaco's price forecasts and adjustments reflect its experience in selling and transporting Knox Creek Complex saleable coal since 2019.

Ramaco's historical (2022) and forecast (2023 through 2037) FOB mine coal sales price for the Knox Creek Complex is shown on Figure 16.1-2.

Figure 16.1-2 Historical and Forecast Coal Sales Prices



Ramaco's forecasted Knox Creek Complex FOB mine coal sales prices are $164.36 per ton in 2023, $172.10 in 2024, $179.69 in 2025 and $186.00 thereafter through 2037.

17.0 ENVIRONMENTAL STUDIES, PERMITTING, AND LOCAL INDIVIDUALS OR GROUPS AGREEMENTS

17.1 ENVIRONMENTAL STUDIES

As part of the permitting process required by the WVDEP and VDE, numerous baseline studies or impact assessments were undertaken by Ramaco. These baseline studies or impact assessments included in the permit are summarized as follows, with pertinent text from the permit replicated below:

- Groundwater Inventory and Baseline Quality
- Surface Water Baseline Quality and Quantity
- Surface Water Runoff Analysis
- Probable Hydrologic Consequences

Groundwater Inventory and Baseline Quality

Ramaco conducted surveys to inventory water use and to determine the extent and purpose of ground water usage in the areas that could be affected by existing and planned mines within ½ mile of proposed mining limits for each permitted mine site. Field teams made door-to-door visits to these potentially affected residents to gather information by way of completing questionnaire forms regarding water supply source(s), extent of reliance, purpose of reliance (domestic, agricultural, etc.), depth of well(s), character of springs, and other data. The teams measured water level depths in wells where possible and agreeable by owners and obtained surveyed locations accordingly. The detailed results of the surveys are included in each site's WVDEP and VDE permit application.

Surface Water Baseline Quality, Quantity, and Runoff Analysis

Baseline surface water monitoring for flow and quality parameters was conducted at strategic, WVDEP and VDE approved locations, as applicable, over a period of six months for each of the permit areas. During mining and through the final release of the permit, the stations selected for each site are monitored in accordance with the approved surface water monitoring plans submitted in the site's permits. Data collected during this period will be compared with the pre-mining baseline data to determine if and how the proposed operation is affecting the surface water systems. If necessary, remedial measures can be taken to assure the protection of the surface water systems.

Based on samples from adjacent mining and the baseline surface water sampling there should be no acid or toxic mine drainage. However, Ramaco proposes that all coal wastes will be treated as potentially toxic material and handled accordingly using encapsulation cells that are discussed below.

Surface water runoff analyses were performed over the watershed(s) associated with each permit site to evaluate the potential impact of proposed operations on flooding and streamflow alteration. Peak discharges were calculated for the "pre-mining", "during-mining", and post-mining" conditions and were compared. These evaluations were performed using SEDCAD 4 software, developed by the University of Kentucky. These analyses and results are included in the individual sites' permits and show that there will be no increase in peak discharge during mining or post mining for any of the permit areas. It should be noted that in order to attain these acceptable results, the construction of some additional sediment control structures was required at the Ram No.1 Surface and Highwall Mine. Original laboratory data sheets for surface and ground water baseline monitoring are included in the permits.

Probable Hydrologic Consequences

PHCs were evaluated for each permit application. Subsidence will likely occur where retreat mining has been executed as approved. It is expected that direct fracturing of overburden will occur with consequently increased porosity (increased storage capacity) and lateral permeability in response to mining. The little water that is present in that strata will be drained into the underground mines, but the overlying intervals contains no significant aquifers other than, perhaps, the coal seams. Highwall mining will be conducted in such a manner that subsidence will not occur and as thus, should be of no consequence to PHC.

In summary, all of the Ramaco existing and proposed mines are well above any significantly producing aquifers. The PHC studies and results are included in each individual sites' permit application. The PHC studies showed no significant ground or surface water resource is likely to be contaminated, diminished, or interrupted, providing that the approved drainage control and revegetation plans are adhered to throughout existing and planned mining activities.

17.2 REFUSE DISPOSAL AND WATER MANAGEMENT

Refuse Disposal

The Jamison Creek Refuse Disposal Area (MSHA ID No. 44-05236) is a coal refuse disposal facility that serves the Knox Creek Preparation Plant. Coarse refuse from the preparation plant is transported to the disposal area by conveyor belt with fine refuse pumped as slurry to the impoundment. The estimated life for this facility as of January 2023 is approximately six years.

A PHC determination included in the Jamison Creek Refuse Disposal Area Permit No. 1302232 concluded that no detrimental hydrologic consequences are either anticipated, or expected, with a fine coal refuse slurry impoundment at this facility.

Further, a Breakthrough Potential Study was conducted by Schnabel Engineering, LLC in April 2020 (Schnabel Report) to assess whether there is a breakthrough potential to the Red Ash and Kennedy seams mined beneath the impoundment. The Schnabel Report concluded that the Breakthrough Potential into the Red Ash mine workings and Kennedy auger holes is considered to be moderate. However, based on the four significant barriers to breakthrough into the Red Ash mine workings that were discussed in the AME report and considering that the Kennedy auger holes are going to be grouted, Schnabel believes that the Breakthrough Potential at this site is somewhat lower.

The refuse disposal structure will be constructed in such a size or manner that will be subjected to the Virginia Dam Safety Act, and/or MSHA regulations. Stability analyses of the refuse disposal structure show that design of the structure exceeds the minimum safety factors of 1.5 for static stability and 1.2 for dynamic stability that are required by the current Virginia State Code of Regulations. The stability analyses were performed using the Rotational Equilibrium Analysis of Multilayered Embankments software that is copyrighted by the University of Kentucky.

Outside of the Jamison Creek Refuse Disposal Area, no coal, or non-coal related disposal, is planned at any of the mine sites.

Water Monitoring and Management

In order to determine the impact of existing and proposed operations on the hydrologic balance, surface water samples are collected bi-monthly with a minimum seven days between sample dates at each of the permitted sites. Samples are sent to a qualified laboratory and analyzed for the following parameters: flow, pH, total acidity, total alkalinity, total iron, total manganese, total sulfates, total suspended solids, and total dissolved solids or specific conductance at 25 degrees C. The samples collected during and after mining will be compared with each other, and with the data collected during the baseline surface water study and used to determine the impact of the operation on the water in the receiving streams.

A waiver of groundwater monitoring during mining was requested for the mine sites due to the proposed mining being well above any groundwater users and any significant aquifers that insure water use.

No specific water treatment facilities other than sediment control are required or planned for any of the mine sites. Based on previous mining and collected water samples. the operations will not contaminate any of the ground or surface water systems of the Knox Creek Complex. Results of water sampling has shown no significant levels of surface water contamination at the mine sites.

Surface water management for both Ramaco's surface and underground permitted mining areas on the Knox Creek Complex generally involves a combination of structures such as; 1) sediment ditches, 2) temporary sedimentation ponds, 3) soil encapsulation cells that are specifically designed to contain potentially hazardous soil in regards to acid forming materials, 4) permanent and temporary diversion ditches, 5) corrugated metal pipe (CMP) placement for drainages that cross access roads or haulroads, and 6) drainage diversion ditches and collections for excess spoil disposal areas. The Big Creek Surface and Highwall Mine has a relatively large network of these construction types. The underground mine locations have a significantly smaller footprint, however, these locations use the same surface water management design considerations as surface mines. Detailed designs for all drainage and sediment control structures are included in Ramaco's permits. Apart from the Jamison Creek Refuse Disposal Area, there are no significant water retention structures subject to the West Virginia Dam Control Act, the Virginia Dam Safety Act, or MSHA regulations, and there are no other permanent impoundments planned at any of the mine permit sites.

All permitted mine sites have a Materials Handling Plan designed to mitigate the potential for acid mine drainage generation regarding those materials excavated during the land disturbance activities associated with development of the proposed mining facility. Some areas have known potentially acid generating materials. This is determined from Acid Base Accounting data that is collected as part of the permitting requirements. Also, selenium data is documented within the water chemistry of the equivalent mine discharge samples. The equivalent water data provides a more appropriate geochemical characterization as compared to in-situ strata testing.

Material that requires special handling for potentially acidic discharges meets the following standards: have a net acid base accounting that is ≥-5 and at least 1 foot thick; have Selenium concentrations greater than 1 mg/kg and at least 1 foot thick; have a pH ≤4 and be at least 1-foot-thick. Materials to be specially handled will be placed in encapsulation cells to assure there is no potential for acid producing material. The cells will be located on the mine bench in an area free of any seeps, springs, or mine drainage, "high and dry", and sealed with a minimum of 4.0 feet of the most imperious material available. The approximate location of planned encapsulation cells is shown on the Geohydrologic Maps that are included in the permit applications.

Discharges from these structures will be monitored in accordance with the approved plans. Sediment structures will be cleaned or enlarged if the total suspended solids exceed effluent limitations. All discharges will go through sediment control structures. The pond discharges will be monitored in accordance with approved plans and treated to meet effluent limitations, if needed. Regarding highwall mining concerns, there is no residual head of water anticipated on any of the designed outcrop barriers which are designed at a minimum of 50 feet width. Based on water samples collected from adjacent mining, there is not anticipated to be any acid, alkaline, or iron laden drainage.

All permitted sites have a surface water runoff monitoring plan. Within twenty-four hours of a one-year frequency, twenty-four hour storm event or greater, a permit-wide inspection and report of the drainage systems is completed and submitted to the WVDEP or VDE, as applicable. The inspection and subsequent report note any damages or deficiencies in the drainage system so that repairs can be implemented immediately. It also indicates if any sediment structure is at or near it's clean out capacity (60 percent). A rain gauge, located at the mine office on the Knox Creek Complex is used to monitor precipitation events. In-stream monitoring stations are used to take stream flow measurements. The rain gauge is monitored daily and reported monthly to the appropriate regulatory authority.

17.3 PERMITS AND BONDING

Coal mines in West Virginia are required to file applications for and receive approval of mining permits issued by the WVDEP to conduct surface disturbance and mining activities. A similar filing and approval process is required by the VDE. The Knox Creek Complex has been issued mining permits and associated NPDES permits by the WVDEP and the VDE as shown in Table 17.3-1 as follows:

Table 17.3-1 Knox Creek Complex Mining and NPDES Permits

Property Description	State Permit Number	State	Permitted Surface Area (Acres)	Issue Date	Current Status	NPDES Permit No.
Big Creek Surface Mine	1102335	VA	447.63	1/22/2020	Active	0082335
Big Creek Jawbone 1 Deep Mine	1402231	VA	42.61	5/22/2017	Active	0082231
Knox Creek Tiller No. 1 Deep Mine	1202204	VA	20.57	2/15/2017	TmpIdle	0082204
Kennedy No. 3 Surface Mine	1402215	VA	106.18	4/3/2017	NonProdActive	0082215
Kennedy No. 3 Deep Mine	1702202	VA	75.95	2/14/2017	Idle	0082202
Knox Creek Preparation Plant	1302184	VA	41.94	12/2/2017	Active	0082184
Knox Creek Refuse Disposal Area	1302232	VA	322.71	11/23/2018	Active	0082232
Mudlick Surface Mine	1102334	VA	26.25	7/7/2020	Idle	0082234
Total			1,083.84			

A total bond amount of $12.2 million held by Ramaco is based on the mine closure reclamation liability cost estimate as of December 31, 2022. The ARO estimate for all sites within the complex is $9.2 million, as of December 31, 2022. Both the WVDEP and VDE utilize a bond matrix that determines the rate per acre based upon the activity that the land is to be used for. This rate per acre is simply applied to the permit sites' acreage to obtain the bond requirement. WEIR concludes that Ramaco's overall bonding approach, the bond amounts, and the ARO estimates that are currently allocated for the Knox Creek Complex sites appear reasonable.

Upon searching the WVDEP and the VDE violation records, it was found that the Knox Creek Complex has an excellent environmental compliance record without a history of any significant fines or citations over the last two years.

17.4 LOCAL STAKEHOLDERS

As indicated in Section 13.4.2, Ramaco currently employs 107 personnel at the Knox Creek Complex and is projected to have a maximum employment of approximately 275 personnel during the Knox Creek Complex LOM Plan. The complex creates substantial economic value with its third-party service and supply providers, utilities and through payment of taxes and fees to local, state and federal governmental agencies.

The Knox Creek Complex is located in a rural and fairly isolated area of West Virginia and Virginia. Reportedly, there have been no social or community impact issues relative to the Knox Creek Complex. The local area supports Ramaco for the jobs that it provides for people in the surrounding communities.

17.5 MINE CLOSURE PLANS

Upon mine closure, areas will be reclaimed to near AOC configuration. Regrading and backfilling activities are required to commence within 180 days after the mining operations are complete.

The primary pre-mining land use for the Knox Creek Complex is forestland. The approved post-mining land use for Ramaco's permits is forestland. No land within the permit areas have been historically used for prime farmland. The slope of all land within the existing and proposed permit areas is ten percent or greater, which also precludes post-mining land use as prime farmland.

Upon completion of mining operations and regrading, topsoil will be redistributed over the disturbed areas. Mine soil that served as a base for coal stockpiles will be tested to determine if supplemental liming is necessary prior to blending this material with the other mine soil onsite. After the permit area has been graded, soil analysis will be performed to determine the quantity of agricultural limestone, or an equivalent supplement, and fertilizer necessary to achieve the post-mining land use.

All regraded areas will be revegetated as soon as practical to establish quick vegetative cover and minimize erosion. Disturbed and un-reclaimed acreage including excess spoil disposal sites, will not exceed two hundred (200) acres or fifty (50) percent of the permit area, whichever is less. Runoff from these regraded areas will be routed through properly constructed and maintained sediment structures that are designed to retain site runoff along enough for the suspended solids to settle.

Streams on the complex are generally approximately 1,000 feet below the ridges. Soils within the permit area formed in residual parent material derived from interbedded shale, siltstone and sandstone. This consist of very steep soils on narrow ridge tops and on side slopes. The annual precipitation in the area averages approximately 47 inches. Woodlands make up about 85 percent of the total area in this county and soils in this area are well suited to growing forests. The areas to be disturbed and later reclaimed are in the oak-hickory type, of the Appalachian Forest and consists of yellow poplar, basswood, red and black oak, hickory, sugar maple, chestnut oak, white oak, beech, pine/hemlock, scarlet oak, other miscellaneous hardwoods. On dry ridges, spurs and southern slopes white oak, hickory, chestnut oak, Virginia pine and pitch pine are the dominant species. These sites tend to be less productive, and the timber has slower growth, while the moist coves and northern and eastern slopes contain yellow poplar, sugar maple, red oak, black oak, beech, and basswood and are more productive sites.

Both hardwoods and pine seedlings will be hand planted by a reputable tree planting contractor to create a diverse and productive forest. Several species will be selected to create a diverse forest. The overall stocking density for all woody plants on the permitted mine site is at least 500 plants per acre. The stocking density for trees is at least 350 plants per acre. All final land use is planned as forestland except small areas of permanent drainage structures and access roads that have been approved to remain.

Temporary erosion control vegetative cover is established as contemporaneously as practical, with backfilling and grading, until a permanent tree cover can be established. A tree-compatible cover will be used to keep the vegetation that is being established for erosion control from competing too aggressively with the tree seedlings.

17.6 ENVIRONMENTAL COMPLIANCE, PERMITTING, AND LOCAL INDIVIDUALS OR GROUPS ISSUES

Based on WEIR's review of Ramaco's plans for environmental compliance, permit compliance and conditions, and dealings with local individuals and groups, Ramaco's efforts appear to be adequate and reasonable in order to obtain approvals necessary relative to the execution of the Knox Creek Complex mining plans.

18.0 CAPITAL AND OPERATING COSTS

Ramaco provided historical and projected operating costs and capital expenditures for the Knox Creek Complex, which were an adequate check and basis for the LOM Plan cost projections. The operating costs and capital expenditures are included in the financial statements that are audited annually by MCM CPAs & Advisors for Ramaco's 10-K reporting to the SEC. The auditing performed by MCM CPAs & Advisors is conducted in accordance with the standards of the Public Company Accounting Oversight Board.

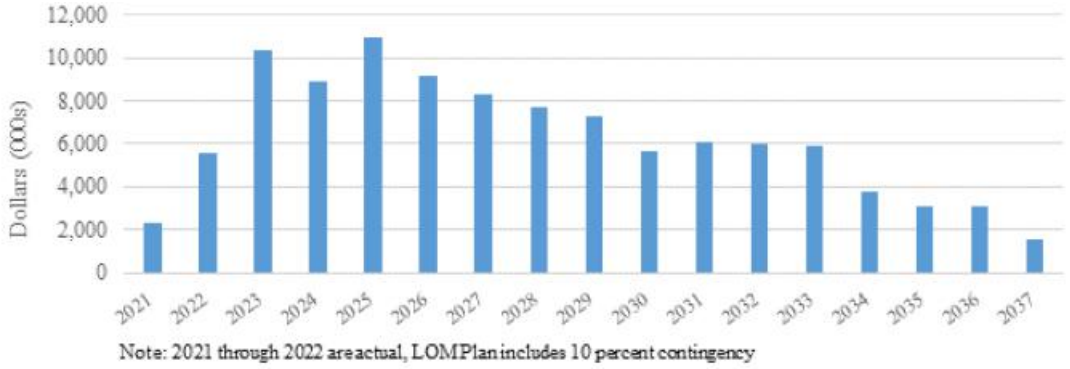
18.1 CAPITAL EXPENDITURES

The Knox Creek Complex will require capital to be expended each year for infrastructure additions/extensions, as well as for mining equipment rebuilds/replacements to continue to produce coal at currently projected annual levels of production.

Ramaco's Knox Creek Complex development costs since 2016 are considered "Sunk Costs" and as economic returns in this economic analysis are presented only on a forward-looking basis, Sunk Costs are not included in the economic return of the project, as estimated in this study.

The projected capital expenditures are categorized according to each mining operation, and the Knox Creek Preparation Plant. Actual capital expenditures for 2021 through 2022 and projected capital expenditures, in 2022 dollars, for 2023 through 2037, are shown on Figure 18.1-2:

Figure 18.1-1 Historical and Projected LOM Plan Capital Expenditures



The capital expenditures in 2023 relate to the development of the Big Creek Jawbone 1 Deep Mine, the Knox Creek Preparation Plant, and rehabilitation of the Knox Creek Tiller Mine.

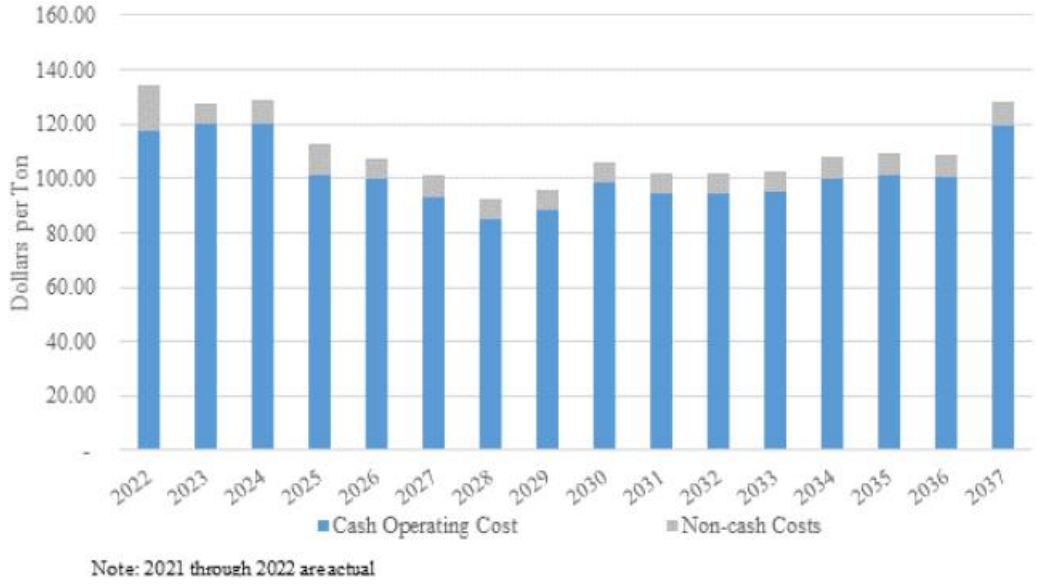
Ramaco began development of the Knox Creek Complex in 2017 and commenced mining in 2019. Mine management has had several years of experience estimating capital expenditures for surface and underground mining and the risk of inaccurate estimates is low. The LOM Plan projected average capital cost of $12.20 per ton for projected mining equipment and infrastructure requirements is $13.15 per ton lower than the historical average cost of $25.35 per ton, which included high development capital from 2021 through 2022 for the Big Creek Jawbone 1 Deep Mine and minimal production. Capital expenditures estimates per annual ton are estimated to have an accuracy within +/- 15.0 percent.

Contingency costs account for undeveloped scope and insufficient data. Contingency for required major projects and mining equipment is estimated at 10 percent and is intended to cover unallocated costs from lack of detailing in scope items. It is a compilation of aggregate risk from estimated cost areas.

18.2 OPERATING COSTS AND RISKS

Operating costs are projected based on historical operating costs and adjusted based on projected changes in staffing, hours worked, and production and productivity for mining areas in the LOM Plan. The Knox Creek Complex actual and LOM Plan projected operating costs in dollars and dollars per ton, are shown on Figure 18.2-1:

Figure 18.2-1 Knox Creek Complex Historical and LOM Plan Operating Costs



Descriptions or explanations of the operating costs considered in the LOM Plan are as follows:

Direct Cash Cost:

- Labor cost, which includes wages and benefits for hourly and salary personnel at the mine and preparation plant.
- Maintenance and supplies, which are expenses related to upkeep of mining equipment and associated infrastructure.
- Utility expenses, which are expenses related primarily to purchase of electrical power to operate mining equipment at the mines and preparation plant equipment, telephone and data lines, water, and garbage services.
- Trucking costs, which are expenses primarily related to transportation of ROM coal from the mines to the preparation plant.
- Allocations (in/out), which are various costs for the preparation plant.
- Professional services, which are expenses related to legal, engineering, and other firms providing services to the Knox Creek Complex.
- Property Tax and Insurance are expenses related to property taxes and liability insurance for risk management purposes.
- Other costs, which are miscellaneous expenses related to operation of the mines and preparation plant.

- Sales related costs are expenses related to Black Lung Excise Tax, Virginia and West Virginia Severance Taxes, and Virginia, West Virginia and Office of Surface Mining reclamation taxes.
- Royalties are expenses related to leased surface and mineral properties.
- General and Administrative, which include expenses related to administrative offices and personnel to manage the mining operations.

Selling, General and Administrative Costs:

- Expenses related to coal sales and corporate administrative costs

Non-Cash Costs:

- Asset retirement obligation accretion, depreciation, and amortization costs

Detailed LOM Plan annual operating costs and capital expenditures are shown below in Table 18.2-1.

Table 18.2-1 LOM Plan Annual Operating Cost and Capital Expenditures

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	Total
Labor costs	13.0	25.8	34.5	33.0	27.5	20.5	20.5	20.5	20.5	20.5	20.5	13.7	11.8	11.8	5.7	0.1	299.7
Maintenance & supplies	11.4	26.4	30.3	28.3	25.5	24.7	23.5	19.3	20.9	21.0	20.6	12.9	10.5	10.9	5.2	0.1	291.5
Utility expenses	1.4	2.5	4.2	4.2	3.5	3.3	3.2	2.6	2.7	2.8	2.7	1.7	1.4	1.4	0.7	—	38.3
Trucking costs	3.5	2.9	5.6	5.7	4.3	3.2	2.2	—	—	—	—	—	—	—	—	—	27.5
Contract Mining	0.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.7
Purchased third-party coal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Professional services	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	1.0
Property tax & insurance	0.4	0.5	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	8.9
Other costs	0.0	0.0	0.5	0.6	1.0	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	1.7	0.8	5.7
Sales related tax costs	4.7	7.3	11.9	11.9	10.9	10.3	9.5	7.2	7.8	7.9	7.7	4.8	4.0	4.1	2.0	—	111.8
Administrative costs	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	2.8
Total Cost of Production	39.4	63.9	88.6	85.2	73.6	62.9	59.9	50.6	52.9	53.0	52.4	33.8	28.2	28.8	15.9	1.4	791.0
Asset Retirement obligation	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.1	4.1
Depreciation and amortization	2.3	4.2	9.8	6.0	5.6	5.2	4.8	3.6	3.9	4.0	3.9	2.4	2.0	2.0	1.0	0.0	60.7
Total Costs and Expenses	41.9	68.4	98.7	91.5	79.5	68.4	64.9	54.4	57.1	57.2	56.5	36.5	30.5	31.1	17.2	1.5	855.8
Capital Expenditures	10.3	8.9	11.0	9.2	8.3	7.7	7.3	5.7	6.1	6.0	5.9	3.8	3.1	3.1	1.5	—	97.8

The LOM Plan projected cash operating cost of $98.68 per ton is $18.57 per ton lower than the 2002 historical average of $117.25 per ton. With the long history of cost of sales, no contingency is included, although the accuracy of the LOM Plan projected cost of sales should be considered to be within 15 percent of the historical average.

Capital and Operating Cost Estimation Risk

The Knox Creek Complex has been in operation since 2019 and has had a relatively long period of experience with capital expenditure costs and operating costs. Since the mining operations will continue in similar coal seams and mined in the same manner as historically, there is little risk associated with the specific engineering estimation methods used to arrive at projected capital expenditures and operating costs. An assessment of accuracy of estimation methods is reflected in the sensitivity analysis in Section 19.3.

For purposes of the Preliminary Feasibility Study relative to the Knox Creek Complex LOM Plan, capital expenditures are estimated to an accuracy of +/- 15 percent, with a contingency of 10 percent, and operating costs are estimated at an accuracy of +/- 15 percent, with no contingency.

19.0 ECONOMIC ANALYSIS

19.1 ASSUMPTIONS, PARAMETERS, AND METHODS

A Preliminary Feasibility Study financial model has been prepared in order to assess the economic viability of the Knox Creek Complex LOM Plan. Specifically, plans were evaluated using discounted cash flow analysis, which consists of annual revenue projections for the Knox Creek Complex LOM Plan. Cash outflows such as capital, including preproduction costs, sustaining capital costs, operating costs, transportation costs, and taxes are subtracted from the inflows to produce the annual cash flow projections. Cash flows are recognized to occur at the end of each period. There is no adjustment for inflation in the financial model, and all cash flows are in 2021 dollars. WEIR's study is conducted on an un-levered basis, excluding costs associated with any debt servicing requirements.

To reflect the time value of money, annual net cash flow projections are discounted back to the project valuation date, using a discount rate of 10 percent. The discount rate appropriate to a specific project depends on many factors, including the type of commodity and the level of project risks, such as market risk, technical risk, and political risk. The discounted present values of the cash flows are summed to arrive at the Knox Creek Complex NPV.

Projected cash flows do not include allowance of any potential salvage value. Additionally, capital previously expended (sunk cost) is not included in the assessment of economic returns.

WEIR's after-tax NPV incorporates a projected corporate income tax rate of 21 percent, as provided by Ramaco.

In addition to NPV, the Internal Rate of Return (IRR) is also calculated. The IRR is defined as the discount rate that results in an NPV equal to zero. Payback Period is calculated as the time required to achieve positive cumulative cash flow for the Knox Creek Complex at a 10 percent discount rate. As the Knox Creek Complex is ongoing with no initial investment required (i.e., already sunk cost), payback period is less than one year.

The actual and LOM Plan coal sales price forecast used to estimate Knox Creek Complex revenue and the annual cash flow detail are shown on Table 19.1-1 as follows:

Table 19.1-1 Annual Cash Flow Forecast Detail

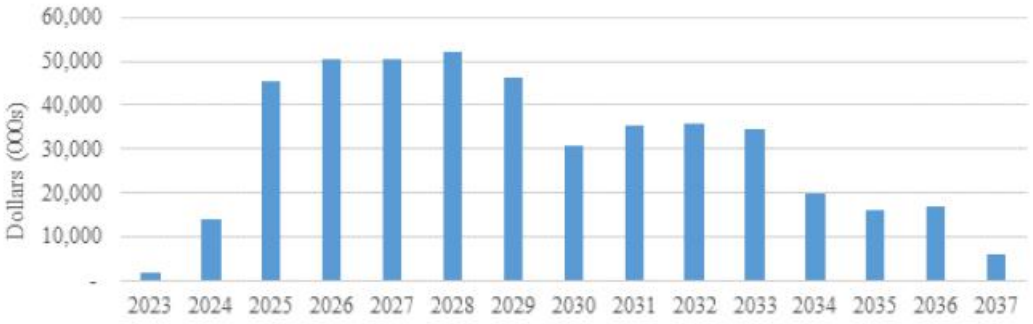
Knox Creek Complex Life of Mine Income Statement

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	LOM Total
Tons Sold (000)	328	532	875	853	787	737	679	513	560	563	550	339	279	286	134	-	8,016
Sales Price ($ Per Ton)	164.4	172.1	179.7	186.00	186.00	186.00	186.00	186.00	186.00	186.00	186.00	186.00	186.00	186.00	186.00	-	183.5
								Dollars (millions)									
Revenues	54.0	91.5	157.3	158.7	146.4	137.2	126.4	95.4	104.2	104.7	102.2	63.1	51.8	53.3	24.8	-	1,470.9
Total Costs and Expenses	39.4	63.9	88.6	85.2	73.6	62.9	59.9	50.6	52.9	53.0	52.4	33.8	28.2	28.8	15.9	1.4	791.0
Income before taxes	12.0	23.1	58.6	67.2	67.0	68.8	61.4	40.9	47.1	47.5	45.7	26.5	21.3	22.2	7.7	(1.5)	615.2
Income tax expense	2.5	4.8	12.3	14.1	14.1	14.4	12.9	8.6	9.9	10.0	9.6	5.6	4.5	4.7	1.6	(0.3)	129.2
Net income	9.5	18.2	46.3	53.1	52.9	54.3	48.5	32.3	37.2	37.5	36.1	21.0	16.9	17.5	6.1	(1.2)	486.0
Adjusted EBITDA	12.0	22.8	56.4	59.4	58.8	59.8	53.6	36.2	41.4	41.7	40.2	23.7	19.1	19.8	7.3	(1.1)	550.8
Capital Expenditures	10.3	8.9	11.0	9.2	8.3	7.7	7.3	5.7	6.1	6.0	5.9	3.8	3.1	3.1	1.5	-	97.8
Total Cash Flow	1.7	13.9	45.4	50.3	50.5	52.1	46.3	30.5	35.3	35.7	34.3	19.9	16.0	16.7	5.8	(1.1)	453.0

19.2 ECONOMIC ANALYSIS AND ANNUAL CASH FLOW FORECAST

The annual cash flow for the Knox Creek Complex LOM Plan are summarized on Figure 19.2-1 as follows:

Figure 19.2-1 Annual Cash Flow Forecast



Cash flows decline after 2028, as a result of a projected decrease in coal production. While not included in these cash flows, Ramaco plans to commence other mining operations within the Knox Creek Complex, as existing operations phase out. Significant tonnage associated with those future, to-be-planned operations, is currently classified as Resource tonnage. As LOM plans are prepared for operations within the current Resource areas of the Knox Creek Complex, updates will be made to this analysis.

The Knox Creek Complex LOM Plan has an after-tax NPV of $249.0 million, at a base case discount rate of 10 percent (Table 19.2-1). As the Knox Creek Complex is ongoing with no initial investment required (i.e., already sunk cost), the IRR is infinite. Cumulative (undiscounted) cash flow over the LOM Plan is positive, at $453.0 million. The Return on Investment (ROI), at a 10 percent discount rate, is 314 percent.

The after-tax NPV, IRR, cumulative cash flow and ROI are summarized in Table 19.2-1 as follows:

Table 19.2-1 After-Tax NPV, IRR, Cumulative Cash Flow, and ROI

	LOM Plan
NPV ($000)	249,018
IRR (%)	Infinite
Cumulative Cash Flow ($000)	452,989
Return on Investment (%)	314

Table 19.2-2 presents key operational statistics for the LOM Plan on an after-tax basis. Over the LOM Plan, the average cash operating cost is $98.68 per clean ton. Operating costs include mining, processing, G&A, but exclude amortization costs on capital expenditures.

Table 19.2-2 Key Operating Statistics

	LOM Plan
ROM Tons Produced (000s)	17,451
Clean Tons Produced (000s)	8,016
Preparation Plant Yield (%)	45.9
Tons Sold (000s)	8,016
	($Per Ton)
Coal Sales Realization	183.50
Direct Cash Costs	98.68
Non-cash Costs	8.08
Total Cost of Sales	106.76
Profit / (Loss)	76.74
EBITDA	84.82
CAPEX	12.20

19.3 SENSITIVITY ANALYSIS

A sensitivity analysis was undertaken to examine the influence of changes to assumptions for coal sales prices, production, operating cost, capital expenditures, and the discount rate on the base case after-tax NPV. The sensitivity analysis range (+/- 25 percent) was designed to capture the bounds of reasonable variability for each element analyzed. The basis for reasonable variability for each element analyzed is summarized as follows:

- Sales Price - Historical coal sales price variability of 44 percent between 2021 and 2022
- Production - Variability in production of up to 63 percent from the 2021 through 2022
- Operating Cost - Estimated accuracy of +/- 15 percent
- Capital Costs – Estimated accuracy of +/- 15 percent
- Discount Rate - based on range of variability from 7.5 to 12.5 percent

Figure 19.3-1 depicts the results of the NPV sensitivity analysis.

Figure 19.3-1 Net Present Value Sensitivity Analysis

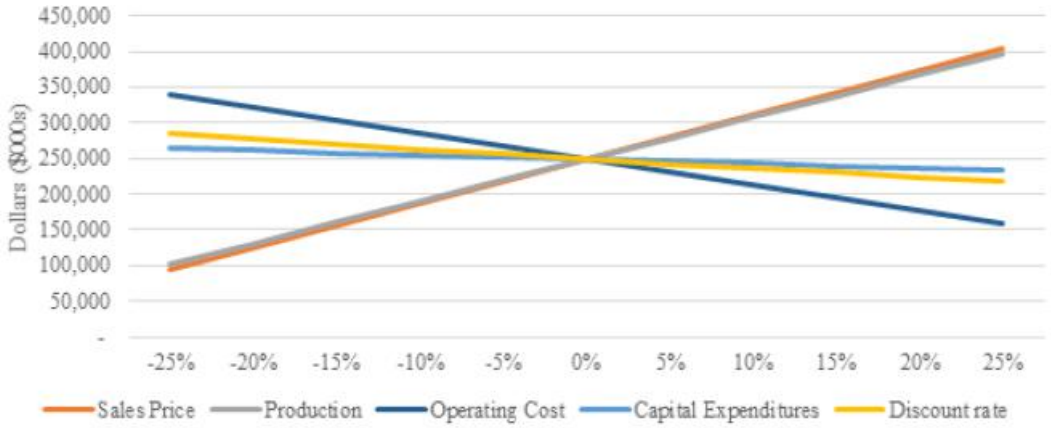


Figure 19.3-1 shows that the Knox Creek Complex NPV is most sensitive to changes in coal sales prices and production. It is less sensitive to changes in operating costs and least sensitive to changes in discount rate and capital expenditures.

20.0 ADJACENT PROPERTIES

This TRS does not include any estimates of coal resources or coal reserves associated with adjacent uncontrolled properties.

21.0 OTHER RELEVANT DATA AND INFORMATION

Conducting a due diligence investigation relative to the mineral and surface rights of Ramaco's mining operations was not part of WEIR's scope of work. This TRS is based on Ramaco controlling, by lease or ownership, or having the ability to acquire the coal reserves and surface lands necessary to support its mine plans.

The ability of Ramaco, or any coal company, to achieve production and financial projections is dependent on numerous factors. These factors primarily include site-specific geological conditions, the capabilities of management and mine personnel, level of success in acquiring reserves and surface properties, coal sales prices and market conditions, environmental issues, securing permits and bonds, and developing and operating mines in a safe and efficient manner. Unforeseen changes in legislation and new industry developments could substantially alter the performance of any mining company.

Coal mining is carried out in an environment where not all events are predictable. While an effective management team can identify known risks and take measures to manage and/or mitigate these risks, there is still the possibility of unexpected and unpredictable events occurring. It is not possible therefore to totally remove all risks or state with certainty that an event that may have a material impact on the operation of a coal mine will not occur.

22.0 INTERPRETATIONS AND CONCLUSIONS

22.1 SUMMARY OF INTERPRETATIONS AND CONCLUSIONS

Interpretation

Ramaco has a long operating history of resource exploration, mine development, and mining operations at the Knox Creek Complex, with extensive exploration data including drillholes, in-mine seam thickness and elevation measurements, and in-mine channel samples supporting the determination of mineral resource and reserve estimates, and projected economic viability. The data has been reviewed and analyzed by WEIR and determined to be adequate in quantity and reliability to support the coal resource and coal reserve estimates in this TRS.

Conclusion

The coal resource and coal reserve estimates and supporting Preliminary Feasibility Study were prepared in accordance with Regulation S-K 1300 requirements. There are 300.6 million in-place tons of measured and indicated coal resources, exclusive of reserves, and 8.0 million clean recoverable tons of mineable reserves within the Knox Creek Complex, as of December 31, 2022. Reasonable prospects for economic extraction were established through the development of a Preliminary Feasibility Study relative to the Knox Creek Complex LOM Plan, considering historical mining performance, historical and projected metallurgical coal sales prices, historical and projected mine operating costs, and recognizing reasonable and sufficient capital expenditures.

22.2 SIGNIFICANT RISKS AND UNCERTAINTIES

Risk, as defined for this study, is a hazard, condition, or event related to geology and reserves, mine operations and planning, environmental issues, health and safety, and general business issues that when taken individually, or in combination, have an adverse impact on Ramaco's development of the Knox Creek Complex. Risks can disrupt operations, adversely affect production and productivity, and result in increased operating cost and/or increased capital expenditures.

In the context of this TRS, the likelihood of a risk is a subjective measure of the probability of the risk occurring, recognizing the magnitude of the risk defined as follows:

Low Risk indicates that the combined probabilities (low/medium/high) together with the economic impact (minimal/significant/adverse), if conditions exist, should not have any material adverse effect on the economic viability of the project.

Moderate Risk indicates that the combined probabilities (low/medium/high) together with the economic impact (minimal/significant/adverse), if conditions exist, could have a detrimental effect on the economic viability of the project.

High Risk indicates that the combined probabilities (low/medium/high) together with the economic impact (minimal/significant/adverse), if conditions exist, could have a seriously adverse effect the economic viability of the project.

Based on a review of available information and discussions with Ramaco personnel, WEIR identified potential risks associated with the Knox Creek Complex LOM Plan. The risks, WEIR's assessment of risk magnitude, and comments based on WEIR's experience with surface and underground mining operations are summarized in Table 22.2-1 as follows:

Table 22.2-1 Knox Creek Complex Risk Assessment Summary

Area of Risk	WEIR Risk Assessment	Comments
Coal Quality	Low	Based on previous production and core hole quality data, coal quality appears to be a consistently good metallurgical coal product.
Horizontal Stress	Low	Observed mining conditions do not indicate horizontal stress problems.
Land Acquisition	Low	All mineral control is maintained through current leases and subleases. No additional acquisitions are necessary for the LOM Plan.
Methane	Low to Moderate	Although methane gas is present in the seams, gas liberation experienced to date has been low to moderate, or at levels that can be safely mitigated during mining. Procedures and continuous gas monitoring are in place to prevent, to the extent possible, methane ignitions and mine fires.
Overburden Stress	Low	The potential for a coal pillar bump or release of stress when mining will be monitored as a part of the normal mining operation. Due to the mountainous terrain, overburden can approach 1,000 feet when mining under ridges. However, the risk of bumps occurring is minimal, since coal outbursts, as a result of sudden release of energy, are typically associated with depth of cover of 1,500 to plus 2,000 feet.
Qualified Employees	Low to Moderate	Recent changes in the coal mining industry have resulted in many coal miners being closed resulting in fewer qualified employees available in general. Ramaco has existing operations with sufficient qualified employees. However, additional mine startups may cause some employee shortages. Ramaco can train inexperienced miners along with its experienced miners.

Area of Risk	WEIR Risk Assessment	Comments
Rail Lines	Low to Moderate	There is currently a shortage of coal rail transportation capacity. The recent upswing in coal prices has resulted in short term increases in rail capacity. This capacity will likely be a relative unknown for the medium to long term.
Refuse Disposal	Low	Ramaco's currently permitted refuse disposal capacity is sufficient for the long term.
Roof Lithology	Low to Moderate	All underground coal mines have the potential to experience unstable roof conditions. The relative consistency of the Norton and Pocahontas Formations that primarily consists of competent sandstones and shales help decrease this risk at the Berwind Complex Deep Mines. Additionally, this potential risk can be kept in the low range through proper ground control engineering and following approved roof control plans.
Geology	Low to Moderate	The structure of the seams at the Berwind Complex all have a relatively gentle dip of approximately two degrees to the northwest or to the south/southwest. There are seven significant faults in the area. There are no known structural anomalies such as sand channels that cut out seams.
Spontaneous Combustion	Low	Seams at the Berwind Complex have a low potential for spontaneous combustion, and Ramaco has not experienced any loss of production due to spontaneous combustion.
Water Inflow	Low	Ramaco mines at the Berwind Complex are relatively dry since the mines are well above drainage.
Market Conditions	Moderate	Market conditions remain volatile for metallurgical coal. Blast Furnace methods for making steel is under pressure from various world-wide government entities due to CO_2 emissions. Markets in China, Japan, Korea, and India are likely to be primary drivers for the metallurgical coal industry.

It is WEIR's opinion that the majority of the risks can be kept low and/or mitigated with efficient and effective mine planning and mine engineering, and monitoring of the mining operations.

23.0 RECOMMENDATIONS

The Knox Creek Complex has sufficient geologic exploration data to estimate mineral reserves and resources. Future exploration work will be undertaken by Ramaco to continuously provide geological data primarily for use by mine operations personnel related to effective implementation of the LOM plans. Future exploration work and mineral property acquisition should include what has been historically implemented related to the following:

Geology

- Have an experienced geologist log core holes, measure core recovery, and complete sampling. Geophysically log core holes to verify seam and coal thickness and core recovery.
- Geophysically log rotary holes to verify strata and coal thickness.
- Continue to prepare laboratory sample analysis at 1.40 and 1.50 specific gravities to better match the preparation plant specific gravity when processing a metallurgical coal.
- Continue collecting channel samples (include parting).

24.0 REFERENCES

References used in preparation of this TRS are as follows:

- Ramaco. 2022. *Jawbone Mine Plan 2023*
- Ramaco. 2022. *Kennedy No. 3 Mine Plan 2023*
- Ramaco. 2021. *Big Creek Surface Mine Plan 2021 - Standard*
- Ramaco. 2021. *Knox Creek Tiller Mine Jawbone Seam Plan 2020 - Standard*
- Harlow, George E., Jr. and LeCain, Gary D., 1993, *Hydraulic Characteristics of, and Ground-Water Flow in, Coal-Bearing Rocks of Southwestern Virginia: U. S. Geological Survey Water-Supply Paper 2388.*

Websites Referenced:

- Securities and Exchange Commission - Modernization of Property Disclosures for Mining Registrants - Final Rule Adoption https://www.sec.gov/rules/final/2018/33-10570.pdf

- MSHA Data Retrieval Site
  https://www.msha.gov/mine-data-retrieval-system
- WVDEP Permits
  https://apps.dep.wv.gov/webapp/_dep/securearea/public_query/ePermittingApplicationSearchPage.cfm
- VDE Permits; Mined Land Repurposing Internet (virginia.gov)

25.0 RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

In preparing this report, WEIR relied upon data, written reports and statements provided by the registrant. It is WEIR's belief that the underlying assumptions and facts supporting information provided by the registrant are factual and accurate, and WEIR has no reason to believe that any material facts have been withheld or misstated. WEIR has taken all appropriate steps, in its professional opinion, to ensure information provided by the registrant is reasonable and reliable for use in this report.

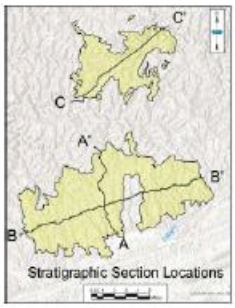
The registrant's technical and financial personnel provided information as summarized on Table 25.1 as follows:

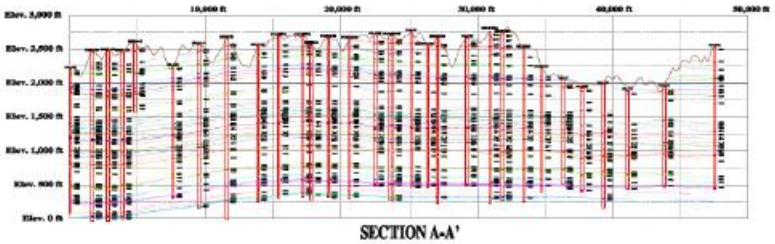
Table 25.1 Information Relied Upon from Registrant

Category	Information	Report Section
Legal	Mineral control and surface rights	3
Geotechnical	Pillar design, roof control plans, and rock quality analyses	13.1.1
Hydrogeological	Hydrogeological Analysis including inflow rates, permeability and tranmisivity calculations, and watershed analysis	13.1.2
Marketing	Coal sales price projections	16
Environmental	Permits, bond, and reclamation liability	17
Macroeconomic	Real price growth (coal sales, labor and other cash costs)	18

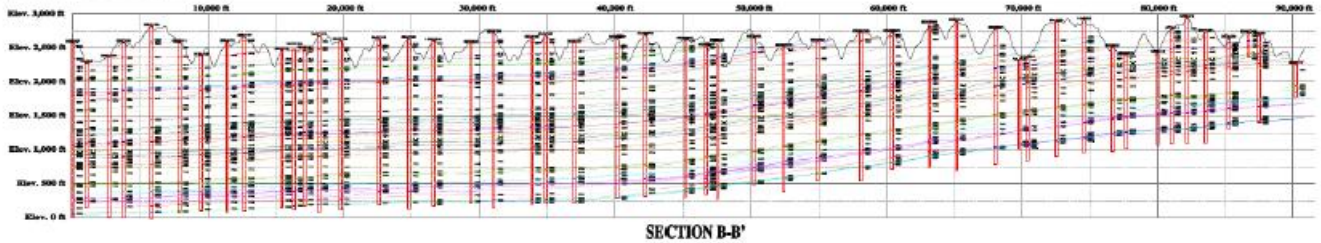
APPENDIX A - EXHIBITS

Exhibit 6.3-2 Knox Creek Complex, Geological Cross Sections





SECTION A-A'



SECTION B-B'

SECTION C-C'